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CONTENTS

DIESEL RAILCARS—A BRIEF SURVEY

By A. H. Sommer, M. I. Loco. E.

IN spite of the enormous strides made in road transport and the claims made by road enthusiasts, railways are and will remain the most important and economical means of transporting goods and passengers; provided the railways take advantage of suitable technical developments.

Foremost among these is the high speed compression ignition engine, more commonly known as a diesel engine and this has been the most important factor in the successful competition of road transport with the railways. This factor was not overlooked by many railway engineers and early attempts made to apply the new power unit to railway working. These efforts although promising, were not entirely satisfactory, one of the factors being the absence of the rubber tyre between wheel and running surface. One attempt to overcome

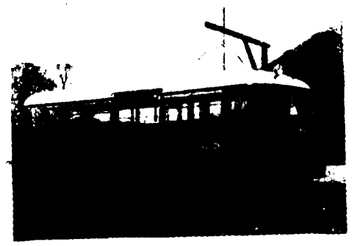
Typical of Wickham's unique tubular construction. The all-steel body is fabricated with solid drawn tube of square section and is designed as a box girder, thereby eliminating the conventional underframe.

this was the adaption of pneumatic tyres to rail vehicles but the load carrying capacity of the tyre is severely limited by the narrow width of the rail head. The adaption of a new type of rail with head six or more inches wide would solve this trouble but at prohibitive expense, with the further disadvantage of the loss of the very low tractive resistance enjoyed by the steel wheel running on the steel rail.

However, due to improvements in engine design and the development of technique in methods of engine and transmission mounting by means of bonded rubber fittings the early troubles have been overcome and the modern high speed diesel engine is as equally reliable as the steam engine and boiler. Moreover the availabili is higher, no time being lost in raising steam or for tl need of frequent withdrawal from service for boil attention.

The main assembly shop of D. Wickham & Co., showing passenger railcars and inspection cars under construction.

Broadly speaking the adaption of diesel power units to railway working has been tackled in two ways, the United States of America developing the high power diesel electric locomotive hauling more or less orthodox rolling stock, and the European solution of self-propelled coaches capable of running as single units or coupled together and controlled by one driver. Both solutions have been remarkably successful and in the U. S. A. the building of steam locomotives has practically ceased.

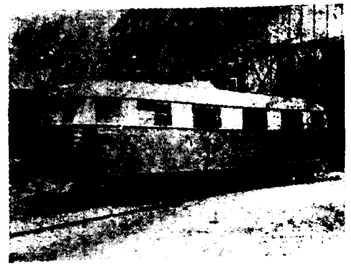


An early railbus with 3 axles supplied to the Peruvian Corporation Railways in 1935.

It must be remembered that in the U. S. A. initially the locomotives were not purchased outright by the railways but hired from Finance Corporations, the hire fees being made possible by the savings in operational

costs. This had a very encouraging effect in speeding up the adaption of diesel units and spread widely knowledge of the possible savings.

Both schools of thought have proved their ideas to be right and are now trying out the alternatives, the Europeon school developing the high power locomotive and the U. S. A. multiple unit rail cars. Possibly the



A two-axle railbus supplied to Buenos Aires Great Southern in 1936.

inal result will be railcars for passengers and diesel ocomotive hauled freight trains.

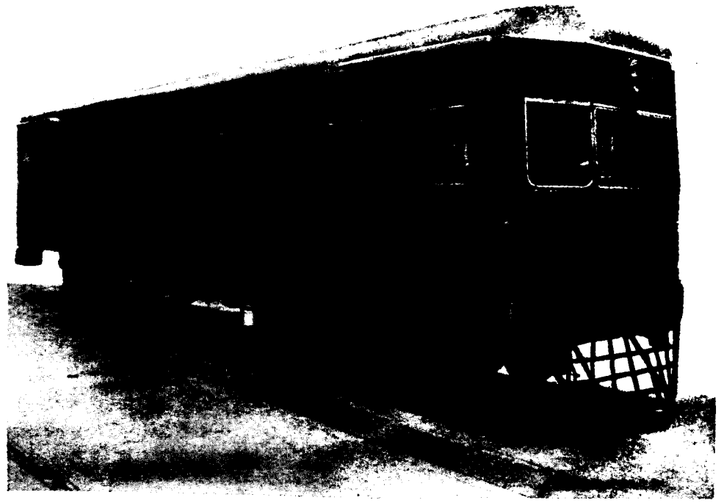
As regards railcars, they are developing into two types, those with vertical engines, usually mounted on the bogies and the underfloor type.

Modern Wickham railbus as supplied to the Burmese and Egyptian Railways. Powered by an underfloor diesel engine rated at 100 B. H. P. this is an extremely economical unit, able to haul a lightweight trailer and having a full consumption of 10-12 miles per gallon.

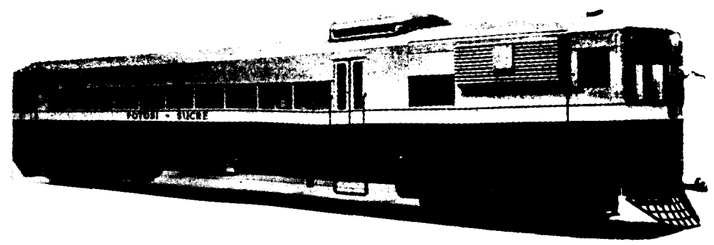
Of necessity the earlier cars were fitted with engines, a wide variety of types and power being available. This type is very popular in the form of permanently coupled three car sets comprising power car, trailer, power car, with controls at the end of each power car. These units have proved very successful in providing high speed non-stop services between large towns.

The production of the horizontal engine for underfloor fitting in road transport led to their adaption for railcars giving the advantage of easy car-to-car communication and the use of all the floor space for pay load. Train make up is also more flexible as the cars can be used as single units or coupled into trains of practically any capacity. The drawback up to quite recently was the limited engine power available from the road engine, in practice it being advisable to limit the 125 HP road rated engine to 100 to 105 HP for rail service. There are now available however horizontal engines designed for railcar work with a working rating of 200 HP and more.

Generally speaking it can be safely asserted that the Europeon school has most experience in the manufacture and running of diesel rail cars both in single unit and multiple operation and over the years have tried all known types of transmission—mechanical, electric and hydraulic. It is significant that the French who have great experience over many years, have standardised on mechanical transmission. The Italians also have



Modern Railcar designed for mountain railways with single end control and mechanical transmission.



Modern diesel electric railcar made in conjunction with Messrs. British Thompson Houston Ltd., for the Bolivian Railways.

exhaustive experience and here again mechanical transmission is extensively used.

Germany on the other hand, after trying electric, hydraulic and mechanical shows signs of settling on a special type of hydraulic transmission comprising a simple type of torque converter combined with a change gear box automatically operated and giving four speeds. This automatic change speed mechanism, in order to operate, requires a slight reversal of input torque at the moment of changing gear and this is very cleverly arranged by sliding longitudinally the runner of the torque converter and so bringing into operation a set of blades giving the required small amount of reversal. It is conceivable that if the necessity of momentary reverse torque could be eliminated, the substitution o a simple fluid coupling in place of the torque converter would result in slightly increased efficiency and lower cost; also the transmission would then without hesitation be labelled mechanical.

British Railways, although late in the field, started off with hydraulic transmission; on official results have been published but the latest information available indicates that mechanical transmission will be used in future cars.

Until quite recently, owing to the lack of a home market, British railcar manufacturers have of necessity shipped their products to countries all over the world

(Continued on page 17)

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 yor 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)

HISTORY OF BRITISH RAILWAYS

BRITAIN was the pioneer of railway development which provided the improved transport essential to industrial and commercial expansion.

Railroads were in use around pits and iron works before the end of the sixteenth century. Trucks were mainly drawn by horses. The first railroad to carry goods for the public was the Surrey Iron Railway built between Wandsworth and Croydon in 1801 to 1803. In 1812, William Hedley, a colliery engineer, following up the work of William Symington, William Murdock, Richard Trevithick and others, showed how locomotives could be used on railroads. About the same time, George Stephenson improved the efficiency of existing models by increasing the draught to the firebox. In 1825 the Stockton to Darlington railway was opened and became the first public railroad on which locomotives were used. The first public line built expressly to use only locomotive haulage was the Liverpool and Manchester railway of 1830. Stephenson's 'Rocket' was the chosen locomotive, as a result of a competition in 1829. From that time, the potentialities of the locomotive railway began to be fully developed.

At first, railway projects were mainly local, promoted by groups of people concerned with the needs of particular areas. Parliamentary sanction had to be sought for each project. The general opinion was that the company would provide the track but would not necessarily act as carriers. Private carriers often ran their vehicles over the companies' lines. But the realization that for reasons of safety and efficiency the company must have all traffic under its own control was endorsed by a Parliamentary Committee in 1839. Railway building was particularly rapid between 1840 and 1875, with a short lull following the collapse of a speculative railway boom in 1846. This period also saw the beginning of a process of amalgamation in order to achieve the economics of concentration and large-scale operation. The State began to intervene. Thus, in 1846 an Act of Parliament prescribed a standard gauge of 4 feet 8½ inches for all new lines except extensions of the Great Western Railway which had a gauge of 7 feet. Not until 1892 was the Great Western gauge completely converted to the standard gauge. In 1850 statutory recognition was given to the Railway Clearing House which began in 1842 and had the function of facilitating through traffic by providing for the adjustment of balances between companies. The Railway and Canal Traffic Act of 1854 laid upon the companies the obligation of providing reasonable facilities, especially for through traffic, and of avoiding undue preference between users. In 1873 jurisdiction under this Act was given to a body of three Railway Commissioners which in 1888 was renamed the Railway and Canal Commission. The Railway and Canal Traffic Act of 1888 drew up a standard freight classification and schedules of maximum freight charges which came into operation in 1893. A company wishing to increase these rates had to justify itself to the Railway and Canal Commission.

During the 1914-18 war the railways were controlled by the Government, acting through a Railway Executive Committee consisting of the general managers of some of the larger companies. This arrangement made clear the advantages of concentration and it was decided that the handing back of the railways to the companies should be accompanied by a comprehensive reorganization. By the Railways Act of 1921, 123 companies were amalgamated into four large groups—the London, Midland and Scottish; London and North Eastern; Great Western; and Southern. A new tribunal, the Railway Rates Tribunal, was established to take over the jurisdiction over charges and questions of undue preference of the Railway and Canal Commission. It was to carry out an annual review of standard rates and fares which were to be adjusted with reference to the principle of maintaining to the companies a standard net revenue equivalent to that of 1913.

In the inter-war years, the railways suffered both from the general industrial depression and from the growing competition of road transport, and the standard net revenue was never earned. Efforts were made to improve services and efficiency. In 1928 powers were obtained from Parliament of own and operate road services. But the railways were at a disadvantage in competing with road hauliers; the latter were not, as were the railways, bound to accept all traffic; their rates were flexible and need not avoid undue preference, and they were not heavily capitalized undertakings. In 1938, the railways put forward 'Square Deal' proposals calling for relief from statutory regulation of charges and for freedom to decide for themselves the rates for merchandise carried. The campaign was interrupted by the outbreak of war in 1939 when the railways again passed under the control of Government, acting, as in the 1914-18 war, through a Railway Executive Committee.

BRITISH RAILWAYS

In 1947 the Transport Act brought the railways of Great Britain into public ownership and created a Railway Executive empowered to operate them on behalf of the British Transport Commission as a single enterprise known as British Railways, with six regional sub-divisions —London-Midland, Western, Eastern, Southern, North Eastern and scottish—corresponding broadly to the former companies.

The Transport Act, 1953, reversed the policy of centralization, and instructed the British Transport commission to prepare a scheme for railway reorganization and decentralization. The scheme was to provide for the abolition of the Railway Executive (if not already abolished) and for the setting up of area administrations which might follow the existing pattern of regions, to which many of the Commission's powers would be delegated. But there would still be central responsibility for some matters including wages and charges.

To increase the competitive power of the railways, the Commission was to have more latitude in fixing railway charges, e. g., only the maximum rates would need to be provided for and published and not concessions made to secure competitive business.

From 1st October 1953 interim arrangements came into effect pending the reorganization envisaged in the Act. The Railway Executive was abolished and the Commission became the employer of all officers and staff of the British Railways. The six regions remained unchanged but wider powers were given to the Chief Regional Officers who became known as Chief Regional Managers.

The Commission's scheme for the reorganization of the railways was published as a White Paper on 13th July 1954 and followed the general principles of the interim arrangements.

The Commission proposed that the existing six regions should be the areas envisaged under the Act. The area authorities should be boards, each consisting of not more than seven persons including a chairman, one or more of the members being a member of the Commission. Members would be drawn in part from outside the industry but would not be representatives of particular interests; they would not be expected to devote the whole of their time to the work of the authorities. The Commission considered that its control in the scheme of organization should be absolute and that it alone should appoint the members of the area authorities. The area authorities would not be incorporated, and the Commission would remain the employers of staff; it would also retain general financial control including the control of charges.

Within the framework of their responsibilities to the Commission, the area authorities would be responsible for the management of the railway system in their areas, but they would leave day-to-day management to their Chief Regional Managers who would continue to maintain close contact with the staff at Commission Headquarters. Functions delegated to the area authorities, which they would exercise in the name of the Commission, would be to promote initiative in improving services and facilities and in effecting economies; to ensure that contact would be made with users to meet their requirements to the fullest extent possible; and to ensure that proper measures would be taken regarding the safety, health and welfare of the Commission's employees.

The scheme was accepted and is being put into operation.

STAFF AND ASSETS

The following figures summarize the numbers of staff employed and vehicles, ships and track owned by British Railways at the end of December 1953.

Staff, total number	593,768
of which: Administrative	76,436
Operative	305,278
Maintenance	197,854
Permanent Way (standard gauge)	
Railroad mileage (incl.—electrified)	19,222
Track mileage (incl.—electrified)	51,607
Locomotives	
Steam	18,584
Electric	65
Diesel	14
Diesel-electric	242
Gas-turbine electric	2
Petrol	2
Narrow-guage [1]	5
Passenger carriages[2]	
Steam	37,197
Electric	4,565

[1] There are about 27 miles of narrow-gauge track open for traffic.

[2] Including rail motor vehicles.

Freight vehicles	1,122,044
Ships [3]	135
Net tonnage of ships	78,436
Road vehicles	
Motors and tractors	5,409
Articulated motive units ..	9,960
Trailers for above	25,823
Horse-drawn vehicles	5,394

The railway system is, of course, fully signalled and has a complete telephone and telegraphic network. A system whereby trains are automatically warned and controlled if signals are against them has been in operation on the Western Region—formerly the area of the Great Western Railway—since 1905. The general adoption of a suitable system on all main line railways has been studied since nationalization and plans are in hand for its installation.

The largest railway station in the country is Waterloo, the London terminus of the South Western main and suburban lines in the Southern Region. It has 14,901 feet of platform face (i. e. the side of the platform towards lines). The longest single platform face on British Railways is at Manchester; it extends for 2,194 feet through the adjacent Victoria and Exchange Stations.

Major development works include the electrification of the line between Manchester, Sheffield and Wath, which was opened in September 1954.

Motive power is the subject of continuous study. Twelve standard classes of steam locomotive are being introduced, while experiments are being carried out with diesel-electric locomotives on main line work. Diesel-electric traction is already being employed for shunting in marshalling yards, where it is more economic than steam traction, and in multiple unit passenger trains. The testing of the design, construction and operation of steam locomotives is carried out at the Locomotive Testing Station at Rugby, which was opened in October 1948.

Refreshment rooms and restaurant and buffet car services are the responsibility of British Transport Hotels and Catering Services. Staff employed at the end of 1953, numbered 15,374. Refreshment rooms are operated, often by concessionaires, at 409 stations, and in 1953 approximately 10 million meals were served on trains. There are 40 railway hotels. The policy has been to sell hotels not connected with transport.

Accidents on British Railways are rare; the only major accident in 1953, a collision between a steam passenger train and an electric train on the Irk Valley viaduct in Lancashire on 15th August, caused the death of 10 persons.

[3] Including 10 jointly owned and 5 operated but not owned. British Railways operate services on twelve routes to the Continent including two train-ferry services, Harwich-Zeebrugge and Dover-Dunkirk. Services are also operated across the Irish Sea, and on coastal waters and lakes.

RAPID EXPANSION OF EAST AFRICA'S ECONOMY

The continued rapid expansion of East Africa's economy is reflected in the latest statement by the East African Railways and Harbours Administration in its revenue position. At £ 1,401,502, the approximate railway revenue for December 1954 was almost £ 90,000 more than that for the previous month, and the total revenue for 1954 was approximately £ 15,250,000, showing an increase of more than 20 per cent. on 1953.

There was a substantial improvement in passenger traffic in the second half of the year—an improvement which, it is anticipated, will continue during 1955.

Similarly, by November the harbour revenue for all ports increased by almost £ 100,000 on the same period of the previous year. This was achieved in spite of the fact that considerable expansions had been taking place which meant reduced working space and facilities for the handling of products which would show a more obvious return in terms of revenue.

PRODUCTION IN CHITTARANJAN

Shri P. C. Mukherjee, Member (Engineering), stated that Chittaranjan's original target of production has already been exceeded and the 200th locomotive will roll out in the first week of February. The new target for Chittaranjan is 200 average size locomotives and 100 boilers per annum. When this is achieved, Chittaranjan will turn over in 36 hours a complete new locomotive.

The Integral Coach Factory at Perambur is expected to start production this year and first coaches will start coming out some time in September or October. It will start producing about 20 coaches this year and reach the target of 350 all steel broad gauge coaches by 1960.

Six Cylinder Oil Engine for Malayan Railway Locomotives

By A Special Correspondent

THE power unit in each of the six diesel hydraulic shunting locomotives recently shipped to Malaya from the works of the North British Locomotive Co. Ltd., is a Paxman four-stroke V6 RPH engine, derated to 300 b. h. p. at 1,250 r. p. m. to suit site temperatures up to 94 deg. F., and a humidity of 70%. This unit is of basically standard type, with six 7 in. x 7¾ in. cylinders arranged in V formation, and pressure charged on Buchi exhaust gas principles by a Brown Boven turbo-blower group running up to 28,000 r. p. m. At normal full load and speed the exhaust temperature in the branches is about 900 deg. F., and the air delivery pressure about 5 lb. per sq. in. Dry weight of the engine including pressure-charger is 6333 lb., or 20 lb. per b. h. p. on the n. t. p. rating of 313 b. h. p.

In this particular size, a leading feature of the engine is the short and extremely stiff shaft and frame system which promotes engine reliability and quietness of running and also gives a most compact power group capable of convenient installation in locomotives and, as was shown in the railcars set to work in Bolivia a year ago, in railcars also. This stiffness and rigidity is enhanced by a shaft diameter well over two thirds of the cylinder diameter, a generous proportion in any case, but even more notable in a three throw shaft. This diameter, first used in the 12 cylinder and 16 cylinder engines of the same range, was retained primarily for the standardisation of main and big-end bearings, so that customers using more than one engine size in the R. P. H. range would need only one class of spares; but also it was realised that this shaft diameter would also result in high performance of bearings, shaft and framing. Being a six-cylinder V, this engine also has a supplementary balancing shaft in the crankcase to look after the secondary forces and the result of all these points has been a remarkably smooth running engine.

Some Necessaries of Progressive India

By W. P. Niyogi, G.I. Loco. E., M.I.I.S., A.A.R., A.R.E.A., V.D.I.

INDIA, while marching ahead with the world's progress, needs some important productions for the maintenance of her progress. Some new railway lines are scheduled to be opened during the next five years to run her trade in a better way and many new wagons are to be manufactured to carry her trade. But it should also be remembered that the maintenance of the existing tracks in India is one of the biggest factors for the smooth transport of her productions. For that reason, she needs some special equipments and those have also to be manufactured.

These equipments are mostly composed of some special types of wagons and machineries, and are extensively used for the maintenance of long distance tracks, as in America. They are very useful for quick unloading, distributing and dressing of ballast. Some of these special equipments and their utilities are discussed here in the following paragraphs.

HOPPER - BOTTOM WAGON

Hopper - bottom wagons are generally designed with floors sloping from the ends and sides to one or more hoppers, which discharge the load by gravity through the hopper doors. When used for ballasting work, continuous ballast distribution is effected by moving the train slowly as successive wagons are unloaded. The hopper wagons are useful for unloading between the rails.

"GONDOLA" WAGON

The 'gondola' type general purpose wagons, with drop-bottom doors controlled by a ratched device at the end of the wagon, are also used for unloading ballast. Because of the difficulties in controlling the amount of ballast to be unloaded, this type is superceded by the other hopper types.

SPECIAL BALLAST WAGON

Special ballast wagons of the hopper-bottom type are designed to unload through controlled doors. This hopper-bottom wagon has a body with sloping floor sufficiently steep to discharge the ballast to the side or centre of the track in the quantity required. The operator walks alongside the wagons working the operating handle which controls the flow of the ballast. The controls for flow of the material from the centre hoppers can be operated from either side of the wagon.

The hopper unloading controls on these ballast wagons are of worm and gear type and are manually controlled. Although it is not practical to close the hopper doors after they are once opened, it is possible to tighten them sufficiently to pinch stone ballast or similar coarse material and prevent its further flow. These ballast wagons are specially designed for ballast service; they are also useful for hauling coal, concrete, sugar beets, ores and similar products.

There is also another type of ballast wagon which may be converted from the flat bottom side unloading type to the V bottom centre unloading type. When used for centre unloading, it is equipped with a longitudinal V type hopper which extends the full length of the wagon. The amount of ballast unloaded is controlled by the opening of the V bottom, which is actuated by a ratchet device at the end of the wagon.

AIR - OPERATED SIDE DUMP WAGON

Modern air - operated dump wagons are built of high-tensile, low - alloy steel to combine strength with light weight. They vary from 23' - 8" inside length to 41' - 0" and from 35 tons to 68 tons in load - carrying capacities.

Practically all dump wagons are of side pivot or down-turning door type. The doors are moved outward and downward, and returned to their normal positions, by means of a simple mechanism synchronised with the movement of the wagon.

Air dump wagons are not suitable for unloading ballast for surface lifting; they are extensively used to unload ballast in bank restoration. The down-turning door acts as a chute or apron to keep the material being unloaded clear of the ballast shoulder section. A spreader should be used to level the material thus unloaded.

PLOUGH EQUIPPED BULLDOZER

Bulldozers equipped with ploughs are used to unload ballast from special ballast wagons of the gondola type with side doors. This equipment does not remove the ballast very close to the floor of the wagon but its performance is very quick.

BALLAST REGULATOR

It is a machine for regulating and ploughing ballast. It is operated by one or two men and is provided with a turntable for removal of the machine from the track or permitting it to be turned to operate in the opposite direction. It is powered with a 100 H. P. petrol or diesel engine with a 4-speed forward and reverse transmission and is equipped with 4-wheel drive. The ballast wings and plough are adjustable to fit any standard ballast section.

This machine can be used ahead of the surfacing gang for regulating and distributing the ballast evenly, filling in all empty cribs and removing excess ballast from the centre of the track, placing it on the ballast shoulder for distributing and final dressing. The ballast wings are so designed that the ballast is at all times pulled back into the track and thus the wastage is minimised. It can be equipped with a broom attachment to clean ballast thoroughly from the tops of the ties.

BALLAST DISTRIBUTOR

This machine picks up ballast from the inter-track space or border by means of a bucket-type conveyor and loads it into a hopper. The ballast is then distributed in the cribs and at the ends of the ties through the adjustable openings in the hopper. The hopper itself can be raised or lowered to give the desired depth of ballast.

The machine is also equipped with wings and levelling blades for dressing the ballast. If necessary, excess ballast can be loaded in the hopper and carried to a point where needed. A ballast chute, between the conveyor and hopper, is provided with a screen which separates dirt from the ballast.

The machine is operated by one man through a bank of hydraulic control valves located in an enclosed cab. It is powered by a petrol or diesel engine driving three hydraulic pumps. The machine is mounted on flanged wheels driven through a chain drive and transmission by a hydraulic motor. The travel speed of the machine is 24 miles per hour. It is equipped with hydraulic brakes and a sanding device. Hydraulic jacks and transverse flanged wheels are also provided for removing the machine from the track.

SPREADER - DITCHER

This is a heavy, rugged, on-track machine designed for a multitude of maintenance assignments including ballasting. With its versatile front plough and adjustable ballast section blades, the machine can plough and flange ballast from between the rails to either or both sides of the track as desired, at the same time shaping existing ballast or dressing freshly applied ballast on the shoulders. The spreader-ditchers are also used extensively to cut foul ballast away from the ends of ties. With the combined spreader-ditcher and bank sloper wings, the subgrade can be levelled, fills dressed, and drainage ditches cleaned. The machine may also be used to carry excess material from cuts, widening and contouring them in one operation.

The spreader-ditcher is generally pneumatically controlled by one operator. The machine has a total spread with both wings of 40 ft. or more, with a vertical range from one foot above to 3 feet below the top of the rail.

ACKNOWLEDGEMENT

It is acknowledged that some datas have been taken from the Bulletin of American Railway Engineering Association, Chicago, to complete this article.

PRESS PARTY TOURS RAILWAY CENTRES

A 14-member Press Party consisting mainly of representatives of leading Indian newspapers and News agencies started from Delhi on January 10, 1955 on a 4-weeks tour of the country to visit places of interest all over the Indian Railways. Their itinerary included visits to Moghalsarai, Chittaranjan, Howrah, Khargpur, Vizagapatam, Dhanushkhodi, Trichinopoly, Bangalore, Bombay and Baroda.

Whilst on the Central Railway the press party saw the passenger amenities provided at the remodelled station of Gulbarga on the Sholapur Division. In Bombay they saw the models of Dadar station old and new and later inspected the remodelled station to see at first hand the progress effected. They visited the electro-pneumatically controlled Signal 'A' Cabin at Victoria Terminus and saw the handling of peak hour traffic at the Suburban station. They also visited the Matunga Carriage & Wagon Workshop where they saw the furnishing of Schlieren coach shells and the building of Air-conditioned coaches. They press party was generally impressed with the fine work done by the Railways since Independence.

British Locomotives for World's Railways

OVER 400 EXPORTED TO INDIA IN FIVE YEARS

SINCE the war, Britain's locomotive industry has exported to all parts of the world locomotives and component parts to the value of no less than £ 100,000,000, says an article in a special trade and transport issue of the *British Trade Journal and Export World*, just published.

Today Britain can offer deliveries of locomotives as speedily as any other country. During the last five years the industry has exported no fewer than 405 locomotives to India, 468 to Africa, 395 to Australia, and 356 to other parts of the world. These were all main-line locos, some of the largest ever to leave Britain.

There have also been numerous orders for Diesel locomotives; these include 30 for Brazil, 25 for Ceylon, 94 for Ireland, and 75 for the Netherlands. Electric locomotives have also been produced in increasing numbers, and these include very large main-line locomotives for South Africa, Spain and Brazil. In 1953, no less than 93 per cent. of the total production of the industry went overseas.

The article recalls that one of the largest contracts ever placed for railway equipment was awarded last year to a British firm (Metropolitan-Vickers). The Central Railway of Brazil ordered 200 complete railway coaches, to be built and equipped in Britain, and 100 sets of electrical equipment to fit into coaches being built in Brazil. The contract, financed in part by an International Bank loan of $ 12,500,000 was worth about £ 7,000,000.

U. K. MASTER PLAN

Referring to the new 15-year plan to re-equip and reorganize Britain's State-owned railways, the article observes that oversea buyers interested in this field will watch with interest implementation of various aspects of what has been called the master plan for British Railways. The £ 1,200 million programme, which will include extensive schemes for electrification, more Diesel locomotives, re-planning of stations, and improvement of rolling stock and the permanent way, may, by the time it is completed, set new standards of modern railway practice which will serve as a model for the world.

The potentialities of gas turbine and atomic power for propulsion are not being overlooked.

LOCOMOTIVES FROM BRITAIN

By R. E. Hicks

GROWING DEMAND FOR DIESEL AND ELECTRIC UNITS

PRESTON, in Lancashire, is today famous as the place where the record-breaking jet bomber and the supersonic jet fighter are made. For a much longer time, however, going back far beyond the jet age, and even beyond the age of powered flight, to the end of the last century, these works at Preston have been renowned for the manufacture of electric and diesel-electric locomotives and trains, trolley buses and tram cars, now in use all over the world.

British-built diesel-electric locomotives or their power equipment of widely varying weights and power, have been supplied to, or are on order for, the Argentine, Australia, Brazil, Ceylon, Egypt, the Gold Coast, Holland, India, Malaya, New Zealand, Nigeria, Rhodesia, Spain, the Sudan and Sweden. The 660-h. p. diesel-electric locomotives used in New Zealand for hauling the Royal train during the recent Royal tour of the Commonwealth were supplied by a British firm. Now the same firm is to supply, this year, ten 1500-h. p. diesel-electric locomotives which will be the most powerful of their type to operate in that country. Rhodesia has ordered twenty-three 2000-h. p. locomotives and they will be the largest narrow gauge diesel-electrics in the world.

Examples of the application of diesel-electric transmission to complete trains are the high-speed five-coach express air-conditioned units supplied to the Egyptian State Railways. Modified versions have also been supplied for suburban services and three-car versions for feeder services. Forty-eight diesel-electric locomotives, each weighing 77½ tons and of 1,105 h. p., have been ordered from Britain by the Western Australian Government.

OVERSEA INTERESTS

This British industry by virtue of its wide oversea interests has evolved naturally over the years into an engineering and production group which can meet the

most diverse conditions required abroad. The limitations of load gauge, axle-loading, gradients, and climatic conditions impose a considerable degree of restraint on standardisation of design. The industry has long experience of "design for the job" and does not attempt to force a standard product on oversea customers which may or may not meet their requirements.

The present high level of activity in both the railway diesel and electric traction field can be noted from the figures for export of locomotives other than steam, which have steadily increased over the last few years from £1.8 million in 1950 to £6.3 million in 1953. This compares with the steam locomotive exports of about £7.5 million in 1950 and £6.2 million in 1953.

MEETING OF THE ZONAL RAILWAY USERS' CONSULTATIVE COMMITTEE, BOMBAY

The Seventh Meeting of the Western Railway's Zonal Railway Users' Consultative Committee, Bombay, was held in the Railway Headquarter Office, Churchgate, on 10th January, 1955 under the chairmanship of Shri P. N. Saxena, General Manager, Western Railway.

After reviewing the action taken on subject discussed at the last meeting held on 27th September, 1954, the Committee discussed over 75 items of interest to the travelling public. Some of the important subjects discussed were the extension of the facility of reserved Third Class accommodation to other trains, augmentation of Bombay Suburban Service, introduction of departmental catering in the Dining Cars and provision of loud speakers at important stations and junctions. Regarding reduction in price of platform tickets, the Chairman stated that no decision had been received from the Railway Board.

The Zonal Committee also met at Bombay Central at 7 P. M. on the same day and inspected the coaches on the various outgoing trains. They found that the standard of maintenance and cleanliness was generally satisfactory. The Members, however, made a number of suggestions for improving the amenities to passengers which the Administration will examine in detail.

ESPRIT DE CORPS

THE dictionary defines *esprit de corps* "the common spirit pervading the members of a group. It implies enthusiasm, devotion and jealous regard for the honour of the group".

It is in the family that initially the group idea starts. The children of different age limits form into separate groups, the elders (the parents) form into another group—which may be called the counsellor's group—and so on. The idea gradually extends itself to friends, neighbours, etc., until, ultimately it encircles the whole nation.

Enthusiasm, devotion and jealous regard for the honour of the group are all characteristics which are acquired by association and conscious effort in a true spirit of common fellowship. They differ according to the talents possessed and training and discipline received.

If it were a group of philosophers, or of scientists, or of learned men of the professions, or of common people, or even of workmen in an industry, the degree of consciousness would vary according to the intensity of the spirit of fellowship that pervades the individual group.

History records fierce battles being fought for the preservation of honour. The honour of a group is the prized possession of every individual belonging to it and no effort should be spared to preserve it unalloyed and untarnished. Jealousy in this regard is a quality of high order—nay a virtue.

How can the railwaymen imbibe this spirit of common fellowship in their work and elevate their thoughts and actions? The first and foremost requirement for this is a feeling that each one of us belong to a particular group of enthusiastic workers engaged in the preservation of national honour with a definite assignment of position and responsibility; the second requirement is a confirmed belief in the brotherhood of man and the fatherhood of God; the 3rd requirement is the realisation that we are all interdependent, one on the other, and fourthly and lastly, the conviction that individuality, however highly developed, has to be subordinated to the common good. Only then can we say that we own that fine quality of *esprit de corps*. Are we prepared to measure our usefulness to society by this yard stick.

N. G. IYER

Indian Standards Institution Notes

THE Indian Standards Institution has published tentative Indian Standard Specifications for (a) Solid-Woven Impregnated Cotton Belting for Power Transmission and (b) Solid-Woven Impregnated Hair Belting for Power Transmission.

These standards prescribe dimensional requirements of these two types of beltings and quality requirements for materials to be used in their manufacture. They also specify minimum tensile strength and elongation of standard belts. A test method for the evaluation of tensile strength and elongation is included in an Appendix to each of the two standards.

These standards have been prepared by the ISI's Pulleys and Belts Sectional Committee (ECTDC 4) on which are represented organizations, such as Ministry of Commerce and Industry (Development Wing), Council of Scientific and Industrial Research, Directorate of Technical Development, Army Headquarters, Government Test House, Calcutta, Central Standards Office (Ministry of Railways), Directorate General of Ordnance Factories, Calcutta, the Institution of Engineers (India) and leading manufacturers of belts in the country. Copies of these standards can be had from the Secretary (Administration), Indian Standards Institution, 19, University Road, Delhi-8, at a price of Re. 1/- each.

***

A draft Indian Standard Specification covering Tungsten Filament Electric Lamps for Railway Rolling Stock has been prepared and circulated for comments to interested parties by the Indian Standards Institution.

This draft which follow closely the published Indian Standard Specification for Tungsten Filament General Service Electric Lamps, lays down the physical and electrical requirements and methods of tests for single coil as well as coiled coil lamps of 10, 15, 20, 30 and 250 watts for operation on 24 and 32 volts normally available on railway coaches. Both clear and internally frosted lamps are covered, as also normal Bayonet type and Edison Screw type lamp caps.

In two Appendices to the draft are given respectively brief descriptions of a photometric integrator for conducting photometric measurements on the light output and a V2 Meter for measuring the effective mean value of the voltage during life tests.

This draft standard has been prepared by the Indian Standards Institution's Electrical Accessories Sectional Committee on which are included, among others, representatives of the Railway Board, Government Test House and other organizations as well as those of Electrical Lamp Manufacturers Association, Lamp Holders Manufacturers Association, Directorate General of Civil Aviation, P & T Department and other trade interest. Comments on the draft will be entertained by the ISI up to 27 December 1954.

***

The Indian Standards Institution, which is preparing Indian Standards for Ink has circulated for comments its two draft standards relating to Ink, Drawing, Water-Proof Coloured, Transparent and Opaque; and Black.

The material conforming to the proposed standard for the coloured, transparent or opaque ink is to be a clear solution of a dye in a liquid medium; alternately it might be a suspension of an opaque pigment in a liquid medium. If desired, a mixture of a dye and pigment may be used.

The proposed standard for black ink prescribes that the material should be composed of carbon in a permanent state of suspension in a liquid medium and should not contain aniline dye except in the form of a toner. It shall contain proper preservative and water-proofing agent.

These draft standards also prescribe the requirements for Sediments, Fastness, Opacity, Performance, Growth of Mould, Thickening and Separation of Pigments, etc.

ABOLITION OF INTER CLASS—MEMBERS OF THE RAILWAY BOARD ADDRESS CONFERENCE

Shri G. Pande, Chairman of the Railway Board told a Press Conference in Delhi on 5th January, 1955, that there would be no Inter Class on Indian Railways from 1st April. He stated that orders have been issued to redesignate the existing classes on the Railways from 1st April. The present Second Class would be renamed First Class and the present Inter Class would be renamed Second Class. Subject to any adjustments that might be made due to "rationalisation", the new First Class would be charged at existing Second Class rates and the new Second Class at existing Inter Class rates.

HOW TO RESERVE ACCOMMODATION

Unless you reserve your berth (I and II Class) or Seat (Inter and 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.

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 by the Public Relations Officer, Southern Railways Magazine)

(Continued from page 4)

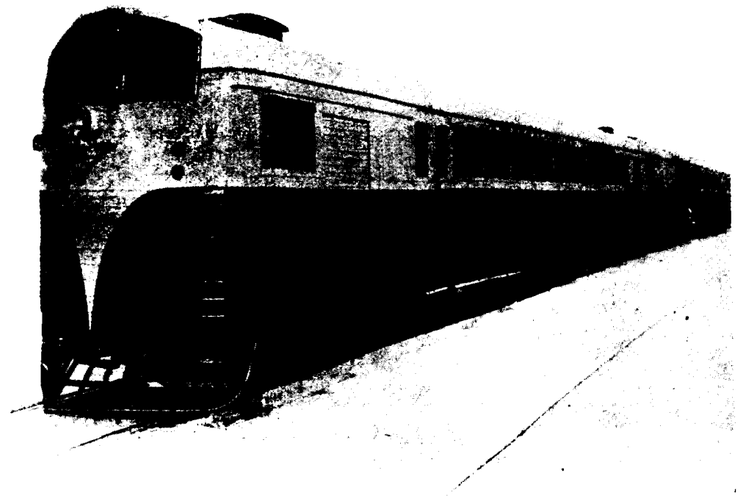
and the extremely diverse conditions experienced have enabled them to gather invaluable information and experience. With few exceptions rail cars built by British manufacturers have been fitted with mechanical transmission.

In the United States comparatively few rail cars are in service and these mainly are fitted with torque converters, may be because this type of transmission was highly developed for use in heavy earth moving equipment where it has special virtues not applicable to railway use. Also no development had taken place in high power remote controlled multi speed gear boxes capable of being coupled together for multi unit operation.

Having very broadly and briefly surveyed the rail car picture the following details of a few cars designed and built by an English manufacturer of 30 years experience may be of interest.

In the early years their experience was confined to various types of small vehicles, from very small track inspection cars to four-wheeled rail buses carrying about forty passengers. The first double bogie coach was built for a British owned railway in South America, where starting at sea level the terminus was at an altitude of 12,000 feet, the highest point reached being over 15,000 ft. above sea level. The first 80 miles of the trip is a continuous climb including gradients of over 4% and a number of zig-zags. The conditions were of the hardest and the problem presented many difficulties, one of them being an air temperature of 75°F

Typical track and altitude conditions for which Wickham railcars have been designed. This shows a Wickham multi-car unit at a 6,000 ft. mountain halt in Colombia.



Two-Car diesel railcar unit supplied to the Colombian National Railways. Powered by Saurer 220 B.H.P. pressure-charged diesel engines and fitted with a Cotal electro-magnetic gearboxes.

at an altitude of 10-11,000 feet climbing 3-4% grades in a ravine with a following wind equal to the car speed.

Obviously the elimination of all unnecessary weight was the most vital problem and it was soon seen that the skimping down of any orthodox type of railway construction offered little return in the way of weight saving. It was found that a departure from the then orthodox was esssential and a solution of the problem was found in the elimination of the standard underframe, the combination of a tubular structure fabricated by electric welding in the form of a body shaped tubular girder enabling this to be done.

The tubular members are of solid drawn mild steel of square section $2\frac{3}{8}'' \times 2\frac{3}{8}'' \times 10$ g. the square section being chosen as offering easier welding technique and final panelling, with of course the additional advantage of being stronger and stiffer as against round tubes of equal diameter. Panelling is 16 g. aluminium.

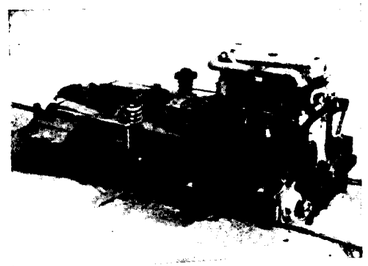
Bogies were also electrically fabricated from steel plate and the complete car with accommodation for 40 first class passengers and luggage, with a light-weight petrol engine, gear box and transmission in each bogie had a tare weight of 12 tons.

In service the engines proved to be the weak factor and eventually these and the transmission were removed and the car is in use as a trailer behind a later type diesel car. At no time however did the novel type of body construction give any signs of trouble and after eighteen years of service the latest report is that the car appears to be good for at least a similar period.

Since this early car was built many others, larger and of course fitted with diesel engines have been supplied both to this railway and others, though all built on identical principles.

On a more normal railway with easier or no grades the elimination of weight might be thought to be of less importance but a moment's reflection will reveal that with a self-propelled (or any other vehicle for that matter) accelerating and stopping unnecessary weight calls for extra horse-power and wear and tear, both costing money.

As regards strength it has been proved in practice that although much lighter no sacrifice has been made in strength; in collisions with vehicles of orthodox construction the tubular body has suffered only minor damage, repaired in a matter of hours whereas the other vehicle has been in the shops for weeks.



A Wickham power bogie fitted with a Saurer pressured charged engine and Cotal electro-magnetic gearbox.

Open road crossings are another source of test when the unlucky driver of the road lorry has just failed to beat the rail car to it. In each case reported no person, (including the driver) in the rail car, has suffered hurt nor has the rail car received other than superficial damage. Such however cannot be said for the road lorry. Fortunately it has been found that road drivers rapidly learn that the acceleration and speed of the rail car is much higher than the steam stock they were accustomed to and behave accordingly.

A few words on the question of mechanical transmission.

The number of gear ratios and final ratios chosen are important and depend upon the duties required and the conditions in which they are to be performed; the variation required for different duty is usually small and easily arranged.

The number of gear ratios is mostly dependent on the ratio of horse-power available and the gross weight—here is another advantage of light weight. In the early days a ratio of $3\frac{1}{2}$ to 4 horse-power per ton was usual but it will be found that investigation of successful

Interior view of a modern luxury rail-car. The car is fitted with adjustable fully roating seats. A buffet and bar with refrigerator and cooking facilities.

running in service has necessitated this to be increased to between 6 and 7 HP per ton. Here again the service required dictates the ratio, on suburban stopping service to run without trouble may call for up to eight or nine H. P. where as a fast long distance non-stop run can be managed with four to five. It must be borne in mind that the introduction of a rail car service should give improved benefits to the customers, the travelling public, in the way of more frequent, more comfortable and faster services, this calling for power.

A multi-car unit showing the power car and two trailers. Typical of the practical application of railcars in modern railway operations

A number of types of gear boxes are available, the most popular being of the four speed epicyclic type arranged for either air or electric operation both types being remotely controlled and arranged for use in multiple operation. Regarding power units, generally speaking a power of about 200 HP per car has been found the most practical and useful and here a single rail engine of the under floor type or two road type underfloor engines offer a solution. The available road type engines have the advantage of lower price due to the method of mass production and these engines are usually rated at 125 HP for road service. It is however unwise to utilise this rating for most railway conditions and a maximum rating and setting of 100 to 105 HP will result in better service.

Railway requirements differ greatly from the road but as more and more railcars are used engine developments will no doubt keep pace and the special features required incorporated, these mainly being ample air supply for brakes and control equipment and larger electrical equipment. Several prominent English engine builders have now available horizontal engines developed for railcar service.

The above remarks apply in the main to the double bogie type car. An extremely useful and paying acquisition for the railway's outlying branch lines is the small-wheeled railbus usually of the 2 axle type. These are extremely economical to run and can compete with road bus services. Typical of this type are those shown in illustrations published elsewhere in this article. Some of these have been in service over 18 years, running in Bolivia at an altitude of 14,000 ft. above sea level and coping with increasing traffic requirements.

With this type of car the road transport under floor engine (suitably derated) provides an ideal power unit with sufficient power to haul the light weight trailer when required. This type of car can be arranged for multiple control but this adds to the cost and it is possible to couple cars together each with its own driver.

Finally a word regarding servicing and maintenance. Putting in service the odd rail car and leaving it to the local loco. running shed and shops to service and maintain is asking for trouble. This is not to disparage the steam loco. man in any way as probably the quickest way to stop a locomotive working would be to put it in the hand of the diesel trained mechanic.

Special running sheds and maintenance shops should be provided or adapted from existing buildings together with specially trained staff, and these can usually be found by taking the younger and brighter members of the upcoming generation and giving them special training. In addition the manufacturers of the vehicles are usually only too glad to receive at their works for special training members of the railway staff.

If this factor is given the attention that is necessary there is no doubt whatever that the introduction of diesel cars will result in better service and economy in running.

YOUR MAGAZINE

The Southern Railways Magazine offers you a variety of topics—short stories, pictures, historical, humorous articles, news, technical railway engineering in its various aspects every month. It only costs Rs. 3 per year. For Railway personnel Post-Free. Fill this in and become a subscriber to-day itself.

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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.

Printed and Published by Sri T. S. S. Rao, Public Relations Officer at S. R. Press for the "Southern Railways Magazine", Manojiappa Street, Fort, Tanjore.
Managing Editor: T. S. Krishna Rao.

CONTENTS

Editorial Notice

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

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

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

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

New Medical Uses of Radio-active Isotopes

BY PROF. J. ROTBLAT

Professor of Physics at St. Bartholomew's Hospital School, London

It was announced recently that radio-active isotopes, produced under Britain's atoms-for-peace plan, are being used in 41 oversea countries, including India.

In the article below, Professor Rotblat discusses the important role of radio-active isotopes as an aid to medicine and surgery. The potentialities of these isotopes as a cheap and portable source of X-rays, says the author, are very great indeed. Every doctor, even in the smallest village, would be able to own an X-ray equipment, needing no supply of electricity and with no maintenance problems.

AN interesting new use for radio-active isotopes has been developed by Professor W. V. Mayneord and his team at the Royal Cancer Hospital, London. Some of the radio-active isotopes of chemical elements being produced in Britain's nuclear energy reactors emit radiations which are very similar to the X-rays commonly used in medical radiography for taking X-ray pictures of various parts of the body. It is now possible to produce high concentrations of these isotopes by putting ordinary substances into an atomic pile and leaving them there for some time.

Such an X-ray source can be of very small dimensions, about the size of a grain if rice, and even with the shielding necessary to make it safe to handle it can be small enough to be carried in a waistcoat pocket. The possibilities arising from such portable and cheap X-ray sources are very great indeed. Every doctor, even in the smallest village, would be able to own an X-ray equipment, needed no supply of electricity and with no maintenance problems; he would be able to carry it with him to patients or to any place of accident.

RADIATION THERAPY

Another great advantage of these miniature sources is that they make it possible to take unusual X-ray pictures, to obtain views which are otherwise impossible to get. If, for example, an X-ray photograph of the jaws and teeth is wanted the source can be put into the mouth and the photographic film outside the face. In this way a photograph of all the teeth can be obtained at once instead of in several exposures as has to be done now. In a similar fashion the source can be introduced into other cavities and so give the doctor a clearer picture of the organs in the body. One can foresee that in course of time all X-ray tubes will be replaced by the much cheaper and simpler-to-handle radio-active isotopes.

In therapy, too, radio-active isotopes are gradually replacing X-ray tubes. In this case use is made of the destructive action of the radiations sent out by the radio-active isotopes to kill malignant cells. Several large therapy units, in which radio-active cobalt or caesium are employed instead of X-ray tubes, are already in existence in Britain.

The main problem in radiation therapy is to be able to discriminate between healthy and diseased tissue and the ideal is to destroy only the latter while affecting very little the former. In a few isolated cases this became

Examining a patient in a United Kingdom hospital by eans of radio-active isotopes produced at Britain's Atomic nergy Research Establishment at Harwell in the English unty of Berkshire. A highly directional Geiger counter held y a nurse is used to follow the distribution of radio-active dine in different parts of the thyroid gland.

ossible with radio-active isotopes used internally. 'hus, radio-active iodine concentrates in thyroid tissue, nd in cases of cancer of the thyroid gland, even when has reached the stage when secondary growths have appeared in various organs, it is possible to destroy the malignant tissue wherever it is merely by giving the patient a drink of water containing radio-active iodine.

FOR TREATING LUNG CANCER

In other kinds of cancer, however, such natural concentration of the radio-active isotope has proved impossible, and special means have to be taken to localize the therapeutic agent in the diseased organ. An important contribution, which opens the possibility of treating cancer of the lung, has recently been made by a group of medical scientists working at the University College Hospital, London, under Dr. E. E. Pochin. They employed radio-active material in the form of a colloidal suspension of particles of such size that when injected into the blood-stream the particles are carried by it until they reach the capillaries of the lungs where they get stuck.

Colloidal gold is precipitated on to sugar charcoal particles about 30 to 40 microns in diameter, and put into the atomic pile where a radio-active isotope of gold is produced. The particles are then suspended in a dextran solution, which is injected into the patient. It is possible to deposit the radio-active particular region of the lung. This method of treatment has so for been tried out in a few cases only and more research is needed before it finds general application.

Apart from these applications in which large quantities of radio-active isotopes are used, there are many other problems in which minute amounts of isotopes are used as tracers, particularly in the study of the working of various organs in the body. Such tests are used as aids in medicine and surgery.

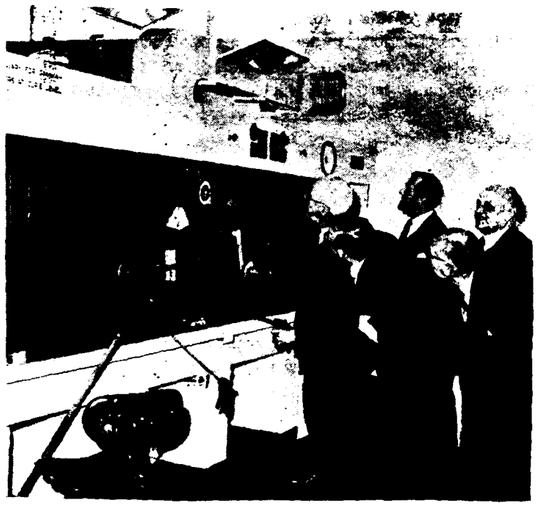
An interesting application to skin grafting has been made in the Plastic Surgery Centre at Salisbury, in Southern England. In many cases of burns, or other skin damage, it is necessary to apply a number of grafts over a period of weeks. If skin grafts could be successfully stored, then one surgical operation might be sufficient for all subsequent grafts, but the difficulty has been to find out whether skin stored for a certain time is still viable. This was solved very simply by incubating sections of the skin in radio-active phosphorus and measuring the activity taken up by the section.

AID TO DIAGNOSIS

Dead skin does not take up phosphorus, while skin which is still functioning does. In this way the best methods of storage of skin grafts could be found. This

is only one example of the uses of radio-active phosphorous in plastic surgery which have already greatly contributed to shortening the time, and to the successful outcome, of such operations.

For other tests the radio-active isotope is often synthesized into organic compound which are natural constituents of the body. Radio-active iodine, for example, can be incorporated into the plasma proteins, and when such plasma is injected into a blood vessel of the patient,



Britain continues to lead the world in producing radio-active material for peaceful international use. To cope with the growing demand from home and abroad for these valuable materials, so important in medicine, science and industry, a number of new buildings have been added to the British Radio-chemical Centre at Amersham, near London. Here Sir Henry Dale, O.M., F.R.S., is seen sealing a bottle by remote control containing radio-active phosphorous when he opened the extensions to the Centre. The bottle was later flown to Brussels where its contents was used to treat a patient suffering from a blood disease. In the picture are left to right: Sir Henry Dale, Sir John Cockcroft, Sir Charles Harington, Sir Ernest Rock Carling and Major G. Boyce.

it mixes perfectly with the blood; by following the activity one can then find out what is going on in the circulatory system. Several London hospitals are using this method as an aid in diagnosis of various diseases of the heart and blood circulation. In particular, it is used to measure the cardiac output, the amount of blood which the heart pumps every minute, a quantity of extreme importance in the assessment of circulatory disorders.

These are but a few examples of the recent advances in the applications of radio-active isotopes to medicine, but they may serve as an illustration of the great scope and versatility of this new method of using nuclear energy for the benefit of man.

INDIA TAKES 44 CONSIGNMENTS IN ONE YEAR

Britain's world lead in the peaceful uses of atomic energy is increasing steadily. Radio-active isotopes pro duced under her atoms-for-peace plan are now speedin intricate processes and cutting costs in factories an laboratories in 41 countries, including India. This wa revealed by Dr. Henry Seligman, Director of the Isotope Division at the Atomic Energy Research Establishmen at Harwell, opening a special exhibition in Birmingham

The exhibition demonstrates the most up-to-dat applications of isotopes in research and industry, an Dr. Seligman said that Britain was competing success fully in world markets with these valuable atomi products. In terms of volume and cost, British export of these materials were greater than those of all othe countries put together.

Production of radio-active isotopes in Britain ha doubled in the past two years. A spokesman of th Atomic Energy Authority disclosed in London recentl that year's total amounted to about 20,000 shipments and at the Birmingham exhibition Dr. Seligman sai that the U. K. last year exported 6,000 consignments Detailed figures for 1954 have not yet been released. But between October 1953 and September last year, Britain's production of isotopes totalled well over 15,000 shipments—of which exports amounted to over 5,000 shipments.

*** *** ***

France was the largest importer during that period, with more than 1,100 consignments. Of the Commonwealth countries, India took 44 shipments, Pakistan one, Ceylon two, Australia 96, Canada (herself a large producer of isotopes) 26, the Gold Coast three, Mauritius three, New Zealand 100, South Africa 152, Southern Rhodesia one, Zanzibar one. The U. S. A. took 35 consignments of these important materials.

MEDICAL USES EXTENDED

Of consignments released for use in the U. K. last year, it is estimated that about half were taken by hospitals and medical research centres. Parallel with the increasing commercial exploitation of isotopes, there medical uses are being extended, especially in the treatment of some types of cancer.

In the industrial field, as Dr. Seligman remarked, "isotopes are becoming an integral part of new developments in production and research. They can be said to represent the most important single discovery since the invention of the microscope".

The Birmingham exhibition shows a wide range of the dustrial applications of radio-active isotopes. It displays instruments for radiographic examination to check the quality of castings, welds and forgings; gauges for detecting leakages in liquid systems, for thickness measurement on continuous production of sheet material; methods for ascertaining the wear of moving parts and bearings, for measuring filter efficiency, tracing mud movement in estuaries, and for following the work of machinery out of sight underground.

An isotope held in a spigot about one inch in length and housed in its permanent home—a protective lead case with a shutter for filming the product—is capable of replacing a costly 1,000,000-volt X-ray plant.

James Whitcomb Riley was an itinerant roadside sign painter. Frequently he travelled with a patent-medicine agent in a horsedrawn buggy. One day they came to a smoothfaced rock where an Evangelist had painted WHAT SHALL I DO TO BE SAVED?

Riley crawled up the rock and painted underneath: "TAKE BARLOW'S STOMACH BITTERS".

Returning to the spot two weeks later Riley noticed that the Evangelist had added a new line: "AND BE PREPARED TO MEET THY GOD".

The technique of White-Metalling Carriage & Wagon Bearings

By A. C. Bhattacharya, A.M.I. Prod. (E).

THE adage " For want of a nail the wheel comes of " may be old but is still perfectly true and is equally applicable in case of Railway Rolling Stock when for want of a correctly lined bearing very many of them have had to be taken off the active movement list or a complete train suffered detention on account of bearing troubles.

The bearings of Carriages and Wagons are very important parts as upon their form and treatment the well-being of the stock, the tractive force required to propel a train, and the comfort of the passengers, greatly depend.

The efficiency of the bearings not only depends on the correct chemical composition of the bearing metal but also on its accurate crystal structure. When correctly produced, the chief characteristics present in a metal are :-

(i) Lowest possible co-efficient of friction with the maximum degree of durability, and

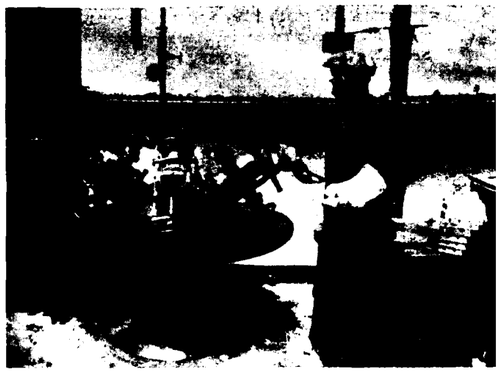
(ii) Sufficiently malleable to adopt itself to the bearing pressure and permitting the same to adjust itself readily to any irregularity in the distribution of load, so that the vehicle can take its own bearing on the journey.

A bearing being tinned in the tinning bath.

BEARING METALS

The bearing metal or the white antifriction metal as it is generally called is an alloy of Lead, Tin, Antimony and Copper or Tin, Antimony and Copper according as it is a Lead Base or Tin Base Alloy.

The Lead Base alloy which is used in our country for Carriage and Wagon bearings consists mainly of three ingredients, Lead in predominance with a comparatively small percentages of Tin and Antimony and sometimes Copper and the standard mixture comforming to Indian Railways Standard Practice consists of :- Tin 4.5 to



The white metalling jig (which illustrates that four bearings can be poured at the same time)

5.5%, Antimony 14 to 16%, Copper 0.75 to 1.25% and Lead the remainder. Although the Lead Base alloy is cheaper than Tin Base Alloy and is employed in Carriage and Wagon bearings because of the stresses and strain in them being considerably less than those in Locomotive bearings, it however requires more careful temperature control because the Tin-Antimony crystals which give a bearing metal its hardness, have less buoyancy in a Tin-base alloy and therefore tend to segregate less than in a Lead-base alloy, though the presence of Copper in sufficient proportion to form Copper-Antimony crystals in the Lead-base alloy counteracts this tendency to some extent.

The essential features of a good bearing are :-

(i) The white metal must wet the brass and stick to it in perfect metallic union.

(ii) The ingredients should be mixed in correct proportions and evenly distributed.

(iii) Correctness of the physical structure of the hard crystal is maintained throughout the melting and pouring operation.

For this reason, it is of great importance that the correct methods are employed when lining bearings with white metal to avoid future troubles and from what the writer has seen, the procedure described hereafter has been found satisfactory and may be adopted with advantage.

For keeping the mixture uniform and in order to avoid the more fluid portion of the alloy alone passing into the bearing leaving behind the hard Tin-Antimony and Copper-Tin Crystals in the ladle or pot, it is essential to keep the temperature of the metal while melting above the melting point of the principal ingredient and stir it gently. On the other hand overheating must be avoided as it will tend to impair the crystal structure of the metal in the following ways :-

1. Formation of oxides of Tin and Antimony. Overheating accelerates the separation of these two metals which as they rise to the surface become exposed to the action of atmosphere and having a greater affinity for oxygen, readily form into oxides.

2. Reduction in Tin-Antimony content.

LAYOUT OF THE PLANT

When dealing with large quantities of bearings in flow production the layout is as follows :-

One pot for running out of old metal at 500° - 550° C.

An electrically heated degreaser for cleaning the greasy bearing shell.

A muffle furnace for preheating bearing shells at 200 - 250 C.

Second pot for tinning at 300 C.

Third pot to contain the lining metal at 360 - 400 C.

PROCESS

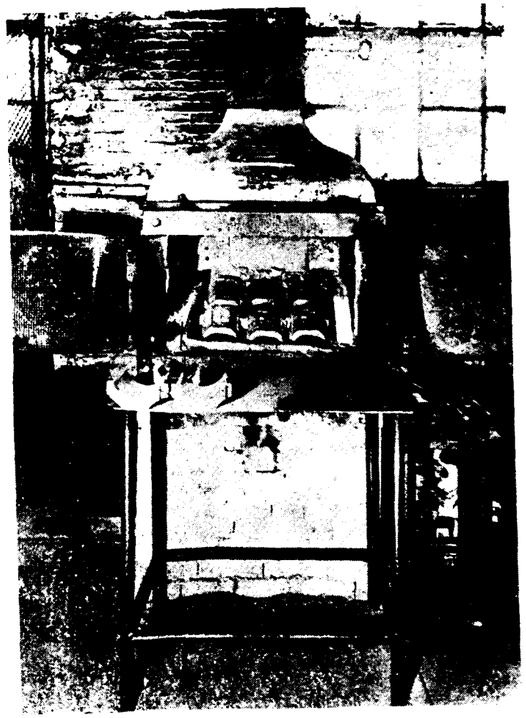
The work of lining the old bearings is done in the following sequence of operation.

1. *Demetalling* :- The old bearings are demetalled at a temperature of about 500 C to get rid of the last traces of old white metal. The time required is approximately 8-10 minutes.

2. *Cleaning of bearings* :- It is essential that the bearing shell should be cleaned and made free from all dirt and grease before tinning to ensure proper adhesion of the white metal lining. Lack of adhesion between lining and shell subjects the lining to excessive stress and, by failing to conduct away the heat generated by friction, may give rise to excessive temperature with resultant distortion and cracking of white metal under working conditions.

The cleaning is done by means of pneumatic wire brush and by granding which take approximately 5 minutes per shell. If the shell is found to be greasy, it is taken on to degreaser and kept immersed in caustic Soda bath (15% solution) for approximately 30 minutes at a temperature of 100°C.

The shell is then washed thoroughly in running water for half hour or so and the water is allowed to drain off for another 30 minutes. The shell is thereafter tested



Pre-heating oven.

for any crack by suspending it in the air and striking the same with a hammer. A good shell gives a clear ring.

3. *Preheating* :– The shell is then preheated within a range of 200° to 250°C in the muffle furnace, care being taken to see that the temperature does not exceed 300°C as otherwise the surface of the shell will be oxidised so as to interfere with subsequent white-metalling. It is sometimes advisable to cover the surface which has to be tinned with liquid flux before preheating to cut down oxidation.

4. *Fluxing* :– Liquid flux which is prepared by adding 2½ lbs. of zinc to 1 gallon of commercial Hydrochloric acid is then applied by means of hand brush to the surface to be tinned. The sides and back are blanked off by using a white wash and black lead mixture to prevent them from tinning. Time taken is generally about 5 minutes for the complete operation.

5. *Tinning* :– A satisfactory method of tinning a shell is to immerse the fluxed bearing surface for 5 to 10 minutes in a molten tinning bath containing pure tin for relining with a Tin-base alloy and an alloy of 50% tin and 50% lead for relining with a lead-base alloy and kept at a temperature of 280° – 300°C. A lower tinning temperature gives a non-uniform streaky appearance and at higher temperatures, tin gets oxidised giving yellow stains resulting in poor adhesion. Every care is taken to ensure that surface to be lined is tinned uniformly all over and to do the same the tinned surface is re-fluxed followed by wire brushing and again dipped in the tin bath. The process is repeated at least 3–4 times and until the best tin coating is obtained. After tinning all traces of flux are removed by wiping with cotton waste. A bristle brush may also be suitable specially where there is danger of fluff in the cotton waste adhering to the surface of the shell. It much depends whether the shell is smoothly machined in the bore or not. Immediately after tinning and as quickly as possible the shell is white metalled so that pouring of white metal may be done before the tinning has solidified.

It is desirable to cover the tinning bath with a layer of zinc chloride flux to prevent dressing.

A general view of the layout in a white metalling shop.

6. *Metalling* :– For metalling the shell is secured in suitable jigs. The mandrel is heated to a temperature of about 120° – 150°C so that it may be hot enough to check premature freezing and cool enough to give a slight chill to the white metal surface, the object being to allow formation of beta (Sn - Sb) crystals in a matrix of tin-lead-antimony eutectic.

However, care has to be taken that the lining solidifies from the shell towards the mandrel and therefore the shell is cooled by spraying with water. This ensures a strong bond between the lining and the shell.

Sufficient well distributed beta crystals (to carry the load) are essential together with a relatively plastic component so that the bearing may conform to the journal rather than vice-versa. If the white metal cools very fast, the formation of essential beta crystals will be arrested and the alloy will lose its antifriction properties.

Since lead base white metal is not so fool-proof from a casting point of view as are the tin base alloys, the metal having a marked tendency to form shrinkage contractions just below the pouring gate, a relatively large pouring gate (about 2 Sq. inch) is provided so as to give a "Head" of at least 2 Cu. inches of metal to feed the contracting mass.

The white metal is then poured from the third pot, kept at a temperature of 360° – 400°C and covered with charcoal dust to prevent oxide getting into the bearing, in a steady stream without splashing and puddled with clean iron wire so as to release entrapped air.

The following points are to be carefully noted while pouring metal into the bearing.

(i) To prevent blow holes the metal should be poured with the mouth of the ladle close to the top of the shell and every attention should be paid to see the mandrel or surface to be lined is free from water, oil or flux.

(ii) The pouring should be at one point only, preferably in mid-position, slowly at first to release air entrapped at the bottom of the bearing.

(iii) White-metalling of each bearing should be done by one pour; therefore the ladle should be sufficiently large to take adequate white metal required for one bearing.

(iv) The method of vertical pouring should be adopted in preference to horizontal pouring as in that case the dross, gases, etc., if any in the metal will rise to the top and escape.

(v) The whole process of tinning and pouring should be carried out uninterruptedly and as quickly as possible.

After pouring each bearing, the mandrel should be swabbed with a rag moistened with clay wash. This will leave a thin layer of fine clay dust on the mandrel surface, which in turn will assist in producing smooth bearings free from blow holes and other surface defects. As it is important to keep the shell and mandrel within the correct temperature it may be necessary after each pour to cool the mandrel by dipping it in clay wash. However, the mandrel should never be damp when the bearing metal is being poured.

7. *Testing* :– When the bearing has finally cooled down it is taken off and suspended in the air and struck with a hammer for a clear ring to test proper adhesion of white metal.

For new shells the production line is entered from item 2 and is proceeded with as described thereafter.

The process described in the foregoing paras has given satisfactory results and though apparently the subject looks like too simple to deserve any careful attention, the importance of adopting correct method cannot be over-emphasized due to its having a direct influence on bearing efficiency.

Acknowledgments: The author acknowledges his indebtedness to the Eyre Smelting Co., Ltd. and to Heatly & Gresham Ltd. for supplying the photographs for re-production along with this article.

Brush Bagnall Diesel Electric Locomotives

GENERAL DESCRIPTION

THE locomotive is of the type designated AIA—AIA, the superstructure being mounted on two bogies, each bogie having three axles of which the two outer axles are motored whilst the centre axle is for carrying purposes only.

The locomotive superstructure has a driving cab at each end mounted behind a short, streamlined, nose end compartment. The power unit with its auxiliary equipment and control gear is mounted in the main body of locomotive. A partition separates the engine from the generator and control equipment, and unobstructed walk-ways are provided on both sides of the power unit.

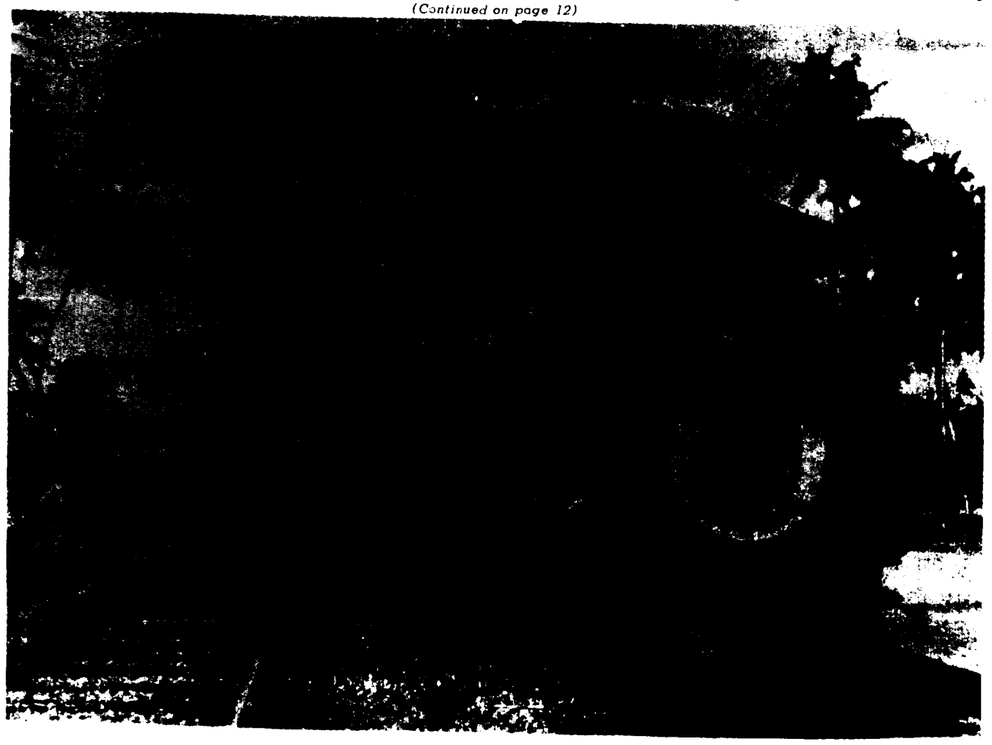
Both driving cabs are fitted with a driver's position and controls on the left-hand side of the cab with an assistant driver's position on the right-hand side of the cab. All instruments essential to the driver are mounted on a panel in front of the driver and his assistant. Unobstructed vision for both men is provided by large driving windows, fitted with pneumatically operated windscreen wipers. A powerful headlamp is fitted into the nose at each end of the locomotive.

Immediately behind No. I cab is the main radiator ducting carrying the radiator fan motor and runner. Air is drawn through the radiator panels, which are mounted vertically on either side of the locomotive, and after passing through the twin branches of the ducting is ejected upwards through a grille in the roof.

Access to the main body of the locomotive is provided by doors in the cab bulkheads. At No. 1 end, the centre walk-way through the radiator ducting branches on either side of the diesel engine; the generous loading gauge of the Ceylon Railways allowing sufficient space between engine and locomotive sides for the withdrawal of the engine pistons and connecting rods from the sides of the crankcase.

Doors are provided in the partition separating the engine and generator compartments and the walk-ways

(Continued on page 12)



TIME TABLES IN HINDI

All Zonal Railways now publish Railway time tables in Hindi simultaneously with English, while the first all-India Railway time table in Hindi was published on October 1, 1954. A periodical scrutiny of these time tables is undertaken in the Railway Board's Hindi Section in order to bring about uniformity in language.

The Board's Hindi Section has been strengthened and staff under the Railway Board has been advised to acquire knowledge of Hindi before the expiry of the 15-year period laid down in the Constitution. The question of providing facilities for learning Hindi to Railway staff posted at outstations is also under the Railway Board's consideration.

The Railway Minister's budget speech last February, the budget statement, the explanatory memorandum and the pamphlet, "Towards Better Conditions of Travel" were published simultaneously in English and in Hindi. It is intended to bring out the Hindi version of most of the important budget documents with effect from 1956-57.

Under instruction from the Railway Minister, replies to Parliament questions which are originally tabled in Hindi are now being furnished in that language, in addition to the usual reply in English.

CONCESSIONAL RETURN TICKETS TO HILL STATIONS

During the period April, 1955 to October 31, 1955, I, II and III Class concessional return tickets at one and half single journey fares for the rail portion plus two single journey fares for the road portion wherever leviable will be issued from all stations on the Central Railway to Pathankot (For Kashmir), Simla, Solan, Dharampore (Punjab) Dehra Dun, Kathgodam (For Naini Tal), Darjeeling, Kurseong, Shillong, Abu Road (For Mount Abu), Ootacamund, Coonoor, Kodaikanal Road, Kodaikanal Out-Agency, Kotagiri Out-Agency and Pipariya (For Pachmarhi) stations provided the chargeable distance between the stations is 150 miles or more. Children over 3 years and under 12 years of age will be charged half of the adult fare. Tickets will be available for completion of the return journey for a period of three months from the date of commencement of the outward journey. No break of journey on the outward trip is permissible.

continue on either side of the main and auxiliary generators, exhausters, compressor and control equipment cubicle. Doors in No. 2 cab bulkhead give access into No. 2 driving cab.

The nose and compartments in front of each driving cab contain a traction motor blower, electrically driven, which supplies filtered air to the two traction motors in the bogie beneath. Access to the nose compartment is by removable panels inside the cab and by hinged louvre panels on the outside of the locomotive nose.

All auxiliaries are electrically driven with the exception of the engine cooling water circulating pump, which is belt driven from the free end of the crankshaft, and the engine lubricating oil pumps, which are gear driven from the crankshaft. Power for the auxiliary machines is taken from the auxiliary generator, which is mounted on an extension of the main generator shaft.

The main fuel tank and batteries are slung beneath the locomotive between the bogies. A separate fuel service tank is mounted in the roof of the locomotive.

Due to the bad weather conditions encountered in Ceylon, which include tropical rain and heavily corrosive salt atmosphere, special care has been taken to make all ventilating and air inlet louvres water-proof and anti-corrosive materials have been used throughout the construction of the locomotive.

DIESEL ENGINE

The locomotive is powered by a Mirrlee, Bickerton and Day, Vee-type 12 cylinder, turbo-charged four-stoke oil engine, with a rating of 1,254 B. H. P. at 850 r. p. m. under normal temperature and altitude conditions.

Under site conditions in Ceylon, the engine develops 1,000 H. P. at 850 r. p. m.

The bedplate is of welded construction, andc arries the crankshaft bearings. The cylinder housing and upper part of the crankcase are also of fabricated construction and the complete crankcase assembly is solidly bolted to the bedplate. The cylinders themselves are of the "wet" type.

The crankshaft is of solid forged steel and is supported by main bearings of steel, white metal lined. The pistons are of light alloy fitted with compression and scraper rings. The piston pins are of the floating type. The connecting rods are of steel "H" section and carry marine type large end bearings consisting of steel-backed white metal shells.

The twin camshafts are mounted in the cylinder housing and are driven by spur gears from the flywheel end of the crankshaft. They are located on the outer sides of the two banks of cylinders, and operate the valve and fuel pumps through roller ended push rods and tappets.

The engine is force-lubricated from gear type lubricating oil pumps, and a shutdown device is incorporated which automatically stops the engine when the oil pressure falls below a certain point, or when the engine speed exceeds a certain limit.

The engine cooling water is circulated by a water pump, belt-driven from the forward end of the crankshaft.

The engine and generator, which are bolted together to form a single unit, are mounted on three pedestals carrying Silentbloc bushes, thus eliminating any possible distortion of the locomotive underframe being transmitted to the diesel engine.

ENGINE AUXILIARIES

The engine is started by motoring the main generator from starting batteries slung beneath the underframe. Starting connections cannot be made until sufficient oil pressure has been built up in the diesel engine by an electrically driven priming pump.

Fuel oil is delivered to the engine fuel rail under pressure by an electrically driven fuel transfer pump. In the event of failure of this pump, fuel is supplied from a service tank under gravity feed. A semi-rotary fuel transfer pump is provided for filling the service tank from the main fuel tank.

Suitable radiators are supplied for the diesel engine oil and water cooling circuits.

The radiator fan which draws air through the radiators and expels it through the roof, is driven by an electric motor fed from the auxiliary generator.

ELECTRICAL EQUIPMENT

The main generator is directly coupled to the diesel engine and provides power to the four traction motors, which are axle hung on the outer axles of the two bogies. The motors may be connected in series-parallel, full-parallel or arranged so that an initial connection in series-parallel is re-grouped automatically to full-parallel.

Control of the locomotive is effected by varying the excitation of the main generator and the speed of the diesel engine. Current for the field excitation of the main generator, auxiliary machines, battery charging and operation of the control equipment is supplied from the auxiliary generator which is overhung from the main generator.

The main control cubicle is mounted in the generator compartment and is provided with doors giving full access to all equipment mounted in the cubicle. The cubicle is dust-proof, and special care has been given to the design of the control equipment to make it suitable for the arduous conditions of railway working.

The locomotives are arranged for multiple unit operation by which means two locomotives are coupled electrically as well as mechanically and operated together by a driver in the leading locomotive.

A single handle on the Master Controller enables the driver to select Engine Starting, Forward and Reverse positions and all running notches.

Lead acid batteries of 192 ampere-hour capacity are provided for starting the main power unit and for supplying the necessary auxiliary power when the diesel engine is not running.

The driving axles are fitted with tubes for the axle suspension of the traction motors, the nose of each traction motor being suspended by a flexible link frc the centre transom.

The traction motors are fitted with roller bearings for both the armature and suspension bearings. The drive from the motors to the axles is taken through single reduction gearing; a pinion on the armature shaft meshing with a resilient gear wheel on the road axle.

BRAKE EQUIPMENT

The locomotive is fitted with twin Westinghouse reciprocating exhausters, electrically driven, to provide vaccum for the train brakes. The locomotive itself is braked by compressed air brakes, four brake cylinders being fitted to each bogie and operating clasp brakes on all wheels. A Westinghouse compressor provides compressed air for the locomotive brakes, and also for the control and other auxiliary equipment.

The driver's brake controls consist of a vacuum brake valve which operates the train brakes and automatically operates the locomotive brakes through a proportional valve. This valve ensures that the locomotive air braking is applied in direct proportion to the vacuum braking on the train. A separate brake valve is supplied which gives independent braking on the locomotive when required.

SURVEY FOR TWO NEW LINES IN BOMBAY STATE

The Railway Board has sanctioned a traffic survey to be carried out by the Western Railway Administration for Metre Gauge lines between Bhaili and Bhadran and Sojitra and Dholka, ex-Baroda State territory.

Work on the construction of the Bhaili-Bhadran and Sojitra-Dholka projects was started in 1949 as a famine relief measure. After the merger of the Baroda State Railway with the ex-B. B. & C. I. Railway, further construction work was stopped in October, 1949, due to the then prevailing financial position.

The Railway Board has now decided to have the traffic prospects of these projects re-examined with a view to arriving at a final decision in regard to the construction of these lines.

NEW 44-MILE RAIL LINE TO BE CONSTRUCTED—ALTERNATIVE ROUTE BETWEEN KANDLA AND DELHI

The Railway Board has sanctioned the construction of a new 44-mile Metre Gauge Railway line from Bhiladi to Raniwara, on the Western Railway. When completed the new line would connect the Kandla-Deesa line with Raniwara and join the Metre Gauge system in Jodhpur with the Metre Gauge systems in Saurashtra and Kutch. It will also provide an alternative main line connection between Kandla and Delhi as well as other important points on the Metre Gauge system. The new route will provide a shorter connection between Kandla Port and a large portion of its hinterland in Rajasthan, Pepsu and Punjab.

The Bhiladi-Raniwara link will reduce the pressure on the line between Palanpur and Marwar Junction, and the Railways will be able to better handle and carry the large volume of traffic expected to develop at Kandla Port for carriage to and from the hinterland.

INAUGURATION OF THE CONSTRUCTION OF THE INDORE-UJJAIN BROAD GAUGE LINE

Shri Lal Bahadur Shastri, Minister for Railways and Transport, inaugurated the construction of Indore-Ujjain Broad Gauge line at Ujjain on 26 March, 1955.

(Continued on page 15)

A hand brake for the locomotive is also provided in each driving cab.

CONSTRUCTIONAL DETAILS

Underframe

The underframe is constructed of four main rolled steel "I" sections, which are reduced in depth over the bogies by means of flame cutting and welding along the neutral axis, in order to provide clearance for the bogies between underframe and rail head.

The two outer main members terminate at the bogie centre cross members, to which they are welded, but the inner main longitudinals continue and are welded integral with the fabricated drag box.

Cross members, which are riveted to the main longitudinals at various points along the underframe, carry channel section sole-bars and an unbroken deck of steel plate covers the underframe skeleton.

SUPERSTRUCTURE

The superstructure is constructed in sections comprising the two cab ends, two sides, and three roof sections.

All the superstructure is constructed of 14 gauge steel sheet welded to frameworks of angle and top hat section.

Entrance doors to the locomotive are provided on each side of both driving cabs. Top hatches in the roof section permit easy access to the cylinder heads of the diesel engine, and the roof itself is easily removable for major overhauls or complete removal of the power unit.

Port-hole type windows are provided in the sides of the engine and generator compartments, and full drop windows are provided in the cab doors and side windows.

BOGIES

The bogies are constructed from box type side frames of welded construction joined by a heavy fabricated steel centre transom, and by two channel members as headstocks.

The weight of the locomotive is carried on the centre bolsters of the bogies. Each bolster rests on eight nests of coil springs carried on two spring planks, one on each side of the centre carrier axle of each bogie. The spring planks in turn are suspended by swing links from the bogie side frames.

The leaf springs for the axles are carried internally in the hollow side frames, suitable openings being provided for inspection and withdrawal, whilst the coil springs are situated below the bogie frames.

Roller bearing axle boxes are fitted in manganese steel horn guides, which are replaceable.

Electro-pneumatic sanding gear, operated from a foot pedal in the driving cabs, is provided for the outer axles of each bogie.

LOCOMOTIVE DETAILS

Locomotive Weight	87 tons
Track Gauge	5′ 6″
Maximum Height	13′ 3½″
Maximum Width	10′ 3⅞″
Length over Buffers	50′ 9″
Bogie Wheel Base	10′ 6″
Bogie Centres	27′ 0″
Minimum Curve Negotiable	5 chains
Clearance from Gearcase to Rail Head	4½″
Capacity of Fuel Tank—main	775 gallons
—service	75 gallons
Wheel diameter—motored	3′ 7″
—carrier	3′ 0″

LOCOMOTIVE PERFORMANCE

Maximum speed	55 m.p.h.
Starting Tractive Effort (26% Adhesion)	33,700 lbs.
Tractive Effort (1 hour rating)	30,000 lbs. at 9.2 m.p.h.
Tractive Effort (continuous)	24,600 lbs. at 11.7 m.p.h.
Estimated Range with Full Fuel Tanks	750 miles

(*Continued from page 13*)

The proposed 50-mile Broad Gauge line will provide a direct connection to Indore, an important trade and commercial centre in Madhya Bharat. This new line will also assist in developing the fertile areas roundabout Indore, Dewas and Ujjain.

The line will cost about Rs. 3 crores and take 2 years for completion. There will be 10 stations on the new line.

Shri Lal Bahadur Shastri, speaking on the occasion, stated that in the Second Five-Year Plan, the Government will undertake construction of about 5000 miles of new Railway line. For this purpose, vast quantities of steel and a large number of trained men would be required. He assured that all efforts would be made to get material and trained men.

Shri Lal Bahadur Shastri hoped that with the construction of this new line, some of the districts of Madhya Bharat which did not have rail transport till now, would get a chance to develop with the assistance of rail facilities.

Shri Mishrilal Gangwal, Chief Minister of Madhya Bharat, speaking on the occasion, referred to the increased demand of industry for quick transport in Madhya Bharat and stated that the new line on completion would meet this demand and fulfil a long cherished dream of people of Madhya Bharat.

9TH MEETING OF BOMBAY DIVISIONAL RAILWAY USERS' CONSULTATIVE COMMITTEE

The 9th Meeting of the Bombay Divisional Railway Users' Consultative Committee was held on 15th March, 1955 at Sholapur and was presided over by the Divisional Transportation Superintendent, Bombay.

Amongst other subjects, the question of introduction of a through III class coach between Sholapur and Manmad was discussed. It was agreed that for the convenience of passengers, a compartment of suitable size would be reserved on 401 Down for passengers arriving Dhond by 102 Up train and travelling beyond that station by 401 Down. The statements showing distribution of Watermen for the hot weather; the progress of passenger amenity works carried out upto end of January, the number of passengers travelling without tickets for the quarter ended 31st December, 1954 and the reports on inspection of refreshment rooms and tea stalls at stations were noted to be satisfactory.

DIESEL ENGINE DETAILS

Maker	Mirrlees, Bickerton & Day
Type	JS12VT
Output at Sea level and normal temperature and Humidity conditions	1,254 H.P. at 850 r.p.m.
Developed continuous Power at Site	1,000 H.P. at 850 r.p.m.
Bore	9¾"
Stroke	10½"
Number of Cylinders	12
Superchargers	Two, Napier type TS200/1
Exhaust Temperature (Cylinder outlet full load)	750°F./850°F.
Lubricating oil pressure	30 lbs./sq. inch

ELECTRICAL EQUIPMENT DETAILS

Main Generator	Brush Electrical Engineering Co. Ltd.
Continuous Rating	850 r.p.m. 652 kW. 630 V. 1,035A.
	850 r.p.m. 652 kW. 750 V. 870A.
Auxiliary Generator	Brush Electrical Engineering Co. Ltd.
Continuous Rating	850 r.p.m. 35 kW., 110 V. 318A.
Traction Motors	Brush Electrical Engineering Co. Ltd.
Number per Locomotive	4
Continuous Rating	196 H.P. 315 V. 517.5A.
1 Hour Rating	225 H.P. 315 V. 610A.
Gear Ratio	82 : 16
Radiator Fan Motor	Brush Electrical Engineering Co. Ltd.
Continuous Rating	110V. 3.1 H.P./12.6 H.P.
	32/115A. 600/960 r.p.m.
Traction Motor Blower Motors	Brush Electrical Engineering Co. Ltd.
Continuous Rating	110 V. 5 H. P. 1980 r.p.m.
Exhauster Motors	Brush Electrical Engineering Co. Ltd.
Continuous Rating	110 V. 3/6.05 H.P. 29/55A.
	600/1,115 r.p.m.
Compressor Motor	Westinghouse Brake & Signal Co. Ltd.

AUXILIARY EQUIPMENT DETAILS

Compressor	Westinghouse Brake & Signal Co. Ltd.
Working Pressure	85/100 lbs./sq. inch
Exhausters	Westinghouse Brake & Signal Co. Ltd.
Type	4-cylinder reciprocating (4V 110)
Normal Speed	600 r.p.m.
"Release" speed	1,115 r.p.m.
Batteries	D.P. Battery Co. Ltd.
Number of Cells	48
Capacity	192 amp.-hours @ 5-hour rate
Traction Motor Blower	Sturtevant
Output	2,940 cu. ft. per min.
	2,170 r.p.m.
Radiators	Serck Radiators Limited
Axle Box Bearings	The Skefko Ball Bearing Co. Ltd

PORTABLE ELECTRIC TOOLS

By F. W. Hughes, M.A.S.E.E. ★

THE practice of 'bringing the tool to the job' has rapidly increased the usage of portable electric tools in industry. Moreover as such tools have been developed for industrial applications, they have also been applied by garages as well as in small workshops by the home craftsman. This article, therefore, offers advice in the selection and use of such tools not only to the industrial but also to the domestic user.

There are a number of factors that should be considered in determining the best model of portable electric tool for a specific job. Before purchasing a tool, it should be examined in regard to its weight, spindle speed, suitability of shape, safety features and ease of maintenance. A tool may be favoured because of its light-weight, yet it may not have a motor powerful enough for the job in hand, since tool weight and motor horsepower are generally roughly proportional. At the same time, it is slow and uneconomical to use a heavy tool when a light tool can do the job equally well.

The spindle speed of a protable tool is usually established to suit its application. If the speed is too h in relation to horsepower, the tool may stall in c...ion. But a tool of the same horsepower with a lower speed has more torque and is less apt to stall. For proper application to the job, it is considered by the present writer that the relationship should be such that the speed under load can drop off to between two-thirds and one-half of the no-load speed.

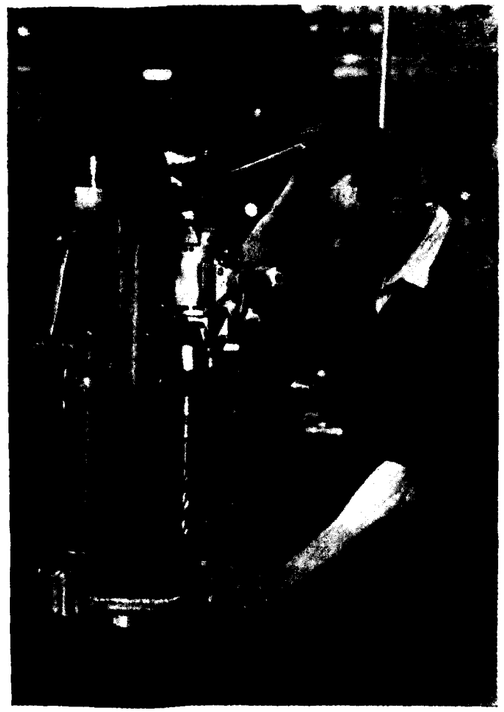
A large tool with a low speed will, of course, have ample torque to drive a small cutter, but at a rate that is too slow to give a satisfactory output. Thus, there are the two extreme conditions, firstly, a speed too high for a motor that is not strong enough, so that the tool stalls and, secondly, a motor strong enough but too slow, so that time is wasted.

Proper cutting speeds must also be considered in determining spindle speed. If spindle speed is excessive and the motor of the tool strong enough to sustain the speed under lead, the cutter will burn. A tool with a lower spindle speed and possibly a less powerful motor is indicated for this situation.

No-load spindle speeds recommended for various sizes of portable electric drills are indicated in Table I. The speeds given are for drilling mild steel. For soft materials, such as aluminium, these speeds can be practically doubled. For harder or tougher materials, such as stainless steel or Monel metal, these speeds should be about one-half of those given.

TYPE OF HANDLE

The smaller portable electric tools, such as drills and screwdriver generally have a pistol-grip-type handle.



It is better to use a tool that is powered to do a job easily than an undersized tool that might be overloaded.

This permits the tool to be held securely and comfortably with one hand. For medium-sized tools, where there is more over-hung weight, a closed end handle is

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better. An auxiliary side handle on low-speed high-torque models lets the operator use both hands to resist any tendency of the tool body to turn. On the larger drills and screwdrivers, side handles or pipe handles (usually located opposite the switch handle) are essential to give the operator good control over the tool.

Closed handles afford the best control for portable saws. For grinders and right angle sanders, straight end handles are preferred. The sanders preferably have an auxiliary side handle at the spindle end.

ELECTRIC CABLE

Every tool should have a suitable motor switch, conveniently located. This switch is generally of the instant-release type. On tools like drills, screwdrivers and tappers, the switch can have a pin for locking it in the 'on' position. But on tools with cutting blades, like saws, there should be no arrangement for locking the switch 'on' so as to product the operator. Still other tools, like grinders and sanders, are equipped with plunger or toggle switches. It is important that all switches be located and protected so as to avoid accidental operation.

Even if the tool is designed for light service, it should have a substantial cable of sufficient size to carry the full load current to the motor. Where an extension cable is needed, this should be substantial enough to carry the current without too much loss in line voltage. Lighting flex should *never* be used for electric tools.

In Table II are shown wire sizes for various ampere capacities and wire lengths for 220 volt tools. These figures actually represent the wire section necessary and this cross sectional area may be made up of the requisite number of wires of any smaller diameter. Data are based on a current equivalent to 150 per cent of the full load with a loss in voltage of not over 5 volts. For 115 volt tools, the wire size indicated for twice the cable length

Safety instructions should always be heeded. In the grinding operation illustrated there is a suitable guard over the wheel and the operator wears goggles.

required should be used. The words under the size represent the recommended insulation.

The motors of portable electric tools are normally designed to operate satisfactorily with a variation in their nominal voltage of up to 6 per cent. Any greater variation has a pronounced effect on the motor performance. A 10 per cent drop in voltage reduces the power of the motor about 20 per cent and the speed of the operation at full load falls off considerably.

The necessity for using the proper rating of cable is obvious. On the other hand, with an increase in voltage, motor speed increases as well, with the possibility that the motor will overheat if operated over an extended period.

EARTHING

All British electric tools to-day are supplied with a three-core cable. The third wire, having green-coloured insulation, is for earthing. One end of the earth wire is connected to the tool housing and the other end should be connected to a good earth contact, such as a water pipe, conduit or copper rod driven into the earth. Earthing is particularly important when tools are being used in a damp area or inside of a tank, or on metal structures that are themselves earthed. The earthing connection should always be made *before* the current supply connection is made.

Some wiring systems are supplied with three-pole earthed socket, in which case the cable can be equipped with a three-pole plug. The prong to which the earth wire is connected is longer than the two other prongs, so that an earth is automatically made before the current can flow through the power wires.

CARING FOR THE TOOL

With few exceptions, the gears in portable electric tools are grease lubricated. The lubricant will remain in the gearbox for quite a long time. When it becomes necessary to replace it, all the old grease should be removed and the box thoroughly cleaned. A grade of grease recommended by the manufacturer of the tools should be used. Care should be taken not to fill the gearbox more than one-half to two-thirds of its capacity.

Ball bearings in tools so equipped are usually permanently sealed. They should never be put in cleaning fluid, as this removes the grease, which cannot then be replenished. If the tool has sleeve bearings, they are usually self-lubricating. Other sleeve bearings can be oiled through a ball valve on the tool.

For production work, portable tools can frequently be mounted on a bench stand in order to minimise operator fatigue.

TABLE I

No-load spindle speeds for portable electric drills

Drill Capacity in inches	No-load spindle speed, r.p.m.
$\frac{1}{4}$	1,700 to 2,500
$\frac{3}{8}$	600 to 900
$\frac{1}{2}$	400 to 650
$\frac{5}{8}$	350 to 550
$\frac{3}{4}$	300 to 450
$\frac{7}{8}$	250 to 375
1	225 to 350

TABLE II

Size of extension cable for portable electric tools
(Based on current equivalent to 150% full load of tool and a voltage drop of approximately 5 volts)

Name Plate Rating of Tool in Amps	0 to 2.0	2.1 to 3.4	3.5 to 5.0	5.1 to 7.0	7.1 to 10.0
Distance in Feet	Wire Sizes (S.W.G.)				
25	20 3 core thin	20 standard	18 standard	18 standard	16 standard
50	20 3 core thin	20 standard	18 standard	18 standard	16 standard
75	20 standard	18 standard	18 standard	18 standard	16 standard
100	20 standard	18 standard	18 standard	16 standard	16 standard
200	18 standard	18 standard	16 standard	16 standard	— standard
300	18 standard	16 standard	16 standard	—	—

Note : If voltage is already low at the source, have voltage increased to standard, or use a much larger cable than listed in order to prevent any further loss in voltage

Brushes are readily removed for inspection. If worn to less than about ¼ in. length, they should be replaced; otherwise the motor will are badly and damage the commutator. If the commutator shows roughness, it can be smoothed with fine sandpaper. A smooth, dark brush track on the commutator is normal.

The switch should operate freely. There should be no likelihood of it sticking in the 'on' position with the possibility of causing an accident The cable connections with the switch and plug should be tight. If the cable is worn it should be replaced with another of the same size.

SPECIAL FEATURES OF TOOLS

Portable electric screwdrivers usually contain a clutch that disengages the drive when the screw (or nut) has been tightened sufficiently. There are three general type of these tool. In one type, there is a positive clutch, enabling the operator to control the release of the driving torque by the pressure he applies. This screwdriver is ideal for driving for wood screws, where torque increases constantly and varies widely. It is not recommended for use in metal assemblies, unless by experienced operators, since the sudden increase in torque when the screw is tightened can cause damage and injury.

In the second type, the clutch of the screwdriver is adjustable. Here the release of the driving torque is not controlled by the pressure applied by the operator but by a change in tension of a spring against which a jaw of the clutch operates. Once the value of torque is set, it remains fairly constant until the jaws of the clutch wear appreciably. This type of clutch is preferred to a positive clutch for driving machine screws and fasteners in metal assembly work.

The third type of screwdriver, the impact wrench, employs a driving torque releasing mechanism that is not controlled by the pressure applied to the tool or by spring tension. Its construction is such that there is practically no torque reaction transmitted to the operator. Tool size must be carefully chosen to suit the work, because the impact can create stress beyond the elastic limit of the fastening device.

Portable electric grinders have an elongated gear housing which can be grasped by the operator's hand. The grinding wheel is mounted directly on the end of the spindle. If the tool is inadvertently dropped or hit against an object so as to damage and possibly crack the wheel, there is the danger of having the wheel fly apart. Before using a wheel, it should be examined for cracks by being sounded with a solid piece of wood, such as a hammer handle.

A maximum surface speed of 6,000 ft. per minute should be observed for the general run of vitrified wheels. Special bonded wheels can run at a higher speed and require separate consideration. A quick way to check the surface speed (in ft./min.) is to multiply one-fourth of the wheel diameter in inches by the speed of the spindle in revolutions per minute. For protection, the operator should always wear goggles and a suitable guard over the grinding wheel is mandatory.

Electric saws are usually equipped with a lower guard that recesses into the upper guard as the tool enters the cut and springs back over the exposed portion of the blade after the tool completes the cut. If the lower guard ever sticks and fails to spring back, the saw should be disconnected from the power source before any attempt is made to rectify the condition.

Unless portable electric tools are fitted with explosion proof motors, they should never be used where ther are inflammable dusts or vapours, because of the arcin between the brush and the commutator. Tool subjected to an excessive amount of moisture should b disassembled, cleaned and baked dry. Otherwise th motor is likely to be earthed, thus endangering th operator.

Table III shows some of the most common causes of portable tool failure together with suggested means of correction.

TABLE III

Possible causes of trouble in portable electric tools

Fault	Check for	Remedy
New tool, motor does not operate	Brush stuck in holder, not making contact with commutator	Remove burr from brush holder
	Poor contact at the socket	Replace plug
	Broken conductor in cable	Cut off broken end or install new cable
Tool has been in service, but motor does not operate. Takes no current	Worn out brushes	Replace brushes, preferably by those recommended by tool manufacturer
	Switch not making contact	Replace complete switch mechanism
	Open circuit in field coil	Rewind or replace field coil
	Two or more open coils in armature	Rewind or replace armature
Motor hums and takes heavy current, but does not operate	Short circuit in field coil	Rewind or replace field coil
Motor operates abnormally. Slow, jerky excessive sparking at commutator, runs hot	Short circuit in armature. Charred insulation may give location of short circuit. Solder may be thrown from connections to commutator bars effected	Rewind or replace armature. *Note :* An accumulation of dirt with carbon and metallic particles between commutator bars can cause a short circuit
Motor operates at excessive speed, gives poor operating performance	Partial short circuit in field coil	Rewind or replace field coil
Ring of fire visible around the commutator	Open circuit in armature	Rewind or replace armature
Motor overheats, solder thrown from connections to commutator bars	Overload voltage too low	Use heavier extension cable
	Dull cutter, requiring heavy pressure	Sharpen cutter
	Motor ventilation poor	Clean vent holes of motor housing
Operator gets shock	Earthing wire not connected	Connect earth wire
	Carbon and metallic dust on brush holder insulation	Clean brush holder insulation

Main Line Electrification in New South Wales

FIRST STAGE COMPLETED

THE first stage of electrifying the main line railway between Sydney and Lithgow, in New South Wales, Australia, is now complete. Last month the first section, between Parramatta, in the suburbs of Sydney, and Blacktown, was opened to traffic as an electrified line. It is expected that the second section between Blacktown and Penrith will be electrified by September of next year and the final stage to Lithgow by the middle of 1957.

The project is an extremely important one for Australia. Roughly one third of the total population of the country lives in and around Sydney and the electrification of the 82-mile route to Lithgow will mean that the towns of Penrith and Blacktown will become dormitory areas of Sydney and that the mining and agricultural areas of the Blue Mountains in which Lithgow is situated will be linked by a fast freight route to Sydney and the eastern seaboard.

STEAM SYSTEM UNSATISFACTORY

A considerable amount of electrification had taken place in Sydney and its suburbs between 1926 and 1951 when the New South Wales Railway awarded the contract for the electrification of the route to British Insulated Callender's Construction Co. Ltd., of London. The change-over from steam to electric traction was necessary because of a growing congestion on the route which was largely caused by increased freight traffic. Owing to severe gradients of 1 in 33 and sharp curves of 12 chains radius at many points in the mountainous region, the existing steam system could not cope with the volume of traffic necessary to move coal from the coalfields around Lithgow, and wool, wheat and stock from the agricultural areas further west.

Before it was finally decided to electrify the route, other alternatives were considered. One was to increase the number of tracks and another to carry out extensive civil engineering works on the construction of new tunnels and realignment of tracks to ease the curves and gradients. Both these schemes were abandoned because of the enormous cost involved and the method of electrification by overhead conductors was chosen as the best practical and the most economic solution.

ADVANTAGES OF ELECTRIFICATION

In the mountainous area between Penrith and Lithgow, electrification has special advantages. It will enable heavier trains to be hauled and higher speeds to be attained. Indeed, it is estimated that the journey times between Sydney and Lithgow will be reduced through electrification by one hour for passenger trains and by two hours for freight trains. Moreover, the gradients in the area are suitable for regenerative braking and all motive power will be fitted for regeneration. Recovery of energy by this means will be approximately thirty per cent of the total energy used in the whole service. Trains descending the mountains will be effectively retarded and the recovered energy will assist in driving ascending trains.

The line crosses the Blue Mountains — part of the Great Dividing Range — from east to west, reaching a height of 3,500 feet above sea-level before commencing the descent of the western slopes of the mountains to Lithgow. Between Parramatta and Doonside the line has four tracks and from Doonside to Lithgow double tracks. Altogether 82 route miles or 232 track miles will be electrified.

ERECTION OF THE SYSTEM

A 1,500-volt D. C. system has been chosen. From Parramatta to Penrith the equipment is of the simple catenary type; from Penrith to Lithgow in the mountainous section it is of the compound catenary type. Supporting structures consist mainly of broad flange beam portals and for the whole contract a total of 7,000 tons of steel and 2,300 tons of copper will be used for the supports and the overhead conductors.

In the erection of the overhead equipment, construction trains are used. First, the 'concrete train' pours the foundations for the overhead structures and these are erected by the 'steel train' fitted with cranes for lifting the steelwork into place. After that comes the 'wiring train' from which are strung the copper conductors.

The work has to be performed with as little disruption of existing traffic as possible and the specially trained teams can accomplish the erection and bolting of an overhead structure in about 25 minutes.

CABLE CONTRACT

An associated contract at present being carried out by British Insulated Callender's Cables (Australia) Pty., Ltd., is for the installation of quad carrier and quad trunk composite cables required for signalling and telephone circuits along the 35-mile section between Sydney and Penrith. The cables and accessories are being manufactured in England by the parent company, British Insulated Callender's Cables Ltd.

CLEANLINESS LEADS TO HEALTH AND HAPPINESS

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

Cleanliness prevents disease; medicine only attempts to cure.

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

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

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