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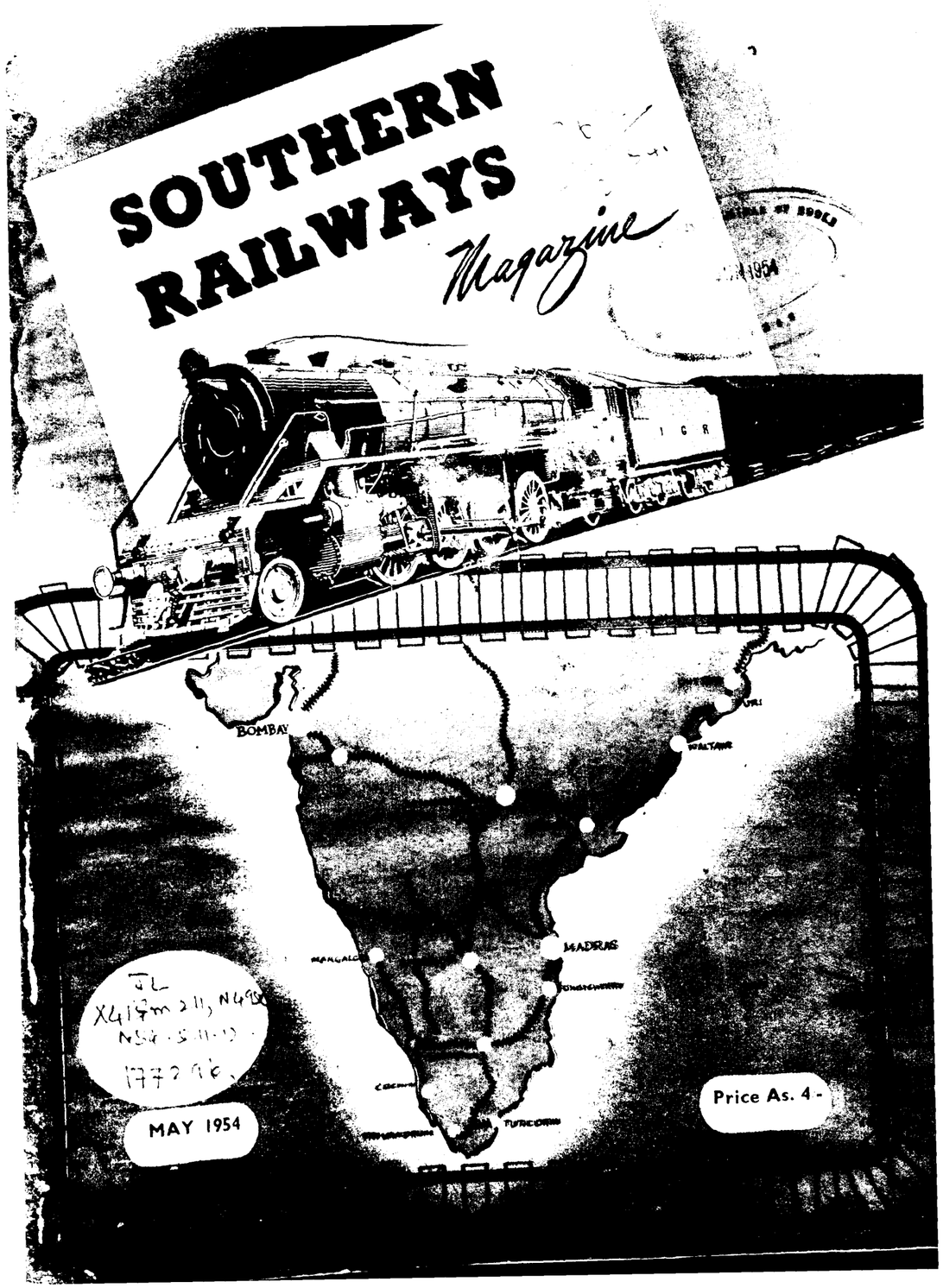
SOUTHERN RAILWAY

MAY-1954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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).

SOUTHERN RAILWAYS MAGAZINE

VOL. V NO. 11 MAY ISSUED MONTHLY

"ORISSA NEEDS MORE TRANSPORT"

LAL Bahadur Shastri, the Railway Minister, during a short visit to the State of Orissa, towards the end of April, had an opportunity of studying the transport needs of Orissa and the possibilities of development of what is perhaps India's poorest State. As a result of the Railway's Minister's "on the spot" probe, there is reason to believe that he made the most of this opportunity and came away impressed with the necessity and urgency of Orissa's transport needs.

The Railway Minister's visit also provided the Orissa Chamber of Commerce with an opportunity of placing a few vital facts before the Minister. They pointed out that the State of Orissa, with the amalgamation of the former princely states, had nearly doubled its present size and now had an area of 59,018 miles. Yet this vast area of land had only 828 miles of railway track over which trains could run, or roughly one mile of railway to every 75 square miles of land. This is considered to be almost the lowest rail mileage of all States in the Indian Union.

In the present stage of national economy, this poverty-stricken State hardly collects an annual revenue of a little over Rs. 10 crores, and has a per capita income not exceeding Rs. 100 per annum. Yet this poor State is rich in minerals, and also has a vast untapped mineral potential. Iron ore, coal, graphite, china clay, manganese, rutile, steatite, bauxite, and even radio-active minerals like zirconium, are to be had. And what is the extent of this mineral wealth in Orissa? During the year 1951, for instance, the value of ores produced by this State came to about Rs. 6 crores as against a little over Rs. 100 crores for the whole of India. Particularly in iron ore, Orissa had a leading position. During the same year (1951), the output of iron ore from Orissa amounted to 1.8 million tons against 3.6 million tons for the whole of India. It is said that 60 per cent of ores used by the Tata's organisation and Indian Iron and Steel Co. come from Orissa because of the high quality of the ore, the iron content of which is as much as 60 to 68 per cent. Geological experts have described Orissa's iron ore reserves as the best deposit of its kind in the world. Apart from iron ore, during the year 1951, this State produced about half a million tons of coal, 150 thousand tons of manganese, 37 thousand tons of rutile, 3 thousand tons of china clay, and about 15 hundred tons of graphite, apart from somewhat lesser quantities of steatite. It is said that the known mineral reserves or Orissa, still waiting to be mined, are estimated to be well over 2000 million tons, and these too all of a very high grade.

The Government of India's choice of Rourkela in the State of Orissa as the site for the new 50,000 ton steel plant, has brought this relatively obscure State into prominence. The choice of this site for an industry of this magnitude obviously meant that the transport facilities to and from this site must be improved, and now the Railway Ministry has decided to give the highest priority to the construction of the Sambalpur—Titlagarh line, which is aimed to provide rail transport facilities for the new steel plant. The Rourkela—Talcher line has been placed next to the Sambalpur—Titlagarh line for priority of construction. The Railway Minister disclosed these priorities during his April visit to Orissa. He also indicated that the narrow gauge Mayurbhanj line might be converted into a broad gauge one.

Another item mentioned by the orissa Chamber of Commerce to the Railway Minister was the need for a deepsea port at Paradip. The Chamber expressed the view that the loss of Chittagong required another port on the eastern seaboard of India, both for defence and trade purposes. Orissa's Minister of Commerce, Sri Sonaram Soren recently told the State Assembly that the report submitted by the French experts on the prospects of Paradip port in the year 1951 mentioned that this port is likely to develop as a medium-sized or even major port capable of handling more than six million tons of traffic annually. This report was still under the consideration of the State and Central Governments. While he was in Orissa the Railway Minister visited the proposed site of the port and seems to have been impressed, but he spoke with caution, and said that under the present Five-Year Plan the funds earmarked for the modernisation and expansion of existing ports would not enough over for the development of a new port, and that the Paradip scheme would have to be viewed in its various aspects—economic, defence, technical and political, before a firm decision would be taken.

In conclusion, it can be said that the visit of the Minister for Railway and Transport, to the State of Orissa was indeed timely. The transport needs of a State with the mineral wealth of the extent now produced, and with extensive reserves, cannot be neglected. Increased transport facilities both by rail and road would not only be of immense economic benefit to Orissa itself, but to India as a whole also. Orissa needs more transport, and it is hoped that both the State and Central Governments will keep in mind the urgency of its needs.

New Locomotive Wheel Centre Invented in Australia

A new design of wheel centre has been developed in Australia in the Locomotive Section of the Rolling Stock Drawing Office, Victorian Railways, in conjunction with Mr. F. C. Paynter, of the Steel Company of Australia Pty. Ltd. It is known as SCOA-P.

The design possesses quite a number of important advantages. Although the wheel centre is lighter in weight, tests have proved that it has a much greater lateral strength compared with the conventional spoked type.

The usual shape of spoke features a heavy cross section. The solid sections at the boss and rim, when they meet the cross section, give rise to segregation of the metal and weakening of the casting. This results at times in failure in service, especially in wheels of the larger diameter.

The disabilities are eliminated in the SCOA-P wheel. This has a thin-walled V-shaped section for the spoke, and a channel section for the rim, both having bulbed edges. The shapes of spoke and rim facilitate moulding operations also, and produce a clean sound casting.

Wheels of the new design yield and bend but do not break, state Victorian railway engineers.

World patents for the SCOA-P wheel are held by the Steel Company of Australia Pty. Ltd., and the company has already granted manufacturing licences to organisations in Queensland, Australia, to the United Kingdom, Belgium, Italy and West Germany. Applications for licences are at present being considered from manufacturers in Spain, Norway, Sweden and Denmark.

SCOA-P wheel centres have been delivered, or are on order for rolling stock in many Australian States and in oversea countries.

The East African Railways recently placed orders for 46 Class 31 locomotives, and 26 Class 30 locomotives, and have specified SCOA-P wheel centres. With these contracts the total number of SCOA-P wheels in use will have reached approximately 6,200 mark.

(Continued on page 6)

POST-WAR RAILWAY DEVELOPMENT

By Maxwell Taylor

Nearly 500 delegates from 30 countries are attending the Congress in London (May 19 to 26) of the International Railway Association which is being held in Britain for the first time since 1925.

SIMPLIFICATION OF EQUIPMENT IN BRITAIN

THE biggest problem which British Railways are having to tackle is how to make up for the accumulated deficiencies of a period of more than 30 years which included two world wars. This is a problem shared by many countries. Paradoxically, the greater the damage suffered by a nation's railway system, the easier it is to repair for, with nearly total destruction, so much equipment that is becoming obsolete and inefficient is swept away, giving greater opportunity for new works and up-to-date equipment. Conversely, where the greater part of a railway system remains intact, renewals and replacements take a lower priority in rehabilitation plans.

British Railways, by the end of World War II, were sadly deficient in up-to-date motive power and rolling stock, while track renewals and maintenance were considerably in arrears. But nowhere was it impossible to provide services well in advance of minimum requirements. Thus, plans to overtake arrears were hampered by severe restrictions on capital expenditure and shortage of raw materials—particularly steel—with comparatively low priorities in each field.

NEW LOCOMOTIVES

In the matter of motive power, the most interesting post-war development has been in the new standard locomotives. Six years ago the motive power of British Railways consisted of more than 20,000 locomotives of some 400 different types. The average age of the locomotives was about 30 years. This multiplicity of types meant an even greater multiplicity of non-interchangeable working parts, and to replace old locomotives according to their original type was not only undesirable but impossible. British Railways therefore set about designing and constructing 12 standard types to replace the existing 400.

Each of the 12 types was designed to give maximum route availability, maximum efficiency in the light of the need for economy in initial costs, simplicity in maintenance and ability to run efficiently on varying grades of coal. Many components of each of the 12 types are interchangeable with those of one or more of the other types. Naturally, a complete change over to the standard types will take several years, but the largest of the standard engines, the "70,000" or "Britannia" class, designed for both fast passenger and freight work, has already established itself as an excellent locomotive.

The new standard locomotives are all steam engines. Why does Britain persist in relying mainly on steam when so many other countries are turning towards diesel-electric locomotives or electrification? Countries favouring extensive electrification generally have available abundant supplies of hydro-electric power; those changing over to diesel-electric traction have indigenous oil supplies; Britain has neither in any considerable quantities. To convert the country's whole railway system to a motive power dependent on imports—as would happen if a change were made from steam to diesel-electric traction—would be unsound economically and strategically.

This is not to say that Britain has no electrified system. Some 2,500 miles of track—mainly in densely populated areas—are electrified, and more is planned. There are hundreds of diesel-mechanical locomotives in service for shunting and a few diesel-electric engines are in use on main lines. But the main source of motive power is still the steam engine, and is likely to remain so for many years.

ALL-STEEL COACHES

Standardisation, with its resulting economies and simplification, is not confined to motive power. New types of standard rail are gradually replacing the old type of "bull-head" rail. The standard flat-bottom rail is stronger, longer lasting and simpler. Compared with the present "bull-head" type of rail, each mile of the new track will require nearly 17,000 fewer components. The number of different types of passenger stock is also being reduced and new designs are a considerable improvement on the old. New coaches are of all-steel construction giving increased strength and consequently greater protection to the passenger.

But all this conversion to better methods and better equipment can only be undertaken as existing equipment becomes obsolete; there can be no question of scraping equipment which is still capable of service. The British Transport Commission might be glad to do so, but neither capital nor materials is available.

A criticism often heard is to the effect that United Kingdom trains are not as fast as they used to be. This is undoubtedly true, but each twice yearly issue of new timetables shows improvements as track renewals are completed and new equipment becomes available. It is very unlikely, however, that the very high speed trains familiar in Britain before the war will be restored, and the reasons for not restoring them are sound ones.

Britain has more railway per square mile than any other country in the world except Belgium; British Railways carry more than twice as many passengers as all the railways in the United States of America. This means that the tracks are densely occupied. Now an abnormally high speed train must have more head room than an ordinary express for reasons of safety. That is to say, it needs more space between it and the next train in front of it. This head room is, in effect, waste of space, and it has been decided that more and fast is better than fewer and faster.

And it must be noted that apart from the 24,000 passenger trains which run daily in Britain, there are 16,000 freight trains to be fitted into a tight daily schedule. Running spectacular services may be nice for the few who can use them, but they are a nuisance to everyone else.

British Railways have an impressive safety record. An examination of post-war figures has shown that passengers travelled over 850,000,000 miles for each fatality in a train accident.

(Continued from page 5)

This type of locomotive coupled wheel was first introduced on the Victorian Railways R class locomotive, and has been adopted for the 60 J class locomotives now being manufactured for the Victorian Railways by Vulcan Foundry, Newton-le-Willows, Lancashire, England. The first J class locomotive arrived early in March, and progressive deliveries are being made at the rate of two a week.

INDIAN PENMEN MEET

By A. B. Naidu

CHIDAMBARAM, the abode of Sri Nataraja, the Cosmic Dancer aspect of Lord Shiva, saw early last month a throng diversified in opinion and interests, when the Indian Centre of the P. E. N. held under its auspices the Third All-India Writers' Conference which was inaugurated by Pandit Nehru the Prime Minister, and presided over by Dr. S. Radhakrishnan the Vice-President of India. Opening on 16th, the 3-day conference was well attended by a representative gathering of delegates and distinguished visitors from all over the country and some from Pakistan and Ceylon.

The establishment in India a few years ago, of a branch of the P. E. N. under the parent body in Britain, may be attributed mainly to the untiring efforts of that parsi philanthropist Mrs. Sophia Wadia. The Indian branch ever since has had as its presidents a galaxy of distinguished personalities of letters like Nobel Laureats Rabindranath Tagore, poetess Sarojini Naidu and philosopher Radhakrishnan, the present president who with his rare combination of oratorial talent and mastery of Oriental philosophy is known as an interpreter of East to the West. The Indian branch is already well established on a sound footing with a wide membership drawn from all over the country representing in addition to English many regional languages.

Chidambaram the ancient city with a rich culture and great tradition behind, was chosen as the venue of this year's conference at the request made on behalf of the Annamalai University.

Prime Minister Pandit Nehru giving his inaugural address.

Sri Sri Prakasa declared open an Exhibition of a collection of rare books. In the photo he is seen taking keen interest in a collection of ancient manuscripts exhibited by the Adayar Library.

Pandit Nehru and Dr. S. Radhakrishnan intently listening to an impressive address of welcome given by Dr. C. P. Ramaswamy Iyer on behalf of the Annamalai University.

A view showing a section of the delegates.

Atlas Diesel

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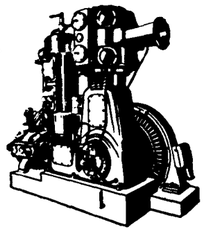
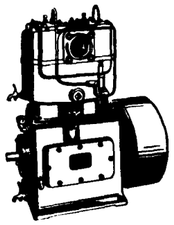
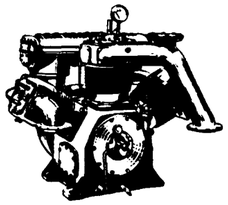
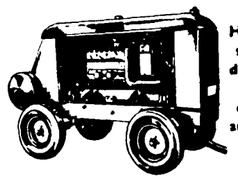




R2A6-Watercooled, stationary—one stage aircompressors. Simple, reliable, low priced and cheap in upkeep. 117 CFM capacity 100 p.s.i. working pressure.



CR-CT Class, water and aircooled 2 stage stationary air compressor. Capacity 150-330 CFM for working pressure up to 125 p.s.i.



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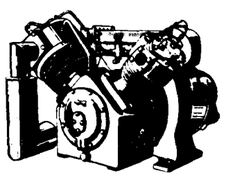
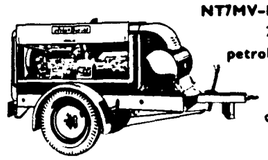


NT-Class, aircooled, 2 stage aircompressors. Compact units for direct flanging to electric motors and for Vee belt drive. 4 sizes, 35-110 CFM, working pressure up to 125 p.s.i.



NT7MV-NT9MV—Portable 2 stage diesel and petrol driven compressors. Powered by Dorman, Armstrong or Standard engines, 60 and 110 CFM

Atlas Diesel

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OF HIGH EFFICIENCY

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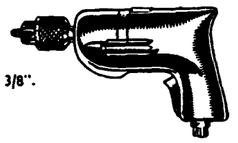
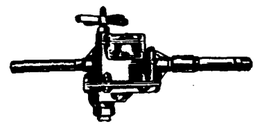
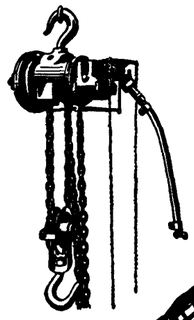


Heavy type drills max. 4".





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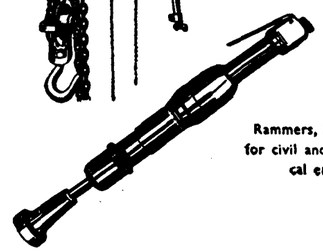

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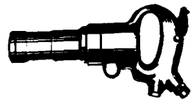

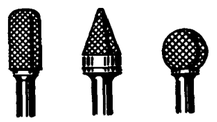

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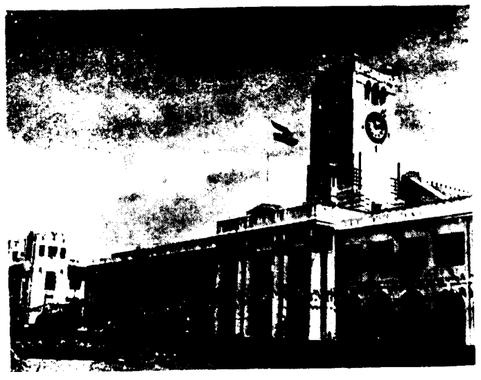
EVEREST

The welcome—Pandit Nehru accompanied by Dr. C. P. Ramaswamy Iyer and Raja Sir M. A. Muthiah Chettiar entering the pandal to declare open the Conference on 16th April.

The inaugural function was an impressive one arranged in a tastefully decorated special pandal adjacent to the Sastri Hall. Welcoming Pandit Nehru and other distinguished guests present, Dr. C. P. Ramaswamy Iyer on behalf of the Annamalai University of which he is the Vice-Chancellor, made a brief but moving speech in which he described Pandit Nehru as "an outstanding statesman as well as a versatile writer," and called upon him to declare open the conference.

And amidst deafening cheers and cries of "Nehru-ki-Jai" and "Jai Hind", Pandit Nehru began his impressive inaugural address, heard in pin-drop silence. Characterising the role played by the writer as a "powerful indirect influence" with which he could bring about an environment in which people could think in terms of logic reason or argument, he deprecated all talks of industrial civilisation, the culmination of which was the dreaded hydrogen bomb. After portraying in brief the developments in the world situation he stressed the need for consolidating our newly won freedom and to fight any tendencies which might disrupt it. He was lustily cheered as he concluded his 40-minute address with the words "Jai Hind".

As the house calmed down Dr. S. Radhakrishnan rose to the mike to deliver his presidential address—believed to be one of the best ever given by any. Profusely quoting from Gita and other Sanskrit works, he kept the audience spell-bound with his extempore speech lasting well over an hour. Tracing briefly the origin and growth of P. E. N. in India and abroad, he declared that in the present world context our life is not worth, if we could not banish fear which surrounds us to-day. "Of all emotions" the philosopher emphasised "the least compatible with freedom and the most degrading to man is fear. We are planting appalling fear in men's hearts and by so doing we corrupt their morals and destroy their minds." Strongly condemning the perennial tendency on the part of sections of human races to dominate over others, styling themselves as "cast by heavens" for the role of leaders of Mankind, Dr. Radhakrishnan declared that "it is over duty to open their eyes and to demonstrate to them the sterility of their programmes, if not fight them."



A General view of the Srinivasa Sastri Hall in which was held the 3-day P. E. N. Conference at Annamalai Nagar.

The delegates numbering about 200 included some of the distinguished men of letters in the various fields representing almost all major languages of the country. Besides, there were also present about 1000 distinguished visitors including Sri Sri Prakasa the State Governor, Sri K. Kamaraja Nadar the Chief Minister, Sri T. T. Krishnamachari the Union Commerce Minister, Raja Sir M. A. Muthiah Chettiar the Pro. Chancellor of the Annamalai University and others.

The Southern Railway administration has once again demonstrated its "administrative prowess" in coping up with the extra responsibility it was faced with during the period. Sufficient number of special trains on either side was arranged and run according to well-timed schedules in advance of important through train.

(Continued on page 13)

REPAIRS & RENEWALS

"TRAINS ALSO NEED CLEANING"

By A. H. Pearson

THE Madras mail has rolled in and come to a stop at one of its termini—say Howrah—after a journey of over one thousand miles. As the train stops the passengers, with bags and baggage, pour out of each coach. Within twenty minutes or so, all that is left is a string of empty coaches, and the dust and litter collected after the long journey.

What happens to these empty coaches now? As soon as the Railway Police and Watch and Ward men have examined each compartment for anything that may have been left behind by passengers, the carriage staff are close on their trail, closing all the shutters and doors of each coach. As an added precaution the upper class coaches are locked with carriage keys to prevent thefts of interior fittings. This shutting up job completed, along comes the part pilot, hooks on, and draws the rake of empty coaches away from the station to the carriage cleaning siding.

The cleaning gang, consisting of sweepers, cleaners, watermen, tank-fillers etc., now swarm into the empty coaches to do their allotted jobs. With brush and garbage-pan the sweepers take up the dust and litter from each compartment. The cleaners, with swabs and dusters, wipe the berths and seats and walls of each coach, thus completing the 'drycleaning' process.

The 'wet-cleaning' gang now swings into operation. With swabs, long-handled brooms, soap and buckets of Water, to which disinfectant has been added, each compartment is thoroughly sluiced down. Lavatories get special attention, as these are potential breeding-grounds for disease-spreading germs. Commodes and urinals are cleaned under water-pressure, wiped and then thoroughly disinfected. Wash-basins also get a thorough clean-up.

The next step is to give the exteriors of all coaches a cleaning up. With doors and shutters fastened, the roofs and outer walls of each carriage are given a good bath from a hose pipe spurting water under pressure. After the laving process, the long-handled brooms are then used to wipe off all accumulations of grime and dirt. Carriage roofs are also washed down. The bathing completed, the cleaners then dry the surface with dusters.

As the washing, wiping and cleaning jobs are being completed on each coach, the tank-fillers are stalking over carriage roofs armed with hose-pipes. A tap is turned on, the hose nozzle is pushed into the overhead water tank opening, and fresh water gurgles into each tank ready for the use of passengers on the next journey.

Throughout the various cleaning operations a supervising train examiner is keeping a watchful eye on the cleaning staff and when they have completed the task, he examines each coach both inside and outside, to ensure that the cleaning process has been done thorough.

The train of ten to twelve bogies from the brake van at one end through each third, inter and upper class coach, to the brake van at the other end is now clean and ready for another long journey almost from one of the country to another. At the appointed time the clean rake is drawn away from the washing siding and taken back to the station platform from which it is to depart.

Every through main line and suburban train is given this routine cleaning procedure, but there are the

(Continued from page 12)

'quick-return' suburban trains, that must return with their passenger loads within about an hour of coming into the terminal station. As the complete routine cleaning can only be done in five to six hours, these 'quick-return' trains cannot be taken to the carriage cleaning sidings. These trains however are given their washing and dressing up right there on the platform. This consists of a thorough 'dry-cleaning' job plus a quick swabbing down with water, and wiping later. Lavatories get particular attention and are given a quick cleaning with a disinfecting solution as an aseptic measure.

At large terminal stations serving thickly populated cities, apart from about 16 through main line trains of 10 to 12 bogies each, there are a score or so of suburban local trains each consisting of 6 to 8 bogies, to be washed, cleaned and wiped down day after day. This job has to be got through between the hours of 6 a. m. and 10 p. m. daily.

With the thousands, and even tens of thousands, passengers travelling on all the through and suburban trains that roll in and out of a large terminal station, it is not uncommon to find someone seriously ill in a compartment, or even dead. What happens then? The railway doctor is promptly called in, and if he finds that the sick or dead person is the victim of any highly contagious disease, like cholera, small-pox, plague etc. after the individual so found is removed from the compartment, the whole coach has to be detached from the train, and completely isolated for special fumigation and prophylactic treatment. Once again, it is the carriage cleaning gangs who will have to do this job according to a prescribed procedure. After fumigation and disinfection, the coach is given the normal routine clean-up, but will not be sent back to form part of a train until at least 48 hours have passed.

The coaches of train do not only gather dust, grime or coal grit during a long journey, but an amazing amount of litter and dirt, the result of human carelessness or indifference. These will be the inevitable scraps of paper, bits of discarded food, broken pieces of earthen teacups, dried leaves from which food has been eaten, cigarette ends, dried spittle, and so on. But before a train starts back on its return journey, every effort is made to remove all the dirt and litter, so that the passengers about to start a new journey can travel in coaches that are clean.

THE SOUTHERN SCENE SERIES—III

OOTY—THE QUEEN OF HILL-STATIONS

By Nilkan Perumal

IN April sun will shed his powerful rays on the plains of South India, a familiar question on every lip will be: "Are you going to Ooty?" And, many do go; not only South Indians, but many Princes and pleasure-seekers from the North, as well. During the last war years, there were tremendous crowds at Ootacamund that the accommodation problem became all too difficult. Hotels converted even verandas into living-space! Many of India's wealthy who usually went to Europe for summer holidays rushed down South to the cool heights of Ooty.

The climate and natural beauties of the *Nilgris* on which Ooty is located as a playground and summer resort for the harassed and over-worked officials were not appreciated until as late as 1826, when the then Governor of Madras Sir Thomas Munroe paid an official visit to these *Blue-Mountains*. Upto the end of the last century, the only means of access to the place was through six-passes which generally followed, though not closely, the tracks which were in existence long before the days of European settlement. Today, however, the main rail and road arteries connecting the Nilgris with the plains, are monuments to engineering-skill and enterprise.

Ootacamund was the summer capital of Madras for long, as Darjeeling for Bengal, Ganeshkind for Bombay, Nainital for U. P. or Panchmari for Madhya Pradesh. When it attained that status, the problem of making it easily accessible engaged the minds of Engineers. Accordingly, Major Dowden, Dy. Consulting Engineer for Railways in Bombay, paid a visit to the *Rigi Railway* in Switzerland, to make a study. There, he obtained drawing and technical data and sent them to the Railway Engineer in Madras, suggesting them basis for railway-construction on the Nilgris.

Twenty three years later, in 1899 to be precise, the first portion of the rail-line, from Mettur to Coonoor was opened up for passenger traffic. Years later, the track was extended up to Ootacamund as the terminal station, under the management of the South Indian Railway Company.

Ootacamund is reached by two routes, one via Madras and Coimbatore and the other through Mysore, by a ghat-road. Leaving Madras at night by the *Blue-Mountain Express* train, you reach Mettupalayam at the foot of the Hills the next morning for breakfast. From there, the hill-railway takes you through a steep-route of twenty three miles, so steep that the train runs only five miles an hour! As one winds ever upward with the engine, labouring and panting in the effort of exertion, one cannot help being struck with the magnitude of the task that confronted the pioneer-engineers who planned and built the track. They must have been lovers of nature too, these engineers, when they decided on the alignment, for, as one looks out through the compartment window, a panorama of diversified scenery meets the eye.

Nine thousand feet above sea level, Ootacamund's pettern is predominantly one of tea and coffee estates and gently undulating downs. It is punctuated by *Eucalyptus* groves and a variety of *bowers* grow in rich profusion—*roses* of differing hue, *gardenias*, *camelias*, *petunias*, *orchids*, *laburnum* and a hundred others.

There are good roads for automobiles in Ooty, while rickshaws ply for hire. Still, people prefer to walk about the town in care-free fashion. There is no lack of hotels and boarding houses, to suit Indian and European tastes. Fruits and vegetables are a plenty. In fact, what you need is money to be spent, and all the rest is at your command, in this charming hill-station. Centres of amusement like parks and cinemas are there, and in the summer months, Ooty has its racing-season. Its golf-course, said to be one of the best in the whole East, is the delight of foreign visitors. Then, like Nainital, there is also boating open in a small lake.

For long, the Governor of Madras, the Secretariat and officials resided here for six months in the summer, but now, the Congress administration, in the name of economy, has done away with that old system. In those days, a flower-show, a dog-show, a tennis-tournament, annual-day celebrations in the Y.M.C.A. all used to be public functions of importance in Ooty, usually graced by the Governor and his wife. By the end of May, when showers begin to fall, the pleasure seekers of Ooty and lowly descend down to the plains.

COGS IN THE WHEEL (VIII)

By Ajax

SOME of the convenient phrases that we come across in the course of our daily work are "*as a local arrangement*", "*in the exigencies of service*", "*in the interests of the administration*", "*this does not give a title to the job*", "*would have continued had it not been for so and so reason*", "*cannot be spared*", "*in public interest*", so on and so forth.

The real import of these cluster of "*meaningful*" words has not been clear to me and I have often wondered, if they are at all comprehensible to any one, however high he may be in the official ladder. Do they at all convey any idea as to the reason why these phrases have had to be used in our correspondence? Is it ever possible to measure the depth of the significance of these words, and are they meant to be seriously thought of? These have been some of my doubts. We have become so used to these set words that we do not stop to think for a moment whether in using them we really mean what they are supposed to convey. Habit is second nature with many of us and so this also has become somewhat of a secondary person with us.

Whenever a certain thing has got to be done and which could not perhaps ordinarily be achieved without much fuss and furore help is garnered from these words to cover, if I may say so, many an omission and commission, or when it is thought prudent not to disclose the real intentions or to avoid an awkward situation. As an example, if it is necessary that transfer of a certain staff from one station to another is to be carried out, it is done in the *interests of the administration*. I wonder could it be anything else. Why is it necessary to say so? After all we are public servants and so long as the needs of the public service are adequately met, we cannot but be serving in the interests of the administration.

And again, could a transfer of a particular individual be at any stage termed and considered as anything other than the administration's interest? Yes, there are certain instances in which an employee sometimes seeks a transfer in his own interest, that is to say, for climatic reasons, for personal convenience of accommodation, or for health reasons. When these matters are to be surveyed and settled it is rare that a transfer is effected, and even if they are accomplished there are "*strings*" attached to it.

What is meant by "*local arrangement?*" Could there is such a thing as a "*local arrangement?*" Especially in the matter of simple office routine work where there is no '*high technique*' involved in the daily output. It will be remembered that for administrative convenience each office is divided and sub-divided into smaller units and the whole thing makes up a homogenous compact body, and if the threads that sew up the different components in a rhythmic manner and the tension is kept up unbroken then smooth working is ensured. But the moment a weak link is discovered and it is allowed to remain unrepaired it will corrode the other parts of the 'body' and the whole system would be infested with the 'disease' which, once taken deep root, it will be difficult to remove.

Such being the wonderful analytical composition of an office I cannot understand '*local interest*' in the sections and sub-sections of the office. It is all one unit and attempts at creating each unit into a water tight compartment unconnected with the whole should be discouraged, and in this respect, the present practice of defining local interest as pertaining to sections and sub-sections should not be indulged in. For such a practice contributes to the unhealthiness of the whole body of administration and the limbs get diseased.

I have known of people who are disinclined to be shifted from one 'chair' to another. I once enquired of the reason. It was merely because one has had to do the same kind of monotonous job for years together and had developed an intimacy with it that the very idea of a change was anathema to him which he literally dreaded and began to get upset with all sorts of fantastic ideas about his incapacity to do the new job and so on and so forth. He was afraid of applying his mind to anything else for fear of committing errors. He was frightened at the idea of attempting to do something new. He had lost confidence in himself and so a change was averse to him. He said he would forgo a promotion rather than attempt doing something which he had not done in the past.

What a devastating effect such an attitude towards work it has. Why should one at all be afraid of tackling new things? And the snag is that it has never been put to his mind that he would have to try his skill at every kind of job. After all, there is nothing '*intricate*' in ordinary clerical work. It may be that there are certain peculiarities in different kinds of work which can easily be mastered within a few days of earnest application. It will therefore be in the best interests of all that one should not be kept at the same desk for a pretty long time. The practice of changing hands as often as possible and giving everyone a brush up of the entire administrative set up would be advantageous and would make one an all-rounder.

One of the reasons why efficiency is at a low level is the fact that one clerk does not know the work of another clerk, sometimes it is because he does not bother to know about it, some times it is due to his not being given a chance to know his colleague's work, sometimes it is due to his being discouraged at going beyond his beaten track and sometimes it is due to the '*pique*' of certain persons who do not fall into that category of workers called '*magnanimous*'. But the argument against such a method of shifting is that a rolling stone gathers no moss. My answer to it is that a rolling stone which accumulates moss spends it in other's interests and dispenses it differently so that the gloss of the moss is reflected in each individual, and that is a real asset worth double its intrinsic value.

AUSTRALIAN-MADE DIESEL ELECTRIC LOCOMOTIVES

Contracts to supply 31 diesel-electric locomotives to three Australian railways undertakings have been obtained by one of the largest engineering companies in the country, Clyde Industries Ltd. of Sydney. The Company has already supplied 37 main-line diesel-electric locomotives to the Australian Commonwealth, and Victorian Railways.

The new contracts, worth about £A 2,300,000 are for 25 800 h. p. general-purpose engines for Victoria; five 1750 h. p. engines for Australian Commonwealth, for coal hauling work; and a 1200 h. p. engine for the Queensland Railways. Clyde Industries Ltd., began contruction of locomotives in 1951 with the assistance of General Motors Corporation (U. S. A.), and at the inception of the work only about 50 per cent of the parts were made in Australia. Today about 70 per cent of the parts are made locally.

Some Problems of supply of Railway Material

By E. La. V. Parisot, E.D., A.M.I.C.E., Controller of Stores, Southern Railway

IN order to facilitate understanding our problems it is necessary to outline the principles of procedure adopted by Railways to procure Railway material.

The main objects of the Stores Department of a Railway are :—

I. To supply every department of the Railway with stores as and when and where required by them at the most economical cost.

II. To keep the stock balance to a mimimum consistent with I.

III. To make the maximum use of returned stores and scrap.

IV. To dispose of scrap at the most profitable rates.

3. The stores referred to in I above can be sub-divided broadly into :—

(a) stock items which can be sub-divided into :—

(i) purchase items

(ii) items manufactured in the Railway Workshops and referred to as "manufactured" items.

(b) non-stock items.

Re : 3(a). Stock items, these consist of parts of locomotives, carriages, wagons, permanent way, signalling apparatus, buildings, Ferry Steamers, Electric Traction Units, consumable stores such as oils, waste, stationery, uniforms etc., in fact every item used by a Railway which is subject to wear and tear and has to be continually renewed.

In order that spare parts and other items can be made available as and when and where required each Railway possesses main and subsidiary depots at convenient centres, i. e.,

(A) for locos, carriages and wagons the main depots are in the various workshops, the subsidiary depots are in the Mechanical district and subdepot headquarters throughout the railway where they are repaired ;

(B) for permanent way, buildings, signalling, the main depots are at convenient centres for B. G. and M. G. track. The subsidiary depots are at Permanent Way and Signalling Inpectors' head-quarters throughout the Railway ;

(C) for main and subsidiary depots under (A) and (B) and stations, hospitals, rest houses etc., requiring oils, waste, tools, stationery etc., there are main depots at convenient centres.

In general, the main depots have to feed the subsidiary depots, i. e., for (A), although the mechanical district depots feed the mechanical sub-depots with spare parts, the former are fed by the workshop main depots by special vans or wagons or by goods direct at regular intervals. Likewise, for (B), the subsidiary depots are fed with rails, sleepers, crossings, cement etc. by the main depots as and when required. As regards (C), there is a regular monthly van train service whereby the Railway is divided into a number of sections. One special van and a number of goods wagons are allotted to each section and are known as a van train. Each van train is attached to various goods trains which run over the various sections. At stations where there is sufficient time the stores are unloaded while the goods train stops. If not, such as at junctions, where subsidiary depots exist, they are unhitched from the train and stabled until the stores are unloaded. Stores staff man each special van which is fitted with living accommodation.

It will be noted that the main depots are responsible for supplying stores to all workshops and subsidiary depots throughout the whole Railway system. It is these main depots manned by the Stores staff that are responsible for ensuring the stocks which they always have in their bins available for issue as and when required.

The method adopted for maintaining these stocks is briefly as follows : every item has what is described as a "maximum" and a "minimum". The latter represents the minimum quantity to which the stock must be reduced before a fresh quantity may be

ordered. The former is the maximum quantity which may be ordered at one time and varies from half, equal to, or twice the minimum depending upon the nature of the item.

Every item is allotted a tally card on which is shown the "maximum" and "minimum" in terms of the quantity and months' stock. The minimum is calculated on the time it takes to procure the item and the quantity which will be consumed during that period, and the maximum as stated above is, half, equal to or double the minimum and is ordered to arrive before the minimum has become exhausted. After the "maximum" had been received and the stock has again been reduced to a "minimum" a further "maximum" will be ordered and so on.

Each depot contains a tally card for every item stocked in the Depot Officer's office. Each card, besides recording the "maximum" and the "minimum", has columns and headings showing the receipts, issues and balance quantities of every item: so as soon as a receipt or issue voucher is received by the depot office from the Wards, where the stores are kept, the quantity is entered in the column concerned and the balance struck. The Depot Office at every issue and receipt keeps a careful watch over the balance, and as soon as it is reduced to the "minimum" for purchase items, 3 (a) (i), they fill in a recoupment memo repeating the information in the tally cards and send it to the Controller of Stores' Office which, in turn, arranges for the recoupment by purchase of a fresh quantity vide para 11 below. For manufactured items, 3(a) (ii), please see next para.

Re: 3(a) (ii), manufactured items, the depots are responsible for placing orders on the workshops for all items manufactured in the shops as soon as the stock has been reduced to minimum but they cannot do this if raw materials such as steel, pig iron and nonferrous materials are out of stock, hence, until our demands for these raw materials which are purchase items and treated as above are fully satisfied workshop production and consequent turn out of locos, carriages and wagons will be adversely affected. Hence the shortages of raw materials present a serious problem to us.

Again, referring to purchase items, it is the duty of the Controller of Stores to procure them up to specification or standard before the "minimum" has become exhausted.

The method adopted by him is to place indents on the Director General of Supplies and Disposals in accordance with an annual programme laid down by the latter and distributed throughout the year for each item above a limited cost. These indents give a full description of the item, specification and delivery dates. On receipt by the D. G. S. & D. i. e. in turn, calls for quotations or tenders and arranges with the Inspection Department to progress, inspect and ensure the item is ready by the delivery date. Incidentally, for items unforeseen we have to place supplementary indents in between the programme dates.

For items below this limited cost the Controller of Stores makes his own arrangements to call for quotations by means of a bulletin or special enquiries.

Stores have to be provided to maintain the following assets :—

1404 locos, 558 B. G., 835 M. G. and 11 N. G.

3009 passenger coaches, 999 B. G., 1982 M. G. and 28 N. G.

582 other vehicles, 301 B. G., 279 M. G. and 2 N. G.

26691 goods wagons, 11319 B. G., 15263 M. G. and 109 N. G.

2 Ferry Steamers

24 Electric motor coaches

48 trailer coaches

10 workshops

7613 track miles of Permanent way including all bridges, buildings, cranes, watering arrangements

28½ miles of mountain railway

36.28 track miles of electric traction

1237 stations, 396 B. G., 822 M. G. and 19 N. G. including signalling apparatus, Clothing for 33000 staff.

The number of different stock items used for the above purposes on the Southern Railway consist of approximately 28000 purchase and 16000 manufactured items. As the Stores Department has to ensure that every one of these items is always available as when and where required involving the recoupment of each once or twice or more a year these figures will give the reader some idea of the immensity of the task of a railway stores organisation."

It has here to be mentioned, as is now well-known, the Southern Railway consists of the 3 ex-Railways, the ex: M. S. M., ex: S. I. R. and ex: M. S. and it is found since integration there are many items used for the same purpose by each of the 3 Railways which have different nomenclatures and specifications. It is, therefore, one of the Stores Department's main objectives to unify these differences in consultation with the consuming departments. When this is completed, the number of items shown in previous para will be considerably reduced and one of the difficulties will be eased. However, until then, we have to carry on as best we can.

In pre-war days, the bulk of our stores were imported from abroad through the agency of Consulting Engineers in London and Agents in India, and the balance from indigenous sources whereas nowadays about 23% are imported through the agency of the D. G. S. & D., London and New York, 12% from abroad through agents in India and the balance of 65% from indigenous sources which shows that the Indian Industry has made tremendous stripes since pre-war days.

It is Government's policy to assist in its further development to the maximum extent possible, but for it to succeed 100% there are two vital factors which must be considered viz., Railways must be supplied with stores fully up to the quality or standard required, and by the delivery dates quoted.

Although specifications are quoted where available it sometime happens the sample submitted by the supplier is in accordance with the specification but the bulk supply is not, and has therefore to be rejected. If it is rejected it means delay in supply and stock becomes exhausted with the result that repairs to locos, carriages or wagons, or workshop manufacture is held up resulting in loss of revenue due to locos, carriages, wagons and labour remaining idle, and incidentally, the public being put to inconvenience and loss due to being unable to move their goods as required. It also results in a waste of materials.

It may be added here that there are cases also where although the item is up to specification it does not last as long as that produced by firms of longer experience and more skilled technique. This requires careful consideration by industry.

It will be noted in earlier para besides the necessity of producing "quality" another vital factor is that of adhering to delivery dates quoted. Although delays are frequently inevitable, and due to no fault of the suppliers e. g., non-supply of steel and other raw materials, difficulty in procuring licenses, rail booking restrictions etc., there are unfortunately a number of cases in which it is felt they could be avoided. In fact, this question of delays is one of our greatest problems and the cause of serious hold ups resulting in the consequences referred to in earlier para which must be repeated, viz., loss of revenue due to locos, carriages, wagons and labour remaining idle, and the public being put to inconvenience and loss due to being unable to move their goods. Even if repairs to a loco, carriage or wagon is not completely stopped the out-turn is retarded because cannibalising has to be resorted to, i. e., an engine or wagon has to wait until another similar wagon comes into the shops from which sound similar parts can be removed and fitted on to the engine or wagon awaiting repairs involving wasteful cost of labour and delay to the outturn of the engine or wagon concerned.

It is calculated that every day a loco or carriage or wagon is out of action it costs the Government approximately :—

Rs. 798 per day of 8 hrs. for a B. G. engine
422 „ „ „ M. G. „
83 „ „ „ B. G. carriage
47 „ „ „ M. G. „
37 „ „ „ B. G. covered wagon
17 „ „ „ M. G. „ „

So it will be seen the loss of revenue due to non-receipt of stores as and when required for rolling stock can easily mount up to large sums of money. These figures, of course, exclude the money lost by users of the Railway whose goods are awaiting to be transported, but cannot be, because the wagons are not available due to their repair being held up owing to non-supply of spare parts by the suppliers.

Re : 3(b), non-stock items, are required for works. The consuming departments send their indents for these items direct to the Controller of Stores' Office which, in turn, adopts procedure similar to that outlined in paras above except that a non-stock item is not included in the programme but is indented for on the D. G. S. & D. in what is described as an "*ad hoc*" indent. It will be noted these are in addition to the stock items referred to above and amount to thousands during the year. It will also be appreciated that similar remarks in respect of the consequences of poor quality and delay in delivery apply to non-stock items as well, i. e., if such an item is received not up to specification and or not by the delivery date required the work will be held up and the object of the work postponed resulting in retardation of the efficiency of the Railway and the capital sanctioned for the work remaining idle.

The Railway being a national concern every member of the public demands their maximum efficiency, but however efficient a Railway may be, it can never be 100% efficient without the full cooperation of the public. Although of course the shortest possible delivery periods are desired, our complaint is not against the actual period quoted but the fact that the item is not delivered by the date quoted. The writer is referring to delays of weeks and months and not days. So it will be realised as these delays are experienced for so many vital items, and every stock item is vital, our efficiency is bound to be adversely affected.

In these circumstances, the writer appeals to readers interested in Railway supplies to appreciate the above situation and never permit quotations to be submitted unless they are certain they can produce a bulk supply up to the specification and by the delivery date quoted by them. If this principle is strictly adhered to then Railway's difficulties will be reduced but if not then efficiency will be retarded.

Re : II, it will be remembered as a result of the war during which it took such a long time to procure stores we had to order quantities to last us for longer periods than nowadays with the result that, combined with the increased cost of stores, our stock balances became abnormally high and gave us surplus stocks. Special efforts have been made during the last two years to reduce these surpluses and no railway is permitted to purchase any new item if it is available on another railway. Good results have been achieved, but of course there are and always will be cases in which, if consumption drops inevitably and it is too late to cancel an outstanding order, a surplus will result, but the subject is watched very closely and every effort is made to keep the balances to a minimum. However, it has to be added the longer each item lasts, i. e., the better the quality and the quicker it can be delivered, the lower will be our stores balances,

and so even in this sphere industry can help us by producing better and better quality goods and delivering them in a shorter time.

Re : III, every item which has been discarded from use by the consuming departments is returned either to the salvaging ward or scrap yard. Prior to the recoupment of items which are normally returned to the salvaging ward, reference is made to the ward to ascertain the number of items available and on receipt of this information an order is placed on the works for repairing them. Further, some non-ferrous scrap items are either reconditioned in the Railway Workshops or exchanged for new raw material by firms which specialise in such work.

Re: IV, all scrap, i.e., other than those items included in above para is inspected by what is described as a Survey Committee comprised of a member from each of the consuming departments before it is disposed of to ensure that none of it can be made use of for a purpose other than its original by the Railway as a whole. The steel is declared to the I. & S. C. who allocates it to Industry and the remainder is either sold by tender or by auction so that the highest credit can be afforded to the Railway.

Summarising II, III and IV, it will be noted that every precaution is taken to ensure that there is no waste of material.

In conclusion, a lot of space has been taken up with describing the methods adopted for keeping the Wheels of Railways turning but it is hoped it will be not only of some interest, but that it will help to illustrate the means by which readers interested in railway supplies are requested to give us their unstinted assistance and thereby help to improve the efficiency of Railways.

(By courtesy The Indian Railway Engineer.)

COLOMBO PLAN TRAINING IN U. K. FOR PAKISTANI LOCO ENGINEER

A Pakistani railway engineer has just begun six months' training in the U. K. under the Technical Co-operation Scheme of the Colombo Plan.

He is studying the operation and maintenance of Diesel electric locomotives in the Southern Region of British Railways. Arrangements for his training have been made by the British Government.

HOW TO RESERVE ACCOMMODATION

Unless you reserve your berth (I and II Class) or Seat (Inter and 3rd Class long distance) in advonce, 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)

HANDSHAKE

THERE is nothing so healthy as a vigorous handshake. The railwayman is willing to learn and understand and in that spirit will stretch his hand across the table and I hope it will be grasped by the administration of which a handshake is a visible symbol.

One of the cardinal principles of the railwayman should be an endeavour to promote understanding and sympathy between himself and the administration. Where there is proper understanding of each other's difficulties, sympathy is created, and where there is a perfect understanding and sympathy, the need for co-operation in the common cause is self-evident.

Passing through life with the eye of a practical philosopher I have been struck with the fact that most of the annoyances and worried that sour the lives of the employer and the employee in their mutual relations are created by a want of that proper understanding and appreciation of each other's difficulties and limitations.

At great cost the world is gradually coming to realize that the ultimate good of humanity can best be served only through international inter-communal and inter-sectional co-operation. How this realisation could be transplanted into the sphere of work of the railwayman is a problem that should engage every one of us.

A railwayman as soon as he has been able to find his feet, that is to say, has put in a few years' hard work and has acclimatised himself to his line of work, soon realises that he is only a spoke in the wheel and that for the successful carrying out of his job he needs the active co-operation of his fellowworker. There must be complete cohesion between one section and another then only can the cementing be laid down evenly and smoothened out so that the glossy appearance of the floor would stand as a shining example of his efforts.

Create that sectional co-operation first, raise it to inter-communal and then to the pedestal of inter-national.

N. G. IYER

IN YOUR OWN INTERESTS

HOW TO PURCHASE TICKETS

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

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

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

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

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

(Inserted in the interests of Travelling Public)

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.

WESTERN RAILWAY

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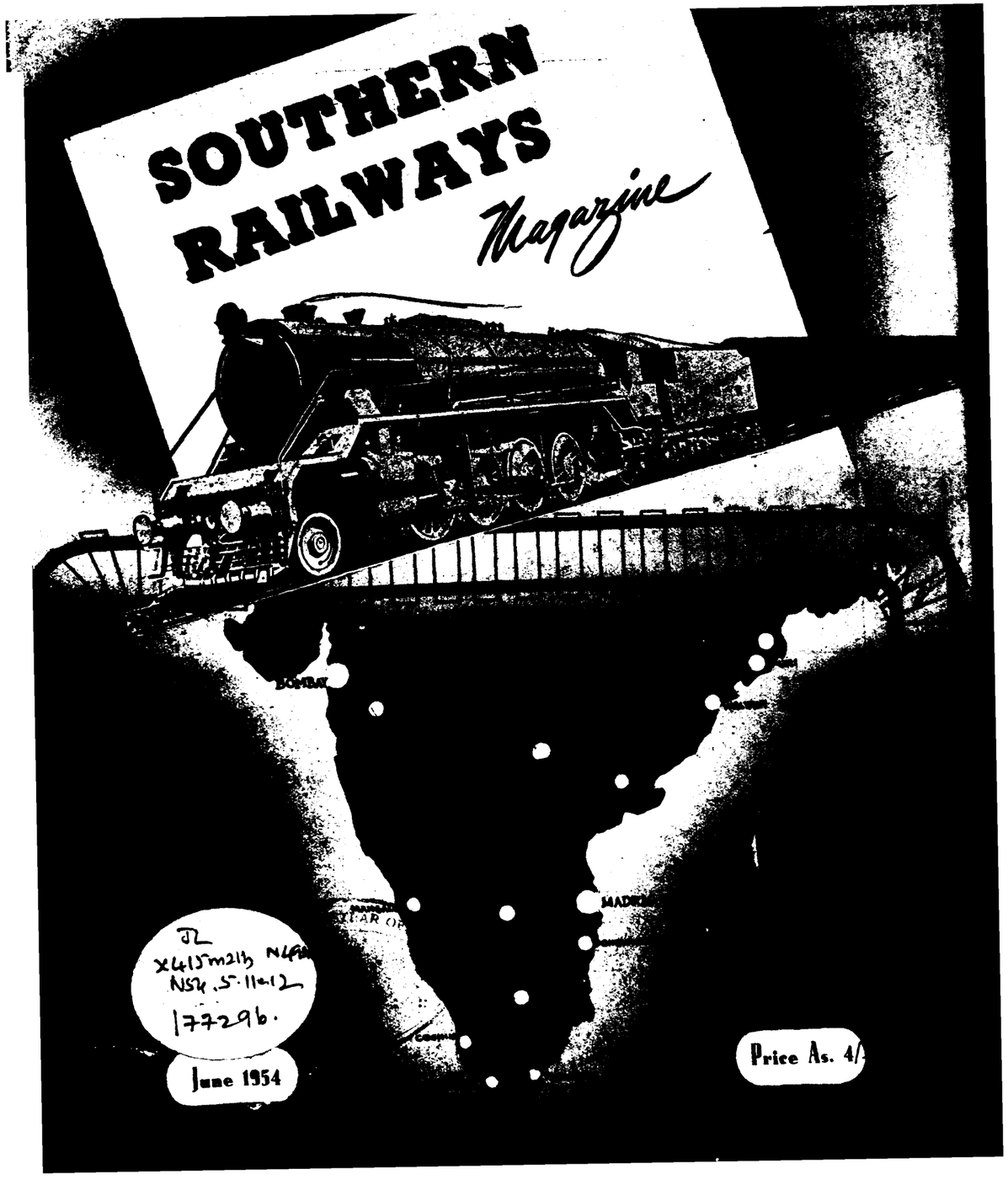

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INDIAN RAILWAYS WORKSHOPS SUPPLEMENT

SOUTHERN RAILWAYS MAGAZINE

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Development of Co-operatives on Railways

INDIA'S first Five-Year Plan envisages considerable development of industries throughout the country. Wherever these new industries will ultimately be located, and depending upon the size of the factories and plants to be built, there will naturally be an increasing concentration of employees to the extent that even new townships near will spring up near by to house all grades of workers. These workers will also be potential consumers of all kinds of foodstuffs, articles, goods etc. as well as investors in savings and insurance schemes of a modest nature. If operatives and workers are not encouraged and helped to provide all their needs on a co-operative basis, private enterprise consisting of opportunist business men and petty traders will soon set up their schemes and shops, with the private profit motive for which the workers will obviously have to pay much more out of their hard-earned wages.

It was to avoid the middleman's profits and to help workers have a share in trading concerns that co-operative stores, banks, credit and insurance societies and canteens had sprung up in the past where there were large concentrations of employees of all grades, i.e. administrative, clerical, technical, skilled and unskilled.

In the past the Railways in India, although not having concentrations of employees in their thousands, other than at workshops, headquarters and a few other centres, did regard themselves as integral units, each employing staff up to the extent of from fifty to a hundred thousand and even more. Realising the importance of co-operative societies, stores, banks etc. the authorities encouraged these. Every Class I Railway in India has had at least one of these co-operative societies for at least two decades. Apart from encouraging the average railway employee to save even a few rupees a month from his wages or salary, the credit societies have been of immense benefit to the Railwayman. When he has needed a large sum of money to meet such expenses as medical treatment, marriages, outfitting children for school, etc. he has been able to borrow from his local credit society and repay in small instalments over the course of even as much as four years. If these societies were not in existance the railwayman would be compelled to borrow money from professional money-lenders and usurers at rates of interest which would eventually cripple him financially, the ultimate result being utter bankruptcy and the loss of his service.

It was with the object of extending and further encouraging the co-operative movement amongst railwaymen in India that the Ministry of Railways placed an officer on special duty to make detailed enquiries in this context and submit a report of recommendations. As a result of this investigation the Railway Board have approved of a plan for the organisation and development of consumer co-operative societies on Indian Railways during the next five years.

The plan aims at setting up a network of primary consumer societies of railway employees, and at a later stage, the formation of wholesale societies to feed the retail societies. For the first three years after registration these societies will be subsidized to the extent of half of their establishment and administrative charges. Interest-free loans will also be granted by the Staff Benefit Fund to those societies which cover an area of operation with less than 1000 railway workers. The Railway Board have also instructed Railway Administrations to ask their administrative officers and senior staff of various departments to render all possible assistance so that the co-operative movement will spread. Administrations have also been asked to provide suitable premises at a nominal rent of one rupee per month, and in new railway colonies, provision should be made for erecting buildings for this purpose.

To provide an incentive to all railwaymen the Railway Board have accepted the recommendation that the value of shares in these societies should be Rs. 10 each, which may be collected from each employee who desires to become a share-holder through pay bills in suitable instalments. Thus even a class IV employee whose basic monthly wage is from Rs. 30 to Rs. 50 would be able to buy a share or shares in his local co-operative.

During the course of the investigations into existing co-operative societies it was found that there were 60 primary co-operative consumer societies and 27 co-operative credit societies, banks, etc. functioning on Indian Railways. In so far as primary consumer co-operative societies are concerned, within the next five years the target to be achieved is 210 such societies. To provide a suitable supervisory agency, the Ministry of Railways as decided that six Inspectors, fully conversant with and trained in co-operative methods, should be appointed, one to each of the six existing Railways.

When this plan of development and expansion of co-operative consumer societies gets under way, and with the help of the Railway Board and each Railway administration, it will be left to the railwaymen themselves to take full advantage of the opportunities that are being provided for them, as by doing so, they will be helping themselves more than they will help the authorities.

NOTES AND COMMENTS

HONOURABLE V. V. GIRI, MINISTER OF LABOUR OPENS TAMBARAM SANATORIUM STATION

ON Sunday the 6th of June 1954, a new suburban station between Chrompet and Tambaram was opened by Honourable V. V. Giri Minister of Labour, Government of India. Primarily intended for the benefit of passengers alighting to go to the famous T. B. Sanatorium, this new station will also serve the needs of the villagers around the locality. The opening of the station was due to the untiring efforts of the Land Lord Mr. Appa Rao, who owns a big garden nearby. It is a new experiment in the annuls of the working of the suburban electric railway systems in that trains stop in only one direction that is trains from Tambaram towards Madras only stop here. Major K. N. Rao, Superintendent of the T. B. Sanatorium who presided over the function gave interesting details of the working of the sanatorium which he said is housing nearly 700 patients and is one of the best equipped hospitals in T. B. in the whole of South East Asia.

Mr. Appa Rao described in his opening speech how it took him several years to achieve this object and how when the General Manager decided to have a station, expedited the works within the shortest possible time that the opening of the new station was possible.

The General Manager Mr. T. A. Joseph said that normally it costs 7 lakhs for a full-pledged suburban station but as the money could not be found, it was decided to experiment on this new method of stopping trains from one direction and if it proves successful it will be tried elsewhere. Even this stop-gap station costed Rs. 40,000.

Amidst cheers, the pleasant function of opening was done by the Hon'ble Minister.

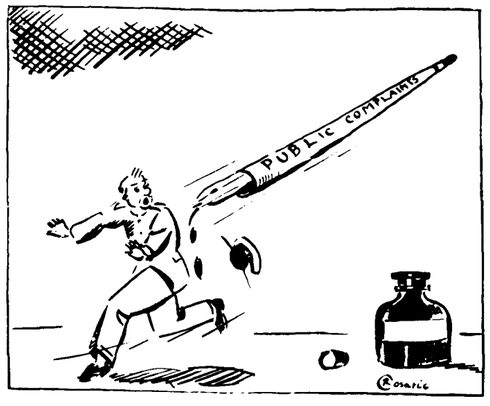
The first train, gaily decorated and illuminated by colour lights steamed in and all there present had a joy ride up to Chrompet.

Mr. A. R. Rao, Senior Deputy General Manager, and Mr. S. R. Sarma, Chief Operating Supdt., Mr. S. Samba-

moorthy the District Traffic Supdt., Madras were also present. It must be mentioned that the arrangements were so perfect and everything went on so well due to the untiring efforts of the D. T. S. Madras, Mr. Sambamoorthy.

LABOUR POLICY OF THE GENERAL MANAGER

Our present General Manager Mr. T. A. Joseph has assumed charge last June and nearly one year has completed since his assumption. One year is too short a period to assess the results but as General Managers on primarily responsible for labour relations, an opportunity was afforded to Railway Labour to have an idea of the policy. The Mysore Region Employees Union had the annual meeting with the General Manager on 8th June 1954 and had before them an agenda of nearly 30 to 40 subjects for discussion. The union leaders it appears went away down-hearted as not one of the item was conceded. It is stated that the discussions were sweet-coated cordial, friendly and so on but the net result was practically nil. One of the disputed item was payment of night allowance to workers when doing night work in shops.

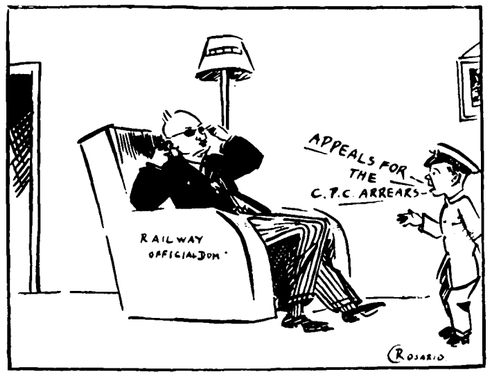


Railway staff have of late been harassed by the growing number of public complaints — many of them being frivolous.

The union leaders said that this allowance is being paid to Golden Rock Workers and wanted the same to be extended to them. The General Manager said it seems that the payment to Golden Rock workers was a mistake and one mistake committed elsewhere need not be repeated at another place. The union leaders genuinely felt that some allowance was necessary as night work involves extra strain and is against nature and all progressive countries do pay allowances. The General Manager was of the view that the new pay commission has given a lot of increased emoluments and hence no more allowance will be given. Similarly other subjects were disposed of and each parked to meet some time next.

The leaders of organised Railway Labour were murmuring "Railwaymen are sleeping giants. They are in slumber. But they will wake up and they must."

I CAN'T HEAR YOU



Payment of the C. P. C. arrears of pay is still due on certain railways. No attention is being paid to the appeals of the staff to expedite payment.

DISSATISFACTION AMONG ASSISTANT SURGEONS CLASS II

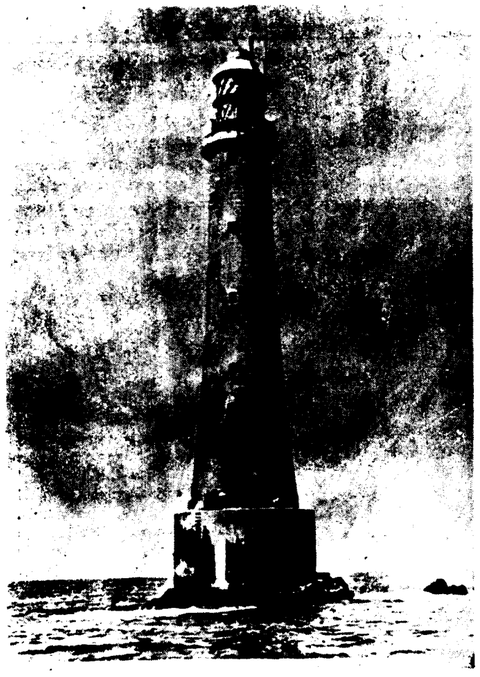
The recent selection held by the Chief Medical Officer to promote class II Assistant Surgeons to class I Assistant Surgeons has created a great dissatisfaction among the medical men. The present Chief Medical Officer who is to retire shortly assumed the charge of Chief Medical Officer ship at the time of integration in 1951. Just before selection a written test was held for there class II surgeons who have put in more than 15 to 20 years and thereby their merits were assessed. The affected staff consider and rightly that this holding of written test is not covered by the code rules and against the policy of the Railway Board. It is also stated that the written test may had to favouritism as the question paper set is liable to be onesided. Medical profession is such a vast one that one enters the profession after qualifying himself in a college and any other test done superficially is unwarranted. To fail a Doctor of 15 to 20 years who has no facility to once again read the whole theory after doing a sternous duty, will tantamont to reject serviced hands. All the Doctors in class II who are doing valuable service to Railwaymen have appealed to the higher authorities and it is hoped that justice will be done to them. We hope that the General Manager will intervene and set right the matters.

IN our London letter for April, the case of the obsolete crockery at Waterloo Station was reported. It was mentioned that Sir Brian Robertson, the Chairman of the British Transport Commission, had asked the Minister of Transport to arrange an impartial enquiry into the complaint lodged by railway staff with the National Union of Railwaymen. This enquiry was held and it was reported that British Railways were not guilty of waste in the smashing of surplus crockery. This was the verdict of Lt. General Sir Humfrey Gale, Colonel Commandant of the Army Catering Corps, who held the enquiry. In his report Sir Humfrey stated that A. J. Brandon-Trehearne, a storeman, criticised the railway's policy without appreciating the underlying reasons. Brandon-Trehearne's name was linked with the original complaints of crockery smashing. The main points brought out in the report were :—(1) His limited experience in a small store at Waterloo provided no evidence that managerial policy as a whole was in any way at fault. In consequence the information on which the press reports were based was misleading. (2) There was no evidence of waste or wasteful intention in handling the surpluses at Waterloo. The methods adopted were similar to those normally used in the catering trade. (3) The review of surplus stocks was undertaken by staff possessing adequate seniority, experience and technical knowledge. Proper steps were taken to retain in service, or to place suitable surpluses in other agencies of the British Transport Commission. (4) The procedure for disposal of surplus equipment is thoroughly sound and is carried out in practice with meticulous care. (5) The investigation shows that the reports submitted to the chairman of the British Transport Commission and quoted by him in his letter to the Minister of Transport are correct in every detail. (6) The measures taken by hotels and catering services to rationalise and standardise their equipment and stores procedure are being undertaken in such a way as to avoid waste and unnecessary expenditure. The report revealed that there were enormous surpluses of obsolete equipment which would never be used. For example, fruit knives and forks were little used nowadays in railway catering. At Peterborough depot there were sufficient knives in stock to last 13 years and 86 years in the case of forks. A. J. Brandon-Trehearne, the storeman who was ordered to smash the crockery, said that he was disgusted with the report and still thought the procedure was wasteful. He intends to continue his fight through the Union.

Sir Brian Robertson, Chairman of the British Transport Commission, said at the annual dinner of the Institute of Transport "After three months in office I find a great deal of the equipment of the railways is out of date and some of it has passed its economic life. There was a general feeling in Parliament, and outside he said, that transport should cease to be the subject of hot, political controversy. This, of course, does not mean that transport can cease to be of political interest but it does mean that the broad issues should be settled. The railways should be given a clear mandate and then be permitted a period of stability without which we have no chance to put our house in order. The time has gone when the representatives of management and workers can regard themselves as being in opposite camps, seeking constantly to gain a victory at the expense of the other. So far as the railways are concerned, at least, there are not two sides any longer. Management and workers alike are faced with a grave common problem which will only be solved by joint effort. In the course of his speech he described London Transport as the finest municipal transport organisation of its kind in the world.

The chances of being killed in a railway accident in Britain have been worked out by Lieut. Col. G. R. S. Wilson, Chief Inspecting Officer of Railways. In addressing the Royal Society of Arts he said :— "If you travel by rail three times a week, you will probably be killed before you are 230,000 years old!" His statistics

showed that in the seven years 1946–52, the number of passengers who lost their lives in accidents involving trains in Britain was 331 including 108 at Harrow in 1952. One passenger was killed for every thirty five million passenger journeys. Speaking of the future, he said it was difficult to foresee any startling new ideas in safety devices. Radar had no application in the prevention of rail collisions and radio only a limited value.



Reference is made in this letter to a fire which occurred at the Lizard Lighthouse in Cornwall on March 19. This photograph shows a typical lighthouse. The gravity of a fire in such isolated places can be appreciated.

Canada's first underground railway, the Yonge Street Subway of the Toronto Transit Commission, was officially opened on March 30 by Mr. Leslie M. Frost, Prime Minister of Ontario. The line runs for some 4½ miles in cut and cover formation beneath or in cutting close to Yonge Street, the main north south artery from a terminus adjoining the Union terminal to Eglinton Avenue. It is laid to the 4 ft. 10⅞ in. gauge, that of the city tramways but has been designed and constructed for operation by Underground Railway stock which has been supplied by the Gloucester Railway Carriage & Wagon Co. Ltd. Other British manufacturers have been closely associated with the work. The main ceremony took place at Davisville Station, the last before Eglinton on the open section of the line. After short speeches by Mr. William C. Mc Brien, Chairman of the Toronto Transit Commission, Mr. Allan A. Lamport, Mayor of Toronto, Mr. F. G. Gardiner, Chairman, Toronto Metropolitan Council, The Rev. C. H. Bentall invoked a blessing on the line and its operation. Mr. Leslie M. Frost expressed his great honour and pleasure in giving Canada its first subway. He then pushed a control handle setting a light to green symbolising the opening of the railway.

The gauge of the railway is non standard since standard gauge is 4 ft. 8½ inches. The railway was planned more than 10 years ago and it has been 4½ years building. 104 carriages have supplied for it. David Brown of Huddersfield have supplied 400 axle units and the Crompton Parkinson Co., provided four 68 h. p. motors for each carriage. The system is not like the London Transport deep level 'tubes'. It is no deeper than their surface lines, the Metropolitan and District and like them makes some excursions into the open through deep cuts. The 'cut and cover' method of construction was chosen. By this method, preliminary trenches are dug along the sides of the streets to locate hydro and telephone conduits, gas, water and sewer mains and utility feeders to individual buildings. When the excavation reaches a depth of about 18 feet, temporary decking is laid as a cover so that street traffic may be resumed while the excavation is carried on to the final depth. Girder beams spanning the piles hold back the pressure of side wall earth and buildings. A Sidewalk superintendent's manual has been issued by the Toronto Transport Commission to explain the work to lunch hour idlers. The subway will handle 40,000 passengers an hour which is nearly three times the capacity of the trams now used on the same route. The maximum speed of the cars 50 m. p. h. but the stations will be too close for this speed to be attained often and the average speed is expected to be about 20 m. p. h. The removal of the trams from surface routes will eliminate bottle necks in street traffic. The trains will consist of from two to eight carriages. There is an automatic block signal system and a system of underground telephones. As in London, brakes will be applied automatically if a driver tries to pass a red signal or if he releases his hand from the controls. Escalators are being built.

Atlas Diesel AD

AIR COMPRESSORS AND VACUUM PUMPS

OF UNEQUALLED ECONOMY

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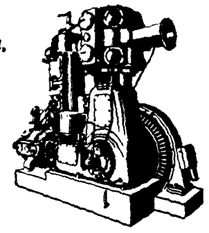
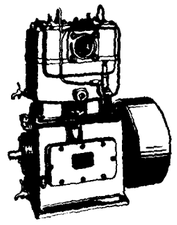
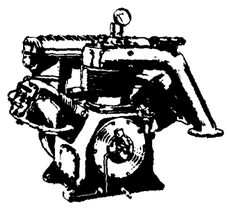
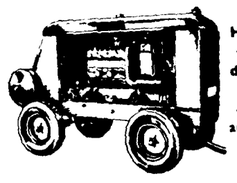




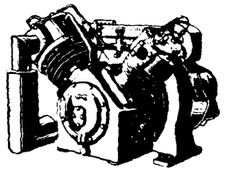
R2A6-Watercooled, stationary—one stage aircompressors. Simple, reliable, low priced and cheap in upkeep. 117 CFM capacity 100 p.s.i. working pressure.



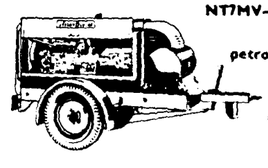
CR-CT Class, water and aircooled 2 stage stationary air compressor. Capacity 150-330 CFM for working pressure up to 125 p.s.i.



HR4V-FR4V-Portable, 2 stage all-watercooled diesel compressors with Atlas-Diesel "Polar" engine, extremely rugged and simple, cheap upkeep, economical, favourable prices, 250 and 160 CFM capacity.



NT-Class, aircooled, 2 stage aircompressors. Compact units for direct flanging to electric motors and for Vee belt drive. 4 sizes, 35-110 CFM, working pressure up to 125 p.s.i.



NT7MV-NT9MV—Portable 2 stage diesel and petrol driven compressors. Powered by Dorman, Armstrong or Standard engines, 60 and 110 CFM

Atlas Diesel AD

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OF HIGH EFFICIENCY

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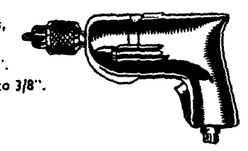
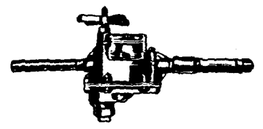
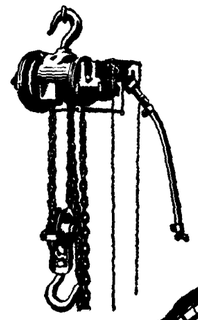
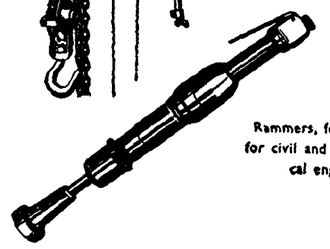


Heavy type drills max. 4".





Air blocks, capacity 1000-11000 lbs.



Rammers, four types for civil and mechanical engineering.

Riveters, clipping hammers, Rivet Bursters.

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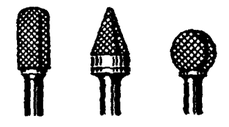

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EVEREST

It is seldom that a lighthouse catches on fire but this happened to the Lizard lighthouse in Cornwall, on the southernmost tip of England, on the night of March 19. Flames broke out in the engine room of this lighthouse, a famous landmark to mariners from all over the world. Assistant Keeper John Billet was alone in the room at the time. Next door were tanks containing 5,000 gallons of oil and in the engine room were four engines each with 40 gallons of oil in its base. Strangely enough, this is the second lighthouse fire in two days for on March 17 Skerryvore Lighthouse in the Atlantic, 60 miles off the Argyll coast, was destroyed. Mr. Billett said :—" There was a sudden burst of flame around No. 2 engine and then all the channellings right around the room were alight. Almost instantly the engine room became full of choking gases and I could not breathe. I escaped and called Mullion Fire Brigade and then got our own station team to work. Sub Officer H. Ireland of the Fire Brigade said :—" The engine room was so thick with fumes that I could not even see the powerful electric lights that were on. One of the machines which just escaped damage—its canvas cover was just beginning to burn—is the " darling " of the station, an 1878 dynamo, one of the earliest in the country. Until recently it still supplied current for the lamps in the lantern. Soon after the firemen left, the light was in action again.

On the night of March 6 heavy waves swept over the sea wall at Cleethorpes, Lincolnshire, washing away part of a bank supporting the town's main railway line. There was an exceptionally high tide and a strong north easterly wind. A 15 foot gap was torn in the bank at Suggitts Lane and the rails were left suspended in mid air. About 100 yards of line were flooded. All trains were stopped from entering or leaving the town. Thirty railway porters were called out to begin the task of filling in the gap. Nearby streets were flooded to a depth of several inches and the water reached the doors of nearby cottages. Passengers for Manchester, Leeds and Sheffield were taken by taxi to Grimsby Station, two miles away. British Railways paid the fares. At Suggitts Lane there is a crossing from the road to the beach. During the February floods last year there was a similar occurrence at this point. A tide expert said that the evening tide along the east coast was between one and two feet above the predicted level. It was not up to danger level and therefore no warning was issued.

Station Master, of British Railways in day to day uniform.

Station Master at London terminal in ceremonial dress.

(Photographs by courtesy of British Railways, Western Region)

Station Masters at London terminals, and some provincial terminals and junctions, are quite important officials. They have a number of assistants and quite a staff of clerks, typists and stenographers. Unlike other stations, these station masters do not always wear the standard uniform adopted by British Railways. They are clothed in dark morning dress consisting of a black tail coat and waistcoat and striped trousers. They also wear a 'tall' or 'top' silk hat. The 'order of the top hat' has been extended to three more station masters, those at Snow Hill (Birmingham), Cardiff (General) and Bristol (Temple Mead). Generally this dress is only worn on ceremonial occasions.

A Signal & Telecommunications employee of British Railways had an unusually lucky escape near Hove. He had been working on the line and was walking down the track when two light engines bore down upon him. He managed to seize the front coupling hook of the leading engine and was carried along for about half a mile until the locomotives were stopped by a gang of platelayers. He was taken to hospital with a fractured wrist and a lacerated knee.

£ 5,000,000 PERSIAN CONTRACT FOR BRITAIN

The United Steel Companies Limited, acting on behalf of the British makers of permanent way materials, have signed a contract with the Seven Year Plan Organization in Persia for permanent way materials to the value of £ 5,000,000.

The Persian Railway authorities with whom the contract has been concluded are planning not only to rehabilitate their main railway line from the Persian Gulf to the Caspian Sea but to complete the braneh line to Tabriz and to build a long extension to Meshed.

SIGNALLING AND INTERLOCKING

By H. C. Towers, M.I.E.E., M.I.R.S.E., M.Inst.T.

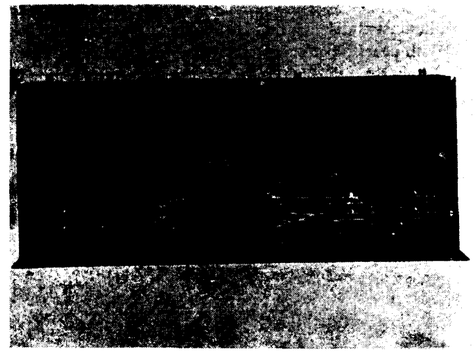
Chapter 16. Panel interlocking.

AT the end of Chapter 1, brief reference was made to relay interlocking schemes or what is nowadays more familiarly known as panels. With power frames, using miniature levers up to 200 or more, the frame is from 40 to 50 feet long. This entails a considerable amount of walking backwards and forwards in order to operate the levers for the many routes such a frame would control. To overcome this difficulty it is necessary to divide the work in the frame depending on the busy periods of the yard. Thus, during peak time, when many trains are passing to and fro, there may be three or four signalmen operating levers allotted to them and at least two during slack periods. Where frames are large, it is necessary to provide duplicate illuminated diagrams in order that the signalmen at both ends can see which lines are occupied and free. All this means additional expense in original installation and recurring charge for wages, etc. The operating portion of the signal cabin is also required to be large.

In the previous chapter it has been shown that the miniature levers in the power frame operate the circuit controllers which work the signals and points and also the mechanical or electrical interlocking between the levers. If these circuit controllers could be operated by electro magnets so that they would in fact become relays, and suitably interlock them, only miniature switches would be required in the operating portion of the cabin for the signalmen to manipulate. This development took place some fifteen years or more ago and was then known as relay interlocking. The miniature switches were mounted on the illuminated diagram itself and were positioned relative to the various units they controlled. These switches took various forms and operated in different ways according to the particular firm who designed and manufactured them. In some cases separate switches were provided for the operation of the points and the signals. To take a simple example, a pair of points leading to two reception lines. There would be two colour light signals, one for each line. The point switch would have an N and R position which when operated from one position to the other would reverse the points or restore them normal as the case may be. There would be only one switch for the signals, which would be turned and the dependant signal would clear according to the position of the points. With this method it will be seen that the power frame and the illuminated diagram have been combined into one unit. Since the illuminated diagram is smaller than the power frame required for the layout shown on it, less operating space is required in the upper portion of the signals cabin. The switches on the diagram operate the interlocking relays controlling the points and signals outside the signal cabin and are in turn electrically interlocked with each other to prevent conflicting movements being set up in the event of opposing switches being operated at the same time. The visual lights repeating the point positions which are usually placed at the back of the levers in a power frame are now positioned on the diagram adjacent to the appropriate switches and the signal lights are repeated in similar manner. In the latter case the lights actually represent the signal. For example, the position of a signal is shown by a red light or lights, and these change to yellow or green on operating the signal switch alongside them according to circumstances.

This type of signal and point operation rapidly developed and diverged into many kinds. In one instance, taking the case of a group of colour light home signals reading into a number of passenger reception lines, a knob is placed on the representation of line drawn on the diagram and next to the signal repeat lights. The knob has a number of positions, each with a painted number on it, corresponding to the number of the reception lines. There is also a small plunger placed in the centre of the knob. After the knob is turned to the required position, the centre plunger is pressed. This action sets the required points and clears the necessary home signals and the signal repeat light alongside it shows green or yellow as the case may be. In the case of the power frame, several lever movements would have been necessary. With this type of panel, it is only necessary to turn the knob and press the plunger which takes a moment or so to perform. The signal will not clear if any of the points associated with the movement do not correctly respond or if any of the track circuits governing the signal are not clear. The signalman will be informed by the fact that the signal repeat indication will remain at red. The knob and plunger operates the various relays necessary to the movements. This type of panel is installed at Liverpool Street, the large London terminal on the Eastern Region where there is very heavy electric suburban and steam main line traffic.

Entrance—exit type (NX system) panel interlocking at Stratford Junction, British Railways.



Panel with switches at Kilburn, British Railways.

(By courtesy of Metropolitan Vickers GRS Ltd.)

Close up view of console showing thumb switches for one control switch system.

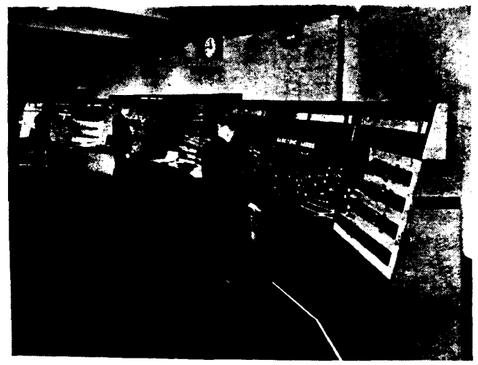
Interior of York Signal Box showing illuminated diagram and console of one control route switches.

(By courtesy of Westinghouse Brake & Signal Co. Ltd.)

On another system of panel interlocking, no selective knob is used at the Home signals. Instead of this, one switch is used at the Home signals and another on each of the reception lines. For example, if a signalman has four Home signals reading into four different lines and he wished to signal a train into No. 2 line, he turns the switch on that line and also the switch at the signal. The necessary points are operated and the appropriate Home signal clears. For the other lines he acts in a similar manner. The same remarks apply to the case of a double junction. If he was signalling a train to the main line or branch, he would turn the switch on that line beyond the points and then the one at the signal. The junction interlocking explained in the chapter on interlocking would automatically be carried out through the electrical interlocking.

From this it will be seen that panel interlocking, in whatever form it takes, required less operating space, a smaller number of signalmen and permit routes to be set up far more rapidly. Another point is that with a

power frame, the signalman has to concentrate on the illuminated diagram and at the same time work his levers. With panels, both control switches and tracks are immediately beneath his vision and also, when operating the switches, he has a far clearer conception of what he is about to do.



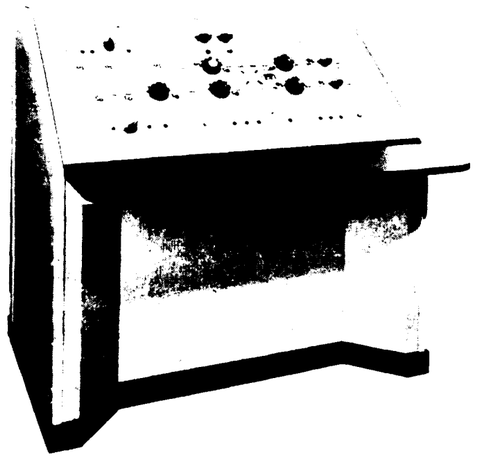
Interior of Liverpool Street Signal Cabin British Railways.

View of panel showing selection dials for routes.

(Courtesy Siemens & General Electric Rly. Signal Co. Ltd.)

In the chapter on electro mechanical signalling, it was shown that points could be worked manually from the full size levers and the colour light signals from levers of the same size and in the same frame by means of circuit controllers attached to the leavers. For reason of economy, and where the number of point movements do not warrant power operation, this method is preferable. Instead of using signal levers with circuit controllers attached to them, some railways utilise a panel for working the signals only. The panel, with the plan of lines and track circuit indications, is placed over the frame in the normal way but the signals are operated by switches placed on the diagram. These switches may be of any of the types available. The interlocking between the point levers and the signal switches is performed electrically. As a variation of this, the panel may be mounted on a sloping desk in the centre of the cabin with the large size point levers each side of it. This type is also in use.

A rather wide variation from panel interlocking is the OCS (One control switch system). This system retains the illuminated diagram as it is and there are no switches on it at all. Beneath it is a desk or console with a number of switches mounted on it in a line somewhat similar to the levers in a power frame. This method is essentially a route system and one switch will set the points and signals for a complete movement. For example, consider the approach on a fast line to a large terminal. To signal an approaching train from this line to a certain platform, a number of points may have to be worked and several signals cleared. The switch concerned with this movement would read 'Up fast to No. 9 Platform.' The turning of this switch sets all the points and clears the signal. A further refinement is that on operating the switch, a line of white lights appears on the diagram which is normally unilluminated. These lights clearly indicate the route set up, right into the platform line. The signals which have been cleared shown green on the diagram in their correct respective positions. The signalman sees immediately the route that he has set up and the signals which have been cleared. The passage of a train is indicated by red lights superimposed on the white. With a power frame this movement might have entailed the operation of ten or more levers. The saving in time can therefore be appreciated apart from the vastly improved indication to the signalman. A switch is provided for each route, including subsidiary routes for shunting purposes. In addition each pair of points has its own switch which can



Small control panel showing route selection dials.

(Courtesy Siemens & General Electric Rly. Signal Co. Ltd.)

be used to operate them individually in case of emergency or for other reason. Conflicting movements are prevented by special circuits between the relays concerned.

In the early part of Chapter I it was made clear that this explanation of signalling and interlocking was mainly intended for operating staff and those closely associated with the Signal & Telecommunication Department. It is therefore not proposed to describe how the various units operated by panel switches are electrically interlocked with each other. This would entail a knowledge of the whole theory of electrical interlocking and circuitry. With this chapter a large number of illustrations have been included to clearly illustrate the various forms of panels and the captions beneath them are intended to explain the differences and methods of operation as simply as possible.

(To be continued)

PRESIDENT'S TOUR BY RAILWAY

The President of India, who was accompanied by his personal staff and Pandit Ravi Shankar Shukla, Chief Minister of Madhya Pradesh, proceeded on tour on the night of April 25, 1954, by train from Nagpur to Amraoti. At Nagpur, the President was received at the station by the Governors of Madhya Pradesh and Uttar Pradesh. After talking for a while to those present at the station, the President accompanied by the Chief Minister of Madhya Pradesh boarded the Nagpur-Bombay Express by which he travelled to Amraoti, where they arrived early on the 26th morning.

On his alighting from his carriage in the morning, the President was garlanded, and the Deputy Commissioner, Amraoti District and other distinguished persons from the district were present, to receive him. A guard of honour was provided by the Police. After introduction of local officials and distinguised persons, the President left to fulfil his many engagements.

On his return journey, the President accompanied by the Chief Minister of Madhya Pradesh, left Amraoti on the night of the 26th April, 1954. The party travelled by shuttle to Badnera and by the Bhusaval-Nagpur Passenger to Nagpur where they arrived in the morning on the 27th April, 1954.

IN YOUR OWN INTERESTS

HOW TO PURCHASE TICKETS

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

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

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

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

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

(Inserted in the interests of Travelling Public)

This section comprises a number of technical articles of engineering interest and on miscellaneous topics written specially for the Indian Railways Loco. Carriage & Wagon Workshops Supplement by experts who are associated with Indian Railways for many years.

Manchester—Sheffield—Wath Railway Electrification Scheme Overhead Line Equipment

IN 1936 the Directors of the London and North Eastern Railway (now a part of British Railways) approved a scheme for converting to electric traction the main railway line between Manchester and Sheffield, together with the branch to Wath-on-Dearne. Factors leading to this decision were the heavy coal and mineral traffic handled, the exceptional geographical features of the route and its favourable position with regard to power supply.

Preliminary work was well in hand at the outbreak of the war, many of the structures for carrying the overhead wires having been erected and orders placed for the cables and substations, as well as for the overhead-line equipment, locomotives and multiple-unit rolling stock. In addition, the construction of a new motive power depot at Darnall near Sheffield had been well advanced. All work, however, was stopped on the outbreak of war but operations were resumed in the late summer of 1947.

As an introduction to the scheme it should be appreciated that the Manchester-Sheffield line is one of the main communication routes between the North-West, the East coast and the Midlands. It carries a heavy flow of mineral traffic from the South Yorkshire, Derbyshire and Nottinghamshire coalfields to the industrial areas of the North-West. In addition to a considerable volume of general freight traffic, there are passenger services connecting Manchester, Sheffield, the Midlands and the South, and the East coast ports and holiday resorts. Each day an average of 90 trains pass over the down line towards Manchester, while some 80 trains use the up line.

The electrification scheme is being carried out in three stages. First the section between Wath and Dunford Bridge via Barnsley Junction, which was officially opened in February 1952: second, Dunford Bridge to Manchester (London Road); including the Glossop branch and Reddish depot as well as the new Woodhead Tunnel which will be completed in 1954; third, Sheffield (Victoria) to Barnsley Junction also to be completed in 1954 and finally Sheffield (Victoria) to Rotherwood Sidings to be completed in 1955. These sections total approximately 68 miles of route, with a track mileage of 300 miles.

The tracks are being electrified on the overhead line system at 1,500 volts D. C. by British Insulated Callender's Construction Company Limited, using equipment similar to that installed by the same organization on the London (Liverpool Street) to Shenfield and on the Manchester to Altrincham electrification schemes.

The overhead line equipment for main line tracks is of the compound catenary type, comprising a main catenary cable of hard-drawn strandes copper from which is suspended, by means of solid copper dropper wires, a hard-drawn stranded copper auxiliary catenary. From this, in turn, is suspended a solid grooved cadmium copper cantact wire, with which the pantograph current collector makes contact. On sidings a simpler form of equipment is used consisting of a main catenary with the contact wire suspended directly from it.

The catenaries are supported on steel bridge structures at a normal spacing of 210 feet but this spacing is reduced as necessary on curves. The contact wire for each track is registered in position by means of a steady arm at each supporting structure.

The structures normally consist of two masts and a bridge member spanning all the tracks to be electrified. At complicated junctions and large groups of sidings, compound structures with three or more masts are used or, if space between tracks is not available for masts, the equipments are supported on cable head-spans between tall steel masts erected on either side on the tracks.

At intervals of approximately one mile, the equipments for the electrified tracks are overlapped and anchord off on special anchor structures, one such structure being provided at each end of a 200 feet overlap span. The overlapping of the equipments provide a smooth transfer for the current collector from one contact wire to another. Insulated overlap spans are arranged at all substations and track sectioning cabins, for the purpose of feeding and sectioning; also at other sectioning points which may be required for traffic operation, or to enable sections of the line to be isolated for repairs and maintenance.

The return current to the substation is taken through the track rails and each rail joint is provided with a stranded copper bond welded to the rail heads, while cross bonds are provided between rails and tracks as necessary.

The first section of the electrification scheme, between Wath and Dunford Bridge, is of particular importance due to the large marshalling yards at Wath which receive and despatch thousands of tons of coal every day to destinations in the North-West. The heavy mineral trains were previously drawn up the 850 feet climb to the summit at Dunford—with a maximum gradient of 1 in 40—by two steam locomotives with two others

acting as bankers on the most severe stretch. For similar loads the electrified service needs only one hauling and one banking locomotive, effecting a considerable saving in crew and fuel costs. Additional fuel economies also result from the use of regenerative braking.

An interesting feature of this section is that the Wath area is liable to subsidence due to underground colliery workings, and provision is made in the design of the overhead track equipment for subsidence to take place up to as much as 4 feet on some lengths. The solution of this problem involved close co-operation between British Railways and the engineers of the BIC Construction Company, because when subsidence occurs the tracks must be lifted up to ensure that the grading remains within reasonable limits. This means that throughout the mining area provision had to be made for the overhead equipment to be raised, in order to maintain a constant height of 16 feet between the contact wire and the rail level.

Available data on mining subsidence was used to prepare charts showing the estimated subsidence along the route; this varied from 6 inches to 4 feet. To these charts were added details of the track lifting which would have to be carried out, and it was then possible to make a reasonable estimate of the total amount by which the overhead equipment would have to be raised.

Three principal methods are used for raising the overhead equipment after subsidence. When not more than four tracks had to be equipped, structures with adjustable bridges and mast bases were employed. Where the number of tracks was more than four, towers with adjustable bases and carrying adjustable head-spans were erected, and separate adjustable anchor masts were provided wherever the equipment had to be terminated.

Structures with 35-feet centres of masts spanning two tracks are designed as portals, and are fabricated from broad flange beam sections. The adjustable connection between the bridge and the masts is adequate to transfer vertical loads of up to 3,160 lbs., and horizontal loads of up to 4,450 lbs., from one to the other. This type of connection involves the use of substantial gusset plates which are welded to the bridge and secured to the masts by clamping bolts. Structures with 66-feet centres of masts spanning four tracks are also designed as portals and fabricated from broad flange beam sections, but in this case knee-braces are used. The end of the bridge and its knee-brace are bolted to a common plate which is clamped to the mast by bolts. The bases of all these structures are made adjustable so that if subsidence causes the foundations to move out of level the masts can beset plumb. After ground subsidence the masts are re-plumbed by packing under the base, additional lengths of holding-down bolts and distant pieces being provided for this purpose. Great accuracy was necessary in mounting these masts on their foundations to ensure that no extra stresses were set up in the structure when the bridges were bolted in position.

Where more than four tracks have to be spanned the equipment is supported from a catenary head-span wire carried on towers. The head-span wire, which has a tension of 10,000 lbs. is attached to the tops of the towers so that no adjustment is necessary to it when subsidence occurs. The two lower wires, which are required to maintain the equipments in position over the tracks, are attached to an adjustable bar which can be raised up the towers as subsidence takes place. As these bars are raised the vertical " droppers ", from the head-span catenary to the insulators, are shortened. The lengths of the head-span wires were accurately calculated before erection so that they could be cut to length on the ground and their terminating clamps fitted. This was essential in order to cause as little interference as possible to traffic during construction work.

Provision has been made in the design of the tower foundations for the front edge of the tower to be jacked up if necessary. This is also to ensure that as subsidence causes the foundations to move out of level, the towers can be re-set in a vertical position by raising them and packing under their bases.

The anchor masts, used for terminating the equipments, required very careful design as the maximum load to be carried by a mast terminating the catenary, auxiliary and contact wires amounts to 12,277 lbs. per set of equipment. The top of the mast had to be left free of bracing so that the equipment can be raised as subsidence occurs; the clamps which secure the insulators can actually be moved right to the top of the mast. As with the structures and towers, the bases of these masts are adjustable so they can be kept plumb.

Special arrangements are made at rectifier substations and track-sectioning cabins where the overhead equipment is connected to sectioning switches. At these places separate structures are provided to carry the switches, and steel bridges are provided across the tracks at a height sufficient to allow for any estimated subsidence. The positive feeder cables are carried across these bridges and terminated on pedestal insulators from which flexible connections are made to the overhead equipment. As subsidence occurs and the track equipment is raised these flexible connections will be cut shorter.

Linked for 100 Years with Indian Railways

METROPOLITAN-CAMMELL Carriage and Wagon Company Ltd. take great pleasure in extending their congratulations to the Railways of India on the completion of their first hundred years of public service.

Throughout this period, the Metropolitan-Cammell Company and the Carriage and Wagon Builders incorporated within their present organisation are proud to have supplied to Indian Railways many thousands of coaches and wagons of all types. During these hundred years, both organisations have grown in size and repute, their histories having been mutually influenced at many stages of development.

Joseph Wright, a London Coachbuilder and founder of the Metropolitan-Cammell Company, was during the early part of the last century a contractor for the Royal Mails and owner of most of the stage coaches then running between London and Birmingham. Undoubtedly a man of great foresight and ability, he turned his attention to railway carriage building in 1840.

Although the earliest railways were laid for the transport of coal, stone, etc. from mines and quarries, he realised that this method of transporting passengers over routes between towns was likely to prove quicker and more reliable than the existing road coach routes. It was natural that this new mode of transport should be adapted for the conveyance of passengers.

In 1845 he acquired six acres of land at Saltley, which was then a village on the outskirts of Birmingham. On that land he built the original Saltley Works—destined later to become the site of the present Head Office of Metropolitan-Cammell Carriage and Wagon Co. Ltd.

By 1853, when a short railway link between Bombay and Thana was inaugurated by the Great Indian Peninsula Railway Co., Joseph Wright and Sons were well established as Railway Carriage and Wagon Builders to many railways.

From the earliest years of railways, Britain has exported rolling stock, and it is understandable that in the design of many features British practice was followed throughout the world.

It was, therefore, natural that new railways should seek assistance in the design and manufacture of rolling stock from one of the leading contractors of the day who already possessed a good knowledge of railways' needs, backed by many years of coach building experience.

Despite the ravages of time and bombing during the recent War, Metropolitan-Cammell still possess a number of the original drawings and tracings of those early days, among these being a proposed body for 2nd class Coaches to be supplied to the G. I. P. Railway—our first order from India!

Work upon this design must have been in progress for a year or two before the inauguration of the line, as one drawing is dated 4th October, 1851. So we can justly claim to have been "in on the ground floor."

Soon after the first line from Bombay was opened, the East Indian Railway Company built a line from Calcutta to Hoogly, a distance of 23 miles, which was first used in 1854.

First rolling stock orders were usually for small numbers of carriage trucks, covered goods wagons and horse boxes. As may be seen from the Company's order books, this trend continued in the following years, during which period the Delhi Railway and Punjab Railway placed their first orders with the Company.

During this decade progress continued with Railways in India and in the design and manufacture of railway rolling stock by Joseph Wright and Sons, whose business was taken over in 1862 by the Metropolitan Railway Carriage and Wagon Co. Ltd. Upon the solid foundation of skilful design and craftsmanship and use of the best quality materials, the Company's reputation was built up and has continued ever since to stand high in India and throughout the world.

More thought was given during those years to the design and layout of rolling stock which previously had been based on adaptations from road coaches. It became apparent that a country such as Indian required special attention to passenger accommodation under climatic conditions widely different from those found in Great Britain.

The heat, glare and humidity of the climate demanded greater protection, and on many early vehicles for superior clsss passengers a double roof was provided, together with deep hooded sun-shades over the upper parts of windows. In this feature India set a fashion which other tropical railways adopted for many years. Another device which enjoyed favour was R. D. Sander's patented air cooling system by which air for ventilation was drawn in by a scoop beneath the carriage and passed through layers of wet cloth before entering the passenger compartment. To keep the cloth moist, water tanks

were provided within the double roof, which fed an automatic tumbler mounted on the body-end, from which the water was fed to the "filters". This is perhaps the earliest attempt at air conditioning in railway coaches.

In 1866 the first vehicles were supplied to the Delhi Railway when orders for 1st and 2nd Class Carriages were received by the Metropolitan Company. These orders are typical of the period when traffic was mainly concerned with the movement of passengers. At the same time, however, horse boxes, carriage trucks and covered goods wagons were supplied. A beautifully executed drawing of the horse box is still in the possession of the Company.

In 1868 the first sleeping cars for first class passengers were ordered by the G. I. P. Railway to simple designs compared with present standards, yet then considered the acme of comfort and the ultimate in speedy transport. Carriages specially designed to provide sleeping accommodation on long journeys were used by Indian Railways considerably before this arrangement was accepted for use on the railways in Great Britain. Longitudinal padded seats were provided and passengers brought their own bedding—as was customary at that time on Indian Railways.

In a country so vast as India, there was obviously tremendous scope for long distance through routes. Despite the lack of centralised control of development in early years, India successfully developed these through routes, and it is probable that the country is served as well by rail as any land of similar magnitude. The original scheme linked the main cities and upon this plan the whole system of Indian Railways was built up. Progress was not rapid during the first 25 years, and not 5,000 miles of track were laid before 1875. During the following 30 years this figure was to be multiplied sevenfold.

The structure of coaches was composed largely of teak, with choice timbers for interior panelling of superior coaches. Iron sections really were of iron and it is interesting to note that Metropolitan-Cammell, the pioneers of all-metal construction, prepared designs for India which incorporated all-metal underframes for vehicles as early as 1866.

By the end of the 1870's, the first railways in India were firmly established; rolling stock was being supplied to the Indian State, Darjeeling, East Bengal and other railways. The next decade was to indicate the broader tasks of the railways and foreshadow the rapid expansion in all types of traffic which was to take place.

It would not be an overstatement to say that the modern history of any country has been influenced largely by the facilities of that country for carrying the commodities necessary for the transaction of modern trade and commerce, and that the design of rolling stock has mirrored not only the improving travelling conditions of the country but also the changing social conditions of the people served.

At about this time, there is evidence in the Company's order books of the start of the very considerable expansion of Indian Railways which took place at the turn of the century, and to appreciate fully the effect upon the rolling stock builders, the pattern of growth of the traffic carried must be considered.

New railway routes were continuously being laid down. People were able to travel along routes connecting business centres and ports with greater convenience than hitherto. As business connections became established and industry developed, the need arose to transport raw materials to industrial centres and to distribute finished products to markets and ports. Thus goods traffic became increasingly important and railways were obliged to develop further routes and new types of rolling stock to meet these needs. Slowly the transport of freight became established as the main source of revenue except in the densely populated cities where extensive suburban passenger services were operated.

Towards the end of the century, passenger vehicles were beginning to take the form and layout of the modern coach. One example of the type of design and workmanship of those days is illustrated on page 9—a special Inspection Car for use on the metre-gauge tracks of the Assam-Bengal Railway, which illustrates the degree to which the coach designer went to mirror the style and atmosphere of the late Victorian type of office interior.

This design is worth further study, as there are embodied in it many features then considered new to railways and accepted for many years after. It is mounted on 4-wheel bogies (of which principle Joseph Wright held the first patent) and has steel channel section solebars and longitudes.

Gradually timber gave way to steel in the structure of the coach as well as for underframe and bogies, but the form of the structure still followed along traditional lines.

The first all-steel coach was built by the Metropolitan Company in 1893.

In Great Britain orders for rolling stock were increasing with the corresponding expansion of railways

overseas. To meet the greatly increased demand by improved manufacturing arrangements under centralised control, the Metropolitan Amalgamated Railway Carriage and Wagon Co. Ltd. was formed in 1902. This new Company took over the business of the Metropolitan Company and other rolling stock builders, and secured the benefit of their combined design experience and production resources.

This was a wise more. Whilst orders were still being received for passenger coaches, indicating a gradual expansion and replacement rather than any big increase in this type of traffic, goods wagons were being ordered in thousands to meet the increasing demands for transport of trade commodities and industrial products.

During the years 1907 to 1909, the Metropolitan Amalgamated Company supplied various railways in India with nearly 11,000 wagons and more than 200 coaches. The Company was, therefore, making a contribution to the greater availability of the material resources of India for distribution for the benefit of the peoples of the world.

Further large orders followed in the years remaining before the outbreak of the First World War, as shown :-

1911—1,715 Wagons and 42 Carriages
1912—5,852 Wagons and 12 Carriages
1913—7,549 Wagons and 26 Carriages

Most of the Wagons were supplied to the Indian State Railways and the East Indian Railway, the latter railway handling exceptionally heavy freight traffic. At the same time, the Company were supplying large quantities of rolling stock to other countries and to the railways in Great Britain. These larger orders reflected the benefit derived from enterprise in development of the agricultural and mineral wealth of vast regions which were inaccessible before they were opened up by railways, in the construction of which British engineers took a leading part.

Production of railway vehicles dropped considerably during the First World War and was restricted for some time afterwards by adverse economic conditions.

In India, the railways had been reorganised and much experience had been gained during the war in indigenous manufacture and maintenance of vehicles types, and as many raw materials and timbers were available within the country it was natural that use should be made of these resources and experience. This resulted in changes in the types of orders placed for rolling stock so that large numbers of steel parts and components were inported for assembly of complete vehicles in India, most of the timber parts being manufactured there.

In 1919 the Metropolitan Company became part of the Vickers Group of Companies.

In December 1918, the Company entered into a contract with the Bengal Nagpur Railway Company for the supply of up to 9,000 wagons of various types during the following ten years.

Order continued to the placed with the Metropolitan Company for goods vehicles which were required in large numbers and for the production of which the Company possessed extensive resources.

During the 1920's it became apparent that standardization of components and certain types of vehicles would assist greatly in the design, supply and maintenance of rolling stock. With this in view, the Metropolitan Company co-operated with the Consulting Engineers, to produce a series of designs which would be suitable for use on many different routes. A number of excellent designs resulted, to which many wagons and parts have been produced for both broad and metre gauge use. One of the standard types of wagons is illustrated.

Meanwhile, great changes had taken place over the years in the principal centres of commerce in India. Bombay, Madras and Calcutta all expanded as the result of increased trading and industrial importance. A greater number of people looked to these cities for employment and suburbs were built to accommodate them. This created a new problem for the railways—that of providing a frequent local service to carry people to and from work at rush periods. So came into being the suburban traffic associated with all modern cities.

To meet the requirements of such suburban services, a special type of open saloon carrying the maximum number of passengers was designed. As the journeys were of short duration, comfort was a secondary consideration and accommodation was provided for a large number of standing passengers.

The Metropolitan Company supplied electric multiple unit stock for use on the first electrification of suburban services undertaken in India; those electrified routes around Bombay were opened just over 28 years ago by the G. I. P. and B. B. and C. I. Railways.

Articulated electric train units were also supplied a year or two later to the South Indian Railway when the suburban services of Madras were electrified.

(Continued on page 12)

Short Review of Cambrian Wagon

THE Company was founded in 1906 and its principal works at Maindy, Cardiff, is situated at the hub of the South Wales Coal Industry. In consequence of this and of its close association with the Powell Duffryn Group—formerly the largest coal-producing organisation in Europe—the Company has specialised for a long period of years in the production of wagons for mineral and goods traffic and in the manufacture of mine and quarry cars of a wide variety of types.

Cambrian Wagon & Engineering Co. was one of the pioneers of the all-steel mineral wagon in Great Britain. More recently the Company introduced the first aluminium topped wagon in this country and has since supplied a number of such vehicles made partly of light metals.

The Maindy Works covers an area of 23 acres and includes forging, stamping, pressing, welding, riveting and wood working shops all equipped with up-to-date plant for the manufacture of railway wagons in their entirely including springs, and many components.

Within recent years an extensive plant was installed for the manufacture of tanks for rail tank cars and liquid storage purposes which are now being produced in quantity.

At present the Company has in hand a 5 year contract for 16-ton all-steel wagons for British Railways for delivery at the rate of 2,500 wagons a year. In addition, it is supplying goods vehicles of many different types for leading railways in various countries abroad.

MB's Contribution to Indian Railways

NO record of the growth and development of Railways in India would be complete without mention of the contribution made by this organisation. Few, perhaps, are aware that the first Railway track of the former East Indian Railway was constructed by Burn & Co.

In the middle of the 19th Century when the importance of modernizing India's communication system was of top ranking priority, John Gray was the senior partner of Burn & Co. So considerable was the reputation which he had built up from the year 1829 when he first joined the firm as a partner, that Burn & Co., was the natural choice by the authorities for undertaking this important work. Gray brought out from Scotland, Peter Nichol, a railway engineer, on the Glasgow and South Western Railway; and between 1851 and 1859 over 100 miles of permanent way was laid for the East Indian Railway, stretching over two provinces.

Glowing tributes to Burn & Co.'s pioneering work for the Indian Railways have been paid by Capt. Edward Davidson of the Royal Engineers in his authoritative book " The Railways of India " published from London

(Continued from page 9)

In 1929 Cammell Laird's Railway Rolling Stock interests were merged with those of the Metropolitan Company to form the present great concern of Metropolitan-Cammell Carriage and Wagon Co. Ltd. with its Head Office at Saltley, Birmingham, and subsequently all the manufacturing resources were concentrated in three large factories covering a total of 188 acres and normally providing employment for 6,000 people in the Birmingham area.

During the early years of this decade, the number of orders placed by the Indian Railways was restricted owing to world-wide trade recession, but when economic conditions improved, Metro-Cammell resumed supply of considerable quantities of wagons and continued to do so until the outbreak of war in 1939.

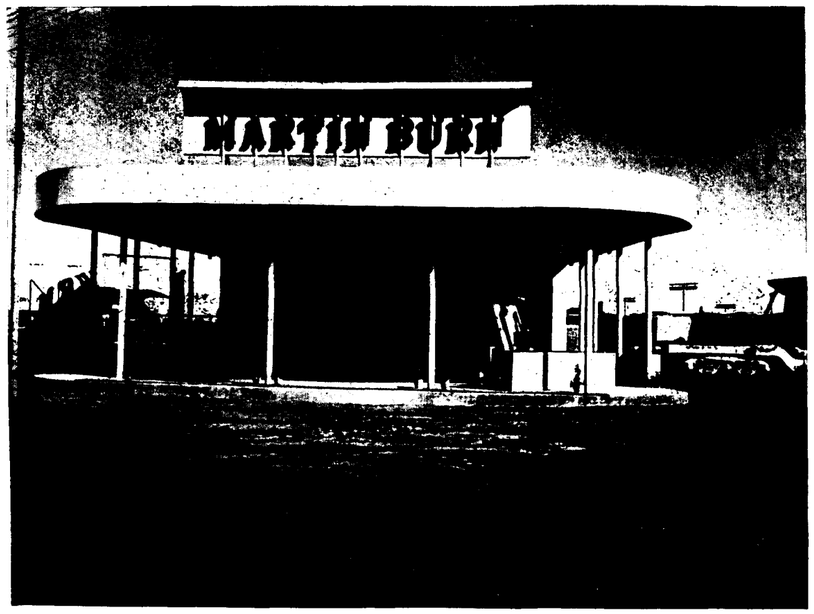
During the war years the whole of Metropolitan-Cammell's resources were diverted to armament production and, except for special types of wagons, manufacture of railway vehicles was suspended. The Railways of India were used to the limit of their capacity of the transport of men and materials for war purposes. These conditions imposed a heavy strain on rolling stock, normal replacements of which could not be provided during the war years. At the end of the war, Metro-Cammell supplied 2,500 wagons which were urgently required by India to make good accumulated dilapidations.

For many years the underframe of a coach was expected to carry its own weight plus the weight of the car body and passengers, consequently this part became very heavy and rather wasteful in the distribution of material from a structural point of view. In an attempt to reduce the weight to which coaches had grown with increased size and equipment, Metropolitan-Cammell have for a number of years been designing steel coaches, the bodies of which carry all the main loads. The work upon this problem has resulted in the more efficient use of structural parts, and as much as 26% of the tare being saved on an all-steel coach.

The Coaches recently supplied to the Indian Government Railways for use on the electrified routes around Bombay were designed along these new lines and it is interesting to note that the driving motor coaches are more than 18 tons lighter than previous for designs for the same service. The design was checked by exhaustive calculations before the prototype was built, after which the first car was subjected to thorough loading tests during which stress and deflection data were recorded to ensure a first class job for India!

Metropolitan-Cammell are determined to continue to supply the best rolling stock, sustained by the past century of co-operation and understanding with India. It is hoped that this brief historical sketch has illustrated the not inconsiderable part played Metropolitan-Cammell in the build-up and supply of rolling stock to Indian Railways over the last 100 years.

The Company probably has a greater knowledge and experience of the special requirements of India than any other concern, and it is hoped that these assets will be as fruitfully employed during the second century of the Indian Railways as they have been up to the present time.



Top :
General view of the Martin Burn Pavilion at the Railway Exhibition

Left :
A Section of Burn & Co. Ltd's. Stall.

in 1868. Davidson records how in the face of tremendous hazards occasioned by the Santhal rebellion and the Indian uprising of 1857, Burn & Co.....finished off their contracts satisfactorily and well...."

Especially creditable was the work of the firm in the Sone district where Burn & Co. laid 78 miles of permanent way during the time of the national uprising. This district was one of the worst affected and loss of property, men and materials was appalling. But, as Capt. Davidson testifies, " Messrs. Burn & Co., prosecuted their work with speed and, undeterred by the interruptions caused by the mutiny, pressed forward their undertaking to a successful conclusion ".

Obviously in spite of the development of main lines, there were many places in need of a transport system for which the provision of broad or metre gauges would have been uneconomical. Another opportunity for enterprise and pioneering thus offered itself and in the latter part of the 19th Century, Martin & Co., took the lead in building and running Light Railways. These Railways were intended to cater for short distance traffic to mitigate the hardship caused to suburban residents and traders who found it difficult to come to the cities daily for their business, educational and other occupations by carts, boats, palanquins and hackney carriages which were the existing forms of transport.

Martin & Co.'s first ventures, made possible by the promulgation of the Indian Tramways Act of Bengal in 1886, were the construction of the Howrah Amta Light Railway, and the Howrah Sheakhala Light Railway, both of which were two-foot gauge and covered a combined distance of some 63 miles. These lines were opened for traffic in 1897. After this first venture other Light Railways followed—

In 1903—The Bukhtiarpur Bihar Light Railway

In 1905—The Baraset Basirhat Light Railway

In 1907—The Shahdara Delhi Saharanpur Light Railway

In 1911—The Arrah Sasaram Light Railway

In 1922—The Futwah-Islampur Light Railway

All were 2 ft. 6 inch. gauge covering a total distance of some 270 miles.

Apart from the seven Light Railways already mentioned construction of the Nepal Government Ranaghat-Krishnagar and Arakan Light Railways was also undertaken by Martin & Co., in the first quarter of the 20th Century. The Chaparmukh Silghat Railway (a metre gauge railway) was built in the year 1920 having a mileage of 50.81 miles.

During the half century of their existence there has been a very marked increase in traffic over most of these Light Railways which could hardly have been anticipated at the time of construction. The tracks, yards, locomotives, station buildings, etc., were not originally designed to cope with the traffic that they are now called upon to handle. Traffic over the Howrah Amta Light Railway has developed from 800,000 passengers per annum in 1900 to nearly 6,000,000 passengers in 1951, and over the Shahdara Delhi Saharanpur Light Railway the increase has been from 1,100,000 passengers in 1913-14 to more than 5,050,000 in 1950-51. Now 64 trains a day leave Howrah Maidan station.

Although results have not been uniform over all the Light Railways, it can certainly be said that the majority of these have more than justified their existence by serving the needs of the people. On an average more than 15½ million passengers are carried annually over the Light Railways of the Martin Burn Organization.

There are other contributions that the Martin Burn organisation have made and are making to Indian Railways. The Indian Standard Wagon Co., Ltd., whose works are situated at Santa in the Burdwan district, has supplied more than 29,000 Railway Wagons since 1920. Rails, Cast Iron Sleepers and Brake Blocks have been contributed in large quantities by the Indian Iron & Steel Co., Ltd. Points and Crossings, Axle Boxes, Buffers, Cast Iron Sleepers and Wagons have poured out of the workshops of Messrs. Burn & Co., Ltd.

Light Railway Rolling Stock and Track have come from the Works of Robert Hudson (India) Ltd., situated in Calcutta, whose products were also used extensively in the construction of some of the nation's major irrigation and canal projects. This Company commenced operations in India in 1917 under the Managing Agency of Martin & Co.

The first Railway in Nepal was entirely equipped with Robert Hudson materials, including locomotives, and subsequently the Company carried out preliminary surveys and laid a further 44 miles of narrow gauge railway through the forests of Nepal.

In addition to fabricating Tipping Wagons, Coal Tubs, Sugarcane Cars, Timber Bogies, Turnouts,

(Continued on page 16)

SHORT HISTORY OF RANSOMES

IN 1789 Robert Ransome, an ironmaster and inventor from Norwich, started his iron foundry in Ipswich, with a total capital of £200, and accompanied by one workman only. Such was the manner of the foundation of the firm of Ransomes Sims & Jefferies, Ltd., and while modest beginnings of great undertakings have been fairly common, it is a notable fact that in our long history, we have never lost our lead in the manufacture of the plough—our original product and still the principal agricultural implement.

At the time of his removal, Robert Ransome already held a patent for tempering with the aid of salt water, plough shares made of cast iron, but it was in 1803 that he made his revolutionary discovery of chilling the undersurface.

This led to the introduction of a type of share with the underside as hard as steel, and the upper portion comparatively soft and tough. In work, this share was self-sharpening, as the upper part wore just sufficiently to allow the hardened under-surface to maintain a sharp cutting edge. This new share was infinitely superior to those then in use, and it still remains popular in various parts of the world.

In 1808, Robert Ransome patented very considerable improvements in the construction of ploughs, making possible the easy replacement of wearing parts. Many features which are considered common practice by plough makers to-day date back to the plough bodies which he built at that time.

One of the comparatively early inventions sponsored by our Company was the Jefferies patent double wheel lifting apparatus. Prior to its introduction, double and multiple ploughs were not popular, as they were cumbersome and awkward to handle. This new feature, however, resulted in their coming into general use.

Early mechanical cultivation was, of course, carried out with the aid of steam power, and while the period now largely belongs to history, it was as pioneers in this field that we can claim to have made a valuable contribution to the development of the powerful multiple implements now in general use. Tractor plough manufacture owes much to our early work, and in this connection we must mention the introduction by us in 1919 of our self-lifting apparatus which made possible the one-man tractor ploughing outfit.

It is only in recent years that close-coupled hydraulically-lifted implements have become a familiar sight. To meet the new requirements we were early in the field developing our mounted ploughs, reversible ploughs, toolbar frames, disc harrows, etc., and our implements in this class have gained considerable popularity.

The large variety of ploughs and other implements which we make to-day satisfies the requirements of agriculturists all over the world. Besides share and disc ploughs for tractor and animal draught, we offer numerous other tillage implements including cultivators, disc harrows, sub-soilers, mole drainers, potato diggers, etc., for all conditions and all soils. A selection of these will be found in later pages.

Before leaving the plough, brief mention must be made of the vast enterprise commenced by the Government of India for bringing into use millions of acres of land hitherto uncultivated. This is an agricultural scheme of unparallelled magnitude, and to Rensomes came the call for the ploughs required to carry out the undertaking. No fewer than 800 Supertracs, the world's mightiest ploughs, are at present employed on the project, and results have evoked high praise from famous agricultural experts and representatives of American industry. We are justly proud of our contribution to this great enterprise.

(Continued from page 15)

Sleepers, Turntables and other Light Railway materials they are Controlled Stockists for Light Rails.

As a befitting celebration of the one hundredth birthday of Railways in India an Exhibition on a grand scale was organised by The Ministry of Railways (Railway Board) and opened by the Prime Minister on 7th March. In addition to the impressive display of the Central Railway Authorities, private enterprise, which has contributed so largely to the development of the Railways in India, was adequately represented. In an area of some 10,000 square feet Martin Burn proudly showed the part which they had played in assisting in this development to date and indicated their preparedness and ability to continue serving the Nation's Railways in the years to come.

One of our most successful ventures in the last few years has been the production of a small tracklaying tractor. This MG or market garden tractor can be used in conjunction with a full range of appliances for ploughing, cultivating, hoeing, harrowing, ridging, rolling, spraying, grass mowing, etc., and has proved a wonderfully sound investment for market gardeners and small holders, as well as for farmers on a larger scale who require a small power unit for the lighter jobs. The MG has also proved its value for operating in confined spaces such as vineyards, orchards and glasshouses.

Another class of agricultural equipment which we produce is thrashing machinery, and our experience with this goes back for more than a century. As long ago as 1841 we exhibited a power-driven thrasher at the Royal Agricultural Society's Show at Liverpool, and later we patented a machine fitted with apparatus for chopping and bruising straw to make it fit for cattle fodder in hot countries. Our latest thrashers are fitted with all modern labour-saving devices which make them almost automatic in their action, and in addition to the ordinary types for dealing with wheat, barley, oats, etc., we supply machines for rice, clover, maize, sunflowers and other seeds, peanuts, etc., as well as balers for hay and straw.

The drying of crops is a question to which we have devoted years of careful study. Since 1933 we have been making, under Davies patents, driers for grass and grain. By means of these, grass can be dried and stored for winter feeding, giving a food which has almost the same beneficial value as spring grazing. The driers can be used for hay-making in wet weather, and for drying grain and other crops. In order to make this type of drier available to a larger circle of farmers, we have recently introduced a smaller model capable of being operated by one man.

The development of scientific methods for dealing with insect pests, fungoid diseases and weeds resulted in our introducing spraying machines of various types, and these are now well known in many countries.

Just as the name "Ransomes" means "Plough" to the farmer, it is synonymous with "Lawn Mower" in the eyes of the discriminating public. We have always maintained an extremely high standard of quality, and our customers have realised that the higher prices

are amply repaid by the saving on running and maintenance costs and the satisfactory service over a long period of years. One of the reasons for the excellence of our lawn mowers is the unrivalled experience we have had in the manufacture of these machines. In 1832 we made our first lawn mowers under Budding's Patent, in the specification for which it is claimed that

> "Country gentlemen will find in using my machine an amusing, useful and healthful exercise."

Considering that the machine, which is illustrated on page 21, was driven by primitive gears, was very heavy and was 19 ins. wide, it is an open question whether the exercise was as amusing as Mr. Budding imagined. Nevertheless, this was the start of an industry which has grown year by year to its present huge dimensions.

In 1899, Mr. J. E. Ransome conceived the idea of utilising the internal combustion engine for driving a lawn mower, and under his direction the first petrol driven lawn mower was built and sold by us.

To-day, we offer a full range of machines for all classes of grass cutting, from the small suburban garden to the large sports ground, golf course or airfield, and from bowling greens to the rough grass of the orchard or roadside verge.

Amongst our manufactures, entirely distinct from agricultural and horticultural machinery are the electric industrial trucks. Actually, we were the first British makers of these vehicles, having commenced production about 35 years ago, and we are now firmly established in the world's markets. With our great experience of the problems involved, we are able to offer trucks for all classes of goods-handling, and the types available include trucks with fixed or elevating platforms from 1 to 4 tons capacity, crane trucks, tipping trucks, tiering trucks, forklift trucks and electric tractors.

In the foregoing pages we have mentioned the principal manufactures with which we are now actively engaged. Many other products have been developed during our long history, some of which have been discontinued, and some have passed to other makers. In the early years of the 19th century we were one of the first to build cast iron bridges, and were among those prominent in supplying railway material during the great boom which attended the development of our present railway system. This part of the business was transferred to Messrs. Ransomes & Rapier Ltd., of Waterside Works, Ipswich, that company being specifically formed for the purpose.

Steam engines, portable, stationary and traction, were for many years one of our major productions, many thousands of various sizes being manufactured at Orwell Works. An early traction engine is shown on page 23, while the curious looking vehicle on page 24, was one of four passenger road steamers supplied to the Indian Government for service in the Punjab.

During both World Wars we naturally carried on with the vital production of agricultural machinery, but we were also prominent in the manufacture of war material. It is interesting to note that during the first world war, we built nearly 800 aeroplanes, while between 1939 and 1945 we produced an enormous amount of war equipment, in spite of the fact that the factory was virtually in the front line for air attacks.

The present area occupied by the Ipswich Works amounts to about 45 acres. Three years ago we completed a really up-to-date foundry on the out-skirts of the town, and plans are in hand for an entirely new implement factory.

Sales are entrusted to a network of reliable agents all over the world, and in two of our larger markets we have established subsidiaries—Ransomes South Africa (Proprietary) Ltd., with selling houses in Cape Town and Durban, and Ransomes S. R. L. in Buenos Aires, Argentina. In Scotland, our subsidiary company, Ransomes Sims & Jefferies (Scotland) Ltd., not only acts as our selling organisation in North Britain, but is also responsible for the production of certain types of implements.

Now, as throughout our history, research and development work go on uninterruptedly, and every year sees the introduction of new designs. Skilful craftsmanship and the use of high grade materials, supported by an efficient sales, maintenance and repair organisation, contribute to the continued satisfaction of our world-wide clientele. Modern methods have as one of their main objects the speeding up of processes of manufacture with resulting increase of output, and it would be only natural if standards in some instances tended to fall. While fully recognising the necessity for keeping abreast of the times, we have set our faces against any lowering of the high standards we have always maintained, and we think we can claim with some justification that our extensive overseas sales help to keep up the reputation for quality with British manufacturers have always enjoyed abroad.

ALUMINIUM IN RAILWAY ROLLING STOCK

By Sumant Misra

THE modern trend in railway rolling stock is to reduce the deadweight and help increase the speed. The design and construction of the present day coaches have been modified to attain the minimum weight possible. However, the increase in the equipment required to provide various amenities tend to add to the deadweight. In our railways, in certain cases, the weight has got increased to such an extent as to reverse the camber on the underframe. An answer to this is the use of light metals. Use of aluminium not only helps reduction in deadweight, it also helps in lowering maintenance costs due to its high corrosion resistance. Lighter weight also means less deadweight and consequently higher operating profits.

In order to derive the maximum benefit all-aluminium coaches should be built. A weight reduction of 6 to 10 tons can be effected if the body as well as the accessories are made of aluminium. Framework, internal and external panels, roofing, water tanks, bulkheads, window sills and frames, seats and fittings are some of the places where aluminium has already been successfully used; in fact there is practically no limit where aluminium can be substituted.

India is unable to meet her steel requirements from indigenous production and has consequently to import a large tonnage to meet the demands of her railway workshops. Aluminium, on the other hand, is the only non-ferrous metal that the country is rich in and the indigenous productive capacity can supply the demands of the railways.

Below are some of the uses where aluminium can and has replaced other metals in rail coach construction.

EXTERNAL PANELLING

The main advantages of aluminium alloy panelling are:

(a) As aluminium does not corrode or rust, aluminium panels last the life of the coach.

(b) Its lighter weight (one-third that of steel) cuts down the dead-weight of each coach resulting in higher operational efficiency and reduced fuel costs. In special types of coaches, e. g. air conditioned coaches and restaurant and Annapoorna cars, whose weight is more than what the underframe was meant to bear, the lighter weight of the metal reduces the need for costly strengthening of the underframe.

(c) The high corrosion resistance reduces the maintenance expenditure and the "lost time" of the coaches in the workshops.

(d) For suburban electrified stock, the light weight saves on the energy consumption. This has been the experience of the London Transport Authorities in the tests they carried out recently.

(e) The high reflectivity of the metal (95% of the radiant heat falling on the metal is reflected) keeps interior cool.

Suitable alloys for this purpose are now produced in India in sufficient quantities. Due to their excellent corrosion resistance, the ultimate cost of aluminium alloy panels is only 35% of the cost of steel panels as the latter require frequent replacement.

INTERNAL PANELLING

The interior panelling of a passenger coach should be attractive, durable, easy to maintain and yet the material used should be available in sufficient quantities at economic rates. The Indian railways have been experimenting with various materials but have not been entirely satisfied with their results.

An interesting development in this sphere is the wood veneered aluminium for the internal panelling of passenger compartments. The veneering of these two materials is now done in India and the bonding is waterproof. This product combines the light weight and long life of aluminium with the attractive appearance of wood and is available at less than Rs. 2 - per sq. ft.

The panelling of bathrooms offers another example where aluminium is used with economy in the construction of coaches. Materials normally available either do not last long or are too expensive. Attractively painted aluminium sheets have been used and offer advantages of lower initial cost, longer life and easy cleaning. The cost per sq. ft. will work out to less than Rs. 1—4—0.

(Continued on page 23)

ROOF TANKS

Aluminium roof tanks for water storage are now the standard equipment in the latest coaches being produced in Switzerland and Germany for broad and meter gauge systems of India; they result in greater convenience and economy to the railways and cleaner water to the travelling public. A 120-gallon roof tank fabricated out of aluminium costs approximately Rs. 500 and weighs less than half of its galvanized iron counterpart. Over 2000 aluminium roof tanks are being used in the coaches in India and some of the Indian Railways have Standardized on them.

ALUMINIUM ROOFS

The railways are conscious that the brighter surface of aluminium reflects up to 90% of the radiant heat falling on it and thus keeps the interior cool. This is apparent from the fact that most of the roofs of the coaches are now being painted with aluminium paint. The excellent corrosion resistance of aluminium alloys and their light weight makes them the ideal material for roofing as they afford lasting waterproof covering for the coaches; such roofs moreover need no constant repairs.

CATTLE WAGONS

Cattle trucks have to endure very arduous conditions in service, not only due to their receiving harsh treatment in service, but also from animal excreta and the need for frequent washing of the bodywork always keeps them wet. Steel under these conditions rusts very rapidly, and consequently wood is often used, although its absorbent nature reduces its durability and makes it difficult to keep it clean. Aluminium does not suffer from these defects and is therefore the ideal material for building cattle wagons.

Three principal advantages which an aluminium cattle truck holds are:

(a) It is more hygienic and easier to keep clean

(b) It is more durable as animal excreta has no corrosive effect on aluminium

(c) It is cheaper to operate and maintain

WINDOW FRAMES AND FITTINGS MADE OF ALUMINIUM

The latest coaches produced in Europe and America incorporate window frames and louvres of aluminium. Coaches now being produced in India and imported from Switzerland also follow the same practice as they stand up to the onslaughts of climate much better. The most

NEW STREAMLINER MAY REVOLUTIONIZE RAIL TRAVEL !

RESIDENTS ALONG THE Delaware, Lackawanna and Western Railroad line in New Jersey rubbed their collective eyes in disbelief recently when the first " ACF-Talgo " train purred quickly by on her test run. This low slung caterpillar-like creation is one of three being constructed by the American Car and Foundry Company. Two will be used for service between Madrid, Spain and various points on the French-Spanish frontier.

The " Talgos " for Spain consist of a diesel-electric locomotive, a baggage unit, and three coaches, the last of which features an observation lounge. The overall length of the train is approximately 370 feet and is for 5′ 6″ gauge track. The design is unique in that a coach consists of four articulated passenger units and one equipment unit, each of which has only one pair of wheels in the rear. The front is supported by a special coupling arrangement on the unit ahead of it, while the first unit is supported by the locomotive which is on conventional type trucks.

Entrance to the coaches is gained through the equipment unit which is in the center of each coach. These equipment units contain various facilities such as air-conditioning, control lockers, washrooms, and kitchenettes for serving light meals.

AMPLE SEATING CAPACITY

Each coach is 100 feet long and seats 64 passengers, 16 in each passenger unit, with the exception of the coach containing the observation lounge unit which is seven feet longer. The entire train seats 176 passengers with 16 additional seats in the observation lounge. An experimental train of this type has undergone successful tests in Spain.

The train which ACF has completed for demonstration purposes is of identical design to the trains destined for Spain with the exception of length and gauge which is generally 4′ 8½″ in the Western hemisphere.

It consists, at this time, of only a diesel-electric locomotive, a baggage unit and a coach of five units, one of them being for equipment and another serving as an observation lounge. The train is 168 feet long, approximately one-third of its eventual length.

The strange appearance of the " Talgo " is accounted for by floors which are lower by 2′ 9″ and an overall height lower by almost 4′ than similar streamlined present day passenger equipment.

The idea for the " Talgo " originated with a Spanish Army engineer, Lieut.-Colonel Alejandro Giocoechea

(Continued from page 21)

annoying experience of not being able to open or shut a window or louvre will not arise if aluminium is used.

LOCOMOTIVE TENDERS AND COAL WAGONS IN ASSAM

The high sulphur content of Assam coal (3 to 8% sulphur) causes an in-ordinate amount of corrosion in the wagons carrying coal from the Ledo Collieries to the various running sheds on the southern banks of the Brahmaputra. The locomotive tenders which also carry this coal have to be reinforced, because of the very severe corrosion, with 1½″ concrete slabs to prevent the coal from coming into direct contact with the steel in the tender.

British railways who are faced with similar problems, because of the high sulphur content of their coal, have turned to aluminium to solve their problem as sulphur has no effect on aluminium.

REFUSE WAGONS

Aluminium alloys are ideal for the refuse wagons which the railways have to maintain for the various municipalities.

LOCOMOTIVE CABS AND TENDERS

Aluminium's high strength to weight ratio has been well utilized in the manufacture of Y. P. locomotives, in which to reduce axle load, cabs are made of aluminium.

The British and African Railways have made loco. tenders in aluminium and find their aluminium tenders last longer and permit the locomotive to operate over a longer range without the necessity of refuelling.

Omar who took his revolutionary ideas on train construction to Mr. Jose Luis de Oriol, a Spanish industrialist, who backed the development from the beginning.

Trains are forced to slow down considerably when rounding a bend, and the Colonel knew if a simpler method of guiding train wheels could be evolved, the use of weight as an anti-derailling factor could be discounted.

This problem has been solved satisfactorily and as a result the "Talgo" is constructed almost entirely of aluminium, providing an overall weight reduction of 75% over similar equipment.

PROBLEM OF HIGH-SPEED TURNS

The scenic railways have overcome this problem of high speed turns, but the ride is jerky, not at all suitable for the comfort loving railroad travelling Public.

Although a lot of engineering and research was required before the many problems were solved, the principle upon which the "Talgo" operates can best be described by saying that by joining a number of short cars, in a special way, so that they would ride as a unit, the jerkiness has been eliminated.

This in turn required a connection which would allow pivotal turning on the curves and at the same time prevent any see-sawing at the ends of the car bodies.

SAVING IN TRAVELLING TIME

The designers and manufacturers of the "Talgo" state that it will save as much as 25% travelling time, and they add further that this is a conservative estimate.

Although the problems presented by curves will remain, it is claimed the "Talgo" will go around curves faster and with a greater degree of safety and comfort. This is due to the natural forces of friction, gravity and centrifugal force which at present work against a train.

In the "Talgo" these forces are either eliminated or utilized to advantage. Friction tends to prevent the wheel from climbing the outer rail, while the effects of centrifugal force are drastically reduced. The centre of gravity is at approximately the same height as the points of suspension.

The "Talgo" hugs the track better because the centre of gravity is approximately two feet lower than in standard railroad equipment.

The light weight of the train reduces the size of motive power required, with savings in initial cost and fuel economy. Because of its lightness the train is capable of fast acceleration.

*** *** ***

REPORTS FAVOURABLE ON ALUMINIUM TRAIN

There have been a number of reports in Canadian newspapers recently reporting on the result of the first year's operation of the all-aluminium "Talgo" train *(The Alcan Ingot*, June 2, 1949*)*.

Typical of this press comment is the following report which appeared in the Smith Falls *Record-News*.

"Spain's ultra-modern "Talgo" train has completed its first year of service. The operators think its success means an eventual revolution in rail travel.

Why, Talgo enthusiasts ask, are the railways of the world hauling massive trains of steel when an 80-ton aluminium train can do the job just as well?

No one says the Talgo is faster than other trains, or that it is more comfortable. But by its unorthodox chasis, a saving of 75% of weight is achieved.

A Talgo unit is made like an aeroplane fuselage lightly and strongly forged from an aluminium alloy. Each unit has two wheels only—at the rear. These project up inside the coach in soundproof boxes so that the car is cradled between the wheels instead of being built on top of them. The result is that the car sits right down on the rails for safety and stability.

The front of each 12-passenger unit is telescoped into the rear of the one in front, so the whole train moves as a single unit.

This makes for smooth and easy handing compared with the jerky reaction of the normal train in which each coach is a separate unit.

Moreover, the simple two-wheel arrangement enables the train to slip effortlessly around corners at a speed limited only by that of the Diesel locomotive".

The Electrification of the GIP Railway

AT the present time, one of the chief problems which is engaging the attention of the railway authorities in this country is the subject of main line electrification. The experience of several years' electrified operation of suburban routes has demonstrated the possibilities of utilizing electricity on the longer runs, although of course the conditions differ greatly where, instead of a series of comparatively short runs with frequent stops, long runs and infrequent stops have to be considered. It is interesting, therefore, at this juncture, to see what has been done in other countries in the way of main line electrification.

India contains some striking examples of electrified main lines which are among the most important installations of this type in the world, and of these the Great Indian Peninsula Railway has one of the greatest lengths of electrified main line completed in recent times.

This magnificent railway, known familiarly as the G. I. P. Railway, was inaugurated in 1849. The first line to Thana was completed in 1853 and, ten years later, through communication with Poona was established. Eighty years after the initial inauguration, the Governor of Bombay, H. E. Sir Frederick Sykes, inaugurated the newly electrified main line section from Kalyan to Poona, thus marking the entry of yet another era of progress. Some idea of the significance of this advance can be obtained by comparing the time taken by the early steam trains for the journey from Bombay to Poona, which was approximately six hours, with the time taken by the electric locomotives of about three hours.

Henley Engineers have played a very considerable part in carrying out the electrification schemes. They first had access to the site on 11th November, 1927. Prior to that date, preliminary surveys had to be carried out and details of general organisation had been prepared. When the actual erection work was started it was found that the survey pegs had been removed by local inhabitants. This necessitated the re-surveying of many miles of line. A surveyor was attached to each section and pegging-out was done as and when required.

Much of the construction work had to be completed before the break of the 1928 monsoon. In some parts of the district over which the route had to pass the rainfall often reaches 200 inches or more in the monsoon period. It will be realised that in such conditions, construction work was next to impossible.

Henley's contract consisted of the supply and erection of 269 miles of 5 and 6-wire 110,000 volt overhead line on lattice steel towers, the conductors being steel cored aluminium. The length was made up by two parallel double circuit lines each 2½ miles long from Kalyan Power Station to Kalyan, two parallel single circuit lines, each 50 miles long, from Kalyan to Igatpuri in a north-easterly direction, and two parallel single circuit lines each 82 miles long from Kalyan to Kirkee, in a south-easterly direction.

It is natural that on a contract of such magnitude, in such difficult country, the engineers were handicapped in many ways. Transport of plant and materials proved exceptionally difficult. Lorries, bullock carts, mule transport and coolie carriers were each in turn utilised. Ordinary porterage up to two miles was generally done by coolies.

On the ridge of the Bhor Ghaut mountains, which are approximately 2,000 feet above sea level, the actual mountain side rises 1,700 feet in just over one mile of line route. In the Eagon Valley each span was in the neighbourhood of 1,730 feet.

Of one hundred miles of line, fifty miles traversed rough and mountainous country, heavily timbered. At this period the monsoon was late in finishing, with the result that very little foundation work could be done. In places the rough nature of the ground prohibited the use of machanical means of handling the conductors and as many as forty coolies were required at times to handle half a mile of conductor.

Much blasting had to be carried out; large percentages of rock were found in excavation; rock that was drilled was often found to be faulty in strata.

In spite of the difficulties of the actual work and the attendant difficulties of heat, insects -with the monotony of the monotony season—all foundation work was finished and the installation completed, with the line energised, in good time.

The following technical details are of interest :—

The towers are of the lattice type, the steel work being galvanised. The normal span is 700 feet. The height of each of the towers, of which there are approximately 2,000, is about 70 feet. The total weight of the towers is 5,000 tons. A total length of 840 miles of steel cored aluminium was used for the conductors.

There are 11 substations on the main line system—at Vangani, Karjat, Thakurwadi, Lonavla, Kamshet, Shelarwadi, and Kirkee on the south-east section, and Vasind, Thansit, Kasara and Igatpuri on the north-east section. The substations at Vangani and Kirkee and at Vasind and Igatpuri are 3-unit, the remainder being 2-unit.

The voltage is transformed from 95,000 to 560 and the energy converted into D. C. at 1,500 volts by means of rotary convertors arranged in pairs and running in series. The D. C. is carried by cable from the substations to the overhead track structures, being fed to the conductor through lightning arrester cabins at a pressure of 1,500 volts.

In addition to the speeding up of the runs referred to above, the electrification of the system has introduced many other advantages, such as :—

Freedom from smoke in the towns and tunnels through which the line passes.

Greater frequency of train services.

Increase in carrying capacity of the line without costly additions to permanent way, owing to the hauling of heavier trains at higher speeds.

Reduced cost of haulage compared with steam traction, and reduction in wear and tear to rolling stock owing to the employment of regenerative braking.

Reduced risk of locomotive failures and loss of time on locomotive account.

Economy in coal consumption and the utilisation of lower grades of coal in the power house.

Freedom from anxiety about failure of water supply.

(W. T. Henley's Telegraph Works Co. Ltd. house magazine "Distribution of Electricity"—September 1931)

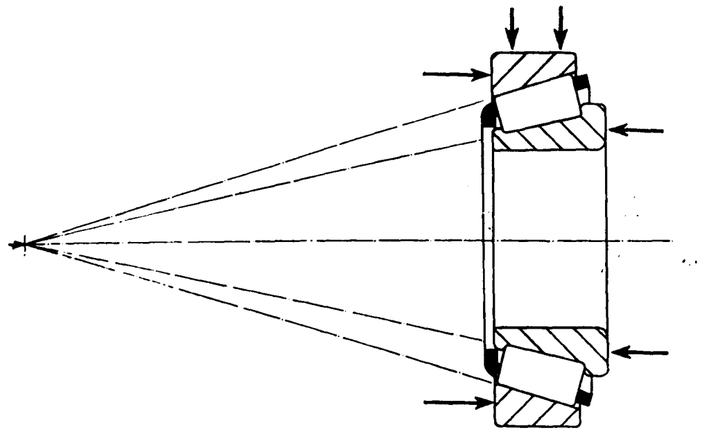
British Timken's Contribution to Indian Railways

IN connection with the special supplement to your magazine entitled INDIAN RAILWAYS LOCO CARRIAGE & WAGON WORKSHOPS SUPPLEMENT we have been asked to assist your Editor by sending an article describing the contribution of British Timken Limited to the progress made on the Indian Railways. Naturally such an article would be far too lengthy for your magazine and consequently an attempt has been made to furnish a condensed version.

Undoubtedly the greatest contribution made by the Timken organisation to the Indian Railways, and to the world in general is to have introduced the Tapered Roller Bearing universally known as TIMKEN. This bearing was first conceived over fifty years ago by Mr. Henry Timken, and his invention was so outstanding and correct in its conception that the bearing today, is fundamentally the same as the first one ever made, and has proved itself completely in every sphere of industry. Like many other inventions the conception was in great manner due to the shortcomings of other types of roller bearings and is a true illustration of the adage that " Necessity is the Mother of Invention ".

What has the Timken Tapered Roller Bearing to offer which other types of rolling bearings have not? Firstly, it is geometrically correct, as is no other form except the cylindrical or parallel roller type which does not have capacity for thrust loads from flange forces. Secondly, it has the highest load carrying capacity of any rolling bearing which is manufactured, a feature which allows of considerable economies in shaft and housing design, and smaller frame openings on rolling stock applications. Thirdly, owing to the unique construction of the Tapered Roller Bearing it can accommodate both radial and thrust loads or any combination of them without the necessity for introducing a separate thrust bearing, and by modification in design of the angles of the bearings, the proportions of radial to thrust load capacity can be varied at will.

Allied to these facts is the meticulous care associated with the metallography of the bearing, or in other words,



Perfect Rolling Geometry and Capacity for both Radial and Thrust Loads.

quality. Quality has many attributes among the most important of which may be cited the following: Perfection in design and manufacture, expert knowledge and world wide experience of the application involved, and metallurgical control over all the materials used. The essential properties required of any steel used for the manufacture of rolling bearings are briefly as follows: —

The fully heat treated steel must present a uniformly hard wear-resistant surface to prevent abrasion and minimise wear. It must have sufficient strength to maintain dimensional accuracy under maximum loading conditions and fluctuations in temperatures likely to be encountered in service. The steel must be resillient, thereby offering maximum resistence permanent deformation, fatigue, and fracture under impact or shock loads.

Freedom from harmful slag or non-mettallic inclusions, as such segregations may form nuclei from which surface disintegration may develop in service.

Finally the chemical analysis, hardenability, and mechanical properties must be consistent from cast to cast.

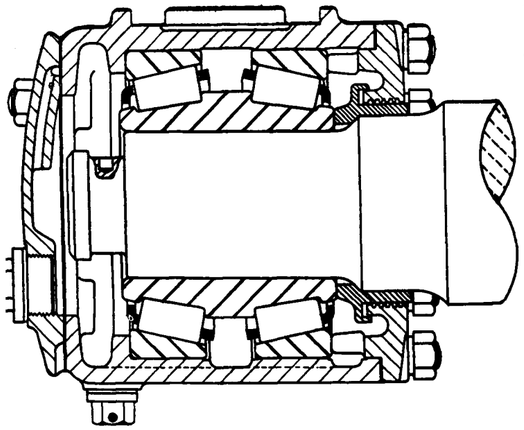
Any consideration of these requirements invariably leads to a discussion on the relative merits of the two main classification of materials which are available, case hardening and through-hardening steel.

The ball and roller bearing industry was built up mainly on the use of through-hardening steels and whilst the steel makers have organised themselves to supply this material, it is often difficult to obtain a suitable case hardening steel of the requisite analysis and quality. It is of course a matter of everyday experience that bearings made from through-hardening steel give reasonably satisfactory service life, particularly with the more lightly loaded applications, and whilst such steel is economical, its heat treatment elementary and expeditious, there are certain dangers inherently associated with its use which cannot be avoided. Through-hardness cannot be disassociated from through-brittleness, lack of impact strength, and an apparent susceptability to surface fatigue, and it is to avoid these possible dangers that we use alloy case hardening steels. Peculiar circumstances may justify the use of through-hardened steel for certain lightly loaded application but it is our invariable practice to use only high alloy case hardening steels for all locomotive and heavy duty applications.

Such steels after carburising, hardening and refining treatments have the advantage of great strength and toughness in the core, combined with an extremely hard and fatigue-resistant case equal in hardness and wear resisting characteristics to those obtained with any other type of steel. These highly alloyed case hardening steels, however, are very expensive in primary, manufacturing, and heat treatment costs, and their use is, therefore, a sure indication of British Timken's earnest conviction that they are essential for heavy duty applications.

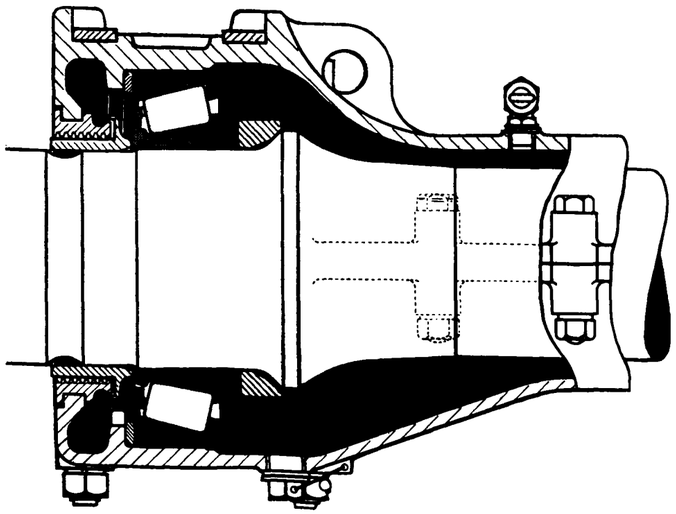
It is an established fact that Timken Tapered roller bearings are pre-eminent in all fields of application throughout the world and consideration of the foregoing remarks helps one to understand why this is so. This pre-eminent position has a peculiar significance when applied to railway applications, as in no other field has their use proved more highly successful.

Proceeding from these elemental considerations to the field of actual railway applications, it is interesting to note that the first prominent milestone of progress, was the building by the Timken organization in 1930 of a locomotive completely equipped, on all carrying and coupled axles, with Timken Tapered Roller Bearing axleboxes. This pioneering effort was a measure of the confidence which the Timken Railway Engineers had in the Timken axlebox, and also vividly illustrated the practicability of such applications. After periods of demonstration during which it covered some 89,000 miles, hauling both passenger and freight trains under all the varying conditions imposed by the many different railways on whose lines it was demonstrated, it was finally purchased by the Northern Pacific Railroad and has satisfactorily achieved every expectation. From this time the adoption of Timken Tapered Roller Bearing axleboxes was both rapid and world wide, and amongst others, trials were instituted in India, under the wise direction of the Railway Board and the Central Standards office, of applications made to to the carrying axles of XB and XC Locomotives and also on the WL Locomotives eventually ceded to Pakistan after partition. These trials were highly successful, and today all locomotives built for the Indian Railways automatically have roller bearings on the carrying axles. Instances of these are the latest WP and WG engines as well as WM, HPS, XD, XT, YB, YC, YD, YP, YL and YG class locomotives whilst the new engines of the WL class will shortly be available with Timken Tapered Roller Bearings on the coupled wheels also. This is only a start, however, and in the not very distant future both WP and WG engines will be seen with roller bearings on the coupled wheels.



Typical Timken axlebox for outside journals.

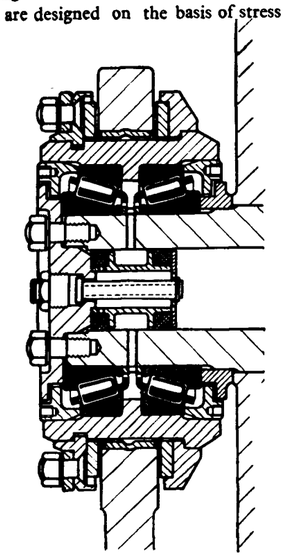
Mention of the WL engines calls to mind the second milestone of progress, this being the fitting in 1934 of



Typical Timken cannonbox for inside journals.

Timken bearings to the crank pins of a Pacific type locomotive, since when a large number of applications of this type have been made throughout the world culminating, as far as India is concerned, with the WL engines previously mentioned being so equipped, an intermediate stage of fitting Timken bearings to the return cranks of the WM Locomotives being highly satisfactory.

The application of Timken tapered roller bearings to the crank pins is extremely interesting in as much as the layout is unorthodox, such stress raisers as knuckle pins and fork rod ends having been eliminated, whilst the side rods, in plan view, are no longer in line as in the usual conception of motion parts. The side rods consist of simple forgings of uniform cross section and narrow rod eyes, which are designed on the basis of stress distribu-



Typical Timken Leading Crank pin application.

tion only and not on the basis of supporting a plain bearing having sufficient bearing area for the applied load. This means that for a given load and a given rod eye area, a reduction in rod eye bending stress is obtained by an improved re-distribution of the material to handle the applied load. Another result of reduced rod eye width is the reduction in the eccentricity of the loading applied to the rod column, so that for any given end load the permissible column stress, calculated on the basis of eccentric load, is higher for a Timken rod than for a plain bearing rod.

Crank pin bearing equipment consists basically of two Timken bearings mounted in a self contained housing, the whole assembly being a press fit on the crank pin. The rod eyes are fitted with high tensile aluminium bronze bushes and the rods are loosely mounted on the crank pin housing. This arrangement allows the rods to follow the motion of the crank pins and axles without binding and permits rod removal without disturbing the bearing equipment. The latter feature is an absolute boon to maintenance personnel.

The Timken organization is interested, not only in roller bearing equipment but has been closely associated with Pioneer work on the design and testing of railway axles.

In 1931 a programme of research was commenced which had as its main objective the improvement of axle design, so that that the life of the axles should be equivalent to the life of the Timken Tapered roller bearing equipment which had been so successful in increasing locomotive availability. This objective was suggested by the fact that with designs of roller bearing axleboxes other than Timken, the life of the equipment had been reduced by the commencement and propagation of fatigue cracks in the axles.

The first phase of the research work was associated with the effect of the press fit used for securing the bearings on the axles, in common with the accepted practice of press fits for wheels, on the life of components when this method of assembly was used. It was well known that the press fit of an axle in a wheel assembly, subject to alternating bending stresses produced a considerable weakening effect on the axle, and was almost the equivalent of an annular notch. It was established that a press fit axle and wheel assembly would break off at bending stresses only one half of those at which failure occured with a plain shaft, and it was also determined that the press fit pressure between the two members reached a peak value at the end faces of the wheel hub.

The programme of research was developed along two lines, these being respectively photo-elastic analysis and actual fatigue testing of full size axles.

The first method provided a means of showing the distribution and magnitude of the stresses present in the component under load, and also made possible, rapid determination of improved stress distribution resulting from modified designs.

(Continued on page 34)

Wheel production at Surahammars Bruk AB

SURAHAMMARS Brucks AB, Surahammar, Sweden, which has specialized in the manufacture of wheels and axles for rolling stock since 1866, supplies wheel pairs for passenger coaches, goods wagons, motor coaches, locomotives and tramcars for all existing trackgauges. The work's production program also includes the manufacture of elastic (resistent) wheels, particularly light wheel pairs with hollow axles and hardened and tempered light wheel centres etc. The wheels are either forged in one piece and rolled, or else built up of centres and tires. Ore from our own mines is used to produce high grade pig iron low in sulphur and phosphorous, and the steelmaking plant possesses furnace equipment that can satisfy the most varied demands. Furnaces for the acid and basic open hearth processes, arc furnaces and high-frequency induction furnaces make it posssible to produce the particular material which may be required by applying the most advantageous method of production. Wheel blanks, tyres and disc wheel centres are forged in hydraulic presses, one of which a 7500 ton press — is the largest in northern Europe. The blanks are usually rolled in special rolling mills to exact dimensions. The axles are rolled and forged under hammers to exact tolerences and with ample reduction.

The various parts for the wheel pairs are machined and assembled in the wheel shop, which is of recent construction. A new assembly method has now been introduced after several years of research work at Surahammar. The old method of manufacture is to press the wheel on to the axle. This process, however, gives rise to a number of factors difficult to control. One only needs to point to the cold working and tearing of the

(Continued from page 33)

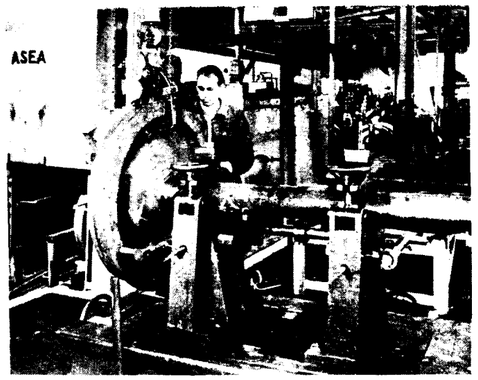
Parallel with these developments a process was evolved for cold rolling the surfaces of crank pins and axles in the region where the pressed member is fitted, as the effect of compressive stresses near the surface of the axle was to increase the endurance limit by at least twice that of axles in the unrolled condition, a fact proved by carrying out trails on full sized axles. This process does not prevent cracks initiating in the wheel fit but it does retard greatly their propagation.

In addition to the above outlined programme of research, Timken have been requested to develop a standard range of axles for use with roller bearings on coaching stock and whilst the embodying in the designs of the principles described results in an increase in fatigue resistance of 60% compared with earlier designs of plain bearing axles, the increase in weight has not exceeded 4%.

It is an undisputed fact that the Timken organisation has made a major contribution to this research work, and the Timken developments of yesterday have become the accepted practice of today whilst the results of Timken research are used by Engineers all over the world.

This article would not be complete without some reference to the Timken axleboxes in service on the Indian Railways and consequently a summary follows of the widespread application to Locomotives and Rolling Stock.

No. of Vehicles	Description	
316	Class "WP"	Steam Locomotives
100	Class "YP"	Steam Locomotives
10	Class "YL"	Steam Locomotives
75	Class "YG"	Steam Locomotives
214	Class "WG"	Steam Locomotives
5	Class "WL"	Steam Locomotives
60	Class "WM"	Steam Locomotives
35	Class "YB"	Steam Locomotives
3	Class "YC"	Steam Locomotives
24	Class "YD"	Steam Locomotives
3	Class "YK"	Steam Locomotives
19	Class "HPS"	Steam Locomotives
84	Class "HPS1"	Steam Locomotives
133	Class "XB", "XC" & "XS"	Steam Locomotives
110	Class "XD"	Steam Locomotives
1	Class "XP"	Steam Locomotive
1	Class "D4"	Steam Locomotive
4	4-8-2+2-8-4	Carratt Steam Locomotives
59	Class "XT", "XT1" & "XT2"	Steam Locomotives
10	4-6-4	Tank Steam Locomotives
7		Electric Locomotives
4		Drewry Railcars
1		Track Recording Car
11		Suburban Coaches
32		Trailer Coaches
32		Motor Coaches



surfaces taking place, this causing additional stresses in that part of the wheel set where the risk for fatigue fracture is already greatest. Wheel seat cracks can to some extent be shown up by supersonic tests, but the final control is always carried out by inspection directly on the wheel seat after the wheel has been pressed off. One must therefore reckon with dismantling after a number of years' service, and if this is done by pressing the wheel off, the mating surfaces are destroyed.

Several of the disadvantages of the old method are avoided if the new Surahammar method is used, e. g. if the wheels are shrunk instead of pressed on. The dismantling of a wheel shrunk on must not be done by pressing it off, but this problem has been solved with the help of Oil Pressure Assembly Method invented and developed by Erland Bratt, SKF. This method consists of forcing oil under pressure through grooves between the wheel seat and the hub bore, whereby the hub bore expands, so that the wheel can easily slide off the axle on the oil film without being damaged.

A shrinking allowance of approximately 0.1% is used as a rule, which means that an ordinary wheel set with a 175 mm (6.9") diameter shall have a difference in diameter between wheel seat and hub bore of 0.175 mm (0.007"). The wheel seat and hub bore must therefore be machined with limits of approximately + 0.01 mm (0.0004"). This degree of precision cannot be obtained by turning, and grinding the wheel seat, hub bore and mating surfaces of the centre and tire was therefore introduced at the same time as Surahammar changed over to shrinking instead of pressing the wheel on to the axle.

The shrinking is done at a temperature of only 200—250°C (390—480°F), thus the structure and strength of the material are not affected. A more detailed description of the Surahammar method is given (by Knut Eklund) in the Proceedings of the 5th international mechanical engineering congress.

If the customers prefer it, Surahammar can still use the old method of pressing the wheels on the axles.

Both manufacturers and purchasers of wheel pairs have always wanted to be able to measure and record the stresses and strains occuring in the different parts under service conditions. Fundamental investigations of these problems have been carried out by Surahammar in co-operation with the Swedish State Railways and ASEA, and this research work has led to very good results. Strain gauges make it possible to obtain a large number of strain values from the outer surfaces of the axles and wheels. It proved difficult at first to transfer the very weak electrical impulses obtained to the instrument cabin in the railway coach, but a solution was found in a

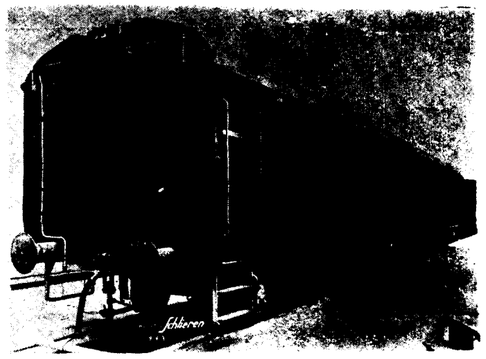
(Continued on page 38)

MANUFACTURE OF RAILWAY COACHES

THE Swiss Car and Elevator Manufacturing Corporation Ltd. was established some 50 years ago and within a comparatively very short time the firm succeeded in becoming one of the most important suppliers of rolling stock to the Swiss Federal Railways and to other Railway Companies at home and abroad. In addition, at an early stage already, the production of motor coaches and tramcars was introduced and as a last item the manufacture of trolley-busses was added to the programme.

All along, special attention has been paid to pioneer work for the improvement and the development of new designs in the line of rolling stock in general and of motor coaches and passenger carriages in particular. The period from 1933 onward deserves to be specially mentioned, for as a result of Schlieren's research work it was the beginning of a new era in the line of passenger coaches.

Step by step the manufacture of all-welded steel light-weight passenger coaches was substituted for the earlier heavy two—and four-axle steel coaches with wooden frames. These modern vehicles are no longer provided

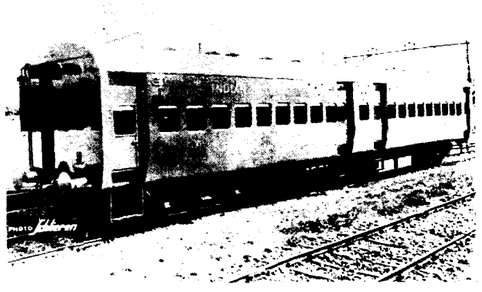


" Schlieren " 3rd class coach-body with ladies' compartment on original standard " Schlieren " bogies.

with underframes in the true sense of the word. On the contrary, the floor is now being welded to the side walls and these to the roof and so a completely welded self-supporting tubular body is arrived at. By this type of design, in comparison with the former steel or wooden coach structures with two or four axles, in spite of numerous additional amenities, a reduction in weight of as much as 30% and at the same time an increase in space by 13%, combined with considerably smoother running, are obtained. It goes without saying that the traction power required is accordingly less, whilst the safety of the passengers is considerably enhanced.

As early as in 1935, in close cooperation with the technical departments of the Swiss Federal Railways, Schlieren switched over definitely from the traditional principle of heavy steel-construction to the manufacture of coaches of the new all-welded steel light-weight type.

Ever since having been put into operation on the Swiss lines, these steel light-weight coaches have proved to be satisfactory in every way and, as a consequence, a great variety of coaches of this type have been manu-



" Schlieren " 3rd class coach with ladies' compartment. Body on service bogies for being transported on to the port of Rotterdam.

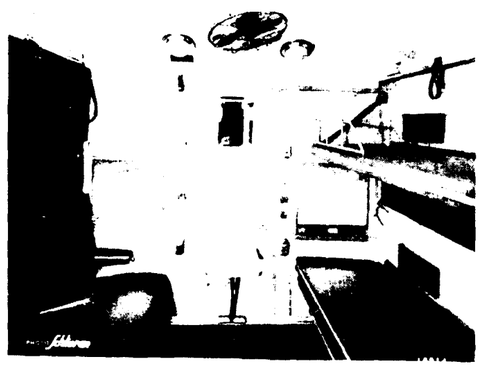
(Continued from page 37)

special slip ring assembly suspended under the car body and connected with the axle by a spiral tube, which was torsion stiff but stretchable and bendable. The enormous accumulation of recorded measurements necessitated much subsequent time-consuming work, but this was eliminated by a classifying impulse calculator, designed by ASEA. A thorough description and discussion of this research work is given by K. Meldahl, ASEA, in the Bulletin of the International Railway Congress Ass., June 1953.

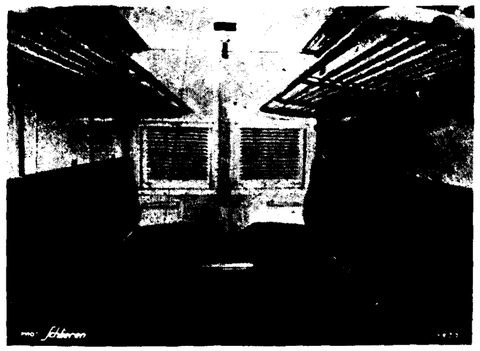
" Schlieren " 1st class coach, wide side corridor, allowing easy circulation, Mosquito-screens, reinforced by expanded metal.

" Schlieren " 2nd class coach with upper berths.

" Schlieren " 3rd class coach.



" Schlieren " 1st class coach with upper berths.



" Schlieren " Interclass coach.

factured by Schlieren and later on by other railway coach-building factories as well. No wonder that on account of the great advantages these up to date cars are offering, there has since their introduction been an increasing demand for them, at home as well as abroad.

For the same reason, as early as in 1947, delegates of the Indian Railway Authorities approached Schlieren, with the result that between the Government of India and Schlieren an agreement has been signed in May, 1949, for the purpose of placing India in a position to turn Schlieren's new passenger coach designs to her advantage as well.

Naturally the manufacture of the coaches ordered by the Government of India, Ministry of Railways, Railway Board, gave rise to numerous new problems, for the special climatic conditions and the Indian way of living had to be considered in the construction of these vehicles, whilst on the other hand care had to be taken that none of the advantages of the new " Schlieren " coaches would be lost.

Here are some of the features of the coach types developed for India :

A fundamental difference between travelling in India and travelling in Switzerland is that the distances in India are incomparably longer. Therefore, in the case of India sleeping accommodations should be provided on principle is all coaches, whatever their class may be.

The first and second class coaches designed for Indian are of the compartment type with side corridor and the upholstered seats can be turned into berths. In addition, folding berths are fitted to the walls. The interclass coaches are provided with upholstered seats for four persons each and above them strong luggage racks are fitted which can be used as berths in case of need. The third class seats are made of wooden laths similar to the third class seats in Swiss coaches, but the seats are arranged for 4 passengers on the one side and for one passenger on the other side. Here again, the seats as well as the luggage racks offer sleeping accommodations.

No doubt it will be appreciated by everybody acquainted with the Indian climate that apart from lavatories with washing facilities and showers in the first class coaches, all classes, including third and interclass coaches, are now provided with fans. For this purpose a lighting generator equipment and a lighting battery are fitted in each coach and so the comfort of fresh air and good lighting is now extended to the third class passengers as well. Each window is equipped with a sliding glass shutter and a louvre shutter and in the first class in addition with a sliding mosquito-screen.

Up to now 50 fully furnished and 50 unfurnished " Schlieren " all-welded steel light-weight coaches of various classes have been supplied to the Indian Railways.

On the occasion of the Indian Railways Centenary Exhibition, early in 1953, as a contribution towards the show, a most attractive miniature model, size 1 : 8, of a fully furnished first/second class " Schlieren " coach was sent to the Indian Railways, by Schlieren, with a view to offer to the visitors of the exhibition in this way an impressive picture of the passenger rolling stock introduced by the Government of India from Schlieren.

However, all this is only the starting-point towards a much bigger scheme. The main plan of the Government of India is to be in a position, at the earliest date possible, to manufacture these all-welded steel light-weight coaches of the " Schlieren " type by their own people in their Integral Coach Factory now under construction in Perambur/Madras and to take thus a step of paramount importance towards the economical advancement in all welfare of the young Republic of India.

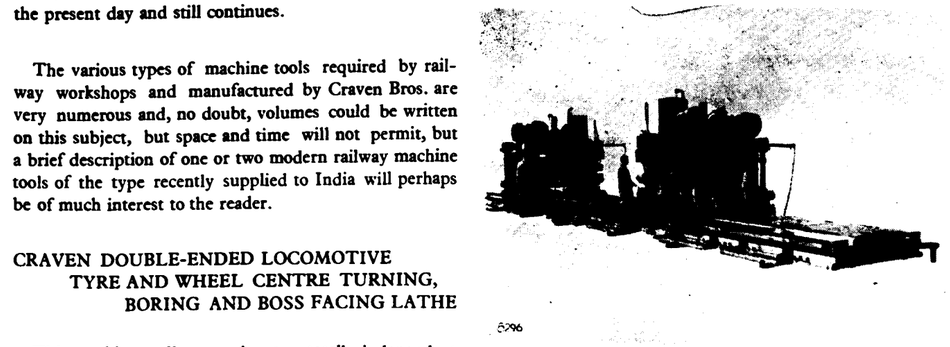
CRAVEN MACHINE TOOLS

THE firm of Craven Bros. (Manchester) Ltd., of Reddish, Stockport, England, has been supplying machine tools to the Indian railway workshops for close on one hundred years. It was stated in the Centenary Issue of the Southern Railways Magazine that more than one-hundred-and-fifty "Craven" machine tools were supplied to Indian railways prior to the year 1900. It is pleasing to note that the demand for these excellent machines has been maintained until the present day and still continues.

The various types of machine tools required by railway workshops and manufactured by Craven Bros. are very numerous and, no doubt, volumes could be written on this subject, but space and time will not permit, but a brief description of one or two modern railway machine tools of the type recently supplied to India will perhaps be of much interest to the reader.

CRAVEN DOUBLE-ENDED LOCOMOTIVE TYRE AND WHEEL CENTRE TURNING, BORING AND BOSS FACING LATHE

This machine really comprises two totally-independent machines with their beds bolted together so that the two separate handstocks face one another. A cross-bed fitted over the main bed shears, in front of each headstock, is adjustable to and from the respective faceplate by hand, and carries two swivelling-type compound tool rests. The left-hand rest in each case has a four-position tool turret for successive turning operations on the wheel rims or tyres, while the right-hand rest has a flat topped tool slide with tee-slots for bolt and plate clamping of boss facing tools and boss boring bars. Both rests can be used simultaneously, and the length of transverse and longitudinal feed traverses are controlled by automatic feed trip mechanism on the side of the cross-bed and swivel slides.



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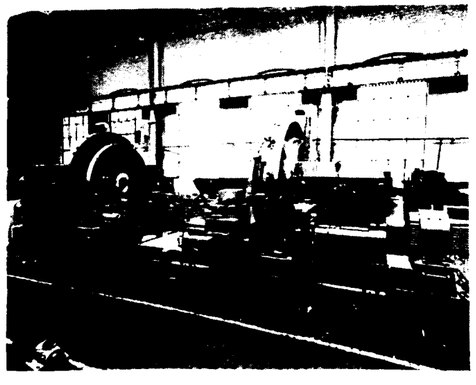
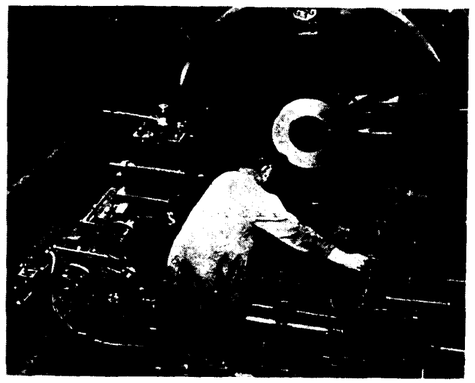
Built to accommodate plates up to 40 ft. long by 3 ft. wide, this special milling machine is the second of its type to be exported to India within the last few years.

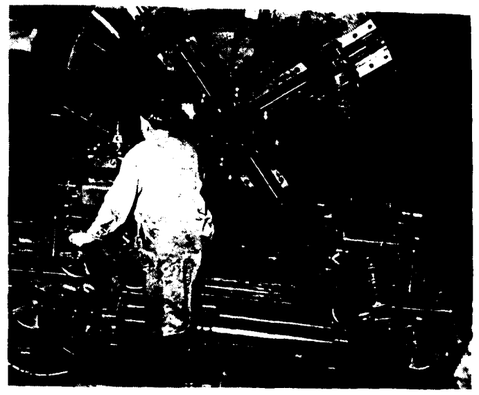


Craven Double-Ended Locomotive Tyre and Wheel centre Turning.

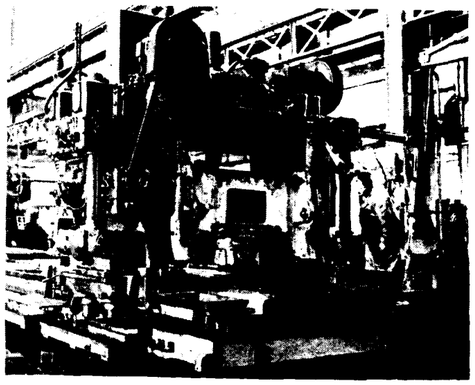
Both ends of the machine are able to turn and bore wheel centres up to 6'–6" diameter or to bore the corresponding tyres up to 7 ft. diameter on the tread. Each headstock is driven by a separate 25 H. P. variable-speed motor, and has four gear changes to give spindle speeds from one to 60 r. p. m. Four independently-adjusted, reversible jaws are fitted to each 7'–10" diameter faceplate and are able to grip either the outside of the tyres or inside the rim of the wheel centres, radial tee-slots being provided also for additional clamping purposes. Pockets in the faceplate allow wheel centres with crankpins in position to be flat against the faceplate jaws. A feed box at the end of each cross-bed, obtaining its drive from its respective headstock via transmission gears and a short shaft at the front of the main bed, provides a total of eight feed changes ranging from 12 to 96 cuts per inch. Quick power traverse motion to the rests is obtained from a separate motor with convenient push-button control. The total weight of the whole machine is about 46 tons.



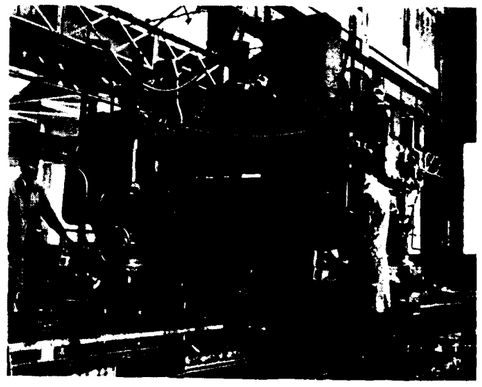
View showing the wheel centre turning and boss facing operations.



View showing the tyre boring operation.



View of one machine unit showing 3 ft. 10 ins. diameter cutter head which is fitted with twelve independently adjusted cutting tools.

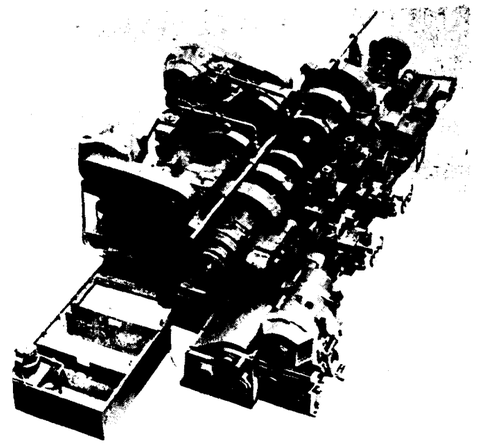


View showing auxiliary vertical milling head. This is suitable for either longitudinal or transverse traverses, or for machining small radii, etc.

"CRAVEN" LIGHT RAILWAY WHEEL TURNING AND GRINDING LATHE

Specially designed to meet the conditions and requirements outlined by the customer, this wheel lathe is fitted with two powerful, independently-driven grinding heads mounted on a short auxiliary slide bed secured to the rear of the main bed, in addition to the two normal rests at the front. The purpose of these grinding heads is for finishing the treads of a special type of chilled, cast-iron wheel straight from the "black" casting, without any previous operation, thus ensuring roundness and concentricity with the axle. The front rests, which are used for turning the treads and flanges of steel-tyred wheel sets, using high-speed tools, are not used at all when dealing with the special type of cast-iron wheel just mentioned.

Wheels in the region of 23 ins. diameter on tread, mounted on their axles at 2'—6" gauge, can be accommodated. The left-hand headstock is fixed and the right-hand headstock movable, the latter being traversed along the bed by power for loading purposes and clamped in its working position by electrically-operated, quick-locking mechanism. Each headstock



Craven Wheel Turning and Grinding Lathe, with 2'-6" diameter faceplates suitable for re-turning or grinding the treads of light railway or tramway wheel sets.

spindle is fitted with a sliding barrel, adjusted axially by means of a large handwheel and bored at its front end to receive split cone collets for gripping the axle journals. The two faceplates are 2'—6" diameter and each has two drivers of the side-push type to engage the wheel rim.

Both headstocks are driven in unison through a single bed shaft from a 25 H. P. constant-speed motor and sixteen-speed gear box. Spindle speeds range from 1.27 to 15.2 r. p. m. Power feeds are provided and the flat topped rests are arranged to carry a suitable form of wheel lathe tooling.

Each grinding head has transverse hand adjustment and quick power traverse upon a broad base saddle, which in turn has longitudinal hand adjustment upon the auxiliary bed. The transverse slide swivels for setting to suit any angle of the wheel tread, while the actual grinding spindle and its immediate mounting have a longitudinal oscillating traverse of 3 16 in. magnitude, which is continuously operating at a speed of forty cycles per minute, with the object of distributing wear evenly over the grinding wheel face. The drive to each grinding spindle is by 25 h. p. constant-speed motor through multi-vee belts. The abrasive wheel is 26 ins. diameter by 3 ins. wide when new and, using the pulley supplied with the machine, it runs at an approximate speed of 630 r. p. m.

Both a fixed push-button station and a portable, pedestal-type station are provided and further push-buttons on each grinding head operate the transverse quick traverse motor and are interlocked with the transverse hand motion, in order to prevent dangerous high-speed rotation of the handwheel.

CRAVEN DOUBLE-HEADED LOCOMOTIVE FRAME PLATE MILLING MACHINE

This large dimensioned, special purpose machine for machining the side faces, machining holes and small radii, or for cross-milling operations on locomotive frame plates, was recently installed in India and will accommodate plates up to 40 ft. long by 3 ft. wide. It is arranged with two main cutter heads, each 3 ft. 10 ins. diameter, mounted on vertical spindles.

A heavy bedplate has two longitudinal slideways upon which two independently-driven, bridge-type travelling machine units are mounted, and the central portion of the bedplate, situated between the slideways, forms a tee-slotted work table 4 ft. 6 ins. wide.

Each main milling head is centrally housed in an adjustable cross-beam supported between Vertical slideways forming the inner faces of the uprights, and the front of the beam is arranged in the form of a cross-slide upon which a small auxiliary milling head is mounted. The whole beam assembly has both fine hand-operated vertical adjustment and rapid power elevation for applying the cut for initial setting purposes. Powerful clamping mechanism effectively locks the beam to the uprights during operation.

Both machine units are of identical construction but are mounted on the bed in opposite directions, so that the two auxiliary milling heads face inwards. Each main cutter head comprises a giant inserted-tooth face-milling cutter with twelve independently adjusted cutting tools. Cutter speeds range from 3 to 6 r. p. m. and the drive is by means of a 25 H. P. constant-speed motor through a four-speed gear box and intermediate gearing to an internal gear ring bolted to the back of the cutter heap body. The working height available beneath the main cutter head is from 3 ins. to 13 ins., the vertical movement being effected by a 10 H. P. constant-speed reversing motor through two elevating screws adjacent to the inside of the uprights. Convenient hand adjustment is also provided.

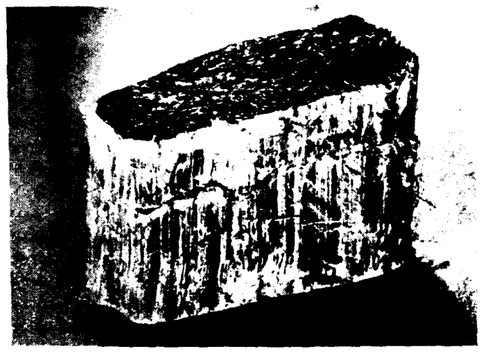
There are nine rates of milling feed ranging from .25 to 4 ins. per minute, the 10 H. P. motor mentioned above providing the feed drive. The longitudinal traverse drive is of considerable interest in that it is transmitted

(Continued on page 46)

ASBESTOS AND THE INDIAN RAILWAYS

By F. L. Mautner ★

IT is a truism that the development of railways has been closely bound up with the development of that most important of all metals—steel. Rails, locomotives, steel goods wagons and coaching stock all owe their origin to this basic material. What is not nearly so widely appreciated is the fact that modern railway engineering practice depends, to a surprisingly large



extent, on the inter-marriage of steel and *rock*. For in its crude form, asbestos is rock. It is a mineral which has to be mined and processed before it can be usefully applied.

The asbestos industry can be divided into two distinct groups. The primary group is concerned with the extraction and preparation of asbestos for industrial processing. The secondary group consists of the asbestos manufacturing industry. This turns the crude asbestos into products which, during the past sixty years, have played an increasingly important part in the complex industrial life of today.

ASBESTOS—AMPHIBOLE ANE CHRYSOTILE VARIETIES

Asbestos, in the earth's crust, is found in most countries of the World, and new deposits are reported from time to time. By no means all crude asbestos is, however, of commercial value. Crude asbestos can be divided roughly into two groups—the amphibole variety and the chrysotile. Of the two the latter is by far the more important. Chrysotile asbestos can chemically be described as a hydrous magnesium silicate, which occurs mainly in a dark greenish rock formation known geologically as Serpentine. Although there are many known deposits of chrysotile asbestos, only few are of commercial importance and the mining of the material is not a simple matter. Asbestos is what can best be described as fibrous rock. It occurs in veins which, when separated from the rocky enclave, reveal a greenish white material. When crushed this becomes a fibrous mass, the fibre staple being determined by the thickness of the vein. The separation of the fibrous matter from surrounding rock requires complicated plant, which must be specially designed to prevent damaging the fibre during its removal from the surrounding rocky substance.

The principal chrysotile asbestos producing countries of the World are Canada, Southern Rhodesia and the U. S. S. R. Further deposits of considerable importance occur in Swaziland and the Union of South Africa. Canada is by far the largest producer of chrysotile asbestos and Southern Rhodesia ranks second in importance in the Western World. Very little reliable information is available on asbestos production in the U. S. S. R., but it is known to be substantial.

(Continued from page 45)

through dual worm reduction gear units on the saddles to two pairs of pinions in engagement with racks at the front and rear of the bedplate. Each pair of pinions has special provision for the elimination of backlash, and the two pairs are coupled together to drive in unison.

The Auxiliary Milling Head fitted to the cross-slide at the front of each cross-beam is an independent unit. A 9 H. P. constant-speed reversing motor provides the drive to the spindle through an eight-speed gear box giving speeds of 12 to 98 r. p. m. Vertical adjustment to the spindle for hand feed or cutting is 21" and the extent of the transverse traverse is 5'—5½" which amply covers the full width of the table.

Push button control is provided and the various motions are interlocked for safety purposes. The machine is complete with coolant system.

★ *Director, Asbestos, Magnesia & Friction Materials Ltd.*

The amphibole varieties differ greatly in importance, and are divided into several types, which differ in chemical composition. Two of them have commercial and industrial significance; the blue type, known as Crocidolite, is the more important. This is lavender blue in appearance, and although the fibres of Crocidolite are not as flexible and strong as those of the chrysotile variety, they are important because they greatly resist attack by acids. Blue asbestos is mined mainly in the Union of South Africa, but substantial deposits are known to exist in Australia.

The second amphibole variety, although not as important as Crocidolite, is a type referred to as Amosite. This is found in the Union of South Africa, and is a brownish material of exceptional staple length. The use of Amosite in asbestos manufacture is increasing, because it has the advantage that when fluffed into a feathery mass, its density is much lower than that of other varieties. Low density is associated with good insulation properties.

THE MAGIC MINERAL

Asbestos has perhaps been flattered more often than any other industrial raw material. It has been called the magic mineral, a boon to humanity, the silk of the mineral kingdom—and many other things. Why is it that this comparatively new material has become of paramount industrial importance?

The answer to this question lies in the secondary industry. This uses raw asbestos to manufacture a wide range of products, each of which possesses unique properties. Asbestos as a material was known in Roman times, but its importance as an industrial raw material was only realised less than a 100 years ago. During this comparatively short time the highly industrialised countries of the World have developed asbestos-goods-producing industries which have evolved special processes that use this oddity of Nature in a surprisingly varied manner.

CLOTH FROM ROCK

The fibrous structure of the rock makes it possible to spin the material, and the asbestos textile plants of the world now produce asbestos yarns—yarns which are incombustible. The technique of asbestos spinning has been perfected to such an extent that fine yarns as well as coarse can now be produced. A yarn which does not burn has many obvious applications where resistance to heat or flame is essential. The yarns themselves are converted into a great variety of textile products ranging from cloth, to the bases for woven type brake linings. Various types of asbestos plaited packings and electrical specialities are further products of importance.

It has been discovered that asbestos has an affinity to a number of binding materials—for example, rubber and cement. These binders used with asbestos fibre have led to the development of asbestos building materials, where cement is used, and compressed asbestos fibre jointing sheets, where the binder is rubber. Another example of the use of asbestos with other substances is the development of heat insulating materials. Whilst asbestos itself is a good conductor of heat, the fluffy mass of opened asbestos fibres traps innumerable air cells. This gives asbestos a high insulation value, as well as resistance to heat and flame. Heat insulating products containing asbestos take various forms. There are those made of asbestos fibre alone, and others where the fibre is used in conjunction with light magnesium carbonate.

It has also been found that the combination of either asbestos textile bands or fibre alone, with various synthetic chemicals, means that products with high co-efficients of friction can be manufactured. The significance of asbestos in the maunfacture of brake and clutch linings lies in the fact that friction generates heat. Brake linings are manufactured for brakes and clutches not only in motor vehicles, but also in heavy industrial equipment.

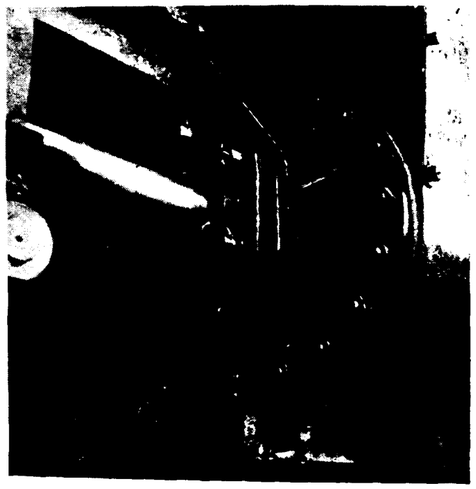
It is quite clear that asbestos products have had a considerable impact on industry generally, a fact usually not appreciated by the public at large. Asbestos products are not 'consumer articles', yet they play a vital part in the industrial scene.

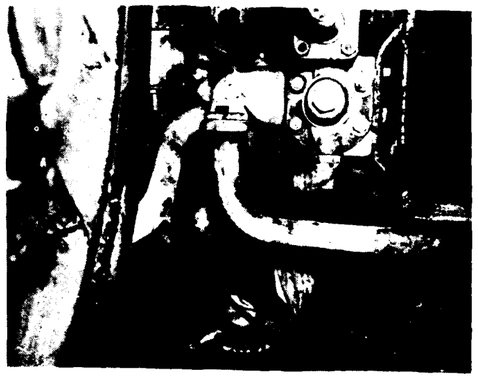
We of A. M. & F. M. Ltd. are concerned with the whole range of asbestos materials, with the exception of building materials. We manufacture asbestos textiles in India, and will shortly produce other products as well. We also sell in India the complete range of technical asbestos products as distinct from building materials. Our position as the authority on the uses of asbestos products in this Country is a direct result of this wide experience.

ASBESTOS AND THE RAILWAYS

How do asbestos materials concern the railways in particular? Let us take a specific example—a train. It is hauled by a locomotive, which is a heat engine—its connection with asbestos is obvious. To conserve heat and thus save fuel, the locomotive boiler must be insulated. This can be done in several ways. The most common method is to fabricate asbestos mattresses made from chemically pure asbestos cloth, filled with

asbestos fibre. This type of insulation is removable and extremely durable. Mattresses are produced by our Associated Company, J. W. Roberts Ltd., at Leeds, who are specialists in the field of railway engineering. They are made for every known type of locomotive, and each mattress is a tailored job—it fits a locomotive boiler like a glove.





Steam piping on locomotives must also be insulated to conserve heat and save fuel. The method of insulation can again be varied, but small pipes are usually dealt with by wrapping round asbestos yarn. Larger pipes are usually covered with a material known as asbestos fibre filled rope lagging. This consists of a fibrous filling with an asbestos yarn cage braided around the filling to keep it in position. Both materials are made by A. M. & F. M. Ltd. in Bombay.

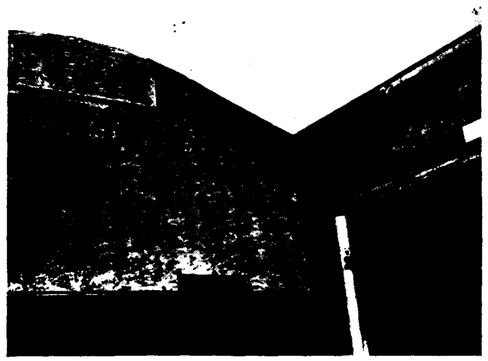
Where pipes have to be joined, flanges are used. To deal with these, some form of jointing medium must be used which nearly always takes the form of compressed asbestos fibre jointing. This material is a composition consisting mainly of asbestos fibre and rubber. It is produced in sheet form, the sheet being either cut to suit a flange at the factory, or the gasket cut on the spot in the railway workshop.

Locomotive cylinders are sometimes insulated by means of 85% Magnesia, a specially blended mixture of light magnesium carbonate and high grade asbestos fibre. Specialists in this field are our Associated Company in England, Newalls Insulation Co. Ltd. A. M. & F. M. Ltd., who are experts in the application of Newalls 85% Magnesia, not only sell this material, but will also produce it in India in the near future.

Locomotive cylinders must be steam-tight where the rod enters the cylinder. Asbestos packings, made in Bombay, here play a vital role.

Locomotive fire box backplates are sometimes insulated for cab comfort by means of a patented process developed by J. W. Roberts Ltd., whereby asbestos fibre is sprayed. This process involves the ejection of self bonding asbestos fibre from a spray gun which wets the fibre at the exit and deposits it on a surface. The resulting layer has a high insulating value. A. M. & F. M. Ltd. act as Sole Licensees for J. W. Roberts Ltd. in India, and maintain an extensive organisation for the application of Sprayed 'Limpet' Aebestos.

Reference has already been made to the high frictional properties of certain asbestos products, but the converse has also been achieved. Another of our Associated Companies, Ferodo Ltd., mak ers of brake and clutch linings, manufacture a range of technical plastics bearing the trade name 'Ferobestos'. A locomotive bogie must be free to oscillate, and 'Ferobestos' bogie centre liners ensure that the least possible friction exists between the bogie centre and the locomotive chassis.



These are only some of the ways in which asbestos materials are used on a locomotive, and we can justly claim that we make a substantial contribution to the satisfactory operation of locomotives on the Indian Railways.

The locomotive hauls wagons or carriages. The layman's first reaction will probably be that asbestos cannot possibly be applied to these—no heat is involved. This is not so. A prime consideration in the case of railway carriage construction must be insulation and the prevention of corrosion, particularly in a climate like India's. Sprayed 'Limpet' Asbestos is ideally suited for this purpose. After the application of a primary adhesive to the steel roofs and steel sides of a railway coach, 'Limpet' Asbestos is sprayed on the surface and allowed to dry. An insulating layer of any desired thickness is thus produced. This intimate contact with the steel plate can be achieved even on the most irregular surface, and the layer once dry adheres to the steel so tightly that it can only be removed with difficulty. Since asbestos resists heat, is vermin proof (because it is rock) and is chemically inactive, its advantages will be readily appreciated. This, however, is not all. It has been found that the application of a sprayed asbestos layer in railway carriages eliminates drumming, produced by the vibration in the structure whilst in motion. Sprayed 'Limpet' Asbestos also prevents corrosion. It reduces the possibility of condensation, so common in railway coaches, and any condensation which might occur is absorbed by the fibrous layer of asbestos without affecting the steel plate. Any moisture thus accumulated evaporates at the next temperature change. Every steel coach produced in India and many imported steel coach shells are treated by A. M. & F. M. Ltd. with Sprayed 'Limpet' Asbestos.

A. M. & F. M. Ltd. have a contribution to make in the furnishing of a railway coach as well, for J. W. Roberts Ltd. make a sheeting material known as 'Limpet' sheet. This is an asbestos base material which has the great advantage of flexibility. 'Limpet' sheet can be safely bent to a 9" radius and thus provides the railway coach constructor with a medium for internal lining. The familiar curved ceiling of a railway compartment is usually formed by a 'Limpet' sheet, which is fire resistant, vermin proof and completely inert. 'Limpet' sheet can be readily drilled for fixing screws, and its surface is specially prepared for painting, which can be carried out without the use of a primer or rubbing down.

'Ferobestos' technical plastics again find their way into coach bogies, but perhaps the largest quantity in terms of weight is contained in air-conditioned coaches. Apart from 'Limpet' sheet, Sprayed 'Limpet' Asbestos is applied by A. M. & F. M. Ltd. to every air-conditioned coach built in India in considerable thicknesses. This provides a permanent, corrosion-preventive, fireproof and highly efficient means of insulation.

The electrical industry is making increasing use of asbestos materials. The field coils of electric traction locomotive motors have to be wrapped with a high temperature resisting material. Turner Brothers Asbestos Co. Ltd., the largest asbestos textile manufacturers in the World, produce a wrapping material marketed under the trade name 'Pyroflex'. This is an asbestos webbing woven from extremely fine asbestos yarn. The material is specially treated to ensure the removal of all possible conducting particles which may have found their way into the tape, and is, therefore, an ideal medium for coil insulation.

(Continued on page 50)

TRACK FASTENINGS ON RAILWAYS

GUEST, Keen, Williams, Ltd., are well known in connection with India's railways as manufacturers of bolts, nuts, rivets, track fastenings, wagon forgings, signalling components and other products which are essential to the needs of the modern railway. The Company also act as the Indian representative of a number of overseas manufacturers of products used in railway workshops all over India; these include breakdown cranes, traversers, electric welding equipment and electrodes, wood working machinery and tools, bright steel bars, flame guns and tyre heaters. It is with the supply of high class products such as these that G. K. W. makes a further contribution to the maintenance and running of India's railways system. It would be impossible to describe these in any detail in such a small space but a few general points may be of interest.

Messrs. Cowans, Shelden & Co. Ltd., have specialised in the production of railway breakdown cranes since these came into use on Indian railways and long experience in their manufacture has enabled them to develop improvements to meet the most arduous conditions. A number of 65 ton steam breakdown cranes have been recently supplied to the Indian railways. Another range of equipment, used both in India and abroad, is the wide variety of electrically-driven Traversers, both pit and surface type, such as that illustrated which is installed at Khargpur.

Messrs. Murex Welding Processes Limited have specialised in the Manufacture of welding equipment for over 30 years and with this practical experience are able to provide a most efficient and reliable welding service. The range of Murex equipment includes transformers, motor generator sets, petrol and diesel arc welding sets and various accessories. A number of the 60 or more different types of Murex arc welding electrodes are in use in railway workshops today; welding of bogie under-frames, boilers and all kinds of steel, cast iron, hard-facing and non-ferrous work is undertaken with electrodes designed specially for the purpose.

G. K. W. also handle the Indian interests of Messrs. Thomas White & Sons, Ltd., and Messrs. Drabble & Sanderson Ltd., marketing wood working machinery on behalf of the former and woodworking tools on behalf of the latter. The Thos. White range includes all types of woodworking machines of which a number of circular saw benches, log frame saws, tenoning machines, planers and other types have been supplied to the carriage and wagon works of India's railways. Drabble & Sanderson have built up a reputation for quality saws and cutters second to none and their products have been supplied to woodworking establishments all over India.

Messrs. Exors of James Mills, another member of the G. K. N. Group of Companies, are known throughout the world for their bright steel bars, including those manufactured from Ledloy steels, which are manufac-

(Continued from page 49)

Electric cables liable to become hot during operation must also be insulated with a heat resisting material. Asbestos again provides the answer. The cables can be wrapped by asbestos slivers or covered with asbestos braid.

Overhead railway supply lines can be held in position by 'Ferobestos' separators, whilst the instruments and switchgear in the cab of an electric traction locomotive are mounted on 'SindanyO' boards. These are sheet material made by Turners Asbestos Cement Co. Ltd. in England, another of our Associated Companies. 'SindanyO' boards are available in two grades. The Ebony grade is an asbestos base material, particularly suitable for the mounting of instruments and switchgear. The light grey Natural grade board is arc-resistant, and is used extensively for the manufacture of electric switchgear.

The activities of A. M. & F. M. Ltd. are confined largely to the asbestos field. This is of vital importance because it means that as a Company we can concentrate our efforts in India exclusively to the manufacture and application of asbestos materials. It is because we are specialists with great technical resources that the service which we render to Indian Railways is of very great value. Another of our major responsibilities is the technical advice which we can make available to all present and potential users of asbestos products in the Country. This advice is backed by the experience and technical resources of the largest asbestos concern in the World. Research and development on asbestos and asbestos materials is carried out continuously, and it is our job in this Country to make the benefits of such research available not only to the Indian Railways, but to Industry as a whole.

tured to fine limits in a very large variety of shapes and sizes. These bright bars, drawn to a variety of sections can save many hours of machining and assembly time.

The Hauck Manufacturing Company market a large range of oil burners and flame heaters, applicable to many purposes both in and out of the workshops, from locomotive tyre heaters to weed killers. Hauck Portable Heaters are used extensively in Locomotive, Carriage and Wagon Works and Running Sheds for many jobs such as locally heating and straightening on site damaged wagon plates and pre-heating for welding and annealing.

These are just a few of the workshop jobs which can be performed by equipment supplied by G. K. W.

It has been the aim of the Company since its earliest days to serve India's railways by supplying them with high quality goods, both indigenous and imported, and it is justly proud of its contribution to the progress of the Indian Railway Workshops.

INDIAN DELEGATION FOR WORLD RAILWAY CONGRESS

India is among the 38 countries whose railway administrations have already named official delegations to the International Railway Congress to be held in London from May 19 to 26.

The British Transport Commission, organisers of the Congress, have announced that the Indian Railway Board is sending a six-man delegation. Led by the Board's chairman, Mr. F. C. Badhwar, the delegation will include the Deputy Chief Controller of Standardisation, Mr. V. Venkataramayya; the Assistant Chief Controller of Standardisation, Mr. L. C. Mohindra; the Railway Adviser to the Indian High Commissioner in London, Mr. R. H. G. da Costa; and two Inspecting Officers, Mr. K. C. Sood and Mr. N. Padmanabhan.

HOFFMANN AXLEBOXES

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

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

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

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

The famous London Underground has been using Hoffmann Boxes since 1935 and many thousands are in use today on this vast system. All new stock is being fitted with axleboxes of the Hoffmann design. The little known and unique underground Post Office railway, which is driverless and entirely automatic is another system relying on Hoffmann roller bearings. It is noteworthy that these bearings are fitted to the axles of the latest turbo diesel locomotive and to the Metro-Vick Gas Turbine Electric locomotive which is reputed to be the most powerful in its class in the World.

We will now describe two or three types of axlebox which we are putting forward today for railway work. Fig. 1. shows what is known as the ' Pad-type box '.

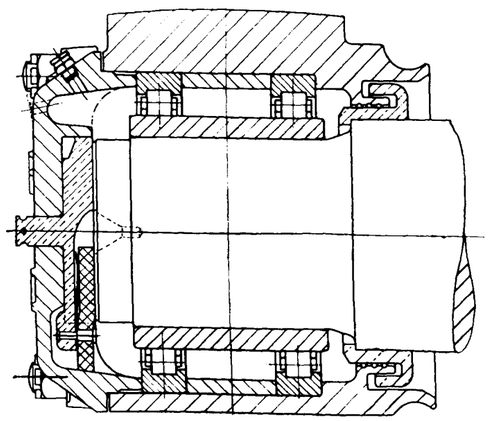


Fig. 1

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

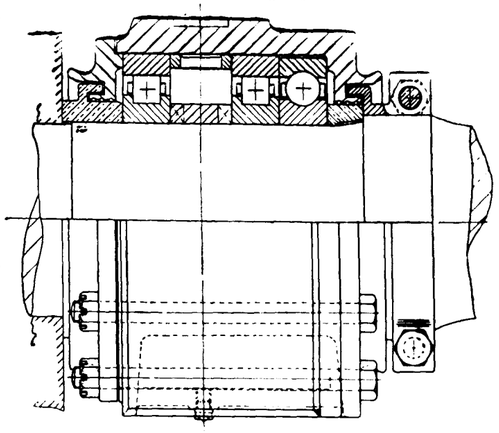


Fig. 2

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

An outstanding advantage of this type of box is the turning, the bogie frame must be lifted, after which the ease and rapidity with which it can be mounted and removed from the axle. Should it be necessary to remove the boxes for inspection purposes or tyre

boxes, complete with outer races, cages and rollers can be slipped off, leaving the inner races and throwers in position on the axles. There is no need to remove the components from the axles for tyre turning.

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

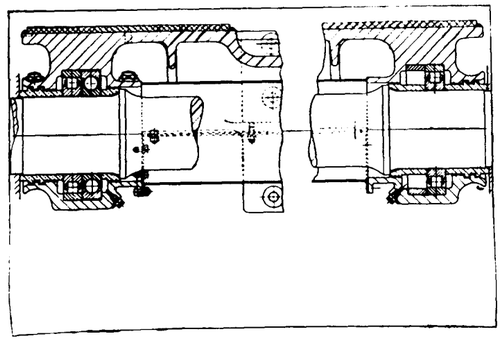


Fig. 3

It is occasionally necessary to leave the end of the axle clear, and often to fit boxes between the wheels, and in both eases the phosphor bronze pad design cannot be used. In such cases a ball bearing may be used to locate the axle and take the side thrust. To illustrate this, the design for an inside box is shown in Fig. 2. Here again the main load is carried on two roller journal bearings and in this particular design each has its own inner and outer races. The ball bearing also has its own races and it should be noted that it is left clear radially in the axlebox so that it cannot carry journal load, leaving its full capacity for dealing with thrust load. A very simple form of mounting is thus obtained and again no adjustment of the bearings is necessary. All the races are clamped firmly endways. The bearings may be inspected after lifting the bogie frame from the axleboxes. In order to carry out inspection it is necessary to remove the thrower which is clamped to the axle and free the detachable end cover after which the axlebox may be drawn to one side leaving the bearings in position. As the distance piece between the outer races is in halves it can be removed, permitting the outer races of the roller bearing to be slipped to one side exposing the outer tracks and the rollers for inspection.

Another type of box known as the cannon box is shown in Fig. 3. and this type has definite advantages with some frame arrangements and has been found particularly useful for two-wheeled leading and trailing trucks. It is also becoming popular for the axles of the main driving wheels of locomotives. The cannon box is suitable only for cases where the wheels are fitted on the end of the axles, and as will be seen from the illustration the bearing arrangement consists of a roller journal bearing at each end of a long cast housing extending between the wheels. A ball location bearing clear on its outside diameter is fitted at one end for locating the axle endways and dealing with thrust. No adjustment of the bearings is required and all the races are held endways. In some cases the cannon box is split along its longitudinal axis or alternatively, loose caps may be provided at the bearing positions only, as in the case illustrated.

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

LAMINATED RAILWAY SLEEPERS

Experiments with laminated railway sleepers are going on in Hungary.

The sleepers are made in three or four layers, stuck with artificial resin with a phenol content.

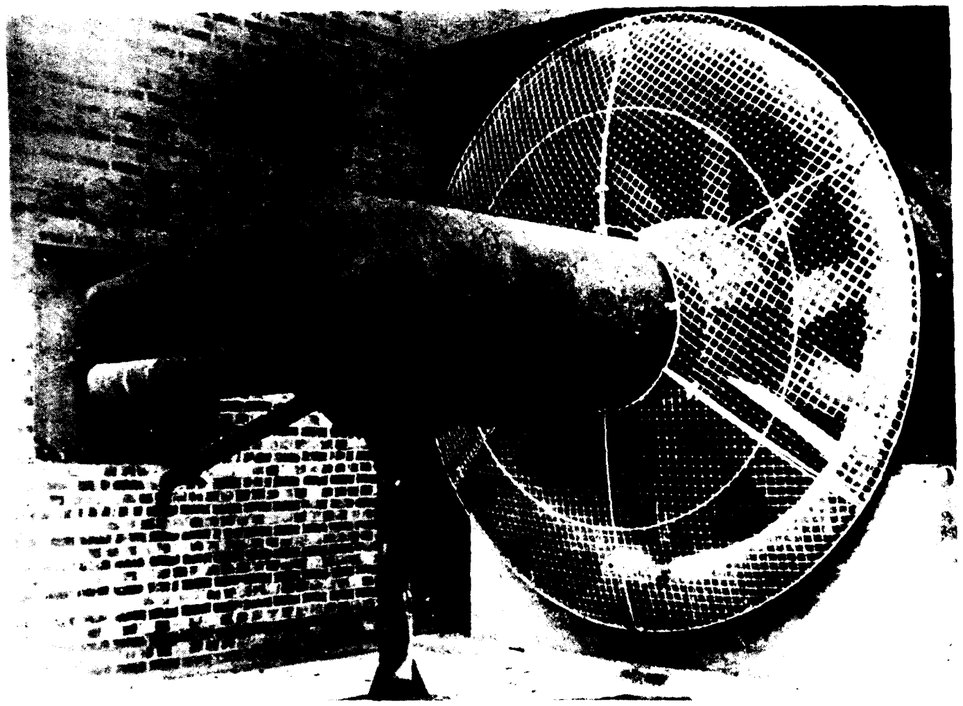
Hungarian press reports state that this method gives a high degree of firmness and prevents fungoid growth and rot.

AIR CONTROL INSTALLATIONS

SINCE its foundation in 1935, Air Control Installations Ltd., of Ruislip, Middx., England has made remarkable and continuous progress, until today it is widely known as one of Britain's leading manufacturers of fans and air treatment plant, and its products are installed in many parts of the world.

Recent deliveries to India include five induced draught boiler fans supplied to Tata Iron & Steel Co. Ltd. These fans are of single box inlet type, with blades having forward-curved heels and self-cleaning tips. Each fan is capable of delivering 52,700 c. f. m. at 4.7 in. w. g. and 600°F. flue gas temperature, and is driven at 735 r. p. m. from an 85 h. p. squirrel-cage constant-speed motor operating on 440 volts 3-phase A. C. supply.

Among other interesting projects recently completed is the provision of a large extract fan for tunnel ventilation on a section of London's tube railways. The new fan is of single-stage axial type, with a 10-ft. diameter impeller running at 208 r. p. m. on a vertical spindle. The fan has a capacity of 100,000 c. f. m. against 0.6 in. static w. g., and is designed for continuous duty with quiet operation. Provision has been made in the design for the considerable variation of air pressure due to the movement of trains in the tunnel.



View from inlet side of one of the four 9 ft. impeller diameter axial flow fans at London Airport. Note the vee-belt drive, shaft and bearings totally enclosed for weather protection.

The recent improvements at London Airport have attracted considerable attention, and here the main ventilating contract for the new road access tunnels was

(Continued on page 58)

The Ganz Works in the Service of Diesel Traction

IN the June, 1952 number of the "Diesel Railway Traction" in an article entitled "A Survey of Diesel Traction" under the subtitle "Pakistan" the following lines appeared:

> "....The old North Western Railway of India was to the fore in trying diesel units years before the war....
>
> "....After the initial troubles of the first year the Ganz 235 b. h. p. railcars have given satisfactory operation. From going into traffic first in February, 1939 until the end of 1951 they had covered an average mileage of 910.000 / 1,460,000 km. / per car. Consumption of high-speed diesel oil is about 1.25 lb. a mile. The original oil engines, roller-bearing axleboxes, under gear and auxiliaries are still in service, and nothing more than normal maintenance of wearing parts has been needed, except that the tyres need renewal every 200,000 miles, and this is the most expensive item of maintenance...."

A small item in the exhaustive survey, these few lines still say a great deal. It may not be without interest to go deeper into the meaning of the quoted lines, and expound in some detail the features of those railcars which for twelve years on end have been operating under strenuous service conditions and which are still in excellent shape. In December, 1938 a ship with a peculiar cargo arrived at the port of.....It is always a relief for a captain to see his charge safely on the wharf. In this instance the captain felt particularly relieved watching eleven complete railcars being hoisted one after the other by the giant cranes. Nine of the eleven railcars were arranged on the deck. This means that the captain new his business and well deserved the joy he felt over the successful unloading of his cargo.

These were the eleven railcars mentioned in such an appreciatory manner in the article just quoted. They were delivered by the Ganz Works, Budapest on the order of the then Northwestern Railways of India. It is of special interest that this railway company was among the first to try diesel traction. Owing to the fact that the Northwestern Railways of India had previously made some unsuccessful trials with diesel traction of other systems, the Ganz railcars were received with marked distrust on the part of many an Indian railway expert, who alleged that the country's climatic and other conditions made diesel traction practically impossible. If the performance of the Ganz railcars had not taken the edge off that argument the development of the railways would have

been greatly hampered. In India, namely, steam traction is extremely costly, since a substantial part of the payload is taken up by tank wagons carrying feed water for the locomotives. This circumstance, above all, had induced the company to order the railcars in question from the Ganz Works, as a last experiment with diesel traction. After the railcars shipped against that order had been assembled, forty-five engineers instructed and the prescribed trial runs performed, on May 1st, 1939 the regular passenger service began in the region with eight railcars of Jullundur.

(Continued from page 56)

carried out by Air Control Installations Ltd. to designs and specifications of Air Ministry dept. W8 H&V. Air Control Installations Ltd. was also responsible for the design and manufacture of the special axial fans and all the mechanical ancillaries. Four large axial fans were supplied, of which two act as standbys, the changeover being effected by providing each fan outlet with a remote-operated multi-leaf isolating damper coupled with automatic fan starting arrangements. Each fan is capable of delivering 172,500 c. f. m., and is fitted with a welded steel impeller having ten hollow aerofoil section blades, the drive being by encased vee-belt from a 100 h. p. variable speed slipring motor to pulleys on the forward end of the fan shaft.

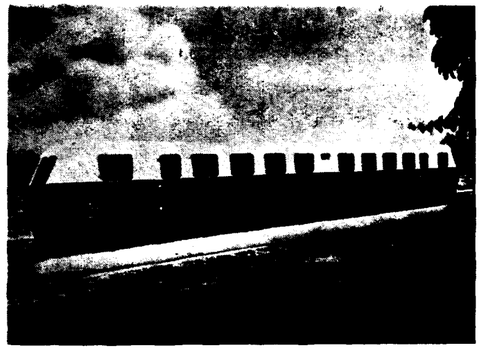
A really strenuous service calling for a daily 300—450 *mile* run with stops at every five miles or so. The railcars were day after day 15 to 17 hours in operation, the small hours of the night being reserved for the regular check-ups. Engineers worked in three shifts and the eight railcars performed the work of twenty-five locomotives. So much about the railcars which have been in operation ever since and still are in excellent condition.

These railcars were built by the Ganz Works. The factory was founded in 1844 by Abraham Ganz, a man of Swiss descent. A great impetus was given to the once unpretentious iron foundry by the introduction of chilled casting which constituted the first step towards its developing into the world-famous Ganz Works of our times. After the death of Abraham Ganz the already flourishing enterprise was reorganized as a joint-stock company and subsequently the Ganz & Co. Electrical, Machine, Wagon and Ship-building Ltd. was formed incorporated a string of smaller and larger factories. The factory ranked foremost in the fields of chilled casting technique, modernization of industrial machinery, designing and manufacture of electric machines and in the distribution of electric current over long distances. The first electric power station built by the factory was installed in Rome in 1885, and during the five subsequent years 60 power plants were completed. The first hydraulic power plant at Tivoli /1892/, the new, two-platform railway cars with longitudinal passage, air-brakes and steam-heating replacing the older side-door types /1885/, the first electrical induction counter for alternating current, are as many outstanding milestones marking the factory's impressive and rapid development. In 1902 Ganz built the Valtellina electric railway, powered by three-phase alternating current, one of the first railways of this system on the *Continent*. In the eighties—the days of Diesel—the manufacture of Banky engines laid the foundation for the factory's subsequent motor building programme, an important line that has been kept up ever since. The first river and sea-going ship built by the factory was followed by many of the same type powered by Ganz—Jendrassik crude-oil engines. The largest of these ships are 4000-ton sea-going vessels. Electrification of railways with phase converters of the Kando system as well as the manufacturing of 100-ton floating slewing cranes were likewise remarkable feats of the Works. Prominent technical experts on the factories staff such as Mechwart, Banky, Zipernovszky, Dery, Blathy, Kando and Jendrassik had largely contributed towards earning a world-wide appreciation for the Ganz Works.

The Ganz Works have acquired international reputation and occupy a leading position in building railcars featuring a great number of innovations such as e. g. mechanical power transmission which was first solved by the factory.

Ganz railcars are known and appreciated practically all the world over. Initially built for domestic use, the first items to appear on the world market were some railcars delivered to Belgium. Next, in competition with 14 foreign factories the tender of Ganz for railcars was accepted by the Egyptian Railways. Later on ever 300 units were delivered to the Argentine and Uruguay, apart from railcars sent to the Union of South Africa, Rhodesia, India, etc. From among the numerous Continental deliveries the railcar trains built for the extremely difficult terrain of the Beograd-Dubrovnik narrow-gauge line in Yugoslavia, deserve special mention.

Production for experts has always been predominant in the factory's *manufacturing* programme, and so it was even round the thirties at the time of the economic crisis. Since 1945 the factory has evolved several new designs, and expanding its pre-war international connections has executed important orders. At fairs and exhibitions abroad Ganz has carried away a great number of first



prizes, its makes meeting with unanimous appreciation everywhere.

The following is a short account of what is expected from a railcar in modern railway service. Between the two main branches of railway service, passenger and goods services, the former has always proved less remunerative, involving even losses on less frequented lines. Under favourable economic conditions when the costs factor of the railway—i. e. the ratio of the total expenditure and the total income—moved somewhere between 60 and 70 per cent, it was considered more or less a rule to allocate part of the higher profits derived from goods traffic to the maintenance of passenger traffic. Yet, when economic depression and, to a still greater extent, the competition of automotive vehicles were gradually curtailing passenger traffic, passenger service of the railway became a losing proposition. At the same time goods traffic was deprived of the transportation of certain commodities coming under higher tariff categories and was no more in a position to cover the losses incurred by passenger traffic. In view of these the rationalization of passenger traffic became an urgent necessity.

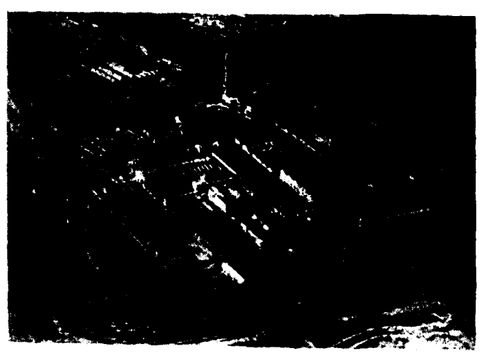
The deficit in passenger traffic is mainly due to the high dead-weight of the carriages which in case of 3rd class carriages is more than ten times, with upholstered cars over 20 times that of goods wagons. The dead-weight of goods wagons is 50 to 70 per cent of the payload, while with passenger carriages it amount to 500 1500 per cent. These figures only refer to cars with all seats engaged. Should the number of passengers only reach half the number of seats, the above percentages will be doubled. And, especially in local services, it is of no rare occurrence that a complete train carries but a handful of passengers. For their sake has an at least 80—90 ton train as the smallest unit in steam traction—to be operated.

Such a local train is composed-according to century—old traditions—of the following units: a 40 t small locomotive, a 10 t guard's and luggage van, a 17 t 3rd class carriage and a 20 t combined 1st and 2nd class carriage, altogether 87 tons. Approximate number of seats is 85, gross weight of the train 95—100 tons. The ratio of dead-weight per passenger is thus 1000 kg.

It appears that the solution of the problem lies in the application of a motor vehicle of lower dead-weight. Resorting to light engine with limited space requirement as a means of traction which is built into a passenger car of similarly light construction a useful vehicle is obtained that combines in itself tractive force with passenger accommodation. At the same time the dead-weight per passenger comes up only to 250 kg. i. e. one quarter of the ratio arrived at with steam traction, and operation costs are substantially lower than those of the latter.

Comparing the operation costs per km per passenger of the above described locol train with those of the railcar, it appears that costs amount to less than half of those of the former.

Should the number of passengers exceed the capacity of the railcar, further accommodation can simply be provided by coupling up a trailer. In this way costs per passenger are further reduced. Increased weight due to increased capacity will, of course, involve reduced traction performance. Should the highest speed and acceleration—with a view to the competition of automotive vehicles—not be desirable to abandon, so two or more power cars can be coupled up which can be controlled from the cab of the front car by means of remote control. Naturally this also has an upper limit when owing to the great number of passengers the use of locomotive traction becomes more economical. In all instances, however, when the number of passengers to be conveyed at the same time is not sufficiently high to



fill a locomotive-hauled train economically, the use of a railcar or a railcar train is indicated.

Apart from cutting down operation costs, motorization offers several other advantages. The most important of these is an increase in travelling speed. In contrast with locomotives frequent stoppages for taking water and fuel can be entirely dispensed with. The lower weight of the trains permits of rapid acceleration, and is less strain for the line than the concentrated weight of the locomotive. Consequently the maximum permissible speed can be increased by approx. 20 per cent. The weight of the fuel consumed by the railcar is incomparably low, thus a single fuelling suffices for covering many times the distance traversed by a locomotive under similar circumstances. With fuel amounting to less than 1 per cent of its gross weight a railcar will easily travel 1000 kg without refuelling. As a result of the above circumstances the travelling speed of the railcar train as compared with the locomotive-hauled one can be increased by 50 to 60 per cent, and in special cases, e. g. with the complete separation of passenger and good traffic, even up to 100 per cent. All these advantageous features offer no little attraction to passengers whose reverting to the use of the railway has a favourable effect on the balance of the companies. Passengers are also drawa by the new up-to-date rolling stock which keeps always spick and span since motor traction is completely free of smoke and soot.

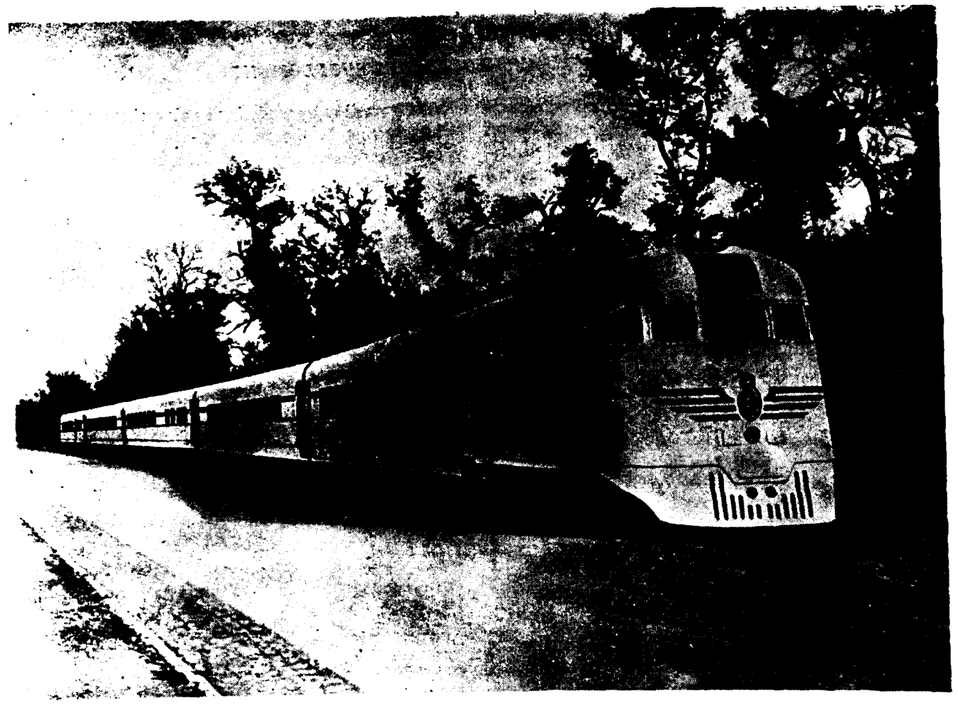
A short glimpse at the question of amortization may prove illustrative in connection with railcars. If, on introducing railcar service the computation of operational costs is based on the established estimates valid for locomotive traction, or in other words no immediate savings are reckoned with but are allotted for the payment of the cost prize of the railcars, it appears that at a 5 per cent rate of interest three years' savings will suffice for covering completely the cost prize of the vehicles. Contrasting this again with locomotive traction where the time of amortization is 30 years, another striking advantage comes in evidence, viz., that the railway company is not bound to stick to the technical level of its rolling stock which, considering the rapid development of technics, may to all probability become soon antiquated and call for improvements at heavy costs, but it is in a position to renew its stock every three years. In this case the railway company will not be able to economize on operational costs but through the high standards of its services it will always stand the competition of the rapidly developing automotive vehicles, and the surplus income derived from this will be instrumental to the financial stability of the enterprise.

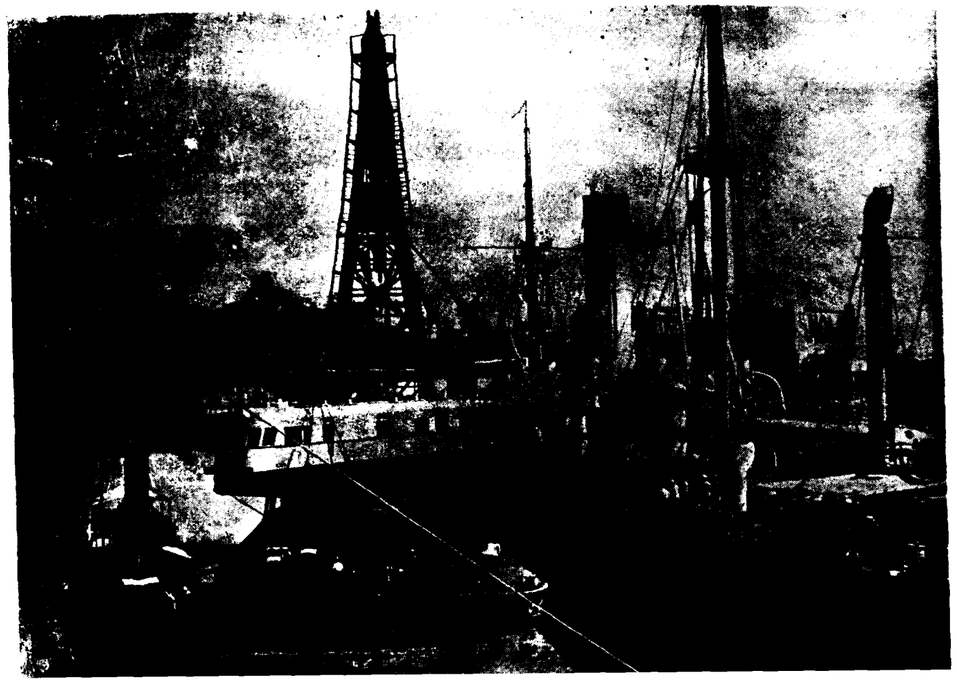
In the following we shall give a brief survey on the activities of the Ganz Works in the field of motorization.

First of all mention should be made of the railcars built and exported by Ganz to many a country in the first decade of our century. These railcars still were steam-powered. Their mechanical equipment consisted of a small steam generator and a steam engine mounted on the axle of the car. The equipment was patterned on the steam goods wagon of the French De Dion Bouton factory and manufactured by the then Royal Hungarian State Machine Factory in 30 HP, later also in 50 and 80 HP designs. Thus activities of the Ganz Works were restricted to constucting the body of the car and to mounting the mechanical equipment. This type of railcar, besides the Hungarian Railways, was also bought by the Slavonian Drava Railways, the Serbian State Railways, the Ploesti-Valeni District Railway in Rumania, the Russian State Railways, by Japan and the United States of America, and the Tzar of Russia purchased a royal train. The boom following the economic depression in the early years of the century rendered the railcar superfluous in its economizing capacity. Nevertheless the operational experiences of these cars offered a sound foundation for tackling the problems of the light railcar in the second " railcar period " in 1925.

In 1925 the Ganz Works delivered a number of special motor vehicles for the Southern Railways in Hungary. These four-wheeled vehicles were essentially railbuses with 29 seats, unsuitable for hauling trailers. It soon appeared that owing to their limited capacity they yielded in no way to further development. In designing a subsequent type due consideration was given to the elasticity of accommodation, and both the number of seats and the output of the engine were increased accordingly. Draw and buffing gears were provided to permit of coupling up a light trailer built for the purpose. In this way a train unit elastically coping with the varying demands of traffic was put at the railways disposal, complying with the essential requirements of motorization. This type proved very efficient insomuch that nearly 200 power cars and over 100 trailers were built for domestic traffic and for several foreign countries. The railcars delivered for the Hungarian State Railways are still in service on local lines. By using them the Hungarian State Railways have succeeded in separating passenger and goods traffic, have overcome the competition of automotive vehicles and have reduced operation costs.

These railcars were built in steel-framed design provided with the Ganz system mechanical power trans-





mission. The cars were originally driven by a semi-portable 6-cylinder petrol engine. Later, struck by an excellent idea, Cyorgy Jendrassik, engineer and subsequently General Manager of the Ganz Works set to the task of fitting the cars with a novel type of diesel engine. His labours were crowned by the designing of the world-known Ganz-Jendrassik diesel engine through which Ganz railcars came to the fore on an international scale.

The first railcar fitted with a Jendrassik engine was delivered for the Hungarian Southern Railways in 1928, to be followed by two trial cars for the State Railways in 1929 and 1930 respectively.

Since 1932 Ganz has been making diesel railcars exclusively, and in the course of time the petrol engines of all previously delivered cars have been replaced by crude oil engines.

The use of the Ganz-Jendrassik diesel engine meant a further reduction of the operational costs owing to both cheaper fuel and higher efficiency quotient. By using diesel oil instead of petrol nearly 70 per cent of the original cost of fuel is saved. Another invaluable advantage of crude oil above petrol is that the former is not inflammable, a decisive factor in favour of motorization.

In 1932 an expert of the Belgian State Railways visited Hungary to study the Ganz railcars. His favourable report was followed by the first important order from abroad. The Belgian Railways stipulated an engine performance of 6 HP for every ton of the laden railcar as against the 4.8 HP per ton performance hitherto attained.

This by no means easy task was achieved partly through further reducing the weight of the body and partly through slightly increasing engine performance. Weight reduction was attained by the use of a special chrome steel alloy as well as by electric arc welding. Engine performance was stepped up by designing a new, VI JaR 135 type, which turned out to be most suitable for four-wheel railcars.

In building the Belgian railcars good use was made of past experiences, and the efforts of the Ganz Works were crowned with success. The laden weight of the car was 20 tons, the normal performance of the engine 120 HP so that the stipulated 6 HP per ton performance was attained. Besides giving full satisfaction to the Belgian Railways this car type became the basis of Rumanian motorization too.

Ganz contributed to the motorization of the Rumanian railways by delivering engines and mechanical equipment as well as by rendering ample assistance in designing so that at the present time there are 150 Ganz-system railcars in operation in that country.

It should be noted in this connection that the excellent engines built into the Belgian cars proved such a success that a further 350 units were subsequently manufactured and sold. This engine marked VI JaR 135/180 has a normal output of 120 HP but it could reach 173 HP as a maximum, an important safety factor which explains its popularity.

Increased speed and higher capacity marked the road of further railcar development. The highly qualified engineers of the factory evolved a novel, 8 8-wheel railbus fitted with a new engine of 220 HP rated output, capable of travelling at nearly 130 kmph. Seven railbuses were supplied for the Hungarian State Railways the first of which was named "Arpad".

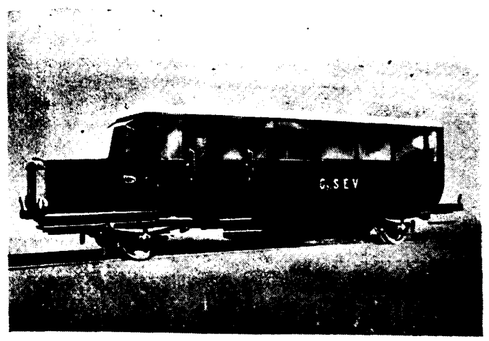
They were first put into service on the Budapest—Vienna line, covering the distance in 2h 59, as opposed to the 4 hours required by express trains even after the line had been electrified.

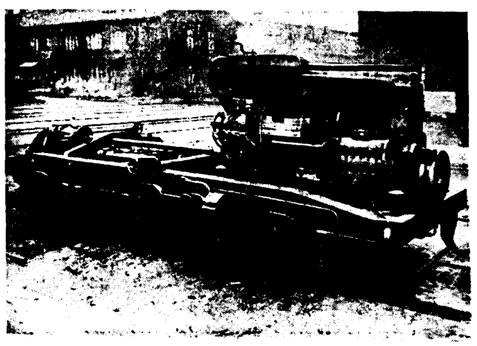
The "Arpads" earned international fame to Ganz; a steady flow of orders was forthcoming from practically every part of the globe. It goes without saying that while these orders had been executed in the course of the decades, demands had been gradually increasing as to both capacity and comfort. The next step in development was the elaboration of several types of luxury railcar trains offering the greatest comfort and suiting a diversity of purposes. Some of these will be described below.

In 1934 tenders were invited by the Egyptian State Railways for 10 eight-wheel railcars destined to communicate on the Cairo—Suez line traversing the uninhabited desert. The line had been laid in 1920 but remained in disuse ever since. Competing with 13 foreign forms Ganz secured the order. The ten railcars were built along the same lines as the "Arpads" and possessed similar mechanical equipment, yet their exterior was adapted to Egyptian requirements and in view of the climatic conditions they were supplemented by air-conditioning equipment.

The complete satisfaction of the Egyptian Railways was manifested by a repeat order, now for 10 twin railcars, a few months after the first consignment had been put into service.

Rather interesting are the events leading up to this second order. The railcars were destined to operate on the Cairo-Helwan line the electrification of which had





been pending for some ten years. The company had been snowed under with electrification plans, tenders had been coming in by the score, yet estimates were so enormous that the plans could not so far be implemented. Some of the first batch of Ganz railcars was then directed to the line to perform service in the slack hours of the day. It soon appeared that the railcars could fully and economically comply with the exigencies of traffic and the railways decided in favour of diesel traction instead of electrification. Tenders were again invited in 1936, and—in the teeth of keen international competition—Ganz once again succeeded in secouring the order as the lowest bidder, for 10 twin railcars powered by Ganz-Jendrassik engines. The "Diesel Railway Traction" devoted a separate article to the results of the competition, writing in alia:

> "The latest case is the 20 vehicles just ordered from Ganz by the Egyptian Government, and this order follows the delivery of 34 cars to Argentina by the same firm. If has taken scarcely 18 month for these 34 cars to be delivered and quick delivery forms one of the main reasons why orders go to the Continent."

Apart from the 30 passenger railcars 2 diesel railcars for the transportation of livestock and perishable goods were delivered for the Egyptian State Railways. As it will have been noted from the above quotation, the achievements of Ganz induced the Argentine State Railways to place an order with them. The order was preceded by a visit of Mr. M. F. Ryan then engineering manager of the Buenos-Aires and Pacific Railways, to the Hungarian State Railways. He was deeply impressed by the rate of motorization effected in Hungary. In the Association of Railway Engineers in Buenos-Aires he gave a lecture on what he had seen and, as reported by the "Railway Gazette" of January 26, 1934, he declared:

> "One thing, however was certain; for branch-line work the petrol or oildriven railcar would oust the local steam train. The Hungarian State Railways, /on which he had travelled/ had 100 such cars in service and placed orders for a further 100. Each of these new cars were equipped with Diesel engines the operating and maintenance cost being half what they were with steam. In his opinion the internal combustion engine and more especially the oil engine, up to 300 b. h. p., would replace steam for light work on all railways.

This piece of intelligence induced the Argentine State Railways to invite tenders for the building of 25 large 8-wheel railcars for 6 distinct purposes with 3 different gauges. The cars were meant to be tried on various lines in different services and further large-scale orders depended on the results of the trials. An international competitive bidding was held on August 8, 1934. Here Ganz submitted the lowest estimates, but many difficulties were yet to be overcome before the order was substantialized. At long last the Argentine Railways sent one of their engineers to Budapest to satisfy himself of the solidity of the enterprise and of the quality of Ganz railcars. On the day of his arrival he was taken on a trial run with the "Arpad". The Argentine engineer typed his report in the car which in itself proved its superior smooth riding qualities. Back again in Budapest he phoned his report to Buenos Aires. Consequently the Ganz Works obtained the order for 18 railcars with on option for another 16 cars, which in practice meant that the Argentine Railways raised the number of trial cars from 25 to 34. An engineer plenipotentiary was delegated to the factory, and the first railcar was completed by November, 1935 ready for the trial run. The trial run was attended by the engineering director and later general superintendent of the Argentine State Railways, Senor Eduardo Huergo. The run was a brilliant success so that the railways called for the delivery of the further 16 railcars. The first railcar was presented by the general superintendent of the Railways to the President of the Argentine Republic, as mentioned in "La Prensa" of April 25, 1936.

PRESIDENT TRAVELS ON NEW RAILCARS

> "The railcars in question are the units recently purchased by the State Railways. Yesterday in the morning the President inspected the new railcars purchased by the General Superintendency of the State Railways to be put into service on lines in various parts of the country. The railcars had for some days been exhibited at Retiro station of the Central Cordoba Railway.
>
> The characteristic features of these vehicles have been repeatedly and amply described on our pages.
>
> The President arrived at the indicated station in the company of the Minister of the Interior, the Minister of Public Works, the Superintendent of the State Railways, the traffic manager of the above-mentioned firm and of several engineers of the civil service.
>
> They immediately boarded the cars already coupled up to form a train of two units. At 10.45 the train was dispatched towards Don Torcuato station. The distance was covered at a medium speed of 85 kmph. The first functionary of our country gave expression to his complete satisfaction with the results of the run".

On the basis of their first deliveries the Ganz Works became exclusive suppliers of the Argentine State Railways and obtained further important orders without competitive bidding.

The first of these orders was for two wide-gauge luxury railcar trains, each composed of two power cars and a trailer in between. The power cars were fitted with higher-capacity 8-cylinder engines. These trains convey passengers, arriving to Patagonia from Buenos Aires on the southern line, to San Carlos de Bariloche, a health resort in the Andes 827 km off the Atlantic coast. The long line traverses an arid, dusty region often visited by westerly winds, to terminate at Bariloche near a picturesquely situated Lake, Nahuel Huapi, surrounded by mountains. This is the favourite health resort of Argentine high society where the State had recently erected a high-class hotel. The two newly purchased luxury trains served the comfort of the visitors. The trains contain de luxe compartments, air-conditioned saloon compartments, first-class seats, kitchen, mail and luggage compartments. Air-conditioning and cooling equipments are also provided for the benefit of the passengers. A steam train would require 24 hours for covering the distance which these railcar trains negotiate in 12 hours. Longer travel is perhaps not the greatest disadvantage of the steam train on this line. Far more so the infernal dust which eddies practically everywhere and penetrating the standard railway cars makes travel unbearable. The diesel railcar offer special protection against dust.

Four railcar trains likewise of thred units, named "Catamarca" were next delivered in a slightly less luxurious execution than the Bariloche trains. Their air-conditioning system showed marked improvement.

For suburban service in Buenos Aires the Argentine State Railways purchased 5 railcar trains each composed of three units, suited for the purpose.

In 1938 a further batch of 38 single railcars was delivered by Ganz to the Argentine State Railways, for a diversity of purposes.

At the end of 1938, to safeguard the interest of the Ganz Works, a special agency was set up with head offices in Buenos Aires. About the same time negotiations were in course with the Argentine State Railways regarding an order for ten more three-unit trains and 7 railcars. This important order placed with Ganz without a previous invitation for tenders was a telling proof of the Argentine partner's trust and satisfaction. Though fully completed, not all items figuring in the order could be delivered on account of the outbreak of the war.

The cable quoted / in translation / below, sent by S. Pablo Nouges to Pal Prager, the late manager or Ganz on December 22, 1941, well demonstrates the satisfaction of the Argentine State Railways over the deliveries: "We wish you that your country should soon revert to peaceful wish you that your esteemed enterprise should carry on its successful activities, which in the past had so efficiently contributed to the motorization of our railways.

Mr. Kimberly, engineering director of the Buenos Aires and Pacific Railways visited the Ganz works. He had been convinced of the superiority of hydraulic power transmission. Having satisfied himself of the excellence of the Ganz mechanical power transmission system, he decided for a parallel test. Power transmissions for six trial cars was delivered by Ganz. The first three power cars completed earned special appreciation by their unbroken trial run between Buenos Aires and Mendoza, covering 1067 km at an average speed of 101 kmph. The successful run was followed by an order for 12 railcars. When these cars were completed the war broke out and it was not without considerable difficulties that they could reach their destination via Italy.

The Central Argentine Railway with its 6000 km long lines is the third railway company in the Argentine in size. Seeing the good results achieved by the State Railways they ordered in 1937 12 twin railcars with 120 kmph. speed from Ganz without aby previous competitive bidding.

In 1938 20 railcars were supplied by Ganz for the State Railways of Uruguay.

Between the years 1936 and 1940 Ganz railcar deliveries to South America totalled 204 units 142 of which were sold to the Argentine State Railways. The value of the 204 cars was over 50 million pengos.

The fame of Ganz also reached South Africa, where the Union of South Africa and Rhodesia placed orders for 12 units in all. Owing to the outbreak of the war only partial shipments could be effected.

In European relation the greatest achievement of Ganz was the delivery of 7 units for the Yugoslavian State Railways. Beograd, the capital of Yugoslavia is connected with the nearest Adriatic port, Dubrovnik through a single-track, 760 mm gauge mountain railway line. Ganz's solution of the extremely difficult problems of traction to the full satisfaction of both passengers and railway company was watched with unprecedented interest by international railway circles.

As the direct outcome of Ganz's good results in Yugoslavia the Bulgarian State Railways ordered a number of similar trains. Subsequently many orders were forthcoming from several Continental countries the enumeration of which falls, however, outside the scope of the present survey.

Soon after the termination of World War II, the Ganz Works have re-established their former reputation. Incoming orders have been taking up the increased capacity of the factory. The stepped-up requirements of post-war years have called for higher capacity, greater comfort and de luxe execution. The most up-to-date railcar trains of Ganz have attained such high standards that they are vying with air transportation. As far as comfort is concerned these railcar trains are in many a way superior to air transportation where space is limited, and they are very popular with the travelling public.

The first against Ganz's post-war customers were again the Argentine State Railways with an order for a total of 26 units. This included a four-unit railcar train to ply between Buenos Aires and the Entre Rios region. The line is interrupted by the Parana river across which—failing a bridge—a ferry service has been installed. The fluctuation of the water level coming up to 6 metres, the ramps to the ferryboat sometimes form a 1:8 gradient in either negative or positive sense. The ferry-boarding ability of the train has been tested in conformity with actual service conditions. The elegant, streamlined train is powered by two 8-cylinder 425-HP turbocharged engines with electro-pneumatically operated remote control. Its rated speed is 100 kmph. Apart from the well proven spring suspension the train is provided with a special damping equipment to ensure smooth ride. Travel on the comfortable up-holstered leather seats surrounded by the mahogany-panelled walls is a real treat. A dining room with 32 seats and a well-equipped kitchen offer additional comfort to the passengers.

A five unit de luxe railcar train ordered from Ganz was destined to operate on the long-distance line between Buenos Aires and Mendoza. The required 120 kmph. speed was ensured by two 12-cylinder, 600-HP, turbo-charged engines in "V" arrangement. A cycle regulator ensures foolproof control and safeguards the mechanical equipment. Another great advantage of this arrangement is that it relieves the driver from the burden of concentrating on the proper use of the control and leaves him ample time to watch the signals.

The equipments ensuring smooth ride are identical with those described at the former type.

In the passenger saloons—surrounded by pleasant, light maplecovered—was light green, leathered tip-up swivel seats are mounted. Passengers growing hungry need not leave these super-comfort chairs because a table for consuming food can readily be inserted among the seats rendering dining just as comfortable as in the actual restaurant car of the train. In the up-to-date, ample-sized kitchen the finest masterpieces of culinary art can be prepared. An excellent air-conditioning equipment protects inside air from dust and moisture as well as keeps it warm in winter and cool in summer. In addition, the train is equipped with plenty of smaller gadgets, all being designed for de luxe travel.

After the war railcar trains of various sizes and purposes has delivered to several European states duly demonstrating the further, unbroken development of Ganz railcar trains.

Looking back on the petrol driven rail cars of the year 1925, and on the types showing the various grades of development until the up-to-the-minute luxury railcar train of the present day. One can justifiably be proud of the past and present successes attained by the Ganz factory and be confident in even greater achievements to follow in the future.

THE EPPING AUTO-SHUNTER

EARLY DAYS

THE use of tractors to move railway wagons is by no means a new idea and almost certainly goes back to the very early days of the first commercially produced petrol or paraffin engined machines.

Recognition of the ability of these pioneer tractors to tow a few wagons at a time soon inspired the fitting of a rough and ready buffer plate—usually no more than a baulk of timber—on to the front of the vehicle so that it could be used to push as well as tow railway trucks.

However, little real headway was made with this Shunting technique for an appreciable time for several good reasons but which for the sake of convenience can be put under two main headings.

Firstly the limited scope of the tractor. The shunting and towing capacity achieved with a simple adaptation of a machine primarily designed only for agricultural purposes was of course quite unremarkable as also was the ability of these early tractors to work successfully on other than a comparatively few sidings which physically and economically favoured their useful employment.

A few examples of this elementary way of moving goods wagons still exist in Great Britain, although for the most part the Shunting Tractor has long since superseded the Shunt Horse.

Secondly, the availability of other more suitable or convenient shunting methods and equipment. Before the recent war locomotives were frequently employed for many shunting duties for which they could not today be considered an economic proposition; present day greatly increased capital, maintenance and operating costs are, of course, the reason.

The employment of shunting horses for the smaller goods yard or dock was also until recently a popular and widely used competitor of the shunting tractor. It is perhaps interesting to mention although the modern

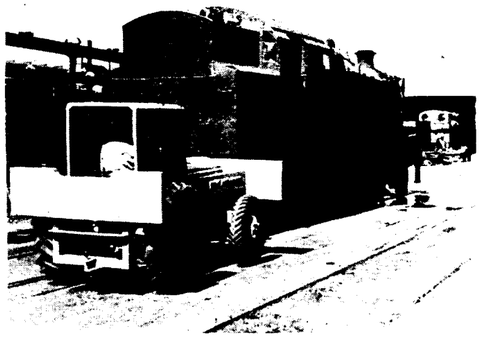
The width of the front buffer plate allows the Epping Auto-Shunter to split the train from a parallel position outside the track. In this case, however, sufficient space has allowed the machine to straddle the rail so that a heavy load can be shunted from a more favourable position.

and very efficient version of the shunting tractor, together with various other more recently introduced mechanical shunting devices, have to all intents and purposes completely superseded the shunting horse in Great Britain there yet remain a few of these animals in service. However, whilst it is true to say that the capital cost of a horse may be less than the "Epping Auto-Shunter" the operating cost, shunting efficiency and general versatility of the latter accounts for the virtual eclipse of the former.

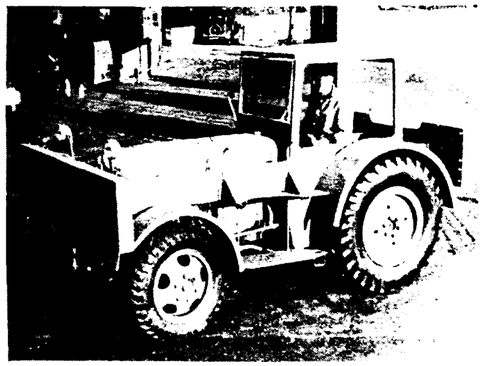
PRESENT TIMES

The recent general march of mechanical handling progress within the factory has tended also to focus attention on the present day economic requirements of dock, railway or works sidings with the result that the advantages of employing a modern version of the shunting tractor—the Epping Auto-Shunter—are daily becoming more widely recognised.

At the outset, the manufacturers of this versatile machine realized that to make a 100 per cent contribution to present day shunting problems a shunting tractor should be able to take the rough with the smooth and that unless it was capable of actually crossing over track and points it would not be meeting the full requirements of the many jobs that were in other respects ideal for this type of machine.



The Epping Auto-Shunter has no difficulty in moving this tank locomotive up a 1 in 30 gradient into the repair shop.



An example of the Epping Auto-Shunter built to the specification of the Eastern Region of British Railways. Note the provision of mudguards and the stand on which the Shunter can be carried on the machine to the next job.

An important advantage of the Epping Auto-Shunter is its ability to cross rails and points without difficulty. Here it is seen taking the most direct and quickest route to a job.

This requirement was to a large extent tied up with a demand for increased shunting capacity and the solution to both problems was found in the incorporation of a really robust but freely pivotting front axle arrangement, the choice of particularly suitable tyres maintained at optimum pressure and the provision of steering brakes the appropriate application of which would help the machine to climb over quite formidable obstacles with a minimum of fuss.

Being thus able to take the most direct route over the rails to move a raft of wagons, actual shunting performance of the tractor became the next most important consideration.

Maximum tractive effort for the Epping Auto-Shunter has therefore logically been ensured by skillful weight distribution and by making the best possible use of carefully planned ballasting. In addition, where the adjacent ground or track ballast conditions are considered unlikely to help the achievement of maximum shunting or towing performance a differential lock was found to turn possible defeat into positive victory.

This device, as its name implies, enables the operator by the application of a conveniently placed lever to provide his machine with a temporary solid axle drive with all its advantages from the point of view of increased tractive effort.

It will thus be seen that whilst the Epping Auto-Shunter basically remains a simple and straightforward item of equipment a good deal of thought and "know-how" has made it into a thoroughly efficient means of handling goods traffic under a wide variety of conditions and locations.

PERFORMANCE

What shunting or towing performance can one expect from the Epping Auto-Shunter? This is always a difficult question to which to give a precise answer but one can begin by stating that the machine should not have difficulty in handling loads of 150 ton on straight level rail with the wagons and track in reasonably good condition and ground conditions such as to enable the Auto-Shunter to take proper advantage of its available tractive effort. Since no two sidings have the same characteristics, theoretical performance figures seldom have any really direct relationship to practical achievement. Therefore some actual figures may make more interesting and instructive reading.

(a) *220 Tons* made up of empty, newly repaired goods wagons moved no straight level rail. All four wheels of the Auto-Shunter were on dry concrete throughout the operation and the differential lock was used to get the load moving.

(b) *174 Tons* made up of a mixed bag of British Railways Coal wagons of which five were of the old grease box type. This raft of wagons was successfully shunted through a curve and up a 1 in 150 gradient. Being a coal yard the ballast was mostly covered with broken coal and coal dust. The Auto-Shunter negotiated a set of points during this operation.

(c) *101 Tons* of loaded goods wagons carrying cable drums. Although on the face of it this represents a considerably reduced performance by comparison with the previous figures it was in reality a noteworthy effort. The Auto-Shunter had to operate straddling the rail with one wheel driving on loose ballast and the other on a concrete roadway at a higher level than the rail. There was a gradient of 1 in 36 against the machine and the train had to be started on and pushed through a curve of only 132 ft. radius.

(d) *76 Tons* of "dead" Tank Locomotive together with coal. This Locomotive after having been left for several days was moved up a gradient of 1 in 30 into a repair shop without any difficulty whatsoever.

From the foregoing it will be apparent that the Auto-Shunter makes the best use of its diesel engine of 42 B. H. P. at 1700 r. p. m. and it should be added that even when working at maximum capacity the consumption of diesel fuel oil will seldom exceed ¾ gallon per hour. The speed range, incidentally, is from about 1½ m. p. h. in 1st gear (which is of course used for maximum shunting and towing performance) up to approximately 14 m. p. h. in 6th gear when travelling on a good road going from job to job.

ADVANTAGES AND DISADVANTAGES OF THE AUTO-SHUNTER

It would perhaps be best to deal first with the disadvantages attaching to the employment of this machine and this will enable us to eliminate a number of shunting operations for which it would be idle to pretend this machine could be satisfactorily used.

First among the disadvantages must be placed long hauls especially when the track is not made up. This slows down the job to an uneconomic level. Secondly it cannot be recommended in the interests of safety that the Epping Auto-Shunter should be used on track adjacent to a running line nor, of course, on or adjacent to electrified line. Thirdly it cannot be expected that the braking system of the Auto-Shunter will be adequate to control more than nominal loads of say 40 to 60 Tons on perceptible gradients.

A possible fourth disadvantage of damage to the track is hardly admissible unless, of course, the track itself is in very poor condition. In this connection it is worth recording that when the Epping Auto-Shunter was undergoing official trials for British Railways deliberate attempts to force open points were unsuccessful. However, this bogey as well as the fear sometimes expressed concerning damage to the tyres of the machine is soon laid by watching a reasonably competent driver using the machine on a familiar siding.

The Epping Auto-Shunter is therefore essentially a machine suitable for shunting or towing duties in privately owned sidings and for relatively close internal work in Railway Goods yards or on the Dockside, and its many advantages can be summed up as follows.

It suffers neither from the physical limitations of the otherwise extremely useful and economic capstan, the necessarily higher capital cost of rail-borne diesel shunting engines nor the inconvenience in terms of time and manpower of the steam locomotive. Being independent of the rail the Epping Auto-Shunter has complete freedom of movement and being able to cross over the track it can quickly be positioned for work whenever and wherever the need may arise.

In addition to normal shunting or towing operations of rail-borne traffic, the machine can also be pressed into

(Continued on page 76)

SPEED RECORDING INSTRUMENTS

INSTRUMENTS for indicating and recording the speed of Steam, Diesel and Diesel Electric Locomotives, also Railcars, are standard equipment on many Railways and their use is being rapidly extended, as not only is there a record where speeds are exceeded on curves and where speeds should be limited, but same protects the individual driver from being criticized where he is not personally responsible.

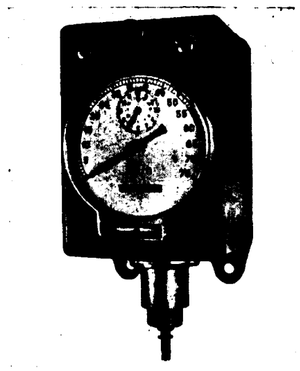
Such instruments of the " TELOC " type as supplied by Hasler Telegraph Works, 26 Victoria Street, London, S. W. 1., are manufactured by Hasler S. A., Berne, Switzerland, and are in service on many Railways in most parts of the World. The Indian Railways have many " TELOC " instruments in service as have also Railways in Australia, Africa, and South America.

The instruments indicate to drivers the speed of travel, time of day, and trip and total mileage and record this information on a chart together with the location and duration of stops, time locomotive or vehicle is at work, and—if desired—record the pressure or vacuum in brake pipes and pressure of steam in heating pipes. Further, a record can be obtained where desired, if electric power is being used, of the passing of closed signals or any other control which can be effected with the aid of electro magnets.

The records are made by a steel stylus operated by cinematic measuring mechanism on specially prepared paper from which copies can be easily taken. No ink is used.

Time is recorded graphically by means of figures marked on the paper. When the vehicle is standing the paper is fed by the clock, but at a reduced speed. The paper feed is five millimetres per mile or kilometre where the instrument is in operation, and five millimetres per hour when the spindle is stopped. At a lower section of the paper a portion is used for recording speed and is graduated similarly to the dial of the instrument.

A section above the speed recording portion is divided by lines into ten divisions, and is used for minutes. These are recorded by a continuous line alternately rising or falling, each up or down movement representing ten minutes; the interval between each line corresponds to one minute. The un-ruled space above the minute record is used for recording hours, which is



The Teloc RT. 835 speed indicator recorder.

(Continued from page 74)

service as an ordinary industrial tractor the availability of which must always be invaluable on the dockside or in any goods yard.

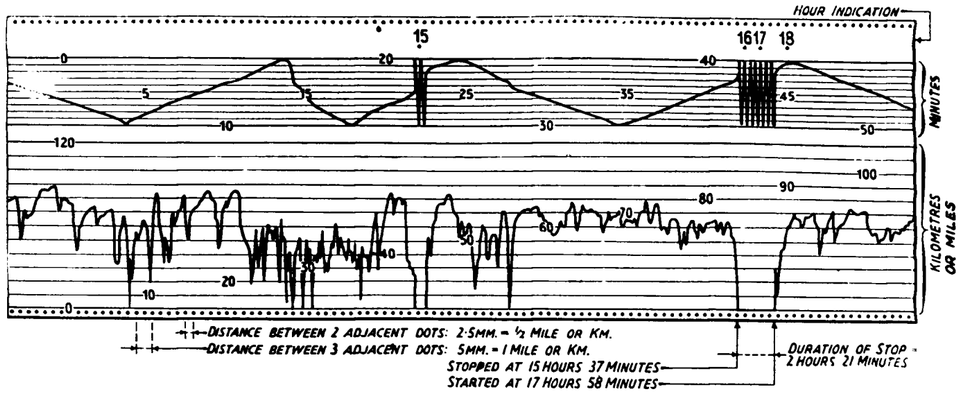
As previously indicated, the basic simplicity of the machine coupled with low fuel consumption and excellent working performance ensures really low cost shunting and towing of goods traffic.

Finally it is true to say that even where the volume of the traffic or the particular nature of the siding may prevent this machine from supplanting completely the various other more conventional means of shunting the advantages of the Epping Auto-Shunter will often commend its use for supplementary duties.

CONCLUSION

A short while ago for the benefits of its members in industry are search organisation in the United Kingdom undertook a survey of available shunting machines. Ten methods or machines were investigated and the report's conclusion to the best of the writer's recollection read approximately as follows :—

> " The Diesel Shunting Tractor appears to be the most versatile machine considered. Economically it is surpassed by the Capstan but for shunting and hauling duties it can be considered as an alternative to the 150 H. P. Diesel Mechanical Locomotive."



Record from Tel RT835 speed indicator and recorder

carried out by means of a wheel provided with 24 sets of points, each forming a figure of one of the 24 hrs.

The wheel rotates behind the paper driven by the clock mechanism. At each hour a pawl is released and causes the wheel to be forced momentarily against the paper, and the corresponding hour in figures is punctured on to the record. The principle adopted consists in indicating by a graphic recorder, the displacement of a part during a pre-determined time interval. The operation is therefore dependent upon two movements, constant and variable.

The constant movement is obtained by a simple clock mechanism, while the variable movement, which is proportional to the speed, is applied to the spindle of the instrument by suitable gearing from the wheel in motion. The combination of the two movements enables the speed to be measured and transmitted to the recording stylus. By means of clock escapement, the constant time measuring mechanism is geared during a pre-determined period with the mechanism of the variable movement.

During this exact movement the measuring piece is moved an amount proportional to the speed. This displacement is transmitted to the stylus after which the measuring mechanism returns to zero to recommence its movement for the next period.

The instrument can be operated by means of flexible and/or rigid shafting and by "electric remote" drive. For steam locomotives having only one cab, the "mechanical" (flexible and or rigid shafting) drive is invariably adopted but for diesel and diesel electric locomotives also railcars having two cabs, where an indicating instrument may be fitted in one cab and an indicator/recorder in the other, the "electric remote" method is particularly suitable, same being operated from a transmitter mounted on one axlebox.

BRITAIN'S THIRD LONGEST TUNNEL OPENED

A three-mile long tunnel, the third longest in Britain, has just been opened by Mr. Alan Lennox-Boyd, British Minister of Transport. Through it will pass passenger and freight traffic on the newly constructed railway line between Manchester and Sheffield.

The construction of the tunnel, which runs under the Pennine Hills, took more than four-and-a-half years and cost £ 4,250,000.

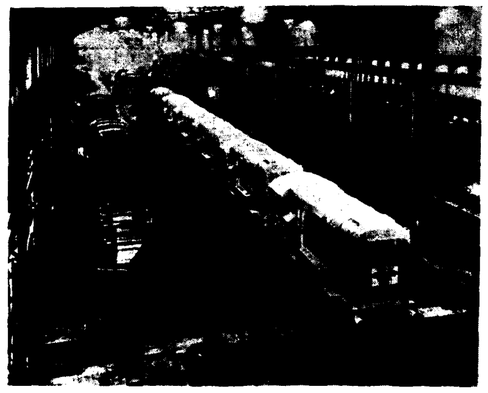
Performing the opening ceremony on June 3, Mr. Lennox-Boyd said: "This is the first major railway tunnel built in the United Kingdom in the 20th century, and it is an event of immense importance in the railway history of Britain".

English Electric Traction Equipment in India

THE English Electric Company has been engaged in the manufacture of all types of electric traction equipment since 1883 and has thus the advantage of many years of manufacturing experience, backed by continual research and development work. Locomotives and trains have been supplied to railways in many different countries, including India, where "English Electric" equipment is in service on the electrified lines operated by the Central Railway, the Southern Railway and the Western Railway.

Among British manufacturers of electric and diesel-electric traction equipment, the Company is unique in being able to design and build complete locomotives and trains in its own works, thereby ensuring maximum co-ordination in the design of electrical equipment, diesel engines and mechanical parts. The Company also handles complete electrification contracts that involve the provision of power generation and distribution equipment in addition to the supply of rolling stock. Comprehensive electrification schemes have been carried out in many countries including Brazil, France, Morocco, Great Britain, India, Japan, Poland, South Africa and New Zealand.

Eight-coach electric train supplied in 1925 to the Great Indian Peninsular Railway by The English Electric Company.



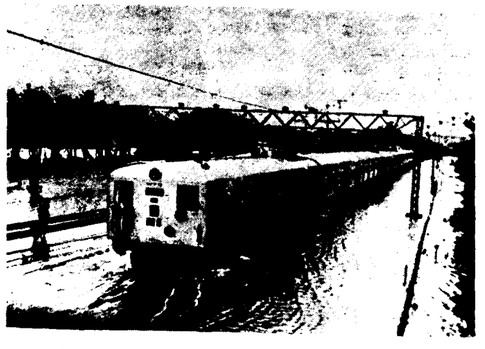
Locomotive Erecting Shop in the "English Electric" Preston Works, showing diesel-electric shunting locomotives under construction.

CENTRAL RAILWAY OF INDIA

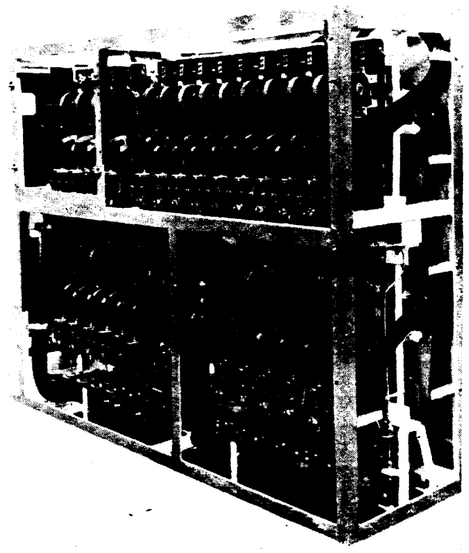
Between 1925 and 1928 the Bombay Suburban Lines of the Great Indian Peninsular Railway, now the Central Railway of India, were electrified at 1400 volts D. C., the suburban electrification terminating at Kalyan, 34 miles from Victoria Terminus, Bombay.

To operate these services, fifty-three 1100-h. p. motor coaches were built using "English Electric" traction motors and control equipment; 102 driving trailers and fifty-one non-driving trailers were also supplied. One motor coach and three trailers normally operate together to form a four-coach unit.

The original electric rolling stock continues to give good service after more than twenty-five years operation in the severe climatic conditions experienced in this part of India, where high ambient temperatures and high humidity prevail for the major part of each year, in addition to which heavy monsoon rains frequently result in the tracks becoming awash.



"English Electric" eight-coach train supplied in 1951 to the Central Railway of India, travelling through monsoon floods.



High-voltage equipment frame for 700 h.p., 1400-volt D. C. motor coach supplied to the Central Railway of India.

Since the inauguration of electric working the passenger traffic handled on the Bombay suburban lines has increased rapidly. In the second year following electrification, the number of passengers carried increased by 68.6%. To meet the demands of continually increasing traffic the original electric rolling stock was recently supplemented by new stock, including thirty-two 700-h. p. motor coaches built by The Metropolitan-Cammell Carriage & Wagon Co., Ltd., and electrically equipped by "English Electric". The new motor coaches are marshalled to form four-coach units, comprising two motor coaches and two trailer coaches, which normally operate as eight-coach trains.

Modern constructional methods and light-weight materials have enabled a considerable reduction in weight to be effected in the new rolling stock, compared with that of the older stock. To facilitate rapid handling at stations six double sliding doors are provided to each coach, arranged for either power or manual operation. The four-wheel bogies each carry two traction motors. Electro-pneumatic brake equipment is provided, with individual cylinders to all brake blocks.

The electrical equipment of these motor coaches is of modern design and provides for series parallel control of the traction motors with automatic control of acceleration. The bulk of the control equipment is mounted on the main equipment frame, which is housed in a high-voltage compartment. This equipment includes electro-pneumatic switches that regulate the operation of the traction motors, and the electro-pneumatic reverser, together with appropriate circuit-breakers and relays to protect the equipment under fault conditions. Switches controlling the compressor and motor-generator set are mounted on a separate panel in the high-voltage compartment. Low-voltage current, supplying the control circuits and the motor-alternator set for coach lighting, is provided by the motor-generator set, which is mounted on the coach underframe together with the motor-alternator set and the compressor supplying air for braking and auxiliary services.

The voltage regulator for the motor-generator set together with other low-voltage apparatus and fuses, is housed in an auxiliary cupboard in the high-voltage compartment. The cab-mounted equipment includes the master controller, with deadman's feature, also the push-button panel, from which the pantograph can be raised and lowered, the motor-generator set started and stopped, and the overload relays reset. The deadman's feature ensures that power is cut-off and brakes applied in the event of incapacitation of the driver.

Three-coach electric train supplied by The English Electric Company to the South Indian Railway.

The traction motors are self-ventilated by means of a fan mounted on the armature shaft which draws cooling air through ducts connected to the motors by flexible bellows from louvred openings in the coach interior.

Principal dimensions and data for the modern rolling stock and also for the original stock, are given below :—

	1925 Rolling Stock	*1951 Rolling Stock*
Track Gauge	5 ft. 6 in.	5 ft. 6 in.
Overall length of motor coach over buffers	71 ft. 7 in.	70 ft. 6 in.
Overall length of four-coach train over buffers	286 ft. 4 in.	281 ft.
Overall width	12 ft.	12 ft.
Overall height from rail level (pantograph housed)	—	14 ft.
Bogie wheelbase	10 ft.	10 ft.
Wheel diameter	43 in.	36 in.
Tare weight of motor coach	62 tons	55 tons
Tare weight of four-coach train	209 tons	175 tons
Seating capacity, four-coach train	437 passengers	415 passengers
One hour rating of traction motor	275 h.p.	175 h.p.
Control Equipment	All electric camshaft	Electro-pneumatic contractors
Mean accelerating tractive effort (four-coach train)	38,000 lb.	31,200 lb.
One-hour tractive effort	18,400 lb. at 23 m.p.h.	18,800 lb. at 27.5 m.p.h.
Continuous tractive effort	12,800 lb. at 25 m.p.h.	12,800 lb. at 31 m.p.h.
Maximum service speed	55 m.p.h.	70 m.p.h.

Recently, an order for seven 3600-h. p., 1400-volt D. C. Locomotives for passenger and freight service on the Bombay-Poona and Bombay-Igatpuri main lines was placed with The English Electric Company. The locomotives, mechanical parts for which will be built by The Vulcan Foundry Ltd., will be supplied during 1954. The main lines over which they will operate are very heavily graded, the Poona main line including one section of fifteen miles continuously at 1 in 37. The increased tractive capacity of the new locomotives, compared with those at present in service, will facilitate improved train performance in given conditions of gradient and loading.

"English Electric" locomotive with battery tender, supplied to the South Indian Railway.

Electric battery locomotive in the Carnac Bridge Marshalling Yard of the Bombay, Baroda and Central India Railway, now Western Railway of India.

The principal dimensions and data for the new locomotives will be as follows :—

Wheel arrangement	Co-Co
Track Gauge	5 ft. 6 in.
Length over buffers	67 ft. 9½ in.
Overall width	9 ft. 8½ in.

Overall height from rail level (pantograph housed)	14 ft. 1 in.
Total wheelbase	50 ft. 7 in.
Rigid wheelbase (bogie)	15 ft. 9 in.
Wheel diameter	48 in.
Estimated weight in working order (adhesive)	123 tons
Estimated maximum axle loading	20.5 tons
Maximum starting tractive effort (at 25% adhesion)	69,000 lb.
One hour tractive effort	47,400 lb. at 28.5 m.p.h.
Continuous tractive effort	39,000 lb. at 30 m.p.h.
Maximum service speed	75 m.p.h.
Braking	Air and regenerative on locomotive, vacuum on train.

SOUTHERN RAILWAY OF INDIA

To meet the demands of steadily increasing suburban traffic, the South Indian Railway, as it was then known, electrified and doubled the track between Madras and Tambaram, a distance of 18½ miles. It was decided that all traffic over this section should be operated electrically and orders were placed with The English Electric Company for seventeen three-coach articulated suburban trains, and four mixed-traffic locomotives for the haulage of through passenger and freight trains. The rolling stock was delivered in 1930 and was subsequently augmented by a further seven three-coach articulated trains.

The three-coach articulated trains each consist of a central motor coach flanked on either side by driving trailer coaches. They are arranged for multiple-unit operation to enable three-, six- or nine-coach trains to be run, according to traffic requirements.

Mechanical parts of these trains were built by the Metropolitan-Cammell Carriage & Wagon Co. Ltd., the "English Electric" electrical equipment being erected on the coaches at the Company's Preston Works. The power equipment of each train comprises four traction motors connected in pairs in series, one pair of motors being mounted on each of the two intermediate bogies of the three-coach unit. The traction motors are of the self-ventilated type but, in the exceptionally dusty conditions in which they have to operate, the ventilating air is drawn from inside the coach through ducts and sliding flexible joints.

Control equipment, which is of the all electric camshaft type, is housed in a high-voltage campartment at one end of the centre coach. The main and auxiliary control apparatus is mounted on two removable control frames. The control compartment also houses a motor-generator set for supplying the control and lighting circuits and a vacuum brake exhauster.

The principal dimensions and data for these three-coach trains are as follows:—

Nominal line voltage	1500 D. C.
Track gauge	1 metre
Overall length of three-coach unit	151 ft. 1 in. over couplers
Overall width	8 ft. 11½ in.
Overall height from rail level (pentograph housed)	12 ft.
Motor bogie wheelbase	7 ft. 6 in.
Wheel diameter	36 in.
Tare weight of three-coach unit	79 tons
One hour rating of traction motor	122 h. p.
Control equipment	All electric camshaft
Mean accelerating tractive effort	12,300 lb.
One hour tractive effort	6400 lb. at 23 m. p. h.
Continuous tractive effort	4700 lb. at 26 m. p. h.
Maximum speed	55 m. p. h.

Substantial increases in passenger traffic on the Madras-Tambaram line followed the introduction of the accelerated and augmented suburban service. During the first three months following electrification this increase in traffic amounted to no less than 180%.

The four 660-h. p. mixed-traffic electric locomotives, built to operate through passenger and freight services, are of the double bogie Bo+Bo type. Two battery

tenders were also built to enable these locomotives to operate in a number of the smaller shunting yards that it would have been uneconomic to electrify.

The principal dimensions and data for these locomotives are as follows:—

Normal line voltage	1500 D. C.
Supply voltage from battery tender	440 volts
Track gauge	1 metre
Overall length	36 ft. 8 in. over couplers
Overall width	8 ft. 6 in.
Overall height from rail level (pantograph housed)	12 ft.
Rigid wheelbase (bogie)	8 ft. 6 in.
Wheel diameter	43 in.
Weight in working order	42 tons
Number of traction motors	4
One hour rating of traction motor	165 h. p.
Control equipment	All electric camshaft
Maximum starting tractive effort	23,500 lb.
One hour tractive effort	14,800 lb. at 16.5 m. p. h.
Continuous tractive effort	9000 lb. at 19 m. p. h.
Maximum service speed	45 m. p. h.

WESTERN RAILWAY OF INDIA

In 1928 The English Electric Company built two electric battery locomotives for heavy shunting duty in the Carnac Bridge marshalling yard at Bombay. These locomotives have given satisfactory service, and have proved themselves capable of handling an increased volume of traffic compared with the steam locomotives previously used, by reason of improved availability, superior acceleration and the use of electro-pneumatic braking.

The locomotives, of the Bo-Bo wheel arrangement, weigh 50 tons in working order and exert a maximum tractive effort (at 25% adhesion) of 28,000 lb. The capacity of the 238-cell battery is 750 ampere hours, at the five-hour rate of discharge. The normal battery voltage is 440.

Adaptability of the Mills "Oilaulic" Presses

SUCH is the adaptability of the Mills "Oilaulic" Presses that there appears no limitations to their application in the engineering and other industries where a sustained and uniform load is to be applied.

Standard machines, from 3 to 250 tons capacity, are now in operation for general high-production work involving straightening, bending, assembling, driving and withdrawing arbors, general fitting and assembly, push broaching, squeeze riveting, coining, piercing, marking and many other similar operations. There are also bench types, used in the ceramic industry, for providing the mould pressure in moulding gas-fire radiants.

These standard machines have been supplied with a wide variety of attachments and where the demands of work exceed the adaptability of such specially-equipped standard presses, completely special machines embodying the "Oilaulic" principle have been designed and constructed.

Some of the more recent applications are shown in the accompanying illustrations.

Fig. 2 shows a Mills Closed-frame "Oilaulic" Press, many of which are now in continuous use on coining and pressing operations which is an entirely new phase in the development of the "Oilaulic" principle.

In one plant two of these presses are removing the "flash" from forged handles of pliers, pincers and nippers. The operation is shown in Fig. 1.

The forgings are of .70% to .80% carbon steel and are from 5 in. up to 12 in. in length.

The long and costly process of removing the "flash" by free-hand grinding has been eliminated by cold reforging or coining. The forgings are placed in the dies in the reverse position to that in which they have been drop forged. The specific load applied varies according to the weight of the flash lines but the result is the same. Special dies force the flash into the metal, leaving an appearance of being very efficiently ground, the flash line being completely removed.

The presses are operated by female labour, the smaller forgings being dealt with at the rate of 840 per hour, which is an output equivalent to the production of five rough grinders.

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The Stampings Alliance Limited, of Birmingham, have also installed the Mills Closed-frame Presses for similar coining operations. The presses have shown remarkable savings in costs in the hot and cold coining, straightening and bending operations performed on a wide variety of steel forgings.

Fig. 1 Coining cold the "flash" lines in forged plier handles on a mills "Oilaulic" Press

Fig. 2 shows the coining operation on a Road Pad End, which is part of a fitting covering the projections on the steel tyres of agricultural tractors, to prevent damage when travelling along a road. Simultaneously with the coining is a piercing and final bending operation. This combined operation is performed hot.

Fig. 3 shows a more conventional press operation. It is a horizontal-type press in the works of Messrs.

Fig. 2 One of the Mills Closed-frame "Oilaulic" Presses to be seen in the Birmingham Works of The Stampings Alliance, Limited. Coining, bending and straightening operations are performed on a wide variety of steel forgings. The above illustration shows the simultaneous coining, piercing and bending of Road Pad Ends.

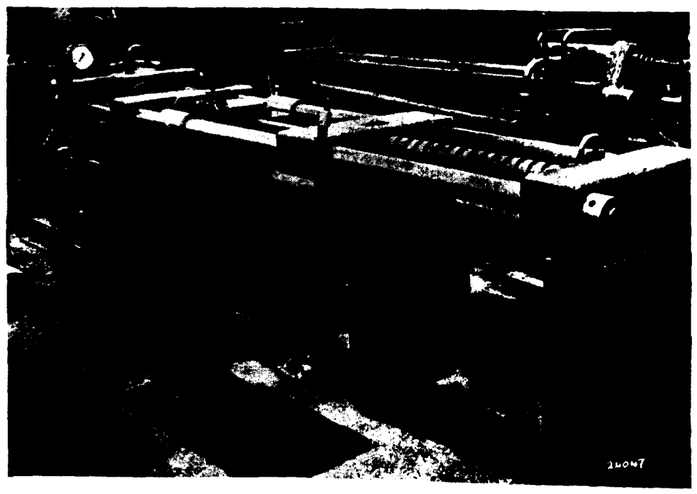

Fig. 3 A horizontal-type Mills "Oilaulic" Press for assembling a steering box and outer ball-race on the ends of a tubular column.

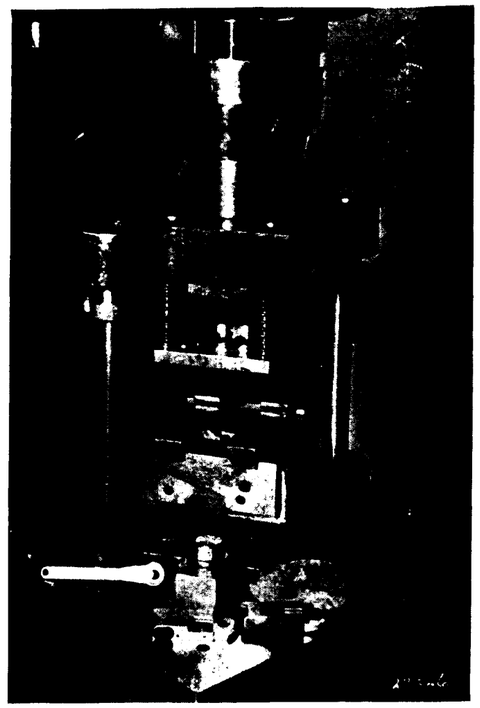

Fig. 4 A Mills 15-ton Press equipped with a die-set for pressing the component.

Burman and Sons Ltd. for assembling a steering box and outer ball race to the ends of a tubular column. The correct relationship of the two units is ensured by the loading fixtures. The complete operation, including loading and unloading, takes 35 seconds.

The development of the Mills "Oilaulic" Press for press work has made rapid progress in the works of Messrs. Reid and Sigrist Ltd., of Braunstone, who manufacture a wide range of aircraft instruments and the well-known Reid Photographic Enlarger and Camera. In these works accuracy is of primary importance and the Mills 15-ton Press installed has permitted precision production of a variety of pressed components. These components have been pressed in a die set from either sheet brass or extruded materials.

The machine has a rapid advance speed of 100 in. per minute and a power speed of 30 in. per minute. It is equipped with power return of 80 in. a minute and a bottom cushioning cylinder with a variable loading from 0 to 3 tons.

Fig. 4 shows the die set on the Mills Press for producing the range finder cover of the Reid Camera. The cover is produced from flat stock in two draws, the stock being located in the die for the first draw by means of a square pierced hole which is subsequently enlarged to provide an accessory holder aperture.

To ensure a uniform and flat surface at the bottom of the deep draw it is necessary to trap the flat stock between two faces during the actual pressing operation. This is accomplished by fitting a die the same shape as the deep drawn face on to the top face of the cushioning cylinder ram which is built in the base of the machine. The cushioning ram is set at a 3-ton load and the main

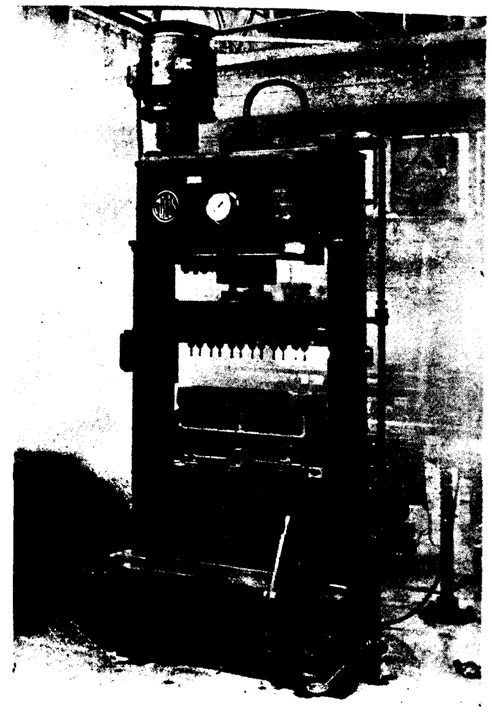

Fig. 5 A Mills Forcing Press for the simultaneous fitting of twelve valve guides in crank cases.

ram at a 12-ton load. During the building up to the maximum set load the flat stock is shallow drawn until contact is made with the cushioning ram at which point the pressing operation continues against the 3-ton load of the bottom ram, which recedes into the base of the machine as the full form is generated on the component. Thus crinkling of the face of the deep drawn section,

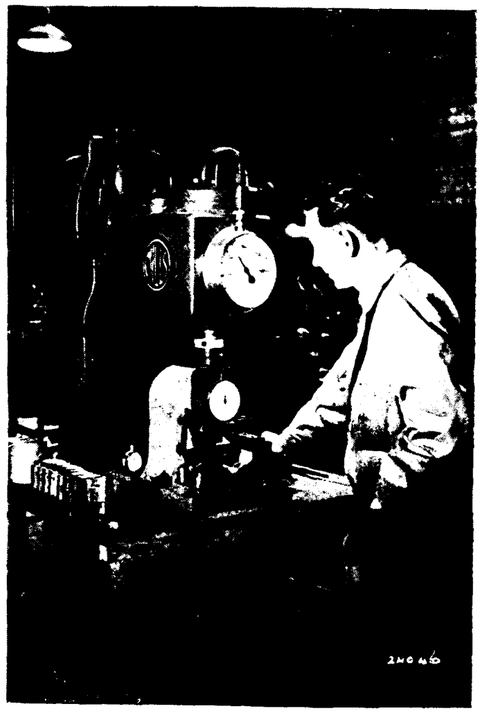

Fig. 6 A bench type Mills "Oilaulic" Press used for applying a set load to check the periphery length of half bearings.

which is $\frac{7}{8}$ in. deep, is prevented by being continuously under compression between the faces of the dies on the bottom and main rams throughout the full stroke. During the return stroke the cushioning ram acts as an ejector to remove the pressing from the lower die. A spring—loaded stripper plate automatically pushes the pressing from the male punch, if adhering to it on the return stroke. Tie bars ensure accurate alignment between the male and female dies. Normally a non-rotation attachment, with guides up the side of the ram cylinder, is provided for the same purpose.

The Mills 30-ton Forcing Press, shown in Fig. 5, is one of several which has been supplied to different firms in the Automobile Industry for the simultaneous pressing of a number of valve guides into cylinder blocks.

The machine illustrated is for pressing twelve valve guides and has been constructed to provide a table height to fit into a transfer line fed by a roller conveyor system. The cylinder block is fed transversely from the roller conveyor on to the press table, where it is located by two diagonally-opposed dowels raised by the vertical lever seen in front of the machine. The foot-operated control is inter-connected with the dowel—locating lever so that the machine cannot be operated until the dowels are positioned in the locating holes reamed in the sump face of the cylinder block.

The loose valve guides are placed on split guide pins accurately located on the lower face of the ram head which is prevented from rotating by slideways cut on the inside faces of the vertical columns.

The total time for the operation is $2\frac{1}{4}$ minutes.

Fig. 6 shows a unique application of a Mills 3-ton Bench Press which is being used in the Birmingham Works of Cylinder Components Ltd., for checking for size the half diameter of shell bearings. The maximum load of the machine has been restricted to 1 ton and a dial, 8 in. diameter and graduated in lbs., has been fitted for ease of setting to precise low loads.

The principle involved is that by applying a set load on one end of the half bearing, the other end abutting against a fixed stop, the periphery length can be measured from which value the half diameter of the bearing can be easily determined.

The machine is set in relation to a master block on which is applied a pre-determined load during which a stop, bolted to the ram, depresses the plunger of a dial indicator which is set to zero. Replacing the master with a machined half bearing and applying the same set load, the bearing takes up a uniform shape against the curved face of the supporting fixture. If of correct size the ram would have made an identical stroke to register a zero reading on the dial indicator. Variations in bearing diameter would affect the periphery length, thus permitting a shorter or longer stroke of the ram. The difference would be recorded on the dial indicator.

Loads from 360 to 1,940 lbs. are used for a range of half bearing sizes; the setting load can be held constant to within plus or minus 5 lbs. for repetition checking. Experience has proved that this set-up can show errors in the half diameter relative to errors of .0005 in. on the periphery length.

Various types and sizes of Mills "Oilaulic" Presses from 1 to 250 tons capacity are available.

All sizes are entirely self-contained, each being complete with the "Oilaulic" pump, electrical equipment, vee-rope motor drive and a standard pusher or nose piece with quick-release holder.

Sizes up to 30 tons capacity have rigid, well—braced cast—iron frames, whilst the presses of 45 tons and above are constructed from heavy—section welded steel plate. Bench presses are fabricated.

The "Oilaulic" Motor-driven pump is the essential power unit which has proved extremely efficient under the most exacting conditions. It is a combination of a multi-ram high-pressure unit and a low—pressure rotor which provide two speeds to the ram—a rapid approach which automatically changes to a slower speed at high pressure when the ram meets resistance by contacting the work. The pre-set maximum power can be attained at any point throughout the stroke.

The pump is built into its own reservoir and is fitted with a filter and an external adjustable relief valve for regulating the pressure from zero up to the maximum load of the press. When maximum pressure is to be regularly maintained for periods exceeding 15 seconds a pressure-sustaining valve is fitted to prevent overheating of the hydraulic oil.

The pressure exerted by the ram is registered by a gauge which can be isolated after the required load has been set.

Extremely sensitive control is provided either by hand or foot, which are interconnected so that when necessary the operator can have both hands free to handle heavy work. The return stroke of the ram on standard machines is actuated by a duplex spring, but power return can be fitted if required.

As sole agents for the complete Mills range our specialists will visit customers' works to give advice on their application and demonstrate their many advantages.

MODERN RAILCARS IN GERMANY

By Dr. Ing. Heinz Fahlbusch, M.A.N., Nuremberg

AN industrial country is inconceivable without an efficient traffic system. The wide distribution of natural resources and specialisation of the finishing industries today involve extensive transportation of raw materials, semi-finished and accessory products before the finished article reaches the user or consumer. The modern trend to keep the residential quarters away from factories and outside industrial areas makes fast transport facilities a necessity. The success of an enterprise depends largely on wide-spread business relations and, to ensure close cooperation with his partners, the manager needs fast services to cover the long distances involved.

Traffic today also plays an important part as an international link. It makes it possible for the people of various nations to come together, to get to know each other, to negotiate and to combine their interests. The traffic volume is continually rising everywhere and it is obvious that there is a high demand for better ways of traffic and more efficient means of conveyance. To meet this vital need, engineers, workers and businessmen of numerous factories and organizations are vying with each other in peaceful competition all the world over. Beside the motor car, ships and air planes, the railways are a most important factor in modern traffic, distinguished by their excellent permanent ways which ensure a high degree of saftey, comfort and speed. Although competition between the various lines of transportation is often very keen, there are still some exclusive domains of the railways, such as bulk transportation, passenger transportation, and long-distance high-speed service, where, on account of their specific features, they give better service than for instance road vehicles.

Germany, which has established close links of friendship to the Indian people with its large industrial capacity, is a suitable partner for India which is about to solve enormous economic problems by means of rapid industrialisation. This holds good in particular for the German rolling stock industries which are again supplying locomotives, coaching stock, special stock and railcars into numerous countries in the world.

One of the leading German rolling stock factories with extensive experience and long tradition is Maschinenfabrik Augsburg-Nuremberg A. G. (M. A. N.), Nuremberg Works.

M. A. N. is bound by two historical facts to make special efforts in the development and construction of rail vehicles. It was in their workshops where 60 years ago the first Diesel engine of the world originated, when Rudolf Diesel translated his epoch-making invention into practice at Augsburg. The second event was the inauguration of the first railway in Germany from Nuremberg to Fuerth in the year 1835. Inspired by the progressive spirit of his age, Johann Friedrich Klett, a citizen of the old town of Nuremberg, which for centuries had been famous for enterprise and industry, founded an engineering factory in 1837 primarily for the manufacture of railway rolling stock. Since that time, M. A. N., which developed from Klett's factory have made the design and construction of rolling stock one of the most important branches of their production programme. More than 155,000 railway units of every description from simple goods wagons to the most modern Diesel railcars have been supplied by the Nuremberg Works of M. A. N. into all parts of the world.

A century of tradition had been built up when the almost continuous development suffered a heavy setback in the second world war by the destruction of the factory. But German industriousness and craftsmanship brought about quick recovery, and larger workshops equipped with the most up-to-date production facilities rose out of destruction and debris.

M. A. N. have taken a leading share in a number of most important developments in the domain of railway rolling stock, the design of modern railcars being of special importance. In this connection, M. A. N. are naturally placed in a favourable position because their Augsburg Works produces a comprehensive range of Diesel engines.

One of the first export orders received by M. A. N. after the war comprised 12 electric two-coach railcar sets for the suburban services between the Greek capital Athens and the port of Piraeus. These sets were put into service in 1952 and have since given continuous service under arduous conditions to the full satisfaction of the Greek Electric Railways. In view of the heavy stressing of these railcars due to overload, frequent sharp braking combined with subsequent high starting accelerations, and also to account for the high humidity of the sea air on site, special care was taken to use amply dimensioned cross sections in the construction of the railcar sets. The coach bodies consisting of the underframe, which is reinforced by the corrugated floor,

the body skeleton made of steel sections, and the steel skin of 2 mm. steel sheet, are arc-welded throughout.

The power coach of the railcar set is designed with 2 driving bogies, all four axles of which are each driven by a nose-suspended motor of 95 kW. through spur wheel axle gearings. The current supply is by 4 current collectors fitted to the bogies and sliding on the conductor rail arranged beside the track. In the operator's cab, all controls and supervisory instruments which are required to ensure perfectly safe driving are conveniently arranged, such as the controllers, driver's brake valve, controls of the electro-pneumatically operated entrance doors, etc. A safety feature is provided which brings the train automatically to a standstill, if it should pass a closed signal or if one of the double sliding doors is not properly closed. The rear coach is a trailer coach fitted with carrying bogies and also an operator's cab. Fully automatic coupling permit to operate several two-coach units as a train, 3 units being usually coupled together.

The interior equipment is selected to suit the purpose of the railcars and, accordingly, seats consisting of a light-weight steel-tube framing with Latex foam rubber upholstering and leatherette covering are provided. In the driving trailer coaches there is a compartment with standard wooden seats for travellers with heavy luggage. The interior walls and the roof are heat-insulated and sound-proofed by means of hardboard plates. The power coach and the trailer coach are coupled by means of central short couplings, system Scharfenberg, and lateral stabilising buffers are also provided. The principal data of the electric railcar set are as follows:

Length over buffers	35,250 mm.
Length of power coach and driving trailer coach	17,000 mm.
Width of coach	2,820 mm.
Height of coach above rail level	3,600 mm.
Bogie centres	10,500 mm.
Bogie wheelbase	2,300 mm.
Track gauge	1,435 mm.
Number of traction motors in the railcar	4 each 130 h. p.
total	520 h. p.
Maximum rail speed	80 km. p. hr.
Seating accommodation in each coach	58
Standing accommodation in each coach	118
Total passenger capacity	352

Another important export order was placed with M. A. N. as general contractor by the Turkish State Railways for the supply of 16 three-coach Diesel railcar sets. Other German firms which cooperated under this order were

Dusseldorfer Waggonfabrik A. G., Dusseldorf
Maschinenfabrik Esslingen, and
Vereinigte Westdeutsche Waggonfabriken A. G.,
Koln-Deutz.

These new railcar sets were required to replace steam service on the railway lines between the most important towns of Turkey. The high speed of 125 km. p. hr., which these sets develop has helped to reduce travelling time considerably so that, for instance, the distance from Ankara to Istanbul is covered in 8 hours as against 14 hours which were previously required. To obtain this high speed, 2 M. A. N. Diesel engines of the type 12V 17,5/21B, each developing 550 h. p. at 1400 r. p. m. were provided for each three-coach set, consisting of two eightwheel power coaches and an eight-wheel trailer coach between them. The power transmission from the engine, which is mounted in the bogie, to the driving axles is by means of a hydraulic transmission, type T24a, by Voith, Heidenheim, incorporating 2 converter circuits. The cooling plant which comprises a main cooling circuit for the engine cooling water and the transmission oil, and an auxiliary circuit for the engine lubricating oil, is located in the roof to ensure better air flow and to reduce the ingress of dirt. The railcar sets are equipped with automatic multi-unit control made by Brown, Boveri & Cie. A. G., Mannheim, which enables up to 4 sets to be coupled together to form a train controlled from one operator's compartment. A remarkable feature is the excellent supervision of all parts of the machinery during operation. Any trouble or defect causes a control lamp to light up in the operator's compartment which in many cases allows the trouble to be rectified even during the run. The following data of the train will supplement the general arrangement drawing shown:

Length of set over buffers	70930 mm.
Length of power coach	23700 mm.
Length of centre trailer	22200 mm.
Bogie centres	15950 mm.
Wheelbase of power bogie	3600 mm.
Track gauge	1435 mm.
Service weight of set	134000 kgs.
Maximum speed	125 km. p. hr.
Seats in passenger compartments	119
Seats in dining compartment	18

To ensure smooth riding, stabilising buffers were fitted between the power coaches and the centre trailer coach, between which short couplings are provided. The coach bodies are made in steel construction partly welded and partly riveted, and a corrugated floor ensures an excellent diagonal rigidity. The electrical consumers in the railcars are fed from nickel-cadmium batteries. The batteries are alternatively charged by generators driven by the traction motors or from the station mains when the set is stopped at a station. The time-proved Knorr brake system and an additional magnet track brake ensure a high degree of operating safety. A fully automatic hot-water heating system, electric windscreen wipers, a pneumatically operated water screen in the driver's compartment and powerful headlights are also provided.

The interior equipment offers the traveller every possible amenity. The seats are well upholstered and covered with leatherette; folding tables at which the waiter, who can be summoned by an optical signal device, serves the meals, adequate illumination and excellent ventilation are other features which add further to travelling comfort. All considered, a vehicle which affords maximum travelling comfort and which makes travelling a pleasure.

Beside the construction of railcars, M. A. N. are continuing their old tradition in the manufacture of general rolling stock.

Recently, 30 modern eight-wheel express coaches in all-steel construction, partly welded and partly riveted, have been supplied to the Chilean State Railways. These coaches, which have an overall length of 22 m. and a distance between bogie centres of 15 m., are designed with a passenger saloon without partitions and 2 open vestibules. A characteristic feature is the robust centre solebar which transmits the draw and buffing forces from the central buffer coupling. The latter is of the automatic Henricot type with rubber-sprung Spencer-Moulton draw and buffing gear. Adequate rigidity of the underframe is obtained with pressed steel plate cross girders and a corrugated flooring whose corrugations are arranged longitudinally. The welded body sides of steel sections and 2 mm. skin panels are riveted to the underframe and the roof. Skin panels which are subject to heavy buckling stresses are reinforced by sections welded to the inside. The interior lining of the coach is also of steel sheet of 1.25 mm. thickness to avoid rotting in the moist and hot ocean climate. A heat insulation of Isoflex is provided between the skin and the interior panelling. The coach is equipped with 124 light-upholstered steel-tube seats, and parcel nets are arranged above the windows.

The exports of passenger coaches also included an order placed with the German rolling stock manufacturers by India for 250 third-class passenger coaches; 1000 goods wagons, 50 hopper cars, and 50 underframes for narrow-gauge passenger coaches. This order, too, was handled by M. A. N. as main contractor and the greater part of the German rolling stock manufacturers cooperated under this contract.

RAILCARS IN LIGHT-WEIGHT CONSTRUCTION

As in all countries with a very high traffic density, the Railways in Germany have to struggle against the competition of road transport. Efforts have therefore been made to take full advantage of the inherent merits of the railway by designing light-weight Diesel railcars and railcar sets, in order to combine maximum economy with an optimum of riding comfort and safety. As a result, the new long-distance high-speed railcar sets, type VT 08, of the German Federal Railways, were developed and have now been in service for 12 months on the Rhine Valley line between Basel and Dortmund.

A long-distance high-speed railcar set of this type comprises as a rule a power coach, centre trailer and driving trailer, but four-coach units can also be formed. To reduce the weight, the bodies of these latest high-speed sets are built in a novel construction which makes extensive use of aircraft construction practices. In contrast to conventional underframes where heavy steel sections are used to transmit the main forces, the body of these railcars is designed to form a closed stress-bearing tube which is remarkable for a very high torsional rigidity. The underframe structure of these cars is of the closed shell type with the skin reinforced by welded-on top-hat sections which enable it to take a fair share in the stresses. Pressed sheet-steel ribs, which are closely spaced and welded to continuous longitudinal tubes taking the buffing stresses, make the tubular body structure an element of high strength. The roof is similarly constructed as the underframe shell.

The combined rib and shell construction reduces to a minimum the body weight of the railcars whose length is more than 26 m. All sheets and sections are arc-welded, their gauge does not exceed 3 mm. thickness, except for the tubes transmitting the buffing loads which are 4 mm. thick. The distance between bogie centres is 19 m., similar to the new passenger coaches used by the German Federal Railways which are also about 26 m. in length.

To eliminate sound transmission, the body sides, the roof and the underframe shell are effectively lined with a sound-proofing compound. The railcar set is powered by a pressure-charged, 12-cylinder Diesel engine of 800 h. p. output, which has recently been increased to 1000 h. p., located in the leading bogie of the power coach. Three different types of engines with identical dimensions to be interchangeable are being used experimentally in the 7 trains which have been put into service up to date, namely, the supercharged M. A. N. engine L 12 V 17,5/21 B with a speed of 1400 r. p. m., an engine of the same output by Messrs. Maybach and a model by Messrs. Daimler-Benz. The power is taken from the engines to the two axles of the power bogie through a hydraulic transmission T 36a with 2 converter circuits by Messrs. Voith, or alternatively through a hydro-mechanical transmission Mo 32 built by Messrs. Maybach. The roller axle bearings and the driving wheel sets are designed for a maximum axle load of 18 tons, and the wheel diameter is 940 mm. Disc brakes and additional magnet track brakes in the carrying bogies enable the train to stop at short distance and ensure a very high safety factor. The carrying bogie used is a notable design in that it has no conventional bolster. The bogie is held in position by a long centre pin mounted in rubber bearings, while the wheel sets are guided in wide axle holding arms which take up the brake forces and also the lateral racking forces.

A Section through the head end of the railcar is given and shows the arrangement of the complete engine plant. The engine compartment of the coach has double walls of thin sheet metal with insulation in between to dampen noise and to insulate against heat. The interior lining of the engine compartment and of its doors consists of light-metal panels. The cooling plant for the engine cooling water and the transmission oil is sub-divided into a main circuit and an auxiliary circuit. At the same time, the cooler is designed to ventilate the engine room. A safety control device with electrical brake operation stops the train automatically in case of emergency. The technical equipment is completed by an automatic compound hot-water heating system with underfloor oil firing, the starter batteries, train telephone, headlights, horns, etc. The passenger compartments in the centre trailer and the driving trailer as well as the dining room in the power coach are furnished with all amenities according to the purpose of the railcars. The sliding doors, which can be opened and closed by hand or pneumatically from the driver's cab, are coupled to the lower door step. When the door is opened it drops into position, and folds back flush with the side wall when the door is closed. The 1200 mm. side windows are operated by means of a crank and the upper pane is arranged to slide into pockets in the body side and the roof. The seats are well upholstered and reading lamps are fitted. The dining saloon is decorated with taste, and a modern kitchen, including refrigerators, allows meals to be prepared to the choice of the passengers.

Any description of the capacity of the German rolling stock industries would be incomplete without mention of the latest development in the field of railcar construction. It is the light-metal articulated day train of the German Federal Railways and a similarly built seven-coach sleeper train of the German Sleeping Car Company. These designs open up entirely new fields in railway engineering. Their outstanding features, apart from the exclusive use of highly resistant aluminium alloys for the stress bearing parts of the coach bodies, are the novel running gear and the arrangement of the power unit. The two end coaches of 17.5 m. length each are streamlined and equipped with 3 standard M. A. N. omnibus engines of 160 h. p. or 180 h. p. respectively. Two of the engines are mounted on rubber bearings forward and below the driver's compartment, being arranged to drive the two axles of the leading bogie through flange-connected hydro-mechanical transmissions made by Messrs. A. E. G. The third engine is installed in the machinery cab behind the driver's cab and is coupled to a generator feeding the auxiliaries and the air conditioning plant. If a traction engine fails, it can be readily withdrawn by means of an ingenious gear and replaced by a complete unit. The maximum speed adopted at the present time is 120 km. p. hr., but supercharged engines are proposed to be used later to give an increased speed of 160 km. p. hr.

The 5 centre coaches are each 12.2 m. long and, like the power coaches, built throughout of light metal. The decisive cut in weight which alone enables the relatively low-powered automotive Diesel engines to be used in such a long train is due to the design of the running gear. In the day version of the articulated train, 2 coach units each are carried on a single axle arranged between the units, a simple guide geometry being applied to adjust the single axles in line with the bisector of the angle formed by the two coach units. This principle enables very high speeds to be attained on curves. Consequently, the number of axles per train is reduced to only 10 as against 28 required, if all coaches were fitted with bogies. The weight thus saved can be spent on the interior equipment or permits to reduce the traction power. The result is, although the coaches are luxuriously equipped, an extremely low deadweight per seat of only 687 kgs. which is less than half the deadweight per seat in a normal express train coach.

The sleeping-car version is fitted with light-weight bogies between the coach units which are designed as Jakob-type bogie and afford a saving of still 12 axles compared to coaching stock with standard bogies.

It goes without saying that this train is equipped for special comfort, and during the recent trial runs it has attracted the attention of railway engineers all the world over. Compared with the Spanish articulated Talgo train, the German articulated train offers the advantages of being able to operate in either direction, while, as a genuine railcar train, it requires no locomotive.

PROSPECTS

The short survey on railcars and passenger stock naturally covers only part of the products of the German rolling stock industries; also, the progress made after the war in the field of railcar development could be only briefly summarised, because any further details would surpass the cope of this journal. It will, however, be evident, even from a short report as this, that the German rolling stock industries have successfully overcome the setbacks of world war II and are again in a position to make a substantial contribution towards technical progress. It is hoped that the railways, in addition to their main objective of conveying people and goods, will be building bridges between the nations to help understanding and to promote peace.

RETIRING ROOMS FOR THIRD CLASS PASSENGERS

The Deputy Minister for Railways and Transport, Shri O. V. Alagesan, answered in the affirmative a question in the Council of States whether Government proposed to provide retiring rooms at moderate rates for third class passengers at any station. He said that during the current year these were proposed to be provided at Lucknow and Delhi main stations. Such retiring rooms were also proposed to be provided at Gandhidham on the Western Railway, but it was not possible to say whether these would be ready and available for use this year.

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 stations 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 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)

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