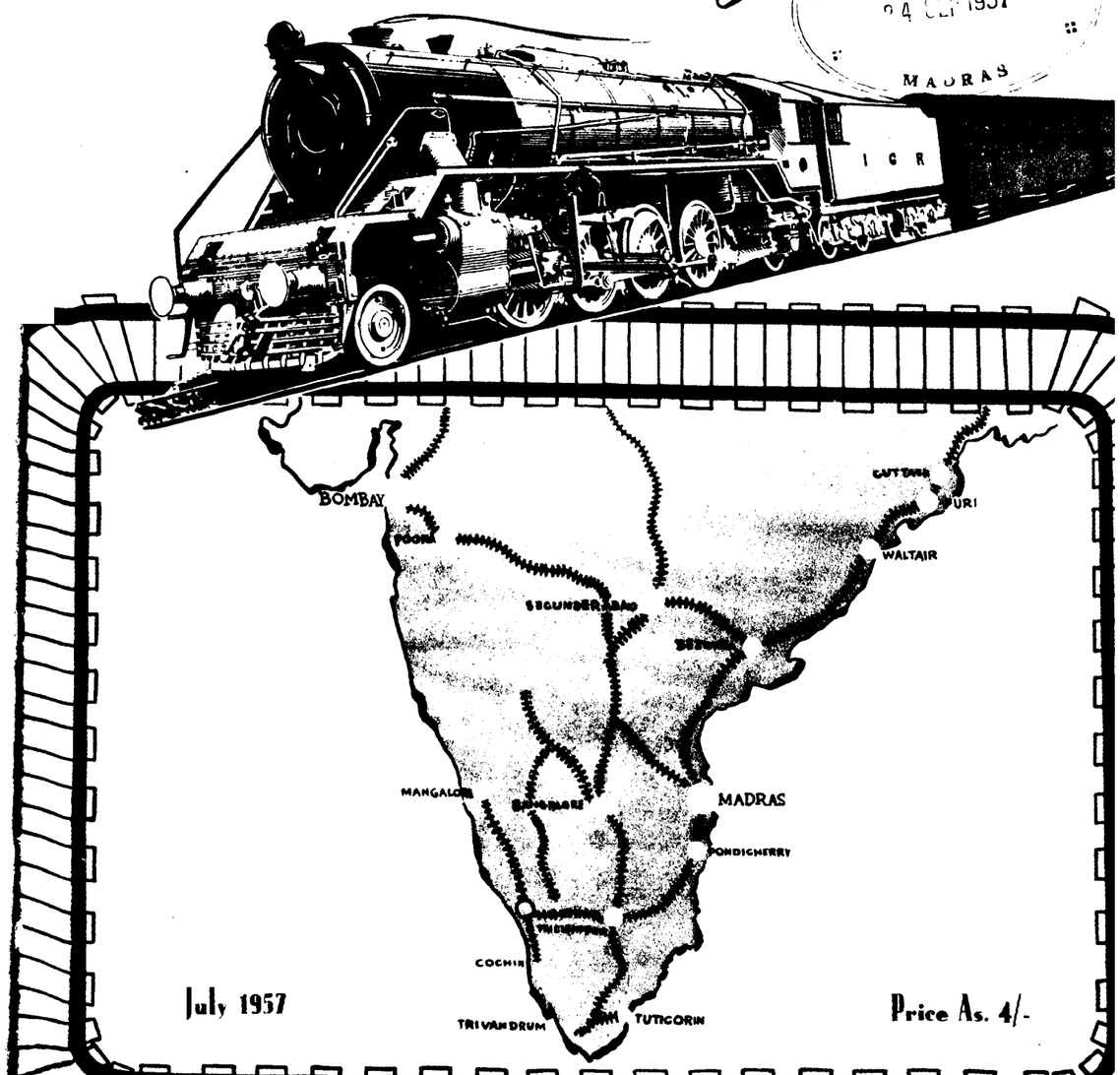
LOCO. CARRIAGE &
WAGON SHOPS SUPPLE

SOUTHERN RAILWAYS *Magazine*



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Editorial Notice

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

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

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

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

Discipline and Production in Railway Workshops

APART from well trained personnel (workmen as well as Supervisors) and good and uptodate machines in sufficient number, one of the most important factors which make for greater production in any workshop is Discipline.

Discipline does not consist of blind obedience to orders, but an attitude of mind which enforces regular and systematic working without loss of precious production hours irrespective of the quality of supervision.

Judging production with this yard stick, it must be admitted that work in Railway Workshops has deteriorated and the out turn of pounds per man hour has been gradually diminishing until today it is at a pretty low ebb.

Prior to the Second World War and in the early nineteen-thirties the Railway Workshops were predominantly controlled by Englishmen in the Superior Services and by Indians in the subordinate supervisory services and at that time discipline stood at a high level.

The Englishmen of those days belonged to a disciplined nation and discipline was a part and parcel of their life and they saw to it that it was observed by all with whom they came into contact.

Punctuality was a habit in which Englishmen generally excelled. When an Englishman made an appointment with anybody, he was usually present a few minutes early, but very seldom even a few minutes late. What punctuality he observed himself he demanded it from others and definitely enforced it on his subordinates.

If a meeting was fixed for a particular time, it was customary for all members attending the meeting to assemble outside the meeting hall a few minutes before time and walk in on the stroke of time.

If trains were scheduled to arrive at a particular station at a particular hour they saw to it that they were not even a minute late and also after their due halt they left the station on the stroke of time. Failure to achieve the time schedules was frowned upon on the first occasion, but a repetition brought on severe disciplinary action including reduction in grade on drivers, guards and others concerned.

If orders were given and if they were not clear, this had to be disclosed by the subordinates at that time and then the matter was explained clearly. But once the matter was supposed to be understood the subordinates were expected to carry out the instructions to the letter in detail and no explanation for failure to carry them out was accepted. The normal rejoinder which a subordinate received if work was delayed sometime was "I want work and I am not prepared to accept excuses".

In those days, Works Manager and his Assistants and the Senior Supervisors of the Foremen Class in the Workshops had a considerable amount of power, which is an essential feature of discipline. For a mistake or inability to carry out orders or dereliction of duty a workman or Supervisor was fined a fairly heavy amount or was reduced in status or sent home for a period on loss of pay. If the action or omission was serious, he was removed from service and in the interest of discipline and at times dismissed and the orders once passed were upheld by superior authority unless they were palpably unjust or unfair.

Englishmen, as a rule, had a very high sense of what is known as 'fairplay' and dispensed justice without fear or favour and it was an extremely rare occurrence if at any time the orders once given were ever reversed.

The Indian Workshop Supervisors with grades of Foremen and Senior Chargemen taking the queue from the English Officers and Managers extracted work from their workmen, especially if these orders came from any high authority. Further, as these foremen themselves were capable of working with their hands, having risen to their present position from the lowest rung of the ladder of workmen, when it came to emergency or a time limit was fixed for a job, they often forgot their higher status as Supervisors took off their coats, rolled up their sleeves and worked with their hands side by side with their workmen day and night until the job was completed within the limited time.

The Supervisors, because they knew the work of the branch of which they held charge, were respected by their workmen, who learnt a considerable amount of work and the various trade secrets from them.

There were, however, black sheep in every fold and Supervisors were no exception. Some of them undoubtedly accepted illegal gratification from their workmen or they bullied their workmen because they were in the

position of Supervisors or they were harsh to the men even to the extent of striking them when the occasion called for it, but on the whole inspite of all their defects they did maintain a very high sense of discipline and extracted a fair day's work for a fair day's pay from the workmen under their charge.

What is the picture today? Punctuality is very seldom observed. If a man comes to his appointment 15 minutes to half an hour late and makes the necessary excuse that the train was late or the buses were crowded and he could not get room etc., such an explanation is accepted without a question. It never strikes the man concerned to start from his home or the starting point half an hour earlier to offset any such obstacles indicated above. The saddest part of it all is that he gets away easily with his excuses and so keeps on propagating unpunctuality on various occasions.

At important meetings, sometimes, the convener of the meeting or the Chairman himself is late and the members invited, should they have come in time, have to cool their heels for considerable period before the meeting starts, with the result that on future occasions when such meetings are called for they deliberately come late because of the example set.

Train services are habitually late these days and the arrival of a train at a station at the scheduled time according to the Time Table is looked as a great achievement. When signals are lowered and the Guard blows his whistle and waves his green flag very frequently nothing happens. The Driver or the Fireman or the Khalasi probably hold up the train in order to meet their requirements in the nearby bazar or elsewhere.

It has now become a habit in most Railway Workshops for the workmen to arrive at the gates of the Workshops when the second buzz is blowing and they still have all way to walk to their places of work, which often take them ten to fifteen minutes and by the time they remove their clothes and get into their working clothes they waste anything from half an hour to three quarter of an hour before starting their work. Similarly, they just wash and change their clothes ready to go at least half an hour before the actual blowing of the buzz indicating the stoppage of work. This happens twice a day and as a result anything from 2 to 2½ hours are wasted out of the 8 hours work per day. This has now come to be looked upon as normal and if 6 hours work can be obtained from the workmen out of 8 hours, the management is quite complacent of having fulfilled its demand.

Orders given are very seldom carried out either completely or in time and it is not unusual to find that for some reason or other the job has not even been started on the day it is supposed to be completed.

Supervisors have very little power over the men because they know the limitations of the disciplinary powers that could be exercised by supervision, particularly when they have rights of appeal which can in most cases have the Supervisor's orders reversed as and when required. Further, the Supervisor who tries to enforce discipline is sometimes assaulted outside the works and has no redress because the occurrence occurred outside the workshop premises. In the circumstances, Supervisors are diffident to enforce discipline.

The service rules regarding discipline and appeal are so much in favour of workman and there are so many loop holes that in 9 cases out of 10 he has an opportunity of being reinstated in service from which he has been removed.

With the dice so much loaded against management and supervision with poorer quality of work and so much loss of time, what is the use of talking about production and increase in production—it just cannot be achieved under present conditions.

Discipline first and discipline last is the only answer which will solve this great malaise under which our Railway Workshops are working today.

Improvement in output can only be expected if the power is put back into the hands of management and supervision where it rightly belongs.

There must be simplification in the labour rules of discipline and appeal and there must be support for every just action taken by the Supervisor against his men so that the men are made to realise that they just cannot get round the disciplinary action by appealing to rules. If all this is done and greater responsibility put on the shoulders of management and supervision and implicit trust is imposed on them at each rung of the ladder of supervision, then and there only can we expect greater production in pounds per man hour in Railway Workshops.

THE AUTOGENOUS RAIL WELDING

By An Engineering Correspondent

INTRODUCTION

IN the manufacture of rails we employ steel of a high carbon content, having also silicomanganese alloys also. The binary rails are an exception, their front zone containing in addition, chromium as an alloying constituent. The following table offers a survey on the tensile strength, the standard analyses and the wearing quality of rails.

COMPOSITION OF THE WELDINGS

d of steel	*tensile strength kg./sqmm.*	*C*	*Si*	*Mn*	*P max.* %	*S Max.* %	*Cr* %	*wear resistance in comparison to standard quality*
				standard quality				
Th	70–85	0,35–0,55	0,15–0,35	0,6–1,0	0,08–	0,06–	—	1
SM	70–85	0,40–0,60	0,15–0,35	0,6–1,0	0,06	0,06	—	1

kind of steel	*tensile strength kg./sqmm.*	*C*	*Si*	*Mn*	*P max. %*	*S Max.%*	*Cr %*	*wear resistance in comparison to standard quality*
			medium-wear resistant rails					
SM	80–95	0,55–0,70	0,15–0,35	0,6–1,0	0,06	0,06	—	1,2–1,4
			wear resistant, self-hardening one-material rails					
SM		0,60–0,75	0–15–0,35	0,7–1,0	0,05	0,05	—	2,0–4,0
SM	90–110	0,50–0,65	0–15–0,35	1,4–1,7	0,05	0,05	—	2,0–4,0
E		0,45–0,60	0–10–0,30	1,7–2,0	0,03	0,03	—	2,0–4,0
			wear resistant rails hardened in a special process : head-hardened rails					
Th	of a Brinell	0,40–0,50	0,15–0,35	0,6–1,0	0,07	0,05		1,6–4,0
Th	hardness of	0,30–0,40	0,5 –0,8	0,6–0,9	0,07	0,05		
SM	125–150	0,30–0,45	0.5 –1,0	0,6 1,2	0,05	0,05		
			binary rails a) head zone					
SM —	110–130	0,60 -0,75	0,15–0,35	0,6–0,9	0,5	0,5	0,7–1,2	3,0–4,5
E —		0,60–0,75	0,15–0,35	0,6–0,9	0,3	0,5	0,7–1,2	
			b) web- and base zone					
SM	50–65	0,20–0,35	0,15–0,35	0,3–0,6	0,06	0,06	—	—

Th – Thomas steel. SM – Siemens Martin steel. E – Electro steel

Rails of guaranteed quality are mainly employed. They can be welded well by autogenous welding, provided that prescribed and tested welding rods are used.

Rails of medium wear-resistant quality as well as wear-resistant, self-hardening, single-component rails; are to be welded according to the above mentioned welding process and attention must be paid to special safety measures, that will be discussed in detail hereafter.

Top-hardened rails can certainly be autogenously welded, but this is inappropriate, since by the repeated heat-treatment a softening will take place by which, after a short period of use, road holes will be formed at the welded joints. A hardening following the welding, fails also to be effective, since at the beginning and at the end backlashes will result, that will entail the same shortcomings. These considerations are of course also valid for all other welding processes applied to rails.

The autogenous welding of binary rails is effected in the same way as that of standard quality rails. There are no difficulties as the base and the web of these rails are made of standard rail steel.

RAIL JOINT WELDING

As is well-known, rails are united by fish plates; yet this joint is imperfect, since both requirements, v.i.z. free movement of the rail end and entirely closed shutting between rail and fish plate, cannot be simultaneously met because of the wear between the two parts. It is therefore obvious, that we took advantage of the progress in welding technique for the perfection of rail joints, in uniting the rail ends by welding, thus limiting or eliminating these spots, that constitute considerable part of the expenses involved in rail maintenance. The welding of rails has reached a level, as far as rails of standard quality are concerned, that does no longer justify objections in order to avoid welding because of technological conditions of the welded joint.

Continuous welding of rails meets other objections nowadays, but a solution of the still outstanding questions may be expected by scientific research, so that development is approaching more and more the ideal state of the endless non-rocking rail.

a. THE VIGNOLES' RAIL JOINT

The rail ends are prepared for autogenous off-hand welding, by gas cutting only, (Fig. 1). After having

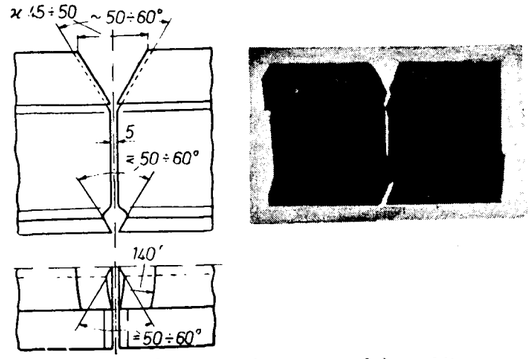


Fig. 1. Vignol rail joint prepared for welding

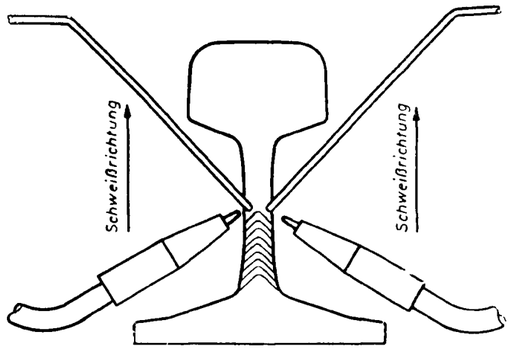


Fig. 2. Welding of the rail web

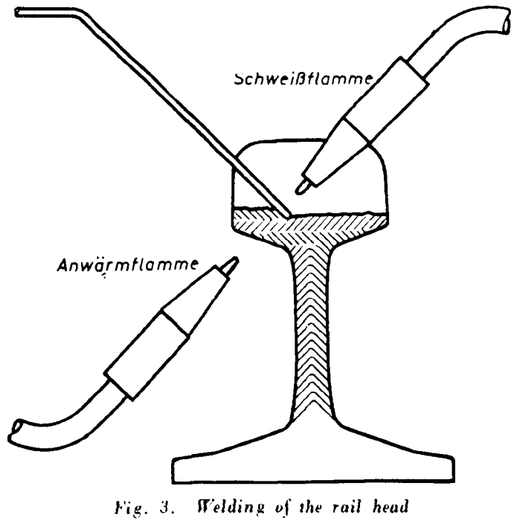


Fig. 3. Welding of the rail head

removed cuttings and oxide formations, the rails are straightened out by a ruler being at least 1 m. (abt. 3.28 feet) long. Immediately afterwards, the weld area is sufficiently preheated on both sides by two burners of 9 — 14 mm. (abt. 3/8″ - 9/16″) and welding of the web at the transition of the rail base to the web is begun. Two operators are working here on both sides simultaneously, (Fig. 2), using >GRIESHEIM< torches NORM of 4 — 6 mm. (abt. 5/32″ — 1/4″) and, at smaller rail sections, also with burner tips of 2 — 4 mm. (abt. 3/32″ — 5/32″).

The welding of the rail web is followed by welding the rail head. The rail head is multipass welded by both operators, using burners of 9 — 14 mm. (abt. 3/8″ — 9/16″) (Fig. 3).

After the first, second and third have been welded, the operation is, for a short time, interrupted and the work to be welded is hammered firmly in red heat. By this, the coarsely crystalline grain, proceeding from the welding process, is transformed into a fine-grained structure in order to give to the joint greater strength and elongation whereas the rail web as well as 2/3 of the rail head and the rail base are welded by means of >GRIESHEIM< GV-1 welding rods (filler rod for autogenous welding having a strength of 52 kg./mm.² = 739,61 lb./sq. in.), the last third part of the runhead is welded by means of >GRIESHEIM< GA-3 welding rods (built up rod for autogenous welding of 250 kg./mm. = 3,555.814 lb./sq. in.)

Brinell hardness. The runhead is finished at once by smoothing the beads of the last layer by the burner and slag remainders as well as scale are removed by a planing tool and wire brush. The overhanging welding material is knocked off by means of a hot chipper. Finally the runway and the sides of the runhead are smoothed by means of a planishing hammer. The working operations are carried out so carefully, that the welding area does no longer distinguish itself from the rail that has not been welded.

After having completed rail web and head, base welding is commenced. Again two operators are simultaneously working, for the time being from the web outward. (Fig. 4). About three layers are welded into the base; at stronger sections, it may be necessary to weld a fourth bead.

In order to prevent imperfect welding from causing a rupture, the center layer of the rail base is, finally, rewelded from below. Such rail joints are, to a considerable degree, superior to the fish-plated rail

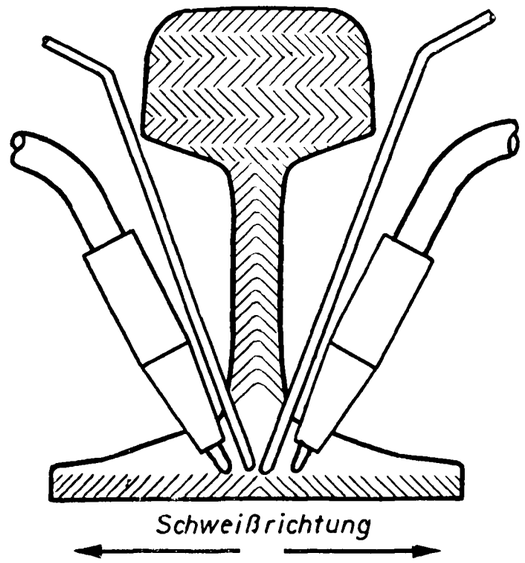


Fig. 4. Welding of the rail base

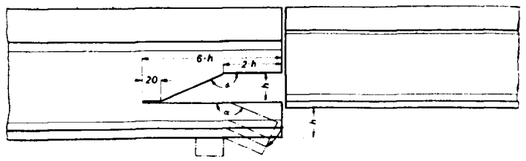


Fig. 5. Welding preparations on a transition joint by adjusting the bigger rail profile to the smaller one.

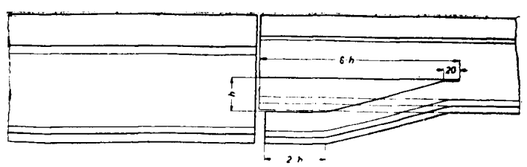


Fig. 6. Welding preparations on a transition joint by adjusting the smaller rail section to the bigger one.

joints. Tracks, exposed to extremely strong wear (curves, slopes) are often not equipped with standard rails, but with medium wear-resistant or wear-resistant rails. To these rails, as far as they are no head hardened rails, a so-called elastic cushion must be applied prior to the execution of the real joint welding by building up beads on both rail webs, by means of >GRIESHEIM< GV-1 welding rods. Built-up welding is done by two operators on both sides simultaneously, right up from below. After that, the rail ends are straightened out and welded in the same way as a standard joint. When welding the rail web, care should be taken that weld beads do not reach the previous laid protective beads. Head hardened rails, as told before, cannot be welded because thereby a softening will take place, that will cause a road hole afterwards.

Rails being used already for a long time, show altered physical properties due to the strain-hardening and ageing and are liable to cracking when being welded. These rails are welded in the same way as those possessing higher grades of strength. In very unfavourable cases, protective beads can also become necessary on the bevelled sides of the rail base.

THE TRAMWAY RAIL JOINT

Tramway rails are prepared for joint welding in exactly the same way as Vignoles' rails. Only the furrow is additionally-double-V-bevelled. The welding order is the same.

THE TRANSITION JOINT

The continuous rail strengthening caused by the permanent increase of wheel pressure not only compelled constructors to use stronger materials, but also obliged them to enlarge rail sections. The double-butt strap joint or transition joint is extremely unfavourable because of the necessary crank since the joints are additionally loaded in shear.

This type of welding can be easily performed by the autogenous rail welding method, by which it is made possible for such transition joints to be easily reached by a nearly ideal flux of force and consequently a relatively high grade of creep strength is obtained.

When uniting two different sections with small difference in height, these requirements can be attained easily by cutting out a key of the higher rail's web, heating the base and pressing the rail together.

When larger differences in height are at stake (over 35 mm. - 13 13/16") the smaller rail section is reversely adapted to the larger one in welding a key into the smaller section (Fig. 6)

Fig. 7 shows a transition joint between a Vignoles' and a tramway rail and from this, we can also learn, simultaneously, about the working methods in welding transition joints.

Firstly head and base of both rails are prepared for welding by means of the gas cutter, in V-shape, just like welding an ordinary joint. Immediately afterwards, welding at the rail web is started exactly on the same spot, where later on the upper side of the cutting spot for the notch or cut out of the key-piece will be.

Not until then does the adaption of the small rail to the big one, or of the big rail to the small one take place. The cutting edge is welded tightly, the key piece is welded into respectively, and then follows the welding of the rail base and finally the welding of the remaining piece of the web is effected.

When the foot sides are strongly tilted the rail base corner of the projecting rail is cut off and a piece of plate, in conformity with the thickness of the rail base, is welded therein.

Thereby a satisfactory magnetic flux is attained. It goes without saying that the joints have to pass correctly from the rail base upward, just as with the standard joint.

At transition joints between Vignoles' and tramway rails in straight sections, it will be necessary to bend the spoon somewhat upward, after previous heating, in order to ensure a smooth wheel entrance into the rail furrow. In curves it is advisable to cut in the spoon slightly at the bottom, then, after previous heating bend off the furrow to a degree that a key piece can be fitted in and welded.

THE MANUFACTURE OF JUNCTIONS AND SWITCHES

In autumn of 1952 the " Bundesbahn " (West German Federal Railways) issued the first instructions for the manufacture of rails without interruption. What, however, applies to uniting rails, is also directive for building junctions and switches. These parts are very heavily stressed by the many connection points occurring within relative narrow limits and it will therefore, at a high working rate, be necessary to repair or to renew them at short intervals, as also keep them under careful observation. So here too prevails the tendency to change from the screw to the welding type of construction. Fig. 8 shows a junction with screwed mountings. The different points have been knocked out in the meantime in such a way, that renewal has become inevitable.

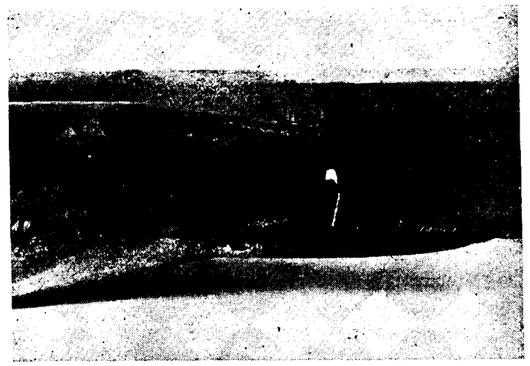


Fig. 7. Transition of a Vignol-rail to a tramway rail

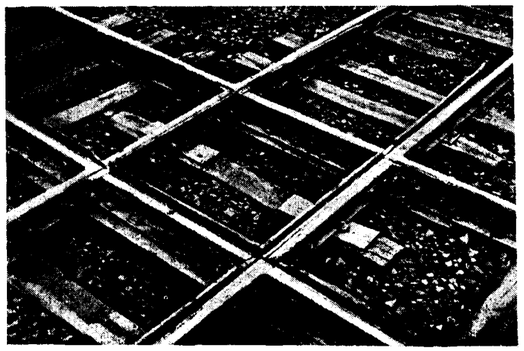
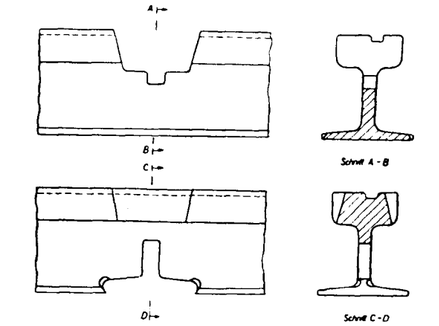


Fig. 8. Junction with screwed mountings

The manufacture of a like junction made of heavy web rails (D180/105) with planed mountings will be briefly described hereafter.

At their points of junction the rails are cut out and laid into each other. Then each spot is welded by four operators, after previous heating, at dull red heat. Empirically it has been found to be effective to weld firstly both welded joints at the rail head. Immediately afterwards, the welded joints at the rail base and finally the fillet welds are welded by the four operators simultaneously right up from below.

Screwed switch points are working loose after a relative short lay-period, when not carefully and continuously maintained. If the maintenance work is discontinued, the guardrails and the pointed tongues at the change of track are speedily worn out and require repair by built-up welding.



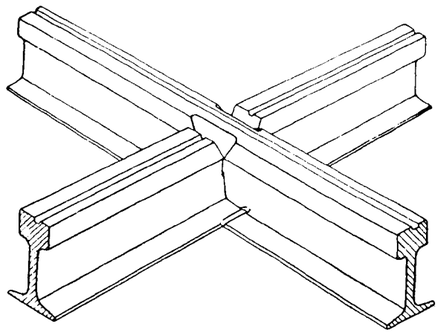


Fig. 9. Welding preparations at a junction of heavy web rails

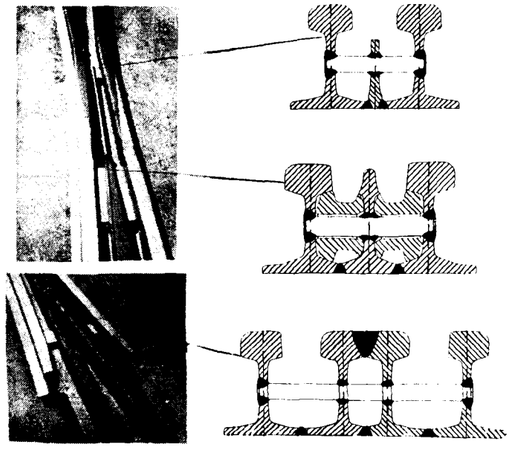


Fig. 10. Making a tongue – completely welded execution

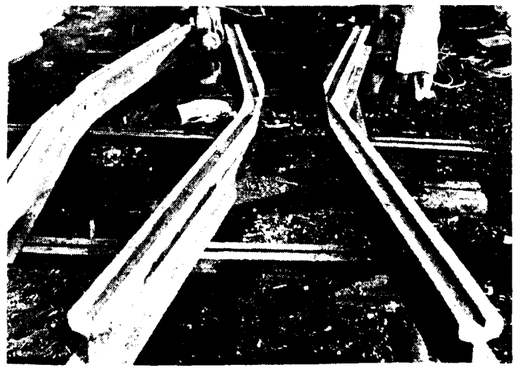


Fig. 11. Welding preparations at a mounting tongue consisting of heavy web rails

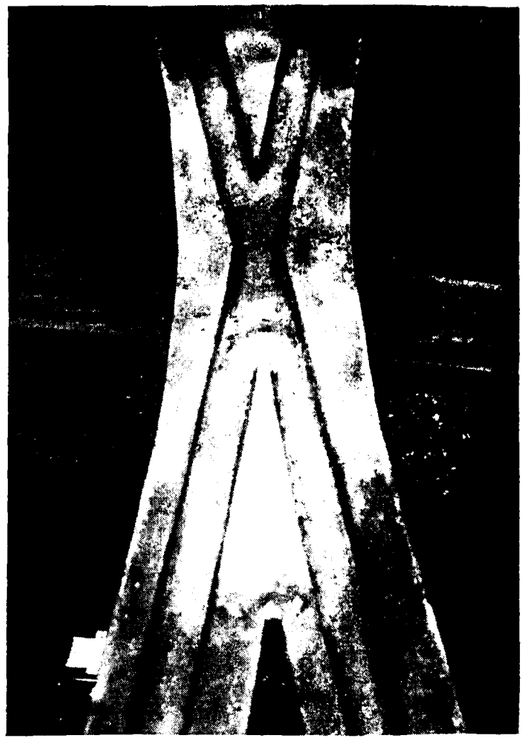


Fig. 12. Welded mounting tongue of heavy web rails

When joining, however, by welding technique, two rails in the form of a pointed tongue, a closed construction is formed by the welded joints at the rail head and base, that can obtain, by welding flat irons, an additional strengthening. When besides the guardrails are incorporated by satisfactory connections into the total frame, the rigidness of the workpiece is increased to such a degree that it will meet all requirements that will appear when it is being travelled (Fig. 10) upon.

Mounting tongues, employed mainly in tramway rails, can also be manufactured satisfactorily of heavy web rails. The rails are, for each junction, bent twice after previous pre-heating (Fig. 11) and finished accurately to gauge on the planing machine. Then head and base of both rails are welded by means of V-joints. (Fig. 12) Care should be taken that the distance between the two rail webs at the uniting points is as large as possible. Hereby a box mould possessing excellent physical properties will be formed.

It should be pointed out, that the main difficulties, when welding rail steel, are found in the hardening because of the formation of martensite. This hardening structure influences stability to a very unfavourable extent. When applying autogenous welding, this hardening is avoided since an amply measured zone is sufficiently pre-heated before commencing the welding work and by this a gradual cooling takes place.

THE BUILT-UP WELDING

Next to the junction tongue the switch point may be the most strained part of a switch, perhaps even of a rail altogether, and that is why it is liable to the largest wear.

Formerly when switch points had flattened to a certain degree they were removed and replaced by new ones. The dismantled pieces represented only scrap value. Sometimes single parts could be re-used. This in itself an expensive solution, still has the disadvantage that the new switch point cannot be adapted sufficiently to the other worn pieces of the switch in order to ensure the smooth crossing that is desirable and striven after. So it was obvious that a repair method should be developed that made it possible to recondition these switch points irreproachably and efficiently after having classified them according to their quality. This method has been found in the autogenous built-up welding. Apart from the switch points, the rail ends united by screwed fish plates are intensely stressed and flattened. The rails themselves too are damaged, so that an elimination is made necessary. All these repairs can be done correctly and efficiently by means of autogenous built-up welding.

The spots to be welded must be cleaned firstly by flame and wire brush so that they are free from oil and dirt. Immediately afterwards built-up welding follows with >GRIESHEIM< GA-3 welding rods by righthand side welding (Fig. 13). In sections of 8 – 10 cm. (3 1/8" 3 15/16") the weldings are effected and they are finished in the welding heat by means of a planishing hammer and forehammer. The execution of these operations can be done most efficiently at the rails in operation in order to

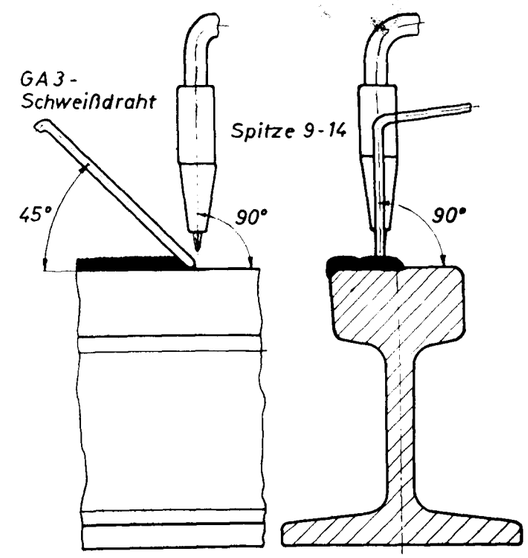


Fig. 13. Position of torch and wire when executing built-up welding on rails

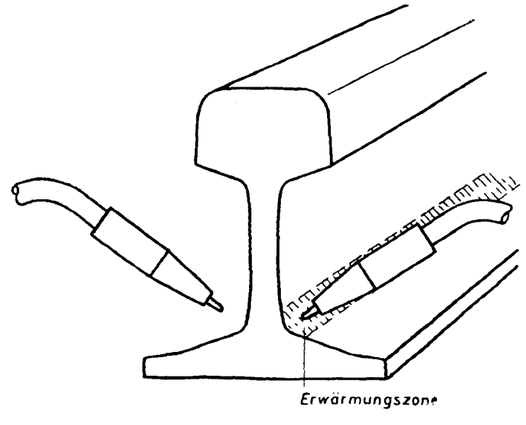


Fig. 14. Counter-heating of a shrunk-through rail

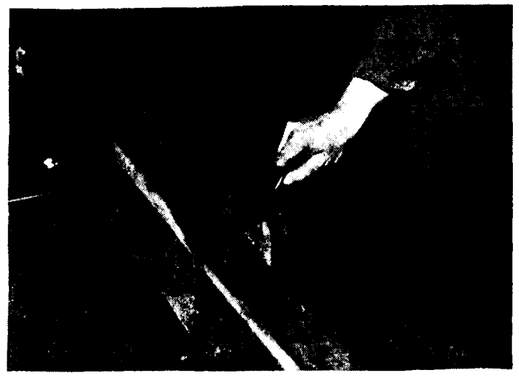


Fig. 15. Repairing the point of a tongue by the autogenous built-up welding

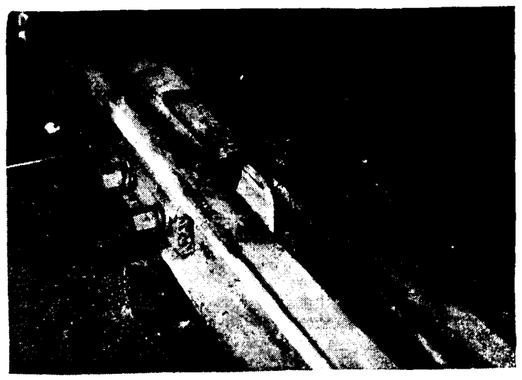


Fig. 16. Repairing a point of a tongue by the autogenous built-up welding

save the expensive dismantling and re-assembly. Interruption of the service will not be necessary.

The necessary height of the built-up welding as well as the control of a straight and smooth running surface after the welding and working, can best be done by means of a ruler of 1 m (3,28 feet) length. Should the rail, due to the welding, be shrunk through downward at the rail head, it has to be erected again by counterheating at the transition of the base to the web. (Fig. 14)

At the built-up welding of switch points a protecting bead is at first laid upon the point of the tongue, that has to be so high, that the guardrails are no longer touched by the crossing wheel. Thereupon the guardrails are

Fig. 17. Repairing a swith tongue by built-up welding on a rail in operation

Fig. 18. Built-up welding on tongues on a rotating device

built-up and worked in the described way mentioned previously and the point of, tongue is completed. The control of the correctly built-up height, with reference to

the general wear is effected by means of a form. The form is set up once at the point of tongue and once more at the spot where the point of tongue is 22,5 mm. (abt. $\frac{7}{8}$") wide. (Fig. 15 and 16).

Finally a general control is made by means of the ruler in order to see whether the switch point, due to the welding, has been shrunk through downward.

This being the case the switch point is straightened again by corresponding counter heating.

The repair of switch tongues will be described shortly hereafter. It can be effected in the switch bed or after the switch has been removed.

Fig. 17 shows built-up welding of a switch tongue in the operational rail of a tramway. Here again built-up welding takes place in sections of 8 10 cm. ($3\frac{1}{8}$"–3 15/16"), the section is finished and the tongues are kept straight by counter heating. Built-up welding is best effected in the direction of the journey. If this is impossible, there will be a need for constructing an outlet at the built-up spot before a train is allowed to run over the tongue, so that the wheel rim cannot run up at the weld. Should the switch tongue show deep out-breaks or crumblings, the inferior layers must be welded with >GRIESHEIM< GV–1 welding rod and prior to that the upper ones with >GRIESHEIM< GA-3 welding rod.

After welding has been completed, there must be a control of the right adjacent to the stock rail. Rough spots are cleared by alignment through the welding flame. If the tongue protection of the stock rail has been worn out, or if it shows out-breaks, the repair has to be effected also by corresponding built-up welding. Should this be neglected it might happen that wheels, their bands being worn at the flanges, cut the switch open whilst running upon it and cause derailments of trains.

Numerous examples in tramway companies confirm, that switch tongues, repaired according to other welding methods, partly break out, partly break in traffic due to too high a tension and thereby give only a limited period of service. It stands to reason, that built-up welding in the switch bed is, due to unfavourable working conditions expensive, but still efficient.

To increase efficiency further, it is recommended, wherever possible, to apply built-up welding to demounted tongues only. Fig. 18 shows a device by which it is rendered possible to execute built-up welding at tongues of 11 m. (36′ 1″) long. It is distinguished by a sturdy construction. The apparatus is of swivelling design, the rotating movement being transmitted by a hand-wheel on to a worm and therefrom to a wormwheel. To store the switch device, that is connected to the tongue at the supporting bearer, it has been narrowed on both sides. The purpose of this device is, that all working operations can be executed in the horizontal position and that the operators are in a position to bring the device always in the desired position.

SYNOPSIS

The field of application of autogenous rail welding is very extended. Only the most salient applications could be set forth.

A remaining success in the undertaking of rail welding can only be ensured, however, if well trained, experienced experts are charged with such work. It is, however, an imperative necessity that these operators are steadily supervised and their executed work is examined.

GREATER USE OF KHADI ON RAILWAYS

There has been a five-fold increase in the purchase of khadi by the Indian railways during 1955–56, compared to the previous year. During 1955–56, the railways purchased khadi cloth worth about Rs. 34.5 lakhs, whereas in the previous financial year the total purchases amounted to Rs. 6.95 lakhs.

The Railway Board recently decided that, in future, mill-made *pugree* cloth at present being used should be substituted by suitable *pugree* cloth made of khadi. The current requirements of this type of cloth are estimated to be between 8,00,000 and 9,00,000 yards per year, estimated to cost between Rs. 10 and 12 lakhs per annum.

ALUMINIUM IN ROLLING STOCK

By R. K. Chari

THE use of aluminium in Railway rolling stock has developed rapidly during the last half century. Combining lightness and superior corrosion resistance with strength comparable to that of steel, aluminium alloys have a great advantage over traditional materials like timber and steel. Aluminium construction enables considerable saving in dead-weight, which can be utilised either to increase revenue-earning payload or to reduce fuel cost. The corrosion resistance of aluminium gives it durability and eliminates the frequent repair work necessary with other materials, which results in high maintenance cost and a considerable part of the available rolling stock being rendered idle during repairs. As a result of these advantages, aluminium construction leads to long term economies, which amply justify the extra initial cost involved.

COACHES

Direct substitution of steel panels by aluminium of the same gauge has resulted in a weight saving of 1 to 1½ tons per coach. This weight saving is of particular importance in air-conditioned coaches, which carry an excessive weight of installed equipment. Whereas steel panels, despite frequent repainting, have an average life of 6 to 8 years, aluminium panels will last, with norma maintenance, the life time of a coach, which is estimated at 30 to 40 years. In view of the non-availability of suitable steel panels, which have to be imported, and the advantages of aluminium, passenger coaches, built in India in recent years, have been extensively panelled in aluminium.

Use of extruded aluminium sections for structural members, now designed in timber and steel, offers ample scope for effecting economies. To consider a single case, the use of aluminium alloy extruded flanged channel sections bent to the contour of the coach roof-sticks, replacing timber filled steel carlines, will effect a weight saving of about 1,500 lbs., at no extra cost. The timber roof decking presently adopted may be retained as such or it may be replaced by aluminium roof sheets secured directly to the roof structure, which will result in a further weight saving of over 1,000 lbs., at an extra cost of about Rs. 800/-.

Adoption of a specially designed aluminium floor, in the place of the existing method of timber flooring covered with oxy-chloride compound, will save over one ton of dead-weight. The aluminium floor will comprise corrugated floor plates fixed to the underframe members. The upper corrugated grooves are then filled with cork and covered with long wearing Ferrobestos. Adopted extensively in modern stock in Europe and America, flooring of this type is giving excellent service in carriages imported into India for suburban systems.

Roof water tanks, fitted in coaches, are normally made in Zinc or galvanised steel sheets. Zinc sheets have to be imported, whilst the galvanised tanks, which are only about 25% cheaper, last not more than 6 to 8 years. Standardisation of aluminium tanks, which are already widely in use in Indian Rail Coaches, will ensure supply of clean and rust-free water and also reduce the dead-weight of a coach by about 600 lbs.

Rail coach windows, normally made in timber, easily warp under the extreme climatic conditions in India, resulting in jammed windows. Steel windows are difficult to handle due to their heavy weight of about 15 lbs. Aluminium windows, weighing only 5 to 8 lbs., have been developed to have the same sturdiness and life. Besides saving about 600 lbs. of tareweight per coach, they require little maintenance, are easier to operate, last longer and retain an attractive appearance throughout. Aluminium windows, louvred and glazed, have been tried out on a considerable scale in Indian Rail Coaches and have proven satisfactory.

WAGONS

Complete plating of a wagon with aluminium, costing about Rs. 1,200/- extra initially, will reduce the tare-weight by one ton. The value of the extra payload capacity thus made available cannot be over-emphasised in the context of the Country's expanding transport demands and limited wagon capacity.

The use of aluminium for the lower panels and flooring alone, where corrosion first sets in, will result in considerable savings in maintenance, achieved at an extra initial cost of Rs. 550 per wagon. This advantage is all the more important in the case of wagons transporting corrosive minerals and sulphurous coal.

Aluminium roofing of covered wagons will obviate the frequent replacement arising due to corrosion of steel,

(Continued on page 18)

NOHAB-GM locomotive to the Norwegian State Railways

IN connection with a ceremony on April 25, outside the workshops of Nydqvist & Holm Aktiebolag (NOHAB), Trollhattan, Sweden, the first in a series of diesel electric NOHAB–GM locomotives was delivered to the Norwegian State Railways, represented by a delegation with Director General H. E. Stokke at the head of it.

As this delivery constitutes the beginning of the dieselization of a whole district of the Norwegian State Railways, the so-called Nordlandsbanen, the President and representatives of the Storthing (the Norwegian parliament), members of the Ministry of Communications, representatives for the Ministry of Finance and the Ministry of Commerce had assembled. Representatives for the press in Oslo and Trondheim as well as Norsk Telegrambyra and Norsk Rikskringkasting had also been invited.

After the delivery a tour around the NOHAB works was made where among other things the manufacture of the locomotives could be followed in detail.

From the delivery of the NOHAB-GM locomotive.

The flower-girl before handing over flowers to Mr. Stokke.

The locomotive now delivered by NOHAB is a streamlined bogie locomotive with 3 driving axles in each bogie. It is equipped with one driver's cab in each end and is arranged for single operator drive.

Together with the underframe, the body of the locomotive constitutes the supporting construction. Both the underframe and the car body are all-welded.

(*Continued from page 16*)

and will also permit an additional payload of ¼ ton at an extra cost of about Rs. 200 only.

The use of aluminium in wagon construction, involving an initial extra cost of about Rs. 1,200/- per ton of weight saved, leads to a three-fold return: increase in payload, marked reduction in maintenance and improvement in wagon availability and reduced operating costs per ton mile.

In India, 100 wagons were plated in aluminium in 1949–50 and were put in service to examine the suitability of the metal. So far, they have suffered practically no corrosion and the results are heartening. For transporting wet coal ash, which corrodes steel very fast, the Calcutta Port Commissioners plated the bottom panels and flooring of their wagons with aluminium in 1953. Examination, after four years' constant service, revealed no signs of deterioration in the aluminium plates.

The diesel-electric NOHAB-GM locomotive, now delivered to the Norwegian State Railways.

The bogies are made according to the so-called flexi-coil principle with the axles displaceable in the journal boxes, which gives the locomotive an extremely smooth and even running.

The driving machinery consists of one V-shaped 1900 HP 16 cylinder 2-cycle diesel engine, manufactured by General Motors, USA. The power transmission is electric and consists of a generator direct driven from the diesel engine, regulation equipment, and D. C. motors, which by gears transmits the tractive power to the driving wheels.

The principle technical data are :

Max. speed	105 km/h.
Max. tractive effort	25 tons
Length over buffers	18600 mm.
Total wheelbase	14300 ,,
Bogie wheelbase	4000 ,,
Wheel diameter	1015 ,,
Weight in working order	98 tons

NSB (the Norwegian State Railways) have much experience of this type of locomotive. A NOHAB–GM locomotive of this type has since some years been in service in the Trondheim district. In spite of the difficult service conditions, very good results have been obtained.

According to an agreement in 1950 between NOHAB and General Motors (GM), USA, about the manufacture of diesel electric locomotives, NOHAB were secured diesel engines and electric equipment of GM's well-known make. NOHAB could at the same time benefit by all the operation results which the world's greatest manufacturer of diesel locomotives had acquired from the manufacture of more than 18,000 such locomotives. Locomotives of this type, supplied by NOHAB, are today rolling also on the railways in Denmark and Sweden. In Belgium 40 locomotives have been built to NOHAB's designs.

After NOHAB's works had been shown, dinner was had at the Town Hotel, whereupon the guests went back to Oslo by special train, hauled by the NOHAB–GM locomotive delivered to NSB.

NON-FERROUS CASTING PLANT

It is reported that the Electrical Manufacturing Company of Calcutta has set up a modern non-ferrous casting plant for manufacturing complete range of conductor accessories etc. required on transmission and distribution lines. Overhead equipment for railway electrification is also licensed to be manufactured by the Company. This is being made from various alloy metals in technical collaboration with French experts. The non-ferrous foundry reportedly employs most up-to-date techniques like gravity diecasting and pressure diecasting.

Activity of the Ganz Works in the field of Railway motorization

By I. Baranszky-Job, B. Sc.
Mech. Chief Designer

BRIEF REVIEW

THE Hungarian rolling stock has achieved special recognition in international relations too. As early as 1885 Hungary began its export activity and during the last 70 years the vehicles of Hungarian origin have gained a reputation throughout the world. The relatively small country supplied all kinds of passenger and goods trains, power vehicles, railcar trains and locomotives in the course of this period not only to European countries but also to Asia, Africa, North and South America.

The many years' result obtained cannot be attributed to ample raw material sources or even to privileged political situation but merely to the outstanding brain and physical works, proper design and careful delivery.

As a consequence of World War I and II the volume and the relations of capital of the Hungarian railway vehicle manufacture have been altered, nevertheless the present exportable wagon factories, first of all the Ganz Railway Carriage Manufacturers & Mechanical Engineers, Budapest, and the Machine and Wagon Works, Wilhelm Pieck, Gyor, as well as the Wagon Works of Dunakeszi – this latter working particularly for home demands — are marching ahead following the traditions of the Hungarian railway industry. In the field of locomotive fabrication the well-known MAVAG Locomotive and Machine Works, Budapest, continues its activity. The equipment of the electric locomotives are supplied by the Klement Gottwald Electrical Works, formerly Ganz Electrical Works. Besides numerous works and enterprizes are co-operating by manufacturing semi-products, components, etc.

It is characteristic for the technical development of the wagon works that the Ganz Works projected and designed the all steel eight-wheel passenger cars, the electric railcars manufactured for the Noord-Zuid Hollandsche Maatschappij firm in Holland as early as 1922, preceding thereby all the other wagon factories. Furthermore, the first Hungarian all-welded rail-vehicle has also been manufactured by the Gang Works in 1930.

In connection with the *power cars* Hungary has played a great part. The first steam railcar of Hungarian origin, system Rowan has been built by the Ganz Works in 1883. This vehicle was in 1904 still in service. At the turn of the century numerous similar railcars of Hungarian origin were running on the lines not only of Hungary but even of the Russian State Railways, Bulgarian State Railways, Adriatico-Fermo-Amandola Railways, Belgian Royal Railways, as well as of the Japanese Railways. At the beginning of this century the Ganz Works manufactured cars driven by petrol engines. After World War I the Ganz Works was engaged with the development of the motorization. The first up-to-date power railbus manufactured in 1925 and delivered for the former Southern Railways was followed by the long row of modern railway vehicles. This result was greatly promoted by the high-speed Diesel engine, system Ganz-Jendrassik manufactured in 1928 and being in use all over the world without any alteration of the basic idea. Following this the eight-wheel railbus with up-to-date car body as well as the "ARPAD" type railcar (Fig. 1) had a great success in summer 1934 on their demonstrative journeys home and abroad. In addition this vehicle was the first running in international traffic communicating between Budapest and Vienna and covering a track of 260 km. during 2 h. 56 min.

Fig. 1. Eight-wheel railbus of the "ARPAD" type with 72 seats, manufactured in 1934 with 220 HP Diesel engine, system Ganz-Jendrassik.

GANZ

BUDAPEST

RAILWAY - CARRIAGE MANUFACTURERS & MECHANICAL ENGINEERS

RAILCAR TRAINS

Railcar Train with Diesel-mechanical, Diesel-electric & Diesel-hydraulic power transmission

RAILCARS

Railcar with Diesel-mechanical, Diesel-electric & Diesel-hydraulic power transmission

RAILWAY CARRIAGE

RAILWAY CARRIAGES AND TRAINS FOR SPECIAL PURPOSES

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MOTORS SYSTEM GANZ—JENDRASSIK

for Railway Vehicles

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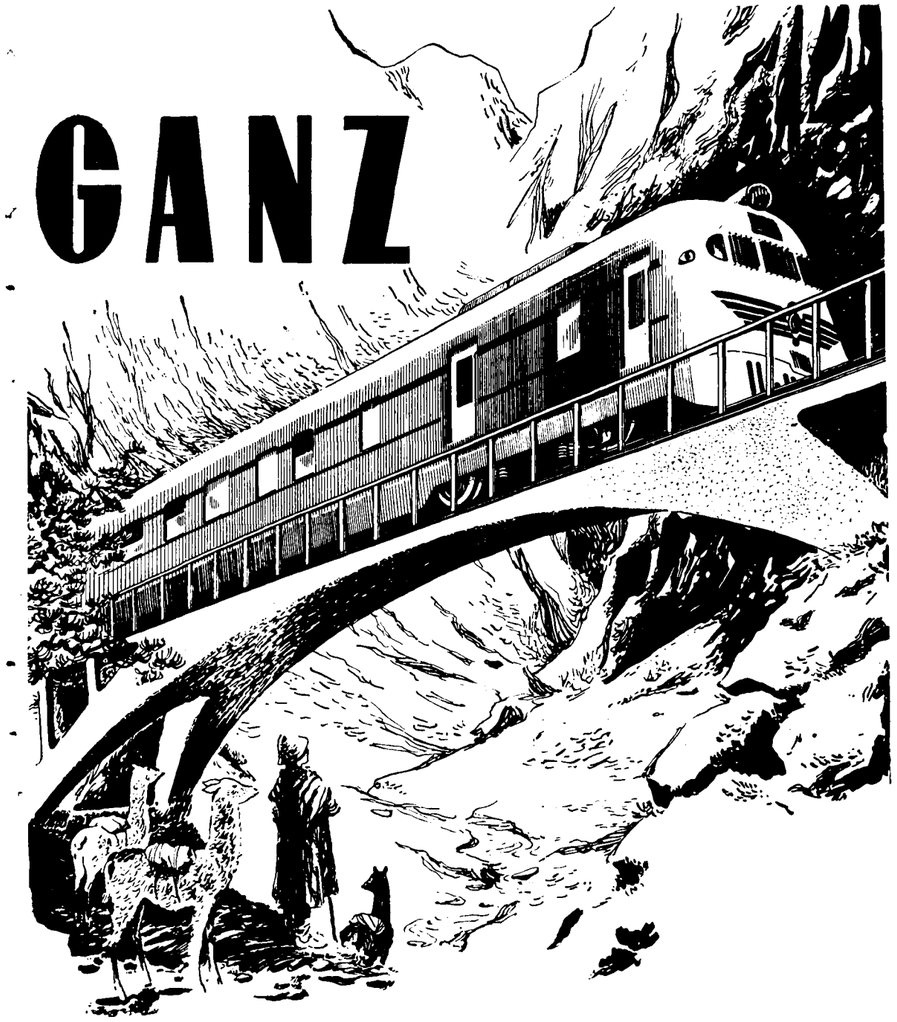
GANZ



PUMPING PLANTS

Pumps and accessories

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The attention of the world was drawn by the economical and technical achievements and the Egyptian State Railways, Ferrocarriles Estado Argentino placed considerable orders with the Ganz Works already in 1934–35 which have been repeated at several times later on. A number of orders were booked from abroad, i. e. from the Buenos Aires and Pacific Railway, Central Argentine Railway, Uruguayan State Railways, Rhodesian Railway, South African Railway as well as from the nearer countries, i. e. Jugoslavia, Bulgaria, Romania, Belgium, etc. It may perhaps interest our readers that the former Indian North Western Railway has also placed an order for 11 railcars (Fig. 2) which have proved very satisfactorily in service.

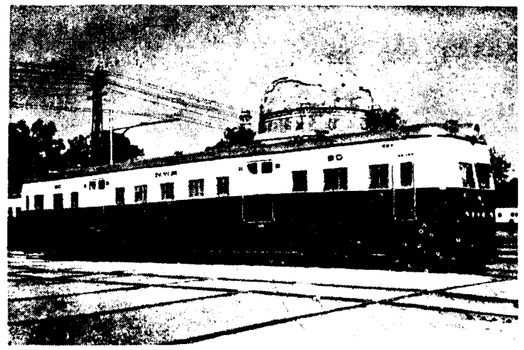


Fig. 2. Eight-wheel railcar delivered to the Indian North Western Railways.

After World War II large railcar trains and railcars with trailers have been ordered by the Soviet Union, Czechoslovakia, Poland, Germany, Bulgaria and last but not least by the Argentine State Railways, Jugoslavia, the Egyptian State Railways and lately by the Burma State Railways.

In connection with the highly developed technical state it is worth mentioning that among the purchasers of the licence of the Ganz-Jendrassik engines and Ganz railcar system have lined up even Belgian, French and remarkable British enterprizes besides the Roumanian, Polish, Holland and Spanish firms.

In the meantime locomotives, passenger and goods cars were exported throughout resulting that Hungarian hauling and trailing railway vehicles have been put into traffic in 18 European countries, furthermore in Asia: India, Anatolia, Siam, China, Japan; in Africa: Egypt, South Africa, Rhodesia, Marocco, and in America: Argentine, Uruguay, Chile, Canada and even on the lines of the United States of America.

LATEST PRODUCTS

The man of our age is particularly interested in the activity of the Ganz Works in the field of rolling stock development after World War II. From the following short summary appears that the factory traced its old and valuable traditions enabling it to match with the most renown firms of the world because of the proper construction and design of the vehicles accompanied by a careful and exact supply policy.

Following World War II the Ganz Works appeared on the world market with renewed type of railcar trains as a further stage of the development of railcar make.

The series of the 6-unit Diesel-electric trains for a gauge of 1524 mm. delivered for the Soviet-Union is of

Fig. 3. Details of the interior of the railcar train delivered to the Argentine State Railways.

Fig. 3-a. Details of the interior of the railcar train delivered to the Argentine State Railways.

paramount importance. This train is capable to run long distances. The first and last unit of the train are railcars. Each railcar is equipped with a Ganz-Jendrassik Vee engine of 600 HP capacity serving as a basic engine, furthermore with an auxiliary engine of 200 HP. D. C. dynamos of max. 650 Volts are driven by the basic engines whereas the generators of 3×380 V with 50 Hz by the auxiliary engines. Each main dynamo supplies two traction engines. The top speed amounts to 110 km/h. The trailers are provided with compartments and the seats thereof can be converted into resting places. This train is apt for accommodating of 184 passengers, its weight in running order is 354 tons. One of the features of the train is the special air conditioning and heating equipment.

Continuing the above mentioned supplies for the Argentine 4-unit and 5-unit railcar trains have been manufactured for the Argentine State Railways, with a gauge of 1435, and 1676 mm., respectively. With due consideration to the long distances to be run the fatigues of travel are facilitated by comfortable seats the majority of which can be put in the direction of travel, furthermore by bars, dining rooms, (Fig. 3) etc. The 5-unit train has been provided with a complete air-conditioning equipment cooled by freon being the most suitable chemical product from the point of view of the health of the passengers. The spring system of the bogies consists of helical springs, respectively of helical and laminated springs, whereby injurious oscillations can be avoided. The friction vibration dampers inserted serve the same purpose. The trains with a gauge of 1435 mm. are designed to meet the increased travel demands and to be suitable for ferry-boat traffic as well. In order to secure this special projecting arrangements have been made in connection with the machinery equipment of the

Fig. 4. Unit railcar train delivered to the Argentine State Railways.

motive bogie enabling the Supplier to solve this problem in the most satisfactory manner.

Each of the three kinds of the trains is equipped with two railcars at the front and rear end of the train, to facilitate running in both directions of travel. The 4-unit train with 1435 mm. gauge is equipped with two engines; each engine is of the 8-cylinder and supercharged Ganz-Jendrassik type with an output of 425 HP. The 4-unit and 8-unit trains with 1676 mm. gauge are equipped similarly with two engines both; each engine is of the 12-cylinder and supercharged Ganz-Jendrassik type of 600 HP capacity (Fig. 4).

Remote-controlled railcar trains have been manufactured in 4-unit and 3-unit design for the Continent with a top-speed of 110-125 km/h (Fig. 5). The trains for a gauge of 1435 mm. provided with kitchen, luggage compartment, ample sanitary equipment, central ventilating and with independent heating per car, have apart from the dining room of 32 seats, 169, respectively 92 comfortable seats; some of these seats can be out in the direction of travel. The weight of the 4-unit train amounts to 194 tons, that of the 3-unit to 156 tons in running order, i. e. filled up with fuel and water. The train has two engines each being a 12-cylinder Vee engine with a capacity of 450 HP.

For the same purpose ten-wheel and eight-wheel railcars have been manufactured partially remote-controlled. The eight-wheel trains are provided with 8-cylinder engines (320 HP), whilst the ten-wheel trains with 12-cylinder Vee-engine (450 HP). Maximum axle load of the fully laden train approx. 13–15 tons.

Special mention deserve the narrow gauge (760,1000 mm.) trailers and railcar trains arousing the interest of the experts through the highly economic and technically perfect arrangement of the relatively large mechanical equipments.

The Hungarian rolling-stock industry has also not been left behind as regards projecting and make of the most up-to-date locomotives, i. e. of the Diesel locomotives.

Without paying special attention to the small locomotives of various gauges for industrial plants mention has to be made to the 400 HP hauling and shunting locomotives to be delivered for the Egyptian State Railway in a quantity of 100 pieces, furthermore to the 600 HP. main line locomotives with electric power transmission (Fig. 6). These locos are equipped with up-to-date Diesel engines, system Ganz-Jendrassik.

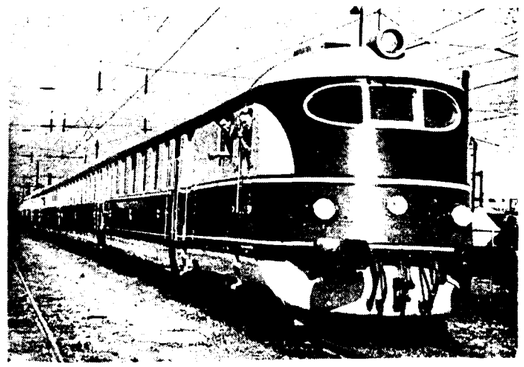


Fig. 5. 4-unit railcar train with dining room of 32 seats, 169 total seats delivered to the German Democratic Republic and equipped with 2×450 HP. fuel engines system Ganz Jendrassik.

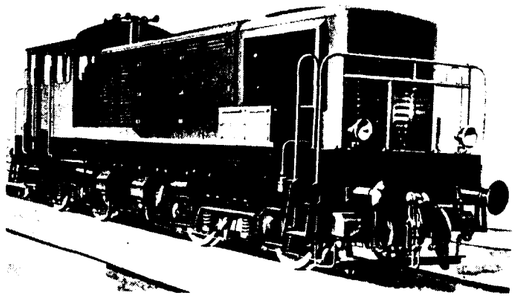


Fig. 6. 600 HP Diesel electric locomotives type BoBo, manufactured by the MAVAG Works, Ganz Works and Klement Gottwald Factory in co-operation.

Though it rather embraces the electric industry, the overhead wire electric vehicles being hauling vehicles likewise, cannot be neglected. The mine locomotives with various gauges between 450–1000 mm. manufactured in single and twin design, have to be mentioned here as well. As to the electric tramcars and trailers very neat types have been manufactured by the Ganz Works. The former are designed in 8-wheel construction with high-speed motors and bevel gear power transmission driven by cardan shafts (Fig. 7).

FEW WORDS ABOUT DETAILS

It would be lengthy to propagate all the details embracing the numerous engineering inventions and skill

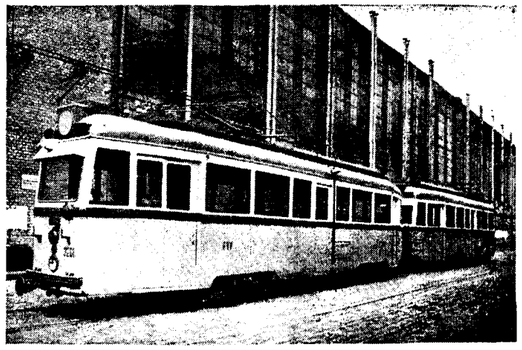


Fig. 7. Eight-wheel electric tramcar for accommodation of abt. 100 passengers.

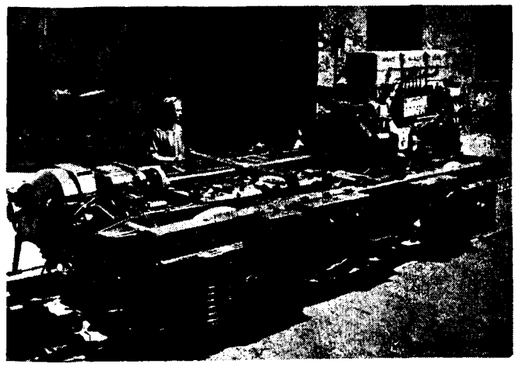


Fig. 8. Power bogie of the Ganz railcars containing the main parts of the machinery equipment.

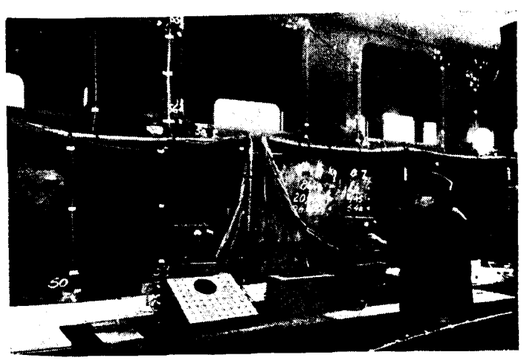


Fig. 9. Stress control of a steel car body by tensometric measurement with the aid of strain gauges.

leading to the present results. Perhaps it would be the Diesel engine vehicles which can rise some interest thus we would mention some data about the machinery equipment thereof.

The basic parts of the machinery equipment—Diesel engine, main clutch, gear box, reversing gear, axle driving mechanism—are housed in the power bogie representing an interchangeable unit to be easily dismantled and tested. Depending on the admissible axle loads the bogies are designed with two or three axles (Fig. 8). The auxiliary machines and equipments—water cooler, air compressor, lighting and auxiliary dynamos, possibly machinery part of the air conditioning equipment etc.—are in general arranged on the underframe.

The engines are of the Ganz-Jendrassik system Diesel engines with ante-chambers; bores: 170 mm. stroke: 240 mm. Speed of the engine: 1150–1250 r. p. m. Output approximately 40 HP per cylinder. The new types of the supercharged engines facilitate to increase the engine output by about 30%, increasing the mean pressure of the piston, making possible at the same time to produce engines with relatively low specific weight. They are vertically, in row or Vee-arranged. Some of the new types are suitable to be located also below the floor having a bore of 135 mm. The weight of the newest type for 1 HP amounts to 6-8 kgs. and 4, 5–7 kgs. for engines with steel and with aluminium crankcase, respectively.

The power transmission is, as a rule, mechanical. It consists of 3 basic parts, i. e. 1) main clutch, 2) gear box and reversing gear built together, 3) bevel gear axle driving mechanism of the driven axles. The gears of the gear box are constantly meshing and the several speeds can be switched by air compressed discs. The above vehicles are equipped with 5-speed gear boxes.

The machinery equipment of the railcars is generally electro-pneumatically controlled. The synchronisation of the machinery equipment arranged at both ends of the longer trains (e. g. full length of a four-unit railcar train for the Continent abt. 96 m, whereas that of the train for the Argentine abt. 130 m) has to be secured even at great distances and this can be performed with the present equipment. When having higher output the switches are automatically controlled in order to ease the driver's desk.

The bogies of the latest design being experimented nowadays by the Ganz Works to meet the various demands still deserve mention. As to these bogie design we shall revert later and give an account about the experimental and practical experiences.

In order to supervise the up-to-date dimensioning of the railcar trains each type is subjected to extensive tensometric measurements during manufacture (Fig. 9) in order to be on the safe side as to the maximum safety combined with the minimum weight. Up-to-date vibration measurements are carried out for testing the running conditions of the trains in order to offer the greatest comfort to the passengers as based on scientific experiments as well.

Summarizing the aforesaid the reputation and practicability of the Hungarian railcars and trains can be attributed to the far reaching satisfaction of the railways' demands, recognition of the reasonable limits of the weight decrease, due consideration of the maintenance costs when designing, service safety, proper arrangement, economic combination of solidity and neat appearance, proper design of the solid machinery of equipment, the distance switching, the remote control as well as the automatic control of hauling vehicles, furthermore to high efficiency and low fuel consumption, in other words to the many years' experiences and extensive export activity and last but not least to the proper application in practice of the recognized and employed basic principles of an industrial branch with old traditions.

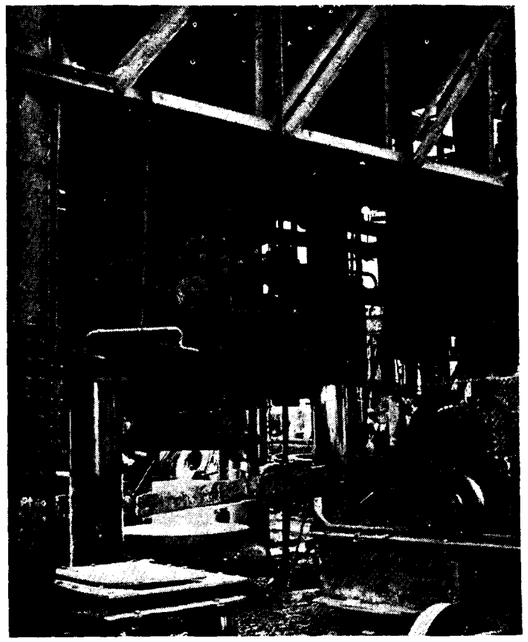
U. S. MACHINE TOOL TEAM

The four-man team of U. S. machine tool experts currently on a month-long tour of India to survey the progress and future plans of India's machine tool industry is expected to visit several plants. The team's survey is in response to an invitation by the Union Ministry of Commerce and Industry. While their trip is jointly sponsored by the U. S. Department of Commerce and the U. S. Technical Co-operation Mission (TCM) in New Delhi, they represent the private machine tool industry of the U. S. They will make recommendations as to methods of improving the productivity of India's machine tool industry, both in the private and public sectors.

Railway Wheels and their Manufacture

FOR centuries after their invention wheels for transport were made of wood. With the advent of the railways, and the consequent heavier loads to be carried, stronger wheels were required. The first railway wheels were of cast iron throughout—a type still surviving in the U. S. A. in the form of solid cast iron wheels with chilled flanges and treads, though now being generally replaced by solid steel wheels. As the demand came for lighter wheels, combined with serviceable strength, various forms of spoke wheels came to the fore —the "hot spoke" type which was built of welded wrought iron throughout—the "cold spoke" type, having a cast iron boss, cast around wrought iron spokes, and its later development whereby the cast iron boss was superseded by a wrought iron boss forged round the cold wrought iron spokes. When means were provided by the Bessemer converter process of making mild steel in large quantities, cast steel spoke wheels were introduced. About 1895 the first steel disc wheel centres were rolled in Germany out of cast steel "cheeses". All these were wheels requiring either a wrought iron or steel tyre fastening on; usually by a process of shrinking a hot tyre on a cold wheel centre. At this time the chilled iron wheel was in general use in the U.S.A. In 1899 Mr. C. T. Schœn was making pressed steel rail cars of 100,000 pounds capacity, having eight wheels per car. The chilled iron wheels were not satisfactory at this heavy loading and the services of an engineer who had designed a disc wheel centre rolling mill in Germany were called upon. This designer thought that by using a grooved tread roll it might be possible to roll a wheel with a flange on, that is, a solid wheel. Such a mill was built in the U.S.A. and put into service in 1903 with complete success.

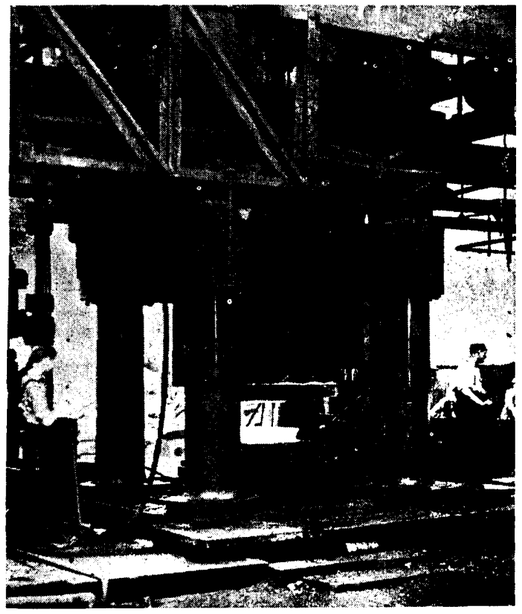
Solid wheels, as their name implies, are solid throughout; that is the whole wheel, tyre portion, web, and boss are all wrought out of one piece of steel, though it can be arranged that the hardness of the steel may vary in the different portions of the wheel. They possess considerable advantages over the "built up" type; to name a few :—The chief one is that the first cost is lower. The reason for this is obvious—the built up type of tyre and disc centre requires the employment of two rolling mills in the manufacture of these parts. Subsequently the tyres have to be bored, the disc centres topped, the one shrunk on the other, and the retaining ring inserted and the lip rolled down — quite an elaborate process, by comparison, when one considers that for very little more than the extra cost of the steel in the tyre the same disc mill might be employed in rolling the solid wheel complete with tyre on. This question of cost over a period of



Wheel Slabbing Press.

years is of importance. A simple calculation shows that a first cost saving of say 10% becomes a very considerable figure in compound interest over the life time of a wheel. Another advantage is that the solid wheel can be made lighter than the built up type. Weight saving is important—it is non-paying load—and any increase of weight means more tractive effort on the part of the locomotive. Again it is unsprung weight in a wheel—a lighter wheel leads to less wear and tear on the track.

Solid wheels are made in three general types—an ultra-light known as a "One Wear" type, which has a limited life and is then removed from the axle and replaced by a new wheel. This type is obviously of use where weight saving is most important and is economical only where the value of scrap steel is high. Next is a "Multiwear" type, which, when tread and flange are worn, can be placed in the wheel lathe and re-formed without removal from the axle. A heavier type still is "Retyreable", which after several re-turnings in the wheel lathe can finally have the wheels machined into centres on which

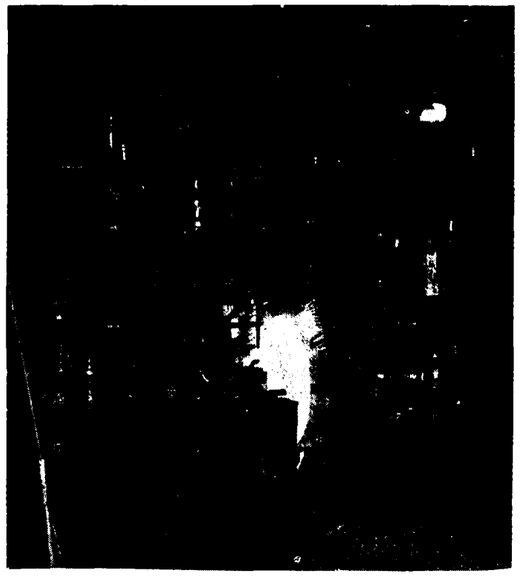


6,000 ton Wheel Forging Press.

new tyres may be shrunk without removal from the axles.

All the above solid wheels are manufactured by a similar method. Steel is made either by the acid or basic Siemens Open Hearth process and cast into six, eight or twelve sided ingot moulds by bottom pouring through a refractory lined funnel and tubular runner bricks to avoid surface defects due to splashing. After cooling the ingot requires cutting into appropriate block weights to make a wheel. This is done by a very heavy type parting lathe using a pair of tools, one sharp pointed V tool to split the turning and one straight tool in each cut, and cutting down to about five inches diameter when the ingot is removed and broken into blocks by the insertion of a wedge in each cut. The top or head of each ingot and a length from the bottom are cut off and scrapped to ensure that only first quality steel is in the block. Another means of obtaining the lumps or blocks is by breaking the ingot. For this a special type of ingot is required of such a weight that each wheel block is about one quarter the weight of the whole ingot. The ingots are nicked circumferentially, half way round only, in three places to a depth of ¼ inch by means of oxy-acetylene, using a length gauge and are placed on a heavy block of steel and supported on rollers and a weight dropped on the middle. Alternatively, breaking is done by applied pressure under a press or in a machine. This breaks the ingot in half. Positioning rams move the ingot longitudinally on rollers and each half is then broken into quarters. Three blocks are obtained from each ingot and the top quarter of the ingot containing the pipe cavity caused by shrinkage in casting is discarded.

The wheel blocks are then gradually heated to a forging temperature of 1200°C. either in a continuous pusher or bogie type furnace from which they are withdrawn by a manipulator and placed upright beneath a heavy forging press. Here the block is upset forged inside a floating steel ring into a circular slab. Then the slab is conveyed to another press which forms it in dies to the rough shape of a wheel but a few inches smaller in diameter than the finished wheel—about 6,000 tons pressure is required to do this. After pressing the wheel block is punched and then reheated before being placed in the rolling mill. Here conical driven rolls engaging the web portion of the wheel spin it around a mandril which is inserted into the bore of the wheel. Pressure is applied to the web rolls and the web is reduced in thickness—at the same time a third but free running box section roll, having a flange groove in it, is applied by pressure on to the tread of the



Wheel Rolling Mill.

Wheels entering Heat Treatment Furnace.

wheel, just behind the line of contact of the conical rolls in the web. The wheel increases in diameter through the tyre portion being reduced in thickness and material flowing from the tyre in the web. Meanwhile two more undriven rolls control the width of the tyre. On the desired diameter being attained the wheel is removed from the mill and placed between contoured dies under another hydraulic press and given a squeeze. This both makes the wheel truly round and forms the web to a cone section thereby increasing the lateral rigidity of the wheel. The next process is heat treatment. Immediately after rolling the wheel is allowed to cool in air to below the recalescence point of the steel, to about 600°C. and then pushed on bogies through a continuous furnace until it attains a normalising temperature of about 830°C. at the withdrawal end. On removal from the furnace it may either be placed beneath pans and allowed to cool slowly or alternatively be put on a rotating table machine and water sprayed on the tread and flange to harden the wearing portions, followed by panning. After testing for soundness by a falling weight destruction test, and tensile test, of representative samples, the wheels are subsequently machined in automatic contour turning lathes and after being mounted on their axles are ready for many years of service on the railways.

TISCO PRODUCTION IN MAY, 1957

Total approximate production of iron and steel at the Jamshedpur works of Tata Iron and Steel Co., Ltd. during the month of May last was as follows: Steel ingots 86,600 tons and saleable steel 65,100 tons comprising 16,200 tons of semis and 48,900 tons of finished steel. Pig iron production during the period totalled 91,300 tons.

"Perlitionising" Process for your Case Hardening Work

THE very great advantages of "Perliton" for case hardening work, are already well-known to Heat Treaters, throughout the world. Many plants in India have adopted the "Perlitionising" Process for their case hardening work, which is a very much more rapid process to the normal pack hardening methods—especially for small parts.

As is probably well-known this somewhat revolutionary case hardening material was supplied in two separate parts :—

'Perliton' Liquid Heat ; and
'Perliton' Carbon.

The 'Perliton' Liquid Heat had to be first dissolved, and then the "Perliton" Carbon was added to the liquid bath, and formed a crust on the top of the Liquid Heat.

Subsequently it was found practicable to supply 'Perliton' Liquid Heat and 'Perliton' Carbon combined into one material, which was found much easier for those using the 'Perlitionising' Process to operate, and control the quantities necessary of both products to make up the carry-away losses inevitable in the operation.

Further very extensive experiments have been recently carried out, and the latest developments in the 'Perlitionising' Process, has been the production of what one can call a "one piece" water soluble carburizer, which will be now known as :—

Perliton 400

and which possesses a high carburizing value.

This high surface hardness values, with shallow case depth, are not brittle, because of a full eutectoid composition and the absence of excess carbon or carbides afforded by this product. 'Perliton' 400 supplies a rapid rate of carbon penetration at low carburizing temperatures and short immersion circles. When needed, however, deeper case depth can be obtained by means of using a higher operating temperature.

CASE DEPTHS

Although all steels do not carburise, or case harden, at the same rate, the following penetrations which are obtainable at various time and temperature cycles, will enable those interested in the subject, to better understand the advantages of this definitely revolutionary case hardening product :—

Temperature @ 1500°F		*Temperature @ 1550°F*	
15 minutes	.004"	15 minutes	.0057"
30 ,,	.005"	30 ,,	.0088"
45 ,,	.0075"	45 ,,	.0110"
1 hour	.0088"	1 hour	.0132"
2 hours	.0110"	2 hours	.0178"
3 ,,	.0154"	3 ,,	.0220"
4 ,,	.0198"	4 ,,	.0264"

Temperature @ 1600°F		*@ 1650°F*	*@ 1700°F*
15 minutes	.0066"	.0088"	.0099"
30 ,,	.0088"	.0132"	.0152"
45 ,,	.0132"	.0154"	.0176"
1 hour	.0154"	.0176"	.0220"
2 hours	.0196"	.0264"	.0330"
3 ,,	.0242"	.0330"	.0396"
4 ,,	.0286"	.0440"	.0506"

ADVANTAGES

"One piece" water soluble carburizer ; reduces need for control tests.

Long lasting, highly stable bath.

Provides eutectoid type case of uniform depth.

Flexibility of use and rapid carbon penetration.

Work is more easily cleaned, because of the water Soluble nature of the compound.

Low drag-out or carry losses, thus reducing operating costs.

Undoubtedly this entirely new type of case hardening material is going to be of the greatest use in India, where industrialisation is slowly begining to have an important place in the economic life of the country.

HYDRAULIC BUFFER STOPS

CONTINUOUS brakes are now relied upon so much that even partial failure when a train is entering a terminal station or dead end may entail a quite serious accident. On the score of safety and freedom from claims to damages therefore it is in the general interests of railway companies to adopt buffer stops that will effectively absorb the shock of collision without causing injuries to passengers or damage to rolling stock. It is more than 70 years ago that the invention of the hydraulic buffer stop provided the complete solution to this problem and it is still the only type of buffer that will give smooth retardation over its full stroke without recoil. Many railway companies in all parts of the World have installed them in their important terminals as a protection against serious accidents due to over running (some of the major installations in India and Pakistan are listed at the end of this article). On the score of safety to passengers and property, they claim the interest of all railway companies as they have proved themselves satisfactory time and again under many varying conditions.

The length of stroke of a buffer stop is of prime importance and after much experimenting in the early days it was found that the smallest size, to be of any real protection on a standard gauge railway, should have a stroke of 5 feet. A pair of hydraulic buffer stops of 5 feet stroke is capable of bringing to rest safely a train of 200 tons weight running at a speed of 6 miles per hour or any other combination of train weight and speed requiring the same retardation effort to bring it to rest in 5 feet.

The minimum distance in which a train can be brought to rest safely from a given speed depends firstly on the ability of the train's structure and passengers to withstand the effects of the retardation and secondly on the constant application of the maximum permissible retardation force throughout the full stroke of the buffer stop. The action of the hydraulic buffer stop is exceedingly simple. The front casting of the cylinder projects forward to support the piston rod which is fitted at one end with a buffer head and at the other with a piston working in the cylinder. The cylinder is completely filled with water, passages being arranged so that the volume of water behind the piston can pass gradually to the front side as the piston is forced back. When the piston is first set in motion at the same speed as the train striking the buffer, a pressure is set up behind the piston opposing the movement of the train. The water passages are much larger at the front end of the cylinder than at the back and consequently, as the speed is checked, less and less passage of water is provided resulting in a constant resistance being maintained to the motion of the train till it is brought to a standstill.

As the piston rod is forced home an amount of water equivalent to the volume of the rod entering the cylinder is displaced and ejected from the cylinder through a relief valve provided in the front casting. It is usual to provide a water drain in front of the buffer stops to carry off this water.

It will be seen from the above that the only parts subjected to heavy pressure or loads are the cylinders, pistons, rods and buffer heads.

A constant supply of water is connected to the front part of the cylinder and acting on the back of the cylinder forces the piston rod outwards thus automatically re-setting the buffer immediately the train is backed away. A pressure of about 35 lbs. per sq. in. is all that is required so that connection to an ordinary water main is usually sufficient for this purpose.

Where an ample supply of water is not always available or it is undesirable to run the water to waste when the buffer stop is operated, the automatic re-setting can be arranged by the displaced water being forced into a receiver fixed to the front casting. The return stroke is then automatic when the train is backed away from the buffer stop as the pressure which has been built up in the receiver, automatically returns the water. This type of stop is also arranged for use with oil instead of water which has some advantages.

The type of hydraulic buffer stop described above is known as the compression stop, being made in sizes up to 11 feet stroke. A pair of 11 feet stroke stops is suitable for bringing to rest a train weighing 890 tons when travelling at 10 miles per hour and it is interesting to note that at this speed the sensation of a train colliding with the hydraulic buffer stop is very similar to that felt when the Westinghouse brake is put hard on.

The weights and speeds of trains continue to increase, however, and the danger of over-running the heavier trains at higher speeds necessitates buffer stops with even longer retardation strokes if the trains are to be brought to rest without damage. For mechanical

(Continued on page 38)

Materials Handling with Ransomes Trucks

RANSOMES Electric Industrial Trucks derive their worth from two main sources.

(*a*) *Their High Use Value.* The ability to serve production lines, to keep pace with rigorous schedules and to avoid bottlenecks where hold-ups cost money by the minute; their high availability for service.

(*b*) *Low Operational Costs.* Battery power costs less than any other form of power. No power is used when the truck is not actually stacking or moving.

The above summarises the experience gained by Ransomes since entering the industrial truck field.

The original Ransomes battery-powered truck, had three wheels, the single drive wheel being at the rear where the operator stood and the two steering wheels were on the front axle. The platform was fixed and carried up to 2,240 lbs.

Soon followed the desire, not only to transport heavier loads, but also to move them faster. This led to the development of a low-lift platform truck which took on the name of "elevating truck". Stillages, were, and still are, used in conjunction with the elevating truck thereby increasing the efficiency of the truck by avoiding loss of time loading and unloading.

Then came the high elevating or tiering truck, the purpose of which was to lift loads high enough to place them on road lorries or works inspection tables etc. Usually loads could be lifted up to a height of 5 to 6 feet. Then followed various types such as, crane trucks, hopper trucks, stevedoring trucks and the like. It should be remembered that there are many handling jobs which will continue to be done with great efficiency with the above types of trucks or by a tractor-trailer system.

The fork truck was originally designed to handle tinplate but its adaptability for service in other industries and for handling other types of loads soon made it universally popular.

The first Ransomes forklift, or tinplate tiering truck, was made over a quarter of a century ago and is still in service in the tinplate industry of South Wales. Many of the same type were supplied. These trucks had a non-telescopic mast and the lift was operated by an electric motor and double reduction worm gear; steering was by tiller arm and the operator stood at the rear.

With the advent of the modern forklift, materials handling came of age. Great progress has been made in the mechanization of handling operations in industrial plants and warehouses and in many cases, development in this direction has been as thorough as production mechanization. However, there are many places where trucks are used only in the most obvious applications and when searches are made, opportunities for economy in handling operations are found to be almost limitless.

The present range of Ransomes trucks include the following :

PLATFORM TRUCKS

Type	*Description*	*Payload (Lbs.)*
TE	Fixed or elevating platform. (hand operated hydraulic gear).	2240
NU or ENU	Fixed or elevating platform. 2 or 4-wheel steer.	4480
NUH or ENUH	Fixed or elevating platform. 2 or 4-wheel steer.	8960
TNU	High elevating platform. 2 or 4-wheel steer.	4480
S	Fixed platform stevedoring truck. 2 or 4-wheel steer.	4480
NU CRANE TRUCK	Fixed platform. Jib capacity 1120 lbs. 2 or 4-wheel steer.	3360
NU HOPPER TRUCK.	Equipped with hopper for sand, cement, etc. Side or end tip. 2 or 4-wheel steer.	4480

TRACTORS

Type.	*Description.*
TE	Hauling capacity—up to 5600 lbs. on hard level ground.
T4	22,400 lbs. hauling capacity on hard level ground.

The list of platform trucks could be sub-divided according to platform area and height.

The Ransomes battery-powered forklift trucks are as follows :

FORKLIFTS

Type	*Height of Lift.*	*Payload (Lbs.)*
FL. 10	8, 9 or 10 feet	1200
FL. 2000	8, 10, 12 or 14 feet	2000
FL. 3000	8, 10, 12 or 14 feet	3000
FL. 4500	8, 10, 12 or 14 feet	4500

Various types of attachments and accessories are available :— load guard, fork extensions, operators overhead load guard, crane attachment, ram or bar attachment, side shifter, lighting equipment, pipe lifters, load clamp, carton clamp, rotating head, paper reel clamp and an automatic load guard for bottle crates.

(Continued from page 36)

reasons it is not practicable to build compression hydraulic buffer stops with longer strokes than 11 feet and it has been necessary, therefore, to adapt this principle of hydraulic retardation—the only satisfactory way of obtaining smooth operation—to buffer stops having much longer strokes. A tension type buffer stop has been designed and patented by Ransomes and Rapier Limited, Ipswich, England, who were also the original inventors of the compression hydraulic buffer stops, incorporating the well tried hydraulic retarding principle but with the piston rod arranged in tension thus making possible much longer strokes than when the piston rod is in compression. This Tension Buffer Stop retains all the old features of smooth retardation and automatic re-setting after impact. A long stroke hydraulic buffer stop of this type having a stroke of 17 feet and capable of bringing to rest a 300 ton train travelling at 13 miles per hour without dangerous shock and recoil, has been installed at Aldgate East Station in London and over a number of years has proved entirely satisfactory.

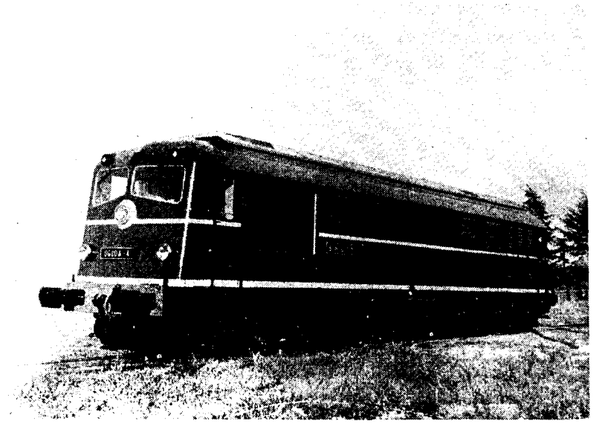
It will be of interest to readers to know that Ransomes and Rapier Limited suppliers to Indian Railways of Cranes, Turntables, Traversers and other Railway Plant over many years, have installed a larger number of hydraulic buffer stops in India and Pakistan notably at Madras Beach Station, Victoria Terminus, Bombay, Baroda Station, Chittagong Station and Karachi Terminus.

Twentyfive years of progress in construction of Shunting Locomotives

(We have pleasure in reproducing below a short write-up in respect of Shunting Locomotives. These Locomotives are constructed by a leading firm Messrs. Compagnie des Ateliers et Forges de la Loire in France which has twentyfive years of leadership and experience in the construction of such locomotives. We are sure this write-up will be of interest to our Engineers. EDITOR*)*

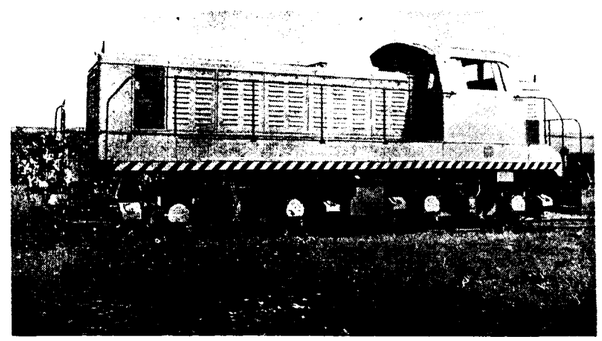
THE Cie des Ateliers & Forges de la Loire (C. A. F. L.) stands as one of the leading French Industrial concerns, the activities of which cover a wide field in Siderurgy and Mechanical Engineering.

For the past 25 years the C. A. F. L. has specialized in the construction of road and shunting locomotives equipped with various types of transmissions electrical hydraulic or hydromechanical. One of the most powerful Diesel Electric Locomotives (4400 hp. in two units) was built in 1933 in the Company's works. Before the electrification of the railway between Paris and Lyon it travelled 100.000 Km. in 100 days on this line.



Diesel Electric Locomotive—Type CoCo 2000/2300 HP.

Taking into account the results obtained in this field, the C. A. F. L. after the 1939-1945 period, followed the evolution of technique in order to obtain the best selling prices and to improve constantly the performances without any diminution of robustness. A large number of locomotives in use on the French National Railways, overseas and in the private industrial works, have been built by the C. A. F. L. The main recent units in the field of Diesel Electric locomotives have been equipped with the Cie Electro Mecanique (Brown Boveri) drives and Sulzer engines viz :



Diesel Electric Locomotive—Type BoBo 600 HP.

—55 500/600 b. h. p. 060 type Shunting Diesel Electric locomotives for S.N.C.F., Subway, Loire Collieries, etc.

— 8 600 b.h.p. BoBo type Shunting Diesel Electric Locomotives for Siderurgic Works.

—35 2000/2300 b. h. p. CoCo type Diesel Electric Locomotives for S. N. C. F.

— 3 700 b. h. p. BoBo type Diesel Electric Locomotives for the Mediterranee Niger system.

Lately a series of 25 shunters 200/300 b. h. p. 040 type have been built for various private and public services fitted with engines of different makes and Cie Electro Mecanique drive.

Moreover the C. A. F. L. is manufacturing with the

(Continued on page 43)

Type BB 68 tons Locomotives for the Pakistan Railways

THE Pakistan Railways have ordered 18 locomotives, type BB, of 68 tons which are being built in the Works at Tarbes and the delivery of which was begun in August 1954.

These locomotives only differ from the « Holland » type in the following respects :

1. The gauge of the track is 1.676 metres (5' 6");

2. The Diesel engine is of the type SGCM 16 V 12 PA, designed for a continuous power output of 750 HP and 825 HP on a one-hour rating. Its effective useful output in Pakistan will be 675 HP on the system at low altitude, and 625 HP on the high-altitude system at 1800 metres (5905');

3. The weight has been brought up to 68 tons by increasing the thickness of the steel footplate ;

4. The gear ratio is higher ; none the less, it enables a maximum speed in service of 70 km/h (43 m. p. h.) to be obtained with the following tractive efforts :

At steady speed : 10400 kg (22930 lbs.)

At starting : 18000 kg (39700 lbs.)

The control equipment is of the single-unit type with a single control desk providing continuous pneumatic control of the speed of the Diesel engine.

The braking equipment is of the mixed type compressed air-vacuum ; the locomotive is braked by compressed-air (compressor Jourdain Monneret A 800) and the load hauled by vacuum (Spiros Vacuum Pump 2 NMV) with a synchronising valve. A supplementary vacuum pump, driven by an electric motor, enables rapid release of the brakes to be obtained.

As the locomotive is required to operate through sandy regions, the doors of the hoods in which openings are formed for the intake of ventilating air for the various machines, are provided with filters.

This type of locomotive is essentially intended for shunting duty.

Finally, the Works at Belfort and Tarbes have under construction 62 BB locomotives for metric tracks intended for various railway systems in Africa and in Spain :

— 9 for the Madagascar Railways ;
—12 for the Cameroons Railways ;
— 6 for the Franco-Ethiopian Railways ;
—15 for the Dakar-Niger Railways ;
—20 for the Spanish Railways.

The locomotives for the first order placed on the 14th October 1953 were delivered between March and June 1954 (6 months between the date of order and the delivery of the first machine).

These locomotives are shorter in length than the standard or wide-gauge machines, because of the suppression of the small hood which serves no purpose, the heating boiler not being considered necessary for these systems ; they have an unladen weight of 44 tons, or 46 tons with a supply of 2000 litres of gas-oil ; in addition, they can be increased by ballast up to 54/56

(Continued from page 41)

collaboration of the Society " ALSTHOM " acting as workmanship master 53 1800 b.h.p. CoCo type Diesel Electric Locomotives for S. N. C. F., Algerian Railways and Argentina Railways.

Researches are being undertaken in connexion with the Regie Renault and the Society Sigma for the building of 2400 b. h. p. Locomotives comprising Sigma Pescara gas generators and Rateau gas-turbines.

On the other hand the C. A. F. L. manufactures Railway Material as castings, tyres, springs, forgings, fittings and the many other parts which enter into the building and the maintenance of rolling stock and track. Particularly the C. A. F. L. is specialized in the manufacture of switches and crossings cast in manganese steel.

tons which means that they are suitable for all the metric-gauge systems which demand 11 to 14 tons per axle, which is the general case.

The metric-gauge bogies have a small wheel-base (2200 mm.—7' 3") which enables the machine to adapt itself to tracks having a small radius of curvature; in addition, those which are intended for winding lines are provided with greasers for the wheel flanges or for the rails so as to reduce wear on the flanges.

The maximum speed in service is 70 km./h. (43 m. p. h.).

The Diesel engine is of the type MGO 12 V SHR provided with an altitude turboblower; the useful power overseas is 730 HP for the systems which do not exceed 1700 metres (5577') in altitude; for the Franco —Ethiopian Railways (which reach 2400 metres—7874'), the output fixed is at 675 HP.

The electrical equipment is identical to that of the Pakistan locomotives (single unit); the motors operate at full field and with 50% parallel connection when the locomotives are ballasted to 52/54 tons; when the locomotive weighs only 44 tons, running with full field is replaced by a small shunt connection of 30%; this enables the tractive effort to be adapted to the adhesive load without changing in any way the adjustments of the generator.

The tractive efforts obtainable are thus as follows:

	At steady speed	At starting
Locomotive of 52/54 tons	8000 kg (17640 lbs.)	13000 kg (28660 lbs.)
Locomotive of 44 tons	6800 kg (14990 lbs.)	11600 kg (24250 lbs.)

The compressed-air equipment is similar to that of the Pakistan locomotives, and comprises a compressor A 800 and a vacuum pump 2 NMV. When the machine is provided with greasers for the wheels or the rails, a second compressor, type A 800, is added to the equipment.

Internal Lubrication of Steam Locomotives

[Contributed by Caltex (India) Limited]

THE proper choice and use of lubricants forms an indispensable part of the steam locomotive. The lubricant in a bearing serves as important a duty as the metal surface of the bearing itself, which would promptly 'burn out' if no lubricant were present. Not only is excessive wear produced in a steam cylinder by lack of lubrication but also steam leakage results. The long life and service rendered by any machine or moving part is entirely dependent upon the selection of correct lubricants. Correct lubrication is the prime factor of profitable railway operation. Due to the economy of correct lubricants these benefits are secured at little or no increase of cost per mile of operation.

The investment involved in the locomotives of any railway is necessarily large. Returns from this investment are largely dependent upon correct lubrication, which lengthens the life of every engine, reducing the rate of depreciation. Maintenance costs are largely due to necessary repairs of the worn parts. Correct lubrication reduces wear to a minimum.

Let us here consider the internal lubrication of locomotives in terms of valves and cylinders.

Internal lubrication of the locomotives has two main purposes:—

1. To reduce friction and wear of valves, valve seats, valve stems, pistons, cylinder walls, and piston rods, to a minimum.
2. To provide an effective oil seal for all these parts to resist steam leakage.

Effective internal lubrication is the result of a series of conditions, each one of which must be favourable if the best results are to be obtained. The oil must be introduced at the proper place and in the correct amount. It must be adequately yet uniformly, distributed or spread over the surfaces to be lubricated. The oil must be adapted to the method of introduction, and distribution, and must possess all the characteristics required for its functions as a Lubricant and sealing medium, and must resist whatever film-destroying conditions are encountered.

If water condensation is present, the oil must still adhere to the surface and form a satisfactory film in spite of this condition. Steam temperatures, and temperatures of lubricated parts, are influenced by operation while drifting, which may produce conditions extremely adverse to correct lubrication. Soot and cinders may be unavoidably drawn into the cylinder from the smoke box, while the oils must still maintain lubrication.

The factors which influence the selection of locomotive steam valve or cylinder oils are as follows :—

1. Quality of steam in valve chest and cylinder which may be wet, saturated or superheated—in the latter case, the governing figure being the total temperature, i. e. the saturated steam temperature plus the degrees of superheat.

2. Method of application, which may be by hydrostatic or mechanical lubricator to one or more of the following points :—

   (a) Steam pipe above valve chamber.
   (b) Valve chamber.
   (c) Upper part of cylinder wall.
   (d) Lower part of cylinder wall.

3. Service—long run road service, or suburban service or shifting service.

Diameter of cylinder is also a factor influencing the distribution of oil, and the quantity of oil required.

MAIN STEAM VALVES AND CYLINDERS

Speed and load are extremely variable. While in some classes of service a high speed may be maintained over a long run, the load may at the same time vary from maximum at starting and on an upward to no load on a downward grade and while slowing for a stop. Speed and load variations have a strong modifying influence on steam quality from time to time.

Steam quality—wet, dry or superheated—is a factor which influences the choice of the oil for valve and cylinder lubrication. So long as the degree of superheat is not extreme, there are always times where there is a condensation in the steam cylinders resulting from light loads and the automatic cut-out of the superheater by the action of the damper during certain conditions of operation or stopping. Even when a high degree of superheat is used, the variable operating conditions will at times result in condensation in the cylinders. With high superheat, and long continuous runs, however, there may be justification for the use of an oil of a body heavier than would otherwise be used.

There are two classes of lubricators employed for the introduction of valve or cylinder oil to the internal parts of a steam locomotive, namely, (1) the hydrostatic lubricator, (2) the mechanical force feed lubricator. Both types of lubricators give excellent service and the choice between them is often difficult.

The hydrostatic lubricator is located in the cab of the locomotive, and is at all times in view and under the control of the engine men. The operation of the lubricator depends upon the oil within the lubricator being displaced by water condensed from steam, which is admitted by a pipe leading from the boiler. The flow of oil is controlled by the adjustment of needle valves.

When a mechanical force feed lubricator is used, it is located near the locomotive cylinders, and consists of an oil reservoir, with several diminutive, positive-acting plunger pumps, which are mechanically operated by a mechanism operated from some moving part of the engine. The plunger pumps are so designed that the quantity of oil discharged can be regulated. After adjustment, this type of lubricator requires no further attention than filling.

It should be observed that the hydrostatic lubricator feeds oil uniformly with respect to time, i. e., a constant number of drops per minute, and that, therefore, an engine running at high speed receives less oil per revolution than when running at relatively low speed, unless re-set by engine-man.

The mechanical force feed lubricator, on the other hand, may be made to feed oil at a constant rate with respect to the revolutions of the driving wheels, i. e., to feed one drop of oil for every so many strokes of the piston. Relatively speaking, this type of lubricator then supplies more oil when the engine is running at high speeds than does the hydrostatic lubricator. By driving the lubricator from a part of the valve gear that has a variable motion, the rate of feed may be made to vary accordingly.

Drifting operation that permits access of cinders from the smoke box to the cylinders is a condition that renders satisfactory lubrication exceedingly difficult. Oil is a binder of the impurities which can only be made more serious by the use of an oil of unusually heavy body. It is frequently the practice to keep the throttle slightly opened when the engine is drifting in order to provide steam to atomize the oil, also to avoid drawing in cinders from the smoke box.

The great majority of locomotive operating conditions call for the use of cylinder or valve oil, which has a body sufficiently light to assure atomization. Whenever extreme water conditions prevail, a compounded oil should be used. The compounding of this oil renders it a very adhesive lubricant, capable of maintaining a lubricating and sealing film in spite of moisture resulting from cylinder condensation and has long-lasting qualities.

The locomotives operating on long, continuous runs in which a heavy load predominates, the use of highly superheated steam sometimes calls for the use of an extra heavy bodied oil for which service Caltex 474 Mineral Superheat Valve Oil (G/o—101/33) is recommended, due to its high lubricating value, heavy body and special quality indicated in high temperature conditions.

(Continued on page 48)

STEAM REVERSING CYLINDERS

Steam cylinders of power reversing gears require but a small amount of cylinder oil to accomplish lubrication. The same Cylinder Oil as is used for main cylinders should be applied by means of the oil cups or other fittings provided for the purpose.

AIR CYLINDERS OF REVERSING GEAR

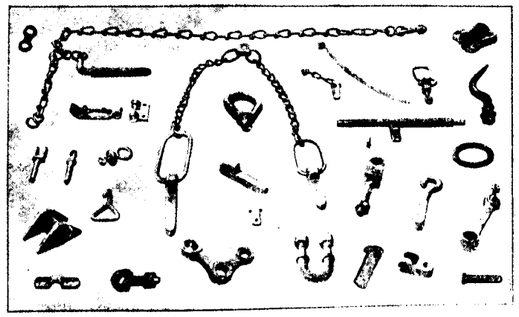
Where power reversing gear is operated by air cylinders, good lubrication and an effective piston seal can be maintained by the application in the shop of Caltex Petroleum Jelly by means of a compression cup or through the gland.

STEAM CYLINDERS OF STROKE ENGINES AND LOCOMOTIVE AIR PUMPS

These steam cylinders are lubricated by feeds from a hydrostatic or force feed lubricator. The same Cylinder

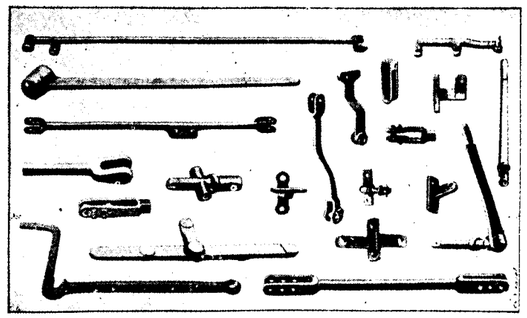
Manufacture of Railway Iron Fittings in France

WHEN a foreign visitor comes to the French Ardennes having in view business transactions in Railway iron fittings what does he expect to find here but the usual scenery of an industrial country: chimney stads smoke black sky, a gloomy dark atmosphere.



Various Parts.

He is ready to retrace his steps thinking that he took the wrong road when he finds himself in a beautiful greeny country, when he sees rivers and torrents winding their course amongst mountainous tracts. He, nevertheless, looks for the factories he has come to see, and suddenly he sees them, hidden in a scenery which surprises him and is, for his eyes, an unexpected enchantment.



Various Parts.

Why is nature so intimately blended here with the industry? It is because, in the Ardennes, nature gave birth to industry.

A very long while ago, men discovered the need to manufacture iron implements. They found in our country both the ore and the fuel, this fuel was the trees of our forests, the ore was there, just by scratching

(Continued from page 47)

Oil should be used for this purpose as is applied to the steam cylinders of the locomotives.

AIR CYLINDERS OF LOCOMOTIVE AIR PUMPS

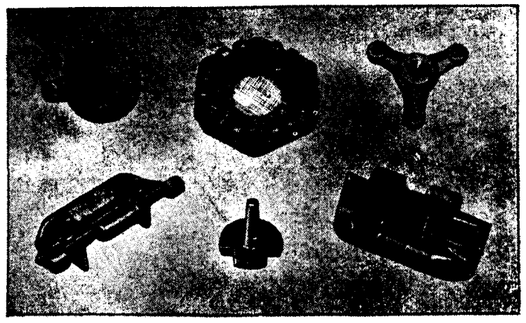
The temperature in these air pump cylinders resulting from air compression is high, requiring the use of a heavy bodied oil. It is recommended that the same Cylinder Oil be used here as is applied to main steam cylinders. Several types of special oil cups and air pump lubricators are employed for this purpose.

AIR BRAKE LUBRICANT

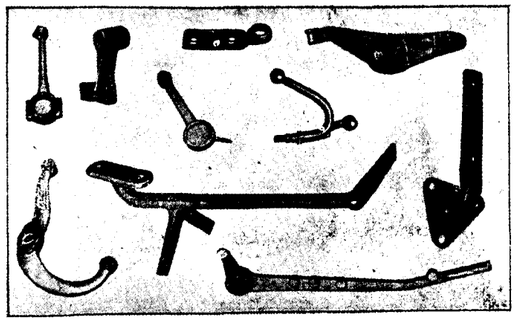
The lubrication of these cylinders requires a special lubricant which will stay inplace and maintain lubrication and piston seal from one shop inspection to the next. Caltex 904 Grease Graphite has been developed specially for this purpose and should be applied in the shop to the cylinder walls in a uniform thin coat by swabbing.

TRIPLE VALVES

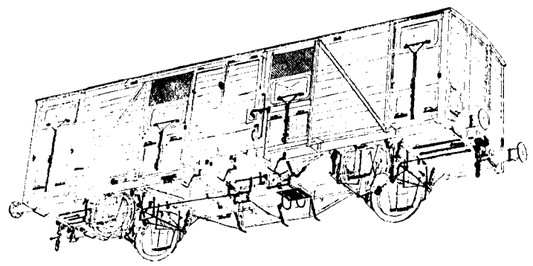
The correct lubrication of triple valves requires care in application of the lubricant as well as its correct selection. There is a difference of opinion as to the relative desirability of a grease or an oil for this purpose. Where a grease is desired Caltex 904 Grease Graphite is recommended. The correct oil for this purpose is Caltex 754 Oil (G/o—101/44). These lubricants are adapted to resist the effects of low temperatures. In either case, the frictional surfaces should receive an extremely light application of the lubricant at the time of shop inspection. The use of either of these lubricants and the observance of the precaution regarding application will assure the free operation of the triple valve at all times and will guard against clogging any of the parts of openings.



Various Parts.



Various Parts.



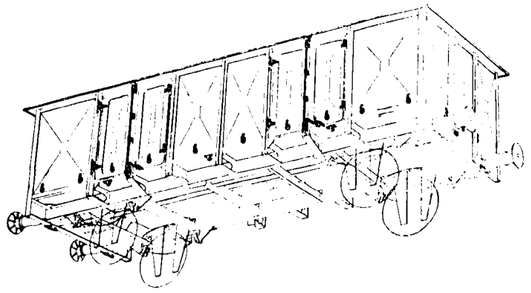
Iron parts for the manufacture of covered Railway Wagon.

the ground, in the limited quantities sufficient for their needs.

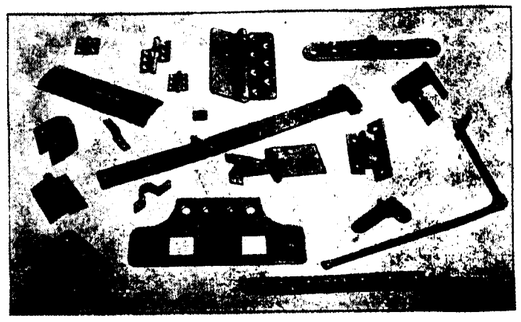
Our iron industry was born then, and its continuous growth was due to the lucky fact that coal and iron mines were in the immediate vicinity.

The very first railways made use of the Ardennes' iron forging and stamping industry for their fittings. Thus, being specialized in these forged fittings manufacture, the industry followed the growth of the railroads adapting itself to its ever increasing need.

This industry supplies all the French Railways' fittings and its exports towards foreign countries are increasing yearly.

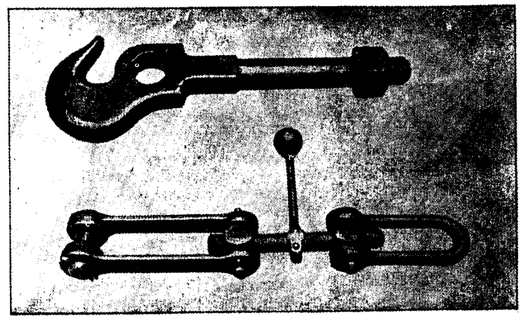


Iron parts for the manufacture of open Railway Wagon.

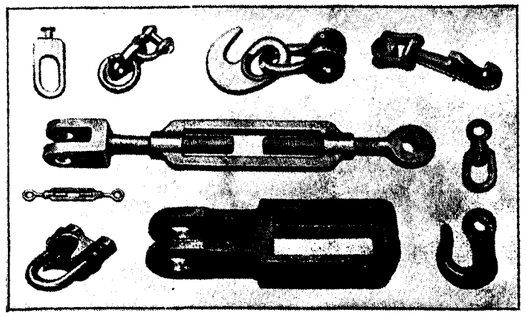


Hinges and Various Parts.

Locks and Various Parts.



Draw Hook, Screw Coupling.



Hooks and Various Parts.

The end of the last world war with the necessity of a total reconstruction of the French Railway system, demanded an ever increasing production. Individually our factories, which are small and medium size, were unable to answer to these enormous needs. But these needs had to be met and the only solution to this problem was the creation of the COMPTOIR DES FERRURES. This company studied a global working plan, and, specializing each plant in the manufacture of the kind of fittings best adapted to its possibilities, got the result it looked for: Heavier production, reduction of the manufacturing costs.

The COMPTOIR DES FERRURES associated factories employing more than 2000 workmen have been now organized for ten years and they deliver fittings to most of the whole world's railways.

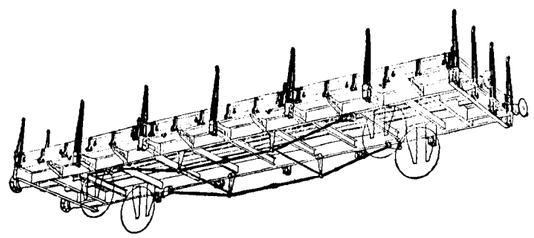
Amongst the COMPTOIR DES FERRURES Foreign Customers, India occupies the very first place. For Years, fittings used in the manufacture of MC, MOX, O, CR Wagons and carriages have been supplied by us and our workmen know them just as well as they know the fittings supplied to the French Railways (S. N. C. F.) Tens of thousands of pieces, from the cotter Pin (W20) of but a few ounces weight to the heavy and strong draw hooks (W445) have been made in our works. I. R. S. Inspecting Officers visit us almost weekly and their presence there does not surprise more than the calls of the French Railways Inspecting Agents.

By the use of a complete and modern range of forging hammer and presses and drop stamps, our equipment for heat treatment ensures for our customers a full guarantee of a manufacture fulfilling their requirements.

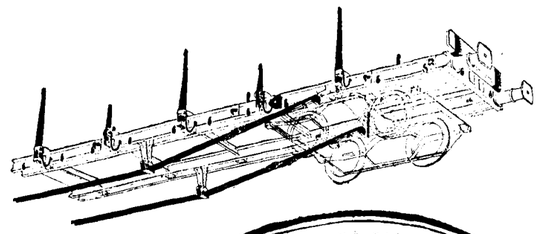
Our mechanical and chemical laboratories, equipped with the most modern apparatus are constantly checking the quality of the various steels. It is at the disposal of all Inspecting Officers for any test they wish to make.

As our factories are all specialized we are able to insure deliveries required by our customers. Large orders are shared among several works in order to avoid any shipping delays even in the case of difficulties in one particular factory.

The COMPTOIR DES FERRURES keeps a complete watch over the manufacture and it is its duty to see that promised deliveries are made in due time.



Iron parts for the manufacture of Flat Railway Wagon.

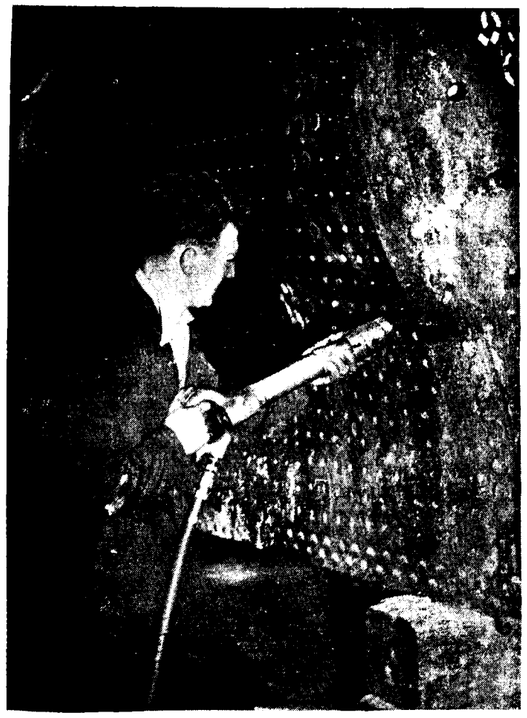


Iron parts for the manufacture of "RORYW" Wagons.

(Continued on page 52)

Range of Armstrong Whitworth Pneumatic Tools for Railway Workshops

TO compile a list of tools for use in Locomotive, Carriage and Wagon Works would mean quoting almost every tool in the new Armstrong Whitworth No. 53 Industrial Catalogue, as there is not a tool in the Industrial range for which a suitable "Railway" application could not be found.



Removing Stay Bolt rivets from Loco. Fire Box with Armstrong Whitworth Size 9300 Rivet Boster.

Armstrong Whitworth's experience in the design and manufacture of portable power tools ensures that each tool is built to the highest standards of engineering precision. The arduous conditions found in the Railway industries to which these tools have been supplied, have proved them to be robust in construction and trouble free in operation.

Armstrong Whitworth manufacture a complete range of reversible and non-reversible rotary air drills, from the 362 series with a capacity of 29/32" and 1", up to the 363 series with a capacity of 1¼" 1½" and 2". These drills can be used for drilling, reaming and tapping, or adapted for tube expanding and flue rolling. Also in this range is the 362 series woodborers, which have capacities up to 4". Tools of practical necessity in the construction and maintenance of the permanent way.

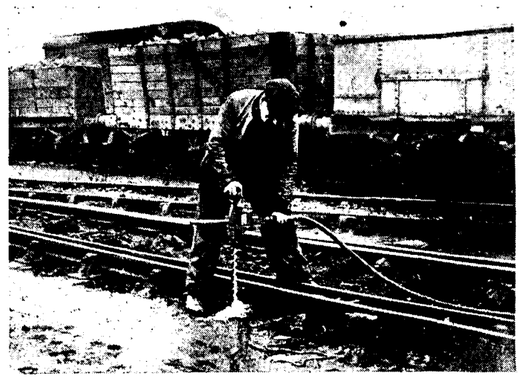
The Armstrong Whitworth Size 3RDC/35 Panel Saw is specifically designed and manufactured for repair work on Railway coaches, such as cutting out for

Cleaning up a weld after a repair job on a Locomotive Frame with an Armstrong Whitworth Size 246 Grinder.

(Continued from page 51)

The COMPTOIR DES FERRURES makes forgings and stampings for all the rolling stock made in Europe for, India (France, Belgium, Austria, Holland, England.) We feel sure that our knowledge of the Indian market in these lines and our producing capacities will enable us to become a supplier of the Indian States Railways. We shall always be happy to study and answer all inquiries.

Our works manufacture also all stampings, forgings and ironwork used in various industries (mines, marine work, motorcars) and in particular galvanized or nongalvanized pieces used in Railways electrification and in the telegraphic and telephone services.



Drilling holes for Chair Screws with an Armstrong Whitworth Woodborer Size 362 RHW.

Stay Bolt riveting in a Locomotive Fire Box with Armstrong Whitworth Size 406 Riveting Hammers.

patchrepairing panels in sheet metal, when they have become badly rusted. This tool is an ideal tool for fast accurate sawing of light timber, it has a 2½" diameter blade, is extremely powerful, and has a fixed Dead Handle for accurate manoeuvrability, whilst being perfectly safe by the provision of a fixed guard. Armstrong Whitworth also manufacture a complete range of Rotary Air Impact Wrenches which have capabilities for nutsetting up to 1¼" capacity bolt diameter, and can be effectively used with available attachments for screwdriving, tapping, drilling, grinding, wire brushing, and sanding. The Sizes 48 HG and 80 Impact Wrenches are particularly suitable for heavy duty work, such as the removal or running down of nuts with bolt diameter up to 1¼".

The 5V Series Grinders are ideal tools for use in Locomotive works for the grinding of horn cheeks. Their rugged construction and tremendous power make these tools first choice for cup wheel grinding. Their design includes a built in muffler which reduces the sound level to 1/6 of that of similar machines.

Armstrong Whitworth manufacture a complete range of Riveting Hammers which are ideal tools for Locomotive works, for applications such as stay bolt riveting. The light Riveting Hammers sizes 76, 79, 712, 46 and 417, have capacities up to ⅝" Hot Rivets, and the Size 83S Close Quarter Riveting Hammer has a capacity of ¾" Hot Rivets. The range of long stroke Riveting Hammers covers Sizes 43, 53, 83 and 93, which have capacities up to 1¼".

Another tool suitable for Locomotive work is the Armstrong Whitworth Rivet Buster. This tool is manufactured in two Sizes, 6300 and 9300, and can be used with a wide variety of Cutting Chisels and Knockout Punches.

RAIL CONCESSION TO CANCER PATIENTS

Travel concessions by rail announced recently for blind persons and T. B. patients are extended to cancer patients on similar terms with effect from July 1, 1957.

Cancer patients travelling alone for admission to or on discharge from hospital or an institute where cancer patients are treated will be allowed to travel on payment of only one-fourth of the normal fare. When accompanied by an attendant, the patient and the attendant will be allowed to travel on payment of only one single journey fare.

The concession, which applies to the first, second and third classes, will be allowed only on production of the necessary certificate from the incharge of the hospital or institute concerned to the effect that the applicant is a *bona fide* cancer patient travelling for admission to or on discharge from a hospital or institute.

Austrian Federal Railways Electric Locomotive for Light-weight Express Trains

In Austria electric traction on main lines has commenced as early as 1911. Considerable developments took place during the periods of 1923 to 1934 and since 1945 and were supported by the richmess with hydro-power. Therefore electric current for the electrified railways chiefly is being supplied by hydro-power plants.

Changeover from steam to electric traction has reached an important stage now, since A. C. 15000 V/16 2/3 cyc. traction runs through from the swiss border in the west to the czechoslovakian border in the east, a total of 515 Miles. Several other main lines, running from Yogoslavia and Italy in the south via Austria to Germany in the north are also electrified. They are crossing the mountains of the alpes by long banks, employing very long grades of as much as 1 : 30 and 1 : 40 and a considerable number of bridges and tunnels, out of which the so-called Arlbergtunnel, covering 6½ Miles is the longest. There are electrified at the moment in total 1030 line-miles of Austrian Federal Railways, understood 28% of the total mileage, but carrying more than 45% of the total traffic capacity.

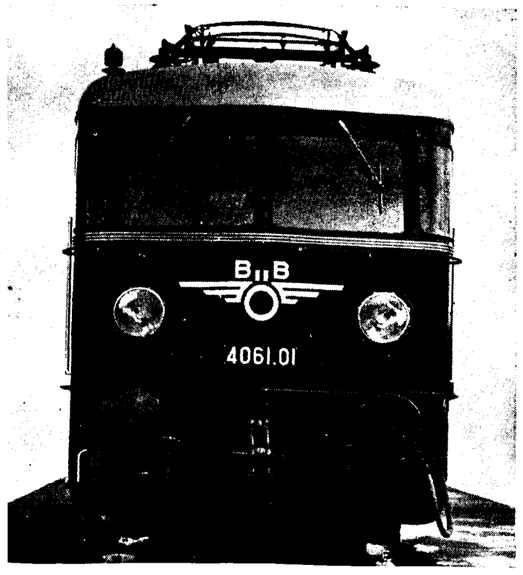
All electric rolling stock to serve on Austrian Federal Railways since the very beginning were manufactured in Austria itself. Now chiefly there are engaged BoBo-type locomotives of 80 t, 3200 HP to 3400 HP and 57—70 mph, CoCo-classes of 110 t, 5400 HP and 70 to 82 mph., shunters with 68 t, 1050 HP and 32 mph. and several classes of straight electric railcars. Full attention is paid also to the problem of 50 cyc. electrification and a BoBo-dual-frequency-locomotive of 2800 HP in use, operating at both 16 2/3 and 50 cyc. by means of straight transformer and AC-motor equipment. In total the electric stock of Austrian Federal Rys. comprises of 380 units.

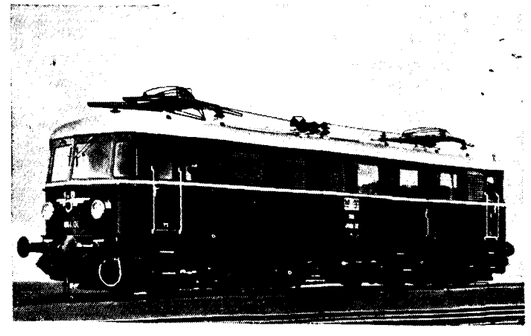
Now, to bridge a gap in traction requirements, the Rys. have brought out a new design of electric locomotive, having a luggage compartment, for hauling express trains formed of light-weight stock. The following progrmme has been adopted for operation scheme :

Hauling of train-tons with a speed of

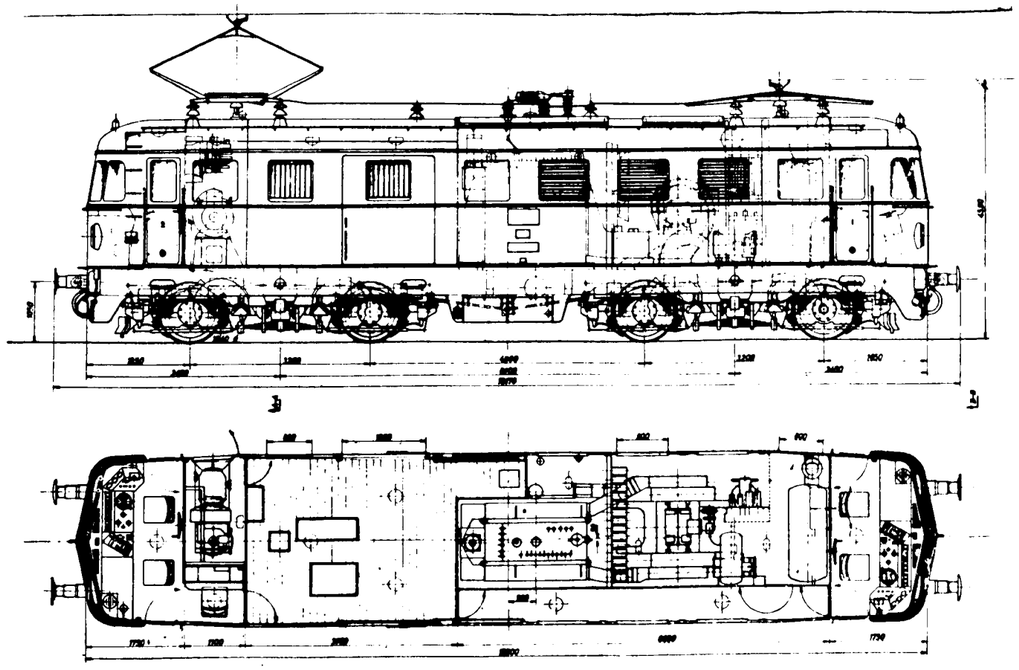
gradient	57 mph.	63 mph.	75 mph.
0	960 t	720 t	350 t
1 : 100	290 t	230 t	120 t
1 : 50	170 t	150 t	

Under consideration of the relatively light-weight (29 t) of the carriages used with the said engine (the carriages are making provision for 80 passengers seating in 2nd class) trains of considerable capacity can be hauled on gradients also with reasonable speeds. As,





Austrian Federal Railways Electric Locomotive. (Class 4061)



in general, European railways use a separate van for luggage in locomotive-hauled trains, the adoption of this type of locomotive dispences with the need for this practice and allows an extra passenger coach to be added without increasing the train-weight.

The mechanical part generally follows conventional design but there are a number of new features. The bogie frames are of welded box sections. The wheelsets are driven by four fully suspended motors, the armature shafts of which are tubular, and the Secheron type flexible drive. Excellent riding qualities at high speed, the location of a reasonably sized luggage compartment, and a satisfactory lookout for the driver were important factors when the mechanical portion was designed. These requirements have been fully met, yet it has been possible to include a luggage compartment of nearly 12 sq. m. and keep the loading almost constant on all axles.

The bogie frames are fabricated by welding, the box section being constructed from folded section channels, made from pressed plates, on the top and flat plates on the bottom side. The centre cross-member carries the traction motor suspension at the side of pivot. The method of housing the bogie pivot, which is connected to the bogie through the medium of a spherical bronze bushing encased in a sliding block is combining simple design with minimum wear.

The axle journals are carried in boxes, having tubular guides. Silentbloc bushings are employed with the guides and in addition to the helical springs friction dampers are provided. The bearings are of SKF self-aligning roller bearing type. The hollow bored axles carry cast steel spoked centres pressed on. Since the Secheron-Lamella axle drive employs a gear on one side only, one centre of each wheelset has an integral face for fitting the straight spur gear wheel.

Traction and brake loads are transmitted from the bogie frame to the bolster via manganese steel liners with very small clearance. Suspension is by under-hanging laminated springs and transmission of weight is effected by means of shackles, hung from rubber shock-absorbers which are connected to the bogie-frame. For smooth riding and to decrease flange wear, the bogies are coupled by a spring-loaded coupling, but as the traction and brake loads are transmitted via the bolster to the underframe, this arrangement is not affected by such loads.

The underframe, of fully welded construction, is composed of tubular members of more or less rectangular shape on either side. Light fabricated cross-members, headstocks and u-shaped girders are welded to the side members, which are also employed for ducting air from the blower fans to the traction motors. A 4 mm. (5/32 in.) plate covers the top surface of the underframe.

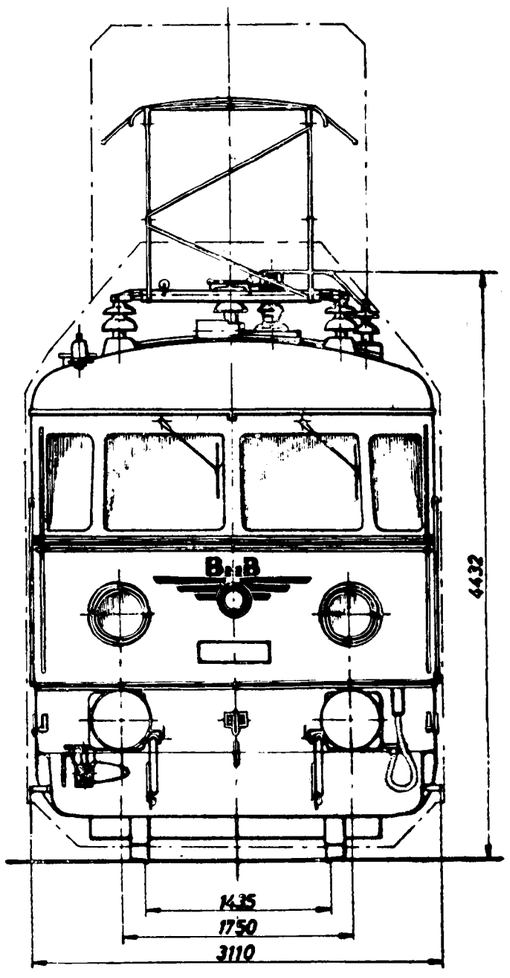
As will be noted from the illustrations, shields are provided. The bogies are protected against snow and dust, and all tool and battery boxes below the side members of the underframe are also furnished with radiussed shields.

The superstructure is also fully welded and is built-up from light-weight rolled angles and cold-bent u-channels, with side walls and roof sheeting of 2 mm. (14 SWG) mild steel plates, tack welded to the structure. Two openings in the roof give access to the electric equipment for lifting. Both the pantographs and all H. T. insulators on the roof are attached to the fixed portion of roof.

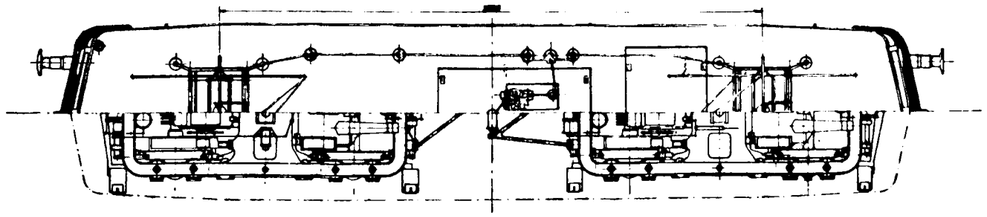
The mechanical braking arrangements are separate for each axle, clasp shoes being used. The arrangement saves much weight compared with that previously used and permits excellent tax access for inspection of traction motors, axle-drives etc. One 10 in. brake cylinder per axle is fitted. Compressed air is supplied by a compressor located in a separate cabinet. Air in the main reservoirs is kept at a primary pressure of 9 atms. An axle-driven brake power adjustor gives a brake efficiency of 73 per cent for speeds of 60 km./hr. or less, and 144 per cent of the engine weight when running at more than 60 km./hr.

Mechanical lubrication is used for the bolster slides, bogie pivot bearings, brakeshaft bushings and bushes of the bogie springloaded connections. Bearings of axles and motor shafts are grease lubricated. Speedometers are provided for both the cabs. Lay-out of equipment inside the cabs to operate the engine is arranged for working of crew in sitting position. A dead-men device is provided also.

So far design of electrical equipment is concerned it has been governed by the two requirements of not exceeding a weight of 28 tons and of using as many parts as possible which are common to other electric locomotives of the Austrian Federal Railways. For the moderate power range required, low-tension control with electro-pneumatic contractors and three preventive coils was found suitable. The voltage increments between the early notches are small, in the interests of adhesion and a high accelerating rate, but are increased on the higher positions of the controller. A unilateral drive has been used in order to minimise the space occupied by the traction motors and permit a low floor level as usual with luggage vans.



Ansicht B-B



Two light-weight, air-operated pantographs of double-pan type are fitted, but only the trailing one is used in service. Current is fed to the transformer through roof mounted isolators and a air-blast circuit breaker.

The core-type transformer with windings of circular cross section, has ten secondary tappings giving a voltage range from 72V to 480V for the traction motors; also tappings at 800 and 1000V for train heating and a 208V tapping for the auxiliaries. The preventive coils are housed inside the transformer. Cooling oil is circulated by a pump and passes through radiator tubes which are forced-ventilated.

The traction motors have a 1-hr. rating of 550 h. p. at 1250 A. Shunts consisting of an inductive and a non-inductive resistance in parallel are connected across the intrepoles to improve commutation. Class B insulation is employed for the armature and the field windings. To accommodate the Secheron leaf-spring drive the armature of each traction motor is shrunk on to a hollow shaft running in roller bearings. A torsion shaft passes through the armature shaft, to which it is coupled at one end by one element of the spring drive. The second spring element couples the other end of the torsion shaft to the pinion in the gear case, which meshes with a gearwheel bolted to the wheel centre. The gearcase is axlehung at one end and is supported at the other end from the bogie frame by a linkage.

The operation of the 24V c. c. electropneumatic control contactors is supervised by a differential relay system which prevents incorrect connections from being established. Nineteen steps of voltage control are provided, of which the first two are used at starting only. Other protective relays comprise two in the high-voltage circuit, a no-current relay, and a heating relay. Instruments include ammeters, traction motor power consumption meter and a battery voltmeter. Lamp signals monitor the operation of the equipment when starting and confirming functioning of the blower fans and of transformer oil pump. Audible warning is given of before the dead mens device comes into action.

The initial order was placed with Wiener Lokomotivfabrik A. G. for design and manufacture of mechanical part and ELIN A. G. for design and manufacture of electric portion for twelve locomotives. They are now hauling light-weight trains over fairly long distances. They are shedded at Salzburg and undertake express service to Vienna (200 Miles). On some occasions they have easily hauled nine such coaches within the scheduled time in lieu of the expected six. The temperatures of transformer and traction motors on such occasions has been far below the calculated figures. A contract for 13 more of the class is being considered and is expected to be signed at an early date.

THE MAIN PARTICULARS

Horse-power at 1-hr. rating	2200 HP.
Equivalent speed	54 mph.
Horse-power at continuous rating	1950 HP.
Equivalent speed	60 mph.
Tractive effort when starting	12,0 t
Tractive effort at 1-hr. rating	6,5 t
Tractive effort at continuous rating	5,2 t
Wheel diameter	1040 mm. (3′—5″)
Weight of mech. part	39,5 t
Weight of electr. equipment	27,5 t
Capacity of luggage compartment	3,0 t
Service weight	70,0 t
Max. permissible speed in service	125 km./hr. (80 mph.)

Are Railroads getting the most out of their Materials Handling Equipment?

By L. A. DePolis,
General Sales Manager, Industrial Truck Division, Clark Equipment Company.

GETTING the highest efficiency possible out of your mechanized materials handling equipment is basically a matter of good management. What are the major points to be considered in reaching this goal? It isn't difficult to enumerate them:

1. Select the right equipment for the job.
2. Use the equipment properly. Don't ask it to do too much (or too little).
3. Make use of special attachments and other devices which will increase the usefulness of the equipment.
4. Insist on proper maintenance and service of handling equipment.
5. Know when the "point of no return" is reached. Replace old machines for new before heavy maintenance costs pile up.

SELECTING PROPER EQUIPMENT IS FIRST STEP

"Variety" is a one-word description of railroads handling equipment needs. Belt conveyors are necessary for receiving, classifying and manifesting freight as it arrives. Pallets are necessary for temporary storage of freight in holding areas. Pallet racks are necessary to assure best space utilization. Fork trucks are needed for pallet handling in freight terminals and in and out of freight cars. Trailers are needed to be used

81–1005—Series 81 Ross Carrier transports boxed-load of trash and rubbish to the dump at the main shops and general stores division of the Milwaukee R.R. Division of the Chicago, St. Paul, Milwaukee and Pacific R.R. in Milwaukee, Wisconsin.

with tractors or fork trucks for horizontal movement. Dollies and rollers may be needed for handling heavy machinery. Hand pallet and powered pallet trucks are needed for use inside freight cars.

Of all these the fork-lift truck is the most common piece of equipment used by railroads. Its mobility, liftability and ease of operation make it an essential machine for the variety of handling chores found at freight terminals. It is n't necessary here to go into the fine points of fork truck selection—capacity, width, upright heights, and so forth—since these requirements differ considerably from one installation to another. It is desirable, however, to mention two points which railroads may not be giving adequate consideration—the types of fork truck power available, and the use of special devices and attachments.

FOUR POWER TYPES AVAILABLE

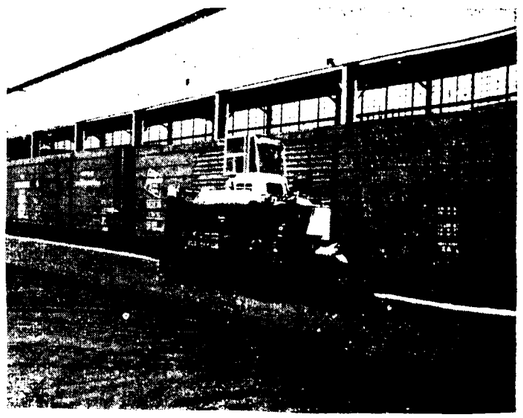
Most fork truck manufacturers offer four types of power—gas, electric, diesel and liquified petroleum gas (LP-gas). Again, gas power needs no elaboration here; it is by far the most widely used, and its advantages are well understood.

Other types of fork truck power, however, may be well suited to certain handling operations. If fuel cost was the only factor involved, all fork trucks would probably be electric, for electric power is the cheapest available. The low-cost operation and longer life span of electric fork trucks usually off-set their higher initial cost.

Of equal importance, the operating characteristics of electrics offer unique advantages; they are quiet, clean, fume-free, and operate efficiently under extreme conditions of heat or cold. This latter feature could be of significance at terminals located in rigorous climates.

A variation of electric power is the "Ready-Power" unit. Ready-power is a gasoline or diesel engine powered direct-current generator adaptable to electric fork trucks. The unit is a completely self-contained packaged assembly, fully automatic after a push-button start, and is used instead of battery power where necessary. The motor generator unit is a source of ready power at all times, eliminating necessity of spare batteries, chargers and related accessories.

Where can electric fork trucks be used advantageously? Practice has shown that gas-power is more efficient for long-haul runs—carrying pallet loads from terminal storage to cars positioned several hundred yards away, for example. But not all operations are long-run. In short-haul moving of palletized freight inside the terminal or in loading trailers parked next to the terminal the economical operation of electrics pays off. An important point to remember is that electrics,



81-1006—Series 81 Ross Carrier transports bolster-load of steel pilings at the main shops and general stores division of the Milwaukee R. R. Division of the Chicago, St. Paul, Milwaukee and Pacific R. R. in Milwaukee, Wisconsin.

because of their fewer moving parts, require less maintenance than gas-powered trucks.

DIESEL POWER IS CHEAP

The principal argument for diesel power is its safety and low cost; although not as cheap as electric power, diesel fuel is less expensive than gasoline. And like gas-power, diesel is most effective for long outside runs.

THE NEWEST POWER TYPE—LP GAS

The newest development in fork truck power is liquified petroleum gas, or as it is commonly known, LP-Gas. In comparison to gasoline, LP-Gas has the advantages of lower fuel cost, less maintenance and longer engine life, and it does not produce harmful fumes. Originally designed for operation in areas where gas fumes would be undesirable, the economies of LP-Gas power have made it increasingly popular for many installations which normally would use gasoline.

In many instances where gasoline power is not desired, the choice lies between LP-Gas power and electric power. When this situation arises an important point to consider is that LP-Gas trucks have a greater degree of flexibility than electrics. Battery-operated electrics are more or less restricted to areas which have battery-charging stations, while LP-Gas trucks can be moved at will.

ECL-1544—Elec-Carloader removes anchor chain links from a trailer and deposits them on a platform truck for delivery to a box-car at Pennsylvania R.R. Butler Street Station in Philadelphia, Pa.

LP-Gas powered fork truck (and electrics), because of their fumeless operation, are especially suited for work around people in closed areas—in terminals or at luggage pick-up points, for example.

To summarize—it is probable, and properly so, that gas-powered fork trucks will remain as the backbone of freight handling equipment. Yet there are specific advantages in other types of fork truck power, and there are certain areas of materials handling in which these types can be advantageously employed. Determining the most efficient application is one step toward a more effective handling program.

AUTOMATIC SHIFT OR MANUAL SHIFT

A second point railroads may overlook is the desirability of specifying clutchless automatic drives for fork trucks. Most fork truck manufacturers offer some variation of automatic drive. Clark Equipment Company's Hydratork Drive, as an example, utilizes the principle of torque conversion.

Hydratork consists of two basic elements: a torque converter and a new type of fork truck transmission which eliminates the need for manual or automatic gear shifting. Power from the motor is automatically multiplied to meet changing power requirements—initial acceleration of a heavy load from a full stop, for instance, or for climbing grades.

Automatic drive offers several important advantages:

—Easy operation. This is important where untrained drivers must be used, or where many different drivers use the same machine;

—Lower maintenance costs. Elimination of clutch wear-and-tear saves considerably on service bills;

—Smooth acceleration prevents load damage due to jerky starts, and reduces possibility of damage from abrupt acceleration while loading freight;

—Greater controlled power for unusually heavy jobs.

Approximately the same advantages apply to fluid couplings used on towing tractors. This feature, available on some models, is standard equipment on Clark tractors. Use of a fluid coupling is especially advantageous when breaking away a heavy load from

standstill since it insures smooth application of full drawbar pull. The fluid coupling prevents loss of torque from the engine, thus permitting full engine power to be applied to the work. When the initial pull is completed and the load is in motion, drawbar pull drops to about half of the starting effort, permitting the fluid coupling to operate at a low temperature. With a fluid coupling the clutch is disengaged only when entering or changing gears.

The advantages of both automatic drive for fork trucks and fluid couplings for tractors should be considered when planning or replanning handling procedures. In most instances economies can be gained through their utilization.

CAN FORK TRUCK ATTACHMENTS BE EFFECTIVELY UTILIZED?

Fork trucks are not only "fork" trucks. The list of attachments which can be substituted for forks is indeed a lengthy one. Clark alone manufactures more than 90 different handling devices. When unpalletized handling is desirable or necessary, special attachments can often be utilized. Several examples will illustrate this point:

—Machinery or other heavy, bulky items can be handled with a crane attachment quickly substituted for forks;

—Tires, wheels, round castings and items of similar shape can be carried and loaded with a ram attachment;

—Large cartons and bales are easily handled with any one of several clamp attachments;

—Use of paper pallets, with a Pul-Pac attachment for handling, can save an appreciable amount of valuable cargo space.

Don't forget that fork trucks need not be restricted to handling duties. With such attachments as sweepers or snow plows, they become utility trucks performing "extra" functions at little extra cost.

Consideration of fork truck attachments to increase machine utility is another step toward efficient utilization of handling equipment.

THOROUGH, CONTINUING MAINTENANCE IS ESSENTIAL

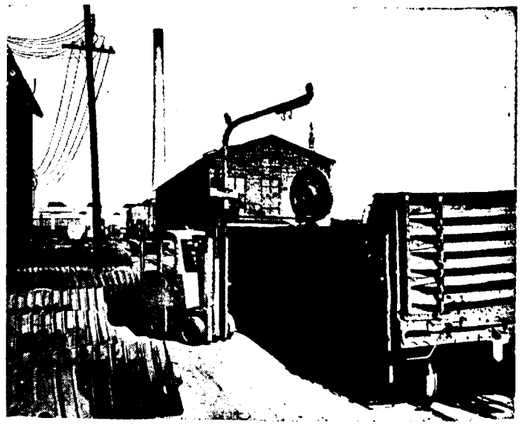
Above all else, the one activity which will increase the effectiveness of your materials handling fleet is the establishment of a thorough, consistent preventive maintenance program. The importance of this cannot be overstressed. Too frequently no consideration is given to preventive maintenance and the cause of machine failures. It is too common a practice to operate a vehicle until it breaks down and requires a major repair. If a little foresight had been used, a major repair would not have been necessary.

A rigid preventive maintenance program is a major step in securing from your materials handling equipment all of the service which was built into it. To paraphrase—an ounce of preventive maintenance is worth many pounds of major overhaul cure. In order to maintain handling operations at the highest efficiency and prolong the life of each vehicle, it is compulsory that preventive maintenance be performed regularly and systematically. This work should be done by qualified mechanics under competent supervision. A complete record of all service done should be maintained, as only through such records can a proper check be kept.

The time and effort required to maintain a preventive maintenance program is mandatory to reduce to a minimum the time lost while a vehicle is in a repair shop.

DRIVER TRAINING REDUCES MAINTENANCE

Since a major cause of equipment breakdown is careless operation, a logical supplement to sound



UT-1305—The Chicago, Rock Island and Pacific Railroad solved their wheel handling problem in the Chicago Shops by designing and building a special crane attachment for their Clark fork-lift truck, a gas-powered Utilitruc. The attachment is used to load and unload single and double wheels, to place them in storage or to take them from storage.

maintenance is an operator training program. Such a program is necessary for freight handlers on at least two counts:

(1) Rapid turnover of fork truck drivers and other equipment operators brings a more-or-less constant influx of inexperienced, untrained labor;

(2) Round-the-clock operation means that each machine is subjected to the varying driving habits of several operators.

Admittedly, these same reasons make it difficult to implement a thoroughly comprehensive training program, yet adequate training can be obtained with some simple, inexpensive techniques. Fork truck manufacturers will gladly furnish driver manuals, safety suggestions and illustrative material on proper fork truck operation. Educational movies can be obtained free. Equipment suppliers are always available to give talks and lectures, and will even assist in setting up "obstacle courses" on which new drivers can practice.

It is advisable that, like preventive maintenance, driver training programs be continuing. From time to time safety quizzes, driver tests and similar devices can be utilized in "refresher" courses, not only to keep operators alert, but to weed out incompetent operators.

WHEN TO TRADE IN OLD EQUIPMENT?

The procedures and programs discussed so far are designed to increase the utility and prolong the life of your materials handling equipment. But in spite of even the most tenacious adherence to these suggestions, the rugged daily wear-and-tear incurred by your machines eventually will raise maintenance and repair bills to the point where it becomes advisable to replace the machine. When is this point reached?

Speaking generally, a gas-powered fork truck will perform efficiently under normally heavy conditions for a period of five to seven years. Electric-powered trucks will last from seven to nine years. It must be understood however, that these figures represent a general average, and that wide deviations from this "normal expectancy" are common. Many electric trucks, for example, are still performing capably after 15 years of hard service.

It is not the age but the maintenance record and general condition of a fork truck—or any other piece of handling equipment—that determines its further

YL-4-1425—Two Clark Yardlift-40 unload plywood to a position where one may handle it from box car at Coutu Lumber Co., West Warick, Rhode Island.

usefulness. And these factors will always vary with individual trucks. As a general rule-of-thumb, however, the following pattern can be established:

Sometime between the second and fourth year of operation, a gas-powered fork truck will need a thorough overhaul. Two or three years later, a second overhaul will be required. It is at this point that an analysis should be made of the two factors cited above to determine the advisability of replacement. If the general condition of the machine is poor, and past maintenance records indicate that future repair bills will be high, then the machine should be replaced. If the opposite is true, then the expense of a second overhaul will be justified. Third overhauls are seldom advisable.

When a decision has been made to replace a machine, a thought should be given to the practicality of keeping the old machine as a "spare" rather than trading it in for a few hundred dollars. Semi-retired fork trucks need little or no maintenance, yet can be very useful for handling odd jobs, as extra equipment during peak periods, or as substitutes for machines tied up in the maintenance shop. Whether or not having a spare truck available for such emergencies is worth the sacrifice of a trade-in allowance will depend on the nature of the operation.

WHAT WILL TOMORROW BRING?

Obsolescence is a word well understood in the railroad industry. The most up-to-date equipment may

(Continued on page 64)

New achievement of Hungarian Locomotive Manufacturing

12 YEARS after the second World-War the MAVAG Locomotive and Machine Factory being—with its past of 85 years of locomotive manufacturing—one of the most significant factors of the Hungarian Heavy Industry, reached a point signalling a further milestone, by manufacturing Steam Locomotives of YL class for the Indian Railways. The position is namely, that out of the 40 YL class Steam Locomotives ordered by the I. R. the Factory in manufacturing the 10th Locomotive produced the 2000th steam locomotive made since 1945, as a result of high rate production increase after the second World-War.

Two thousand.....impressive even as a number, especially when we consider the locomotive manufacturing pace right before the war. Thus, at this occasion it would not be uninteresting to have a short reminiscence on the results of the Hungarian locomotive manufacturing which took its start in the year of 1871, especially on the gigantic development achieved after the second World-War achieved in a new social system, while building socialism, by the collective of the MAVAG Locomotive and Machine Factory.

While the Hungarian Locomotive Manufacturing was based at its start on satisfying inland requirements only, the development of the Factory and production soon made it possible to accept orders from abroad besides satisfying domestic necessities. Thus, even in the past, MAVAG locomotives were rolling over the borders proving the abilities of Hungarian Heavy Industry and increasing its good reputation. Still, Hungarian steam locomotives were not shipped overseas before 1945. The MAVAG Locomotive and Machine Factory besides satisfying the need of the MAV (Hungarian Railways) is producing mostly for export.

The dynamic development of Hungarian Locomotive Manufacturing is proved by the fact that in 1896, at the Millenary Exhibition in Budapest the Factory was able to introduce its 1000th locomotive. This locomotive with her serial Factory number 1000 was a four cylinder compound engine, with wheel arrangement

(Continued from page 63)

become obsolete almost overnight as new designs and new theories become known. The same thing can happen in the materials handling field, and good management demands that new methods be examined and tried when higher efficiency can be obtained.

Two new materials handling techniques that have potentialities for railroad handling are the use of straddle carriers for fast horizontal movement of goods, and the "Mobilvan" system recently announced by Clark Equipment Company.

Originally designed for carrying lumber, the high-bodied, spidery-looking straddle carrier is now receiving industry-wide recognition as a highly efficient, low-cost means of transporting materials horizontally. With one man as operator, the carrier can load itself in five seconds, unload in three seconds, carry a payload of 50,000 lbs. and almost any length, and travel over the road at speeds up to 56 miles per hour.

These performance characteristics can be utilized in railroad handling at several points. As a substitute for tractor-trains, a carrier can pick up palletized freight in terminal storage and in a few moments deliver it alongside freight cars or trailers for loading. The carrier can be used to transfer freight (or maintenance supplies, parts and other materials) from one storage area to another—moving in a few minutes from one end to the other of even the largest Terminal.

MOBILVAN

The Clark Mobilvan System is based on the use of a lightweight van measuring 17′×8′×8′ and having a capacity of 20,000 lbs. Automatic locking devices enable it to be fastened securely to the bed of a railroad flatcar or the body of a flatbed highway truck. The van is moved by fork truck or straddle carrier.

Merchandise is loaded into the van at a shippers' loading dock and the van is transferred to a flatcar or flatbed trailer for transport to its destination. Here the van is transferred to the dock and emptied at the convenience of the receiver. An important advantage of the Mobilvan is that, unlike a conventional highway trailer, it can be used for storage indefinitely.

4—4—0 and 2 m. coupled driving wheels, operated as MAV No. 222.068 and recognised at that time as one of the most rapid train locomotives of the highest output in Europe. The 4000th steam locomotive of the Factory was made in 1917, also for the MAV. This great Mallett system mountain-track locomotive with its (0—6—0) + (0—6—0) wheel arrangement—numerous locomotives of this type are still in service—was at that time the biggest steam locomotive with tender not only of the MAV but of Europe too.

It is worth to mention also the 5000th steam locomotive of the Factory made in 1932. This was a 122 type of the MAVAG, the first machines of which were manufactured in 1924 and which received the serial numbers starting with 424 at the MAV. This steam locomotive with tender, with its 4—8—0 wheel arrangement, a great number of which was and still is manufactured for the MAV, was also delivered recently to the Far East too, with a central buffer and drawbar arrangement.

As far as the type is concerned, though having been developed years ago, as a result of structural improvements and unifications during recent years, is still able to satisfy the most modern requirements and ever increasing production with an economic operation. Thus this locomotive type found a wide-range adaption not only at the MAV but at the railways of many other neighbouring countries too.

The Hungarian Locomotive Industry, since its producing capacity was even in the past surpassing domestic needs, was undertaking significant export deliveries. Besides locomotives it was shipping parts too for the neighbouring countries and also overseas. One of its biggest overseas shipment of this kind was also for the Indian Railways between 1928—1939 including 524 different locomotive boilers, numerous cylinders, coach running gears and other railway parts. During the deliveries of 11 years the customer was fully satisfied with the MAVAG productions and with this successful shipment the Factory reached a position among the prominent Factories even in worldwide respect. The MAVAG, besides locomotives of its own design, manufactures locomotives according to the drafts or prescriptions of foreign customers, in which case the Factory is willing to undertake designiogs too.

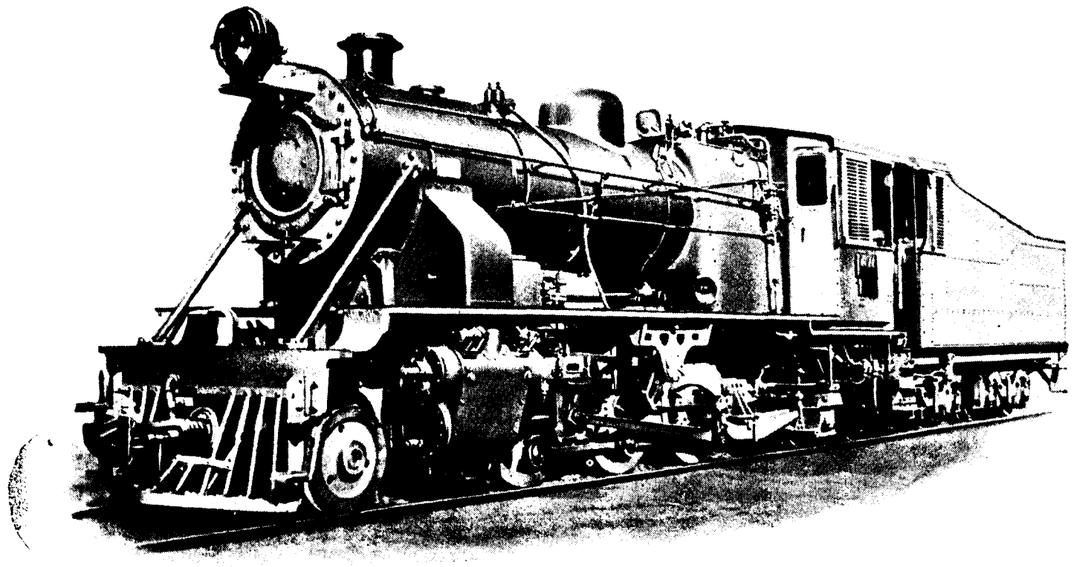
About the end of second World War air attacks caused serious damages as well in the workshops as in the equipment of the factory. Still, after the war having been finished, the Factory started the work immediately and after some months was running to its previous capacity. From then on a new development followed arching steeply upwards. Foreign enquiries for the Factory's products were permanently increasing. This rapid development was greatly promoted by the manufacturing of the wide gauge steam locomotives of the E. R. series with 0—10—0 wheel arrangement, produced from 1945, for the friendly Soviet Union. These locomotives more than 1300, were manufactured according to the technical prescriptions of the Soviet Union. Besides these wide gauge, big steam locomotives, narrow gauge steam locomotives with tender and with 0—8—0 wheel arrangement were also delivered by the Factory for the Soviet Union, always to the full satisfaction of the customer. Thus, in the year of 1950, the 6500th steam locomotive rolled out of the Factory.

To bear witness to the great development of Hungarian steam locomotive production with competitive unit prices, there are besides orders from the MAV, huge orders from the Soviet Union, oil fired locomotives ordered by the Egyptian Republic in 1950, and the recent order for 40 YL class steam locomotives with tender from the Indian Railways.

Especially great advantage rejoices the MAVAG by the fact that the modern test methods could be used in its own laboratories and that the creative activity of experienced engineers of its Designing and Construction Department, arm in arm with the workers, is leading the Hungarian Locomotive Manufacturing in a spirit of constant progress and development towards ever renewing successes. Relying on this co-operation has got the MAVAG from the start on got into the row of leading locomotive factories. About this work displaying great developments I wish to mention only that, that in 1951, for the MAV a new steam locomotive with tender for express trains has also been completed which, with its great dimensions and achievements, is able to compete with all the modern foreign— made steam locomotives of similar type. Steam locomotives for express trains of 4—6—4 wheel arrangement and 120 km/hour speed, are furnished with mechanical stokers and have been built on the basis of wide range railway experiences and modern designing and manufacturing principles.

It has to be mentioned that besides wide, normal and narrow gauge steam locomotives, electric, Diesel electric and Diesel hydraulic locomotives are also featured in the rich production program of the Factory. Thus, a great number of 600 HP Diesel electric locomotives with Bo—Bo wheel arrangement is under construction for the MAV and the Soviet Union and beside these 400 HP Diesel hydraulic locomotives for the Egyptian Republic's Railways and for the Industry are also under construction.

Finally, we have to remember of the 2000th steam locomotive made since 1945, at the MAVAG as mentioned already in our introduction, which was the tenth of the 40 YL class steam locomotives manufactured for the Indian Railways. Although the space available here does not allow to give full account of locomotive manufacturing, we still have to give you a description of the main characteristics of locomotives and some data about their shipping. We also let you have a photograph of the steam locomotive with tender 1 m. gauge, with 2—6—2 wheel arrangement, being under manufacturing at the MAVAG.



MAIN DATA

Locomotive :

Cylinder diameter	12 1/4 in.	(311.16 mm.)
Piston stroke	22 in.	(558.82 mm.)
Coupled wheel diameter	3 ft. 7 in.	(1092.24 mm.)
Boiler pressure	210 lb./square in.	(14.75 kg/cm²)
Heating surface	519.3 square ft.	(48.24 m²)
Grate area	17.75 square ft.	(1.65 m²)
Tractive force based on 85% m. e. p.	13000 lb.	(5850 kg.)
Weight in working order	39 tons	(39.6 t)
Maximum weight on axle	8 tons 2 cwt	(8. 23 t)

Tender :

Weight, fully loaded	33 tons 15 cwt	(34.29 t)
Weight, unloaded	16 tons 4 cwt	(16.46 t)
Water capacity	3000 gallons	(13.62m³)
Coal capacity	4 tons	(4.64 t)
Total length between locomotive and tender buffers	53 ft. 9 1/2 in.	(16.396 mm.)

The locomotives are provided with hydrostatic central lubrication, vacuum brake system and electric light. SKF roller bearings are on both locomotive—and

(*Continued on page 68*)

LOCOPULSOR SHUNTING MACHINE

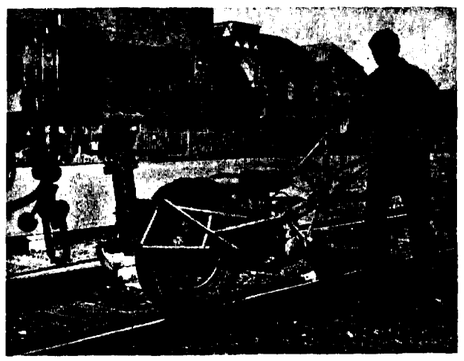
By An Engineering Correspondent

MOST Railway and works engineers will by now be familiar with the device known as the Locopulsor Shunting Machine which is manufactured by E. G. Steele & Co., Ltd., 93, West George Street, Glasgow, C. 2., Scotland, and is used for the shunting of railway wagons in works sidings and elsewhere.

The Locopulsor has found acceptance all over the world and there are now almost 2,000 of these machines in regular daily use in various parts of the world and the manufacturers are constantly on the alert to incorporate any devices which will increase the efficiency of their machine.

The recent development has been the production of a simple device known as the Auto-Pilot which is designed to facilitate the work of the operator in the operation of the machine as the Auto-Pilot automatically maintains the Locopulsor on the rail by guiding the driving wheel.

This device consists of a simple shoe which slips over the rail, as shown in the photograph, and is



practically 100% effective in guiding the machine on the rail.

The Auto-Pilot was actually developed to meet the needs of one of the Railway systems in Europe who had to manoeuvre Electric Locomotives during the course of repairs and it was necessary to construct the device which would allow the Locopulsor to be operated automatically as there was danger to the operator in the live electric rails, but the more universal application of the device became quickly apparent.

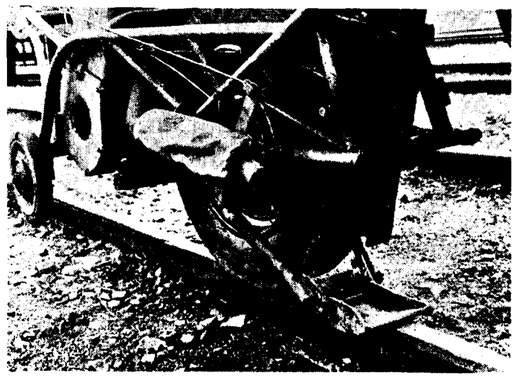
(Continued from page 67)

tender axles. The tender, in contrast with earlier types, is a new construction with four axles and two bogies. The shipment of the locomotives to India takes place from the Yougoslavian port Rijeka. Locomotives and tenders are shipped by the Factory on railway cars with dismounted wheel pairs to the port, where they are mounted before discharging. Thus, on arrival in India they can be put into operation without any particular preparation.

In this short report we intend to point out those newest results which are throwing a sharp light on the developments achieved by the Hungarian Locomotive Production, especially since 1945. Constant development of the Hungarian Locomotive Manufacturing made it possible that the Hungarian Locomotive Industry, besides the locomotives just manufactured and constructed partly for the Hungarian Railways, has considerable export possibilities and obligatory. Thus, the significant export activity of the Hungarian Locomotive Industry i. e. the MAVAG Locomotive and Machine Factory, is one of the most serious factors of the Hungarian Foreign Trade.

The Hungarian MAVAG locomotives become more and more well-known also at the Railway Companies of the overseas countries. The readiness of locomotive manufacturing is cheafly characterized by those locomotives we described above and the production (in small and big series) of which is proving at the same time fundamental fame in world relations. In consequence of the increasing demand of locomotives at home and abroad the Hungarian Locomotive Manufacturing is gaining an ever increasing reputation on foreign markets with its export and provides high esteem not only for the Hungarian Heavy Industry but for the MAVAG too.

We hope that by this short information we succeeded to gain new friends for the Hungarian Locomotive Production and to build up through Foreign Trade new connections also with the Railway Companies of the overseas countries.



The use of this Auto-Pilot is particularly indicated where a wagon has to be moved over a fairly long distance as the amount of effort required by the operator becomes virtually nil beyond walking beside the line of wagons. On the other hand the device is not suitable for short movements or where points and crossings have to be negotiated and when this type of operation is being carried out the auto-pilot shoe is removed from the rail by a simple cable control operated on the handlebars of the Locopulsor. The auto-pilot therefore, does not detract in any way from the manoeuverability of the Locopulsor and contributes appreciably to its universal applicability.

The device has been deliberately kept as simple as possible in order to reduce cost and also to keep the weight as low as practicable and can be fitted easily as an optional extra, even to existing machines.

A compressed-air brake for Diesel or Electric Railcars and Trailers

THE old-established French firm of brake manufacturers FREINS JOURDAIN MONNERET has developed, since 1934, a new air-brake system for railway motor-coaches, railcars and trailers. The chief feature of this brake system is the JMR class R distributing valve (patented S. G. D. G.), on which we can give the following data :

(a) It is *fully automatic* and works when a drop of pressure of 4, 3 lbs. p. s. i. occurs, for any reason, in the train pipe

(b) It is *moderable*, both on application and release, full release being obtained for a pressure of 71 lbs. p. s. i. in the train pipe.

(c) There is no fear of *exhausting* the brake, as the auxiliary reservoir is constantly fed during application.

(d) It is quite *safe*, as it works even for a slow pressure drop.

(e) Pressure in brake cylinders is independent of piston stroke and of possible leaks through piston packings.

(f) Cylinders can be operated under *high pressures*, as the pressure in cylinders can be higher than the pressure in the train pipe.

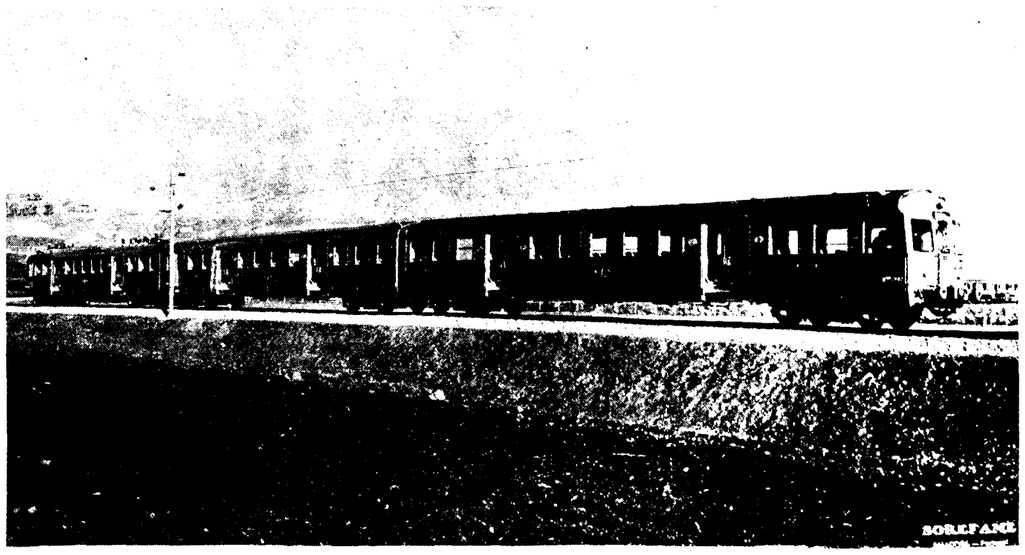
(g) It is *adjustable*. Cylinder pressure can be adjusted between 21.5 and 92 lbs. p. s. i.

(h) It can be fitted with a "dry track-wet track" device. This device is controlled by the driver through an electromagnetic valve and alters the pressure in brake cylinders.

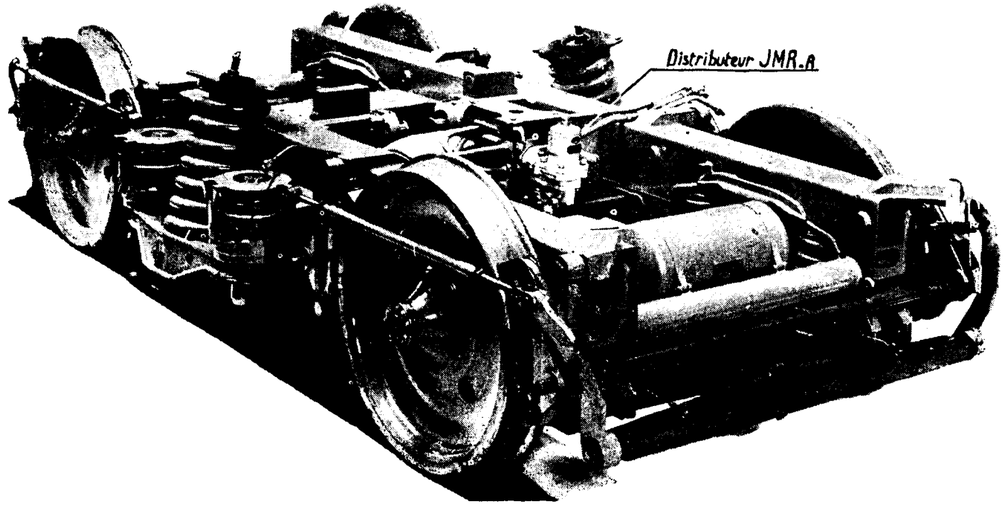
(i) It is *quick-acting*. On the first release, the rapid-acting device in the JMR—R distributing valve takes in a fair amount of air from the train pipe, resulting in a quick pressure drop.

(j) It can be fitted with an "empty-loaded" device which automatically adjusts the pressure in brake cylinders according to the load of vehicles.

FREINS JOURDAIN MONNERET have supplied thousands of these equipments to the French Railways, where they proved quite satisfactory in service.



"SOREFAME" units on the Lisbon-Cintra line Jourdain Monneret JMR-R Brakes.



Boggie equipped with Jourdain Monneret JMR-R Brake.

On the South-eastern district of the Paris suburban ines, on account of the increased traffic on peak hours, wo, three, or even four double units are coupled to orm a 8-car train, on which the JMR—R brake proves uite satisfactory.

The so-called "long-distance units" are also equipped vith JMR—R and the "empty-loaded" device.

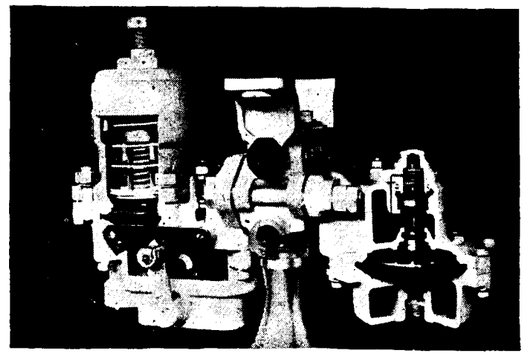
The new "Trans-Europe-Express" fast units have the ame equipment.

Faster and more important units, such as used in Morocco, include seven vehicles (2 motor-coaches and 5 railers—weight : 275 tons length : 500 ft.—max. speed : 7 m. p. h.)

The latter units are fitted with an extra quick-acting alve which brings a still quicker braking action.

FREINS JOURDAIN MONNERET have also lesigned a system of electric control for the brakes patented S. G. D. G.) to obtain instantaneous braking ction from one end of the train to the other, whatever e the number of cars.

Each JMR—R distributing valve is actuated through wo electromagnetic valves (one for application, one for release) which are energized by contacts on the driver's brake valve. The system is quite safe, as, in case of failure of the electric supply, the brake reverts automatically to pneumatic control and retains all the above-mentioned features.



A section of JMR-R Distributing Valve.

The units now in use on the LISBON-CINTRA line (PORTUGAL) and built by Societe SOREFAME, are equipped with this system, which also embodies the "loaded-empty" device.

(Continued on page 72)

Czechoslovak Diesel-Locomotives in the year 1957

By Ing. Ludvik Tejral

THE technical progress achieved by almost all branches of human activity has, until a short time ago, seemed to avoid the driving power applied for the railway traffic which remained an almost exclusive domain of steam as it was at the beginning of railways almost one and a half centuries ago. The area of application of the electric driving power, known for seventy years, remained considerably restricted. But in the last ten years the majority of railway administrations have been, during renewals and extensions of their locomotive stock, gradually abandoning the classical steam locomotive which had to give way to the modern locomotive driven by a Diesel-engine.

The Czechoslovak locomotive-building industry prepared itself for this elementary change which has no parallel in the history of railways. Based on its 30 years of experiences in the production of engine-driven carriages of the most different types, the Czechoslovak locomotive-building industry develops a type series of Diesel-locomotives of various types and dimensions. Until now the following four types have been put into service: A shunting light locomotive, driven by an electric motor, of the CKD type and the T 434.0 series, of an output of 700 HP. A traffic Diesel-electric locomotive for narrow-gauged lines of the CKD type and T 47.0 series, of an output of 350 HP. A CKD locotractor of the BN 150 type in different executions, with hydraulic and mechanic transmissions of the driving power. A CKD Diesel-hydraulic locomotive of the CN 400 type of an output of 400 HP.

The CKD Diesel-electric locomotive of the T 434.0 series is suitable for heavy shunting service in main railway stations, and in industry. In a traffic service this locomotive finds application in the manipulation of freight trains and for passenger trains of a capacity of 200 to 300 seats. The following are the main technical data of this locomotive.

Arrangement of axles	Bo Bo
Total service weight	63 t
Maximum operating speed	70 km./p. h.
Maximum tractive power on the circumference of wheels	14000 kg.
Gauge of wheels	1435 to 1676 mm.
Output of Diesel-engine	700 HP. for 720 n

The welded sheet framework supports bolted covers. Between the covers above the rear undercarriage is located the cab for the engine-driver. The removable type of the covers makes possible an assembly of the machines by means of a crane. The frames of the undercarriages have a box-type welded structure. The axles are fitted in roller bearings. The uneven load on axles during starting is automatically balanced, on one hand, by a mechanical leverage and, on the other hand, electrically, by an automatic shunting of the relieved driving motors. This arrangement makes possible a maximum exploitation of the adhesive weight of the locomotive.

In the cab are two posts for the driver, each of them on the right-hand side of the corresponding driving directions. Both posts are equipped with the driver's

(Continued from page 71)

The JMR—R brake is also fitted on numerous railcars now in service in SPAIN, GREECE, LUXEMBURG, WEST and EQUATORIAL AFRICA, TUNISIA, MADAGASCAR, etc.....

We can mention that the new railcar of the French Railways, with disc brakes, is also equipped with the JMR—R.

Concerning the French Railways, We can add that the famous French class BB and CC electric locos., which hold the world speed record (200 m. p. h.) were braked by FREINS JOURDAIN MONNERET.

FREINS JOURDAIN MONNERET have been brake specialists for the last sixty years. They manufacture all kinds of compressed air and vacuum brakes for rolling stock, steam, electric and Diesel locos., railcars, etc.....

Several thousands of waggons and cars for India, built in Europe, are fitted with automatic vacuum brakes manufactured by this firm.

panel with part of the control devices. The other control devices are located on the front wall in front of the panel. The sitting driver has during driving, all these devices in front of him, so arranged that the most important of them are immediately at hand. The devices in the three switchboards in the front wall of the cab, switch and check both the principal and the auxiliary circuits. The control devices—the controller and the reversing change-over switch—are coupled in both posts to enable the driver to change his post even during driving.

The eight-cylinder Diesel-engine, with cylinders arranged in line, of a special line design, is equipped with a number of protective mechanisms which secure safe operation and prevent damage to the Diesel-engine in the case of an accidental defect of the auxiliary devices. The generator, connected by flanges with the Diesel-engine, is sprung against the frame of the Diesel set. The generator carries an auxiliary installation consisting of an exciter for the generator, a lighting dynamo and a tachodynamo. From the extended end of the generator shaft the ventilator for the driving motors of the rear undercarriage is driven. In the front part of the cover are located water radiators, the ventilator for the driving motors of the front under-carriage and a brake compressor. The space of the rear cover is taken up by a tank for the automatic fuel oil heating, and a Diesel-engine with a compressor. The tank is dimensioned so that the produced steam is sufficient for heating the locomotive and five two-axle passenger-wagons. The engine compressor, the one cylinder of which works as a Diesel-engine and the other one as a double-stage compressor, serves exclusively for the preparation of starting air for the principal Diesel-engine.

The four-pole series-wound driving motors with a paw-type suspension have a separate ventilation. The controlling, lighting and auxiliary circuits are fed with a direct current of a voltage of 48 V from a battery charged by the lighting dynamo.

The locomotives of this type for a long period rendered good services on the lines of the Czechoslovak State Railways. In compliance with world development several prototypes of an improved type of these locomotives, marked T 435.0 series, are under construction. With the same Diesel-engine as well as electric equipment the output was increased from 700 to 750 HP and the weight of the locomotive was reduced. The air-starting system was replaced by the simpler electric starting system, and both the driver's cab and the covers are designed more suitably and, at the same time, have a nicer appearance. The contour of the locomotive was adapted to the profile of carriages for track gauges above 1000 mm.

The CKD Diesel-electric locomotive of the T 47.0 series is intended for track gauges of 750 to 1000 mm. The main technical data of the locomotive are as follows :

Arrangement of axles	BoBo
Service weight	32 t
Maximum tractive power	8000 kg
Gauge	750 to 1000 mm.
Output of Diesel-engine	350 HP for 1250 n

The side walls and the roof are attached to a welded frame-work. The whole forms an all-metal, self-supporting box of the wagon-type, with two driver's posts, a luggage compartment and a machine room. Part of the roof above the machine room is removable. The axles are fitted in roller bearings in the frames of the undercarriages made of welded sheet.

The post contains the driver's panel with all control devices. The engine-driver sits on the right-hand side in the driving direction. Near the left-hand window is located another lever of the controller, and the locomotive brakes making possible a safe control of the locomotive even for shunting.

The space of the machine room, considerably restricted by the width of the drive-through profile, is exploited to the maximum. The essential part of this space is occupied by a set consisting of the Diesel-engine and a generator. The CKD Diesel-engine of the 12 V 170 DR type is a water cooled, electrically started, twelve-cylinder engine. Many engines of this type rendered good services in various stationary sets, and more than a hundred engines of a traffic type also proved their worth in driving Diesel-engine cars of different series.

At the request of the Czechoslovak State Railways (which supplied the data according to which the locomotive was developed) a small luggage compartment with a table for the guard is located between the front post and the machine room. The compartment contains a permanent-heating stove for the hot water heating system which can be, in frosty weather, used also for heating the cooling system of a locomotive which is not is service.

The four-pole series-wound driving motors have separate ventilation. The generator is of a four-pole type with commutator poles.

The CKD locomotive of the T 47.0 series proved themselves fully in operation. The producing plant is working on a series of 40 locomotives of this type for export. Recently a further order from the Czechoslovak State Railways was received.

The CKD light Diesel-locomotive of the BN 150 type is intended, above all, as a replacement of the uneconomic steam locomotives. This locomotive will also do away with emergency shunting, for example, by means of tractors, motor trucks, winches or, on the track, by the locomotive of the manipulation freight train. The profile of the locomotive permits, after adjusting the wheel-pairs, its application on lines of a gauge from 900 mm. upwards. Even the possibility of application of various coupling rods and brake systems according to the specifications of foreign railway administrations is provided for.

The locomotive is driven by an air-cooled, Tatra 301 engine of motor car type, with a mechanical or hydraulical transmission of the driving power. Both types, the BN 150 M mechanical and the BN 150 H hydraulical, or otherwise almost identical. The tests of both the mechanical and the hydraulical prototypes lasted more than a year and were performed in the most different surroundings of industrial plants and railways. The successful result of these tests is proved by orders for more than a hundred locomotives of this type, which reached the makers during the testing period of the prototypes.

The CKD Diesel-hydraulic locomotive of the CN 400 type is intended for shunting in industrial plants and on railways where it can be very well used, for example, for service trains, for shunting on secondary railway junctions, for light freight trains of local lines, etc. An easy control and minimum maintenance are due to simple equipment. The engine is a CKD twelve-cylinder, 12 V 170 DR type, with a V-arrangement of cylinders, which has been used in railway traction for more than a hundred engine carriages of various types and on the T 47.0 locomotives The hydraulic transmission transfers the driving power of the engine through coupling rods on to the axles. The driver's cab located at the rear end of the locomotive is part of the cover. The driver's cab is provided with double controls, one set on each of the side walls. The mentioned types of locomotives have been tested by the makers, CKD Sokolovo, and can be delivered during the next year. Further prototypes, the traffic Diesel-electric locomotive, 1650 HP, and the Diesel-hydraulic locomotive, 400 HP, with propeller shafts and a central cab, will be put into a test service during this year, as well as the above mentioned prototype of a new variant of the Diesel-electric locomotive of 750 HP. Messrs. STROJEXPORT, Praha, Czechoslovakia, sole exporters of rail vehicles, which are made in Czechoslovakia, will gladly give all technical and commercial information about the offered and prepared types of the Czechoslovak Diesel-locomotives.

ALUMINIUM

According to the Chairman of the Yugoslov Foreign Trade Committee, construction of aluminium plant in Yugoslovia with the help of the Soviet Union and East Germany to which we referred earlier, is scheduled to be started next year. Output at this plant reportedly would be about 50,000 tons annually by 1961 and by 1965, output is expected to reach 1,00,000 tons. It may be mentioned that the agreement on the setting up of this aluminium smelter and other plants was signed in August last year.

It is observed from a published report that production of primary aluminium in the United States during the first seven months of this year totalled 966,285 short tons compared with 1,011,928 tons in the corresponding period last year.

In India, there is reported little fresh for aluminium from the market standpoint. Prices remained unchanged and demand ruled good, particularly in sheets.

*** *** ***

PURCHASE OF RAILS FOR INDIAN RAILWAYS

The Union Railway Minister Mr. Jagjivan Ram is reported to have announced in the Parliament that the purchase mission recently sent abroad by the Railway Ministry for procurement of iron and steel has been successful to a great extent and " we are in a position to say that we will be able to implement the Second Five-Year Plan in respect of railway development ". He added that orders have been placed for the purchase of 284,000 tons of rails as against the requirement of 291,000 tons upto the end of 1959.

Rolling Stock—An Industry of long standing in Rumania

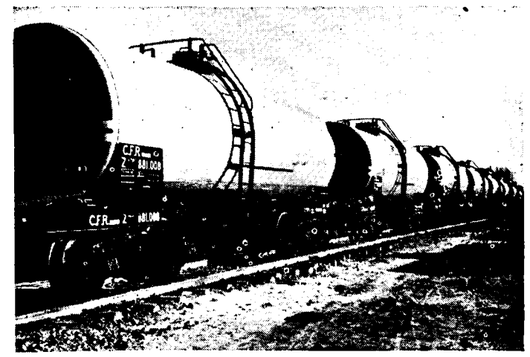
THE setting up of a rolling stock industry in Rumania dates back to the year 1891 when the first freight car factory provided with a foundry of its own was put into operation.

As a result of our country's economic development, shortly after World War II all the requirements of the domestic railway network were being covered and a margin left for export purposes.

Today Rumania's export lists include various mass produced items in this sector whose excellent behaviour in service has been thoroughly checked Among these products are steam and electric locomotives, passenger cars and common and special purpose freight cars.

The Rumanian rolling stock works, which today turn out improved types of locomotives and carriages, have been equipped with high efficiency machines of home manufacture or imported, enabling them to carry out the entire manufacturing process.

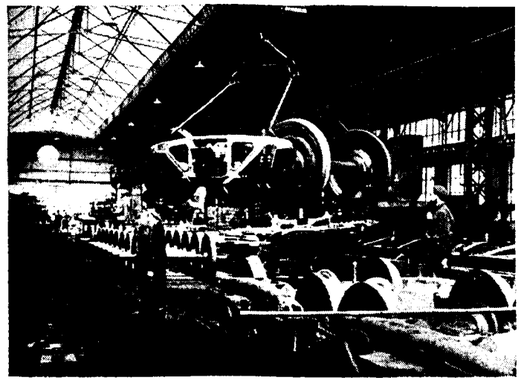
At the "Gh. Dimitrov" works of Arad, for instance, a new plant has been put into service for case-hardened casting, centrifugal casting and casting in bakelite crust. Machined parts are made by means of the latest types of cam milling machines or copying lathes and forged parts through drop forging. The manufacture of small size parts has been fully automotized and their hardening mechanized. Automatic welding has been adopted in the manufacture of passenger cars. Plastics are being used to a much larger extent to replace metals while agglomerated wooden parts have superseded timber and plywood.



50 m Tank-Car.

Lately the quality of the railway wagons has been improved through separate manufacture of sub-assemblies and the drying of paint by means of infra-red rays.

The same works have moreover been provided with a huge assembly shop—the biggest in this part of Europe —where 100 wagons can be assembled simultaneously. Another recent workshop is the boggie assembly shop fitted out with portal milling machines everyone of which is driven by 14 electrically operated motors.

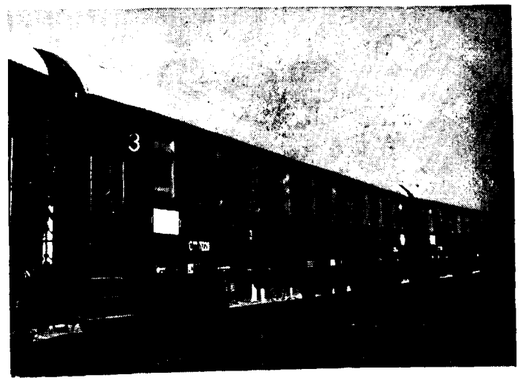


Assembly Shop at the "Gh. Dimitrov" Works in Arad.

Increased capacities have raised the output of these rolling stock works by 300 per cent in 1956 as against 1949, and the 1957 plan provides for a 400 per cent increase against 1949, this amounting to 80 per cent of the entire Rumanian production of rolling stock.

NEW TYPES OF LOCOMOTIVES AND WAGONS TURNED OUT IN THE RUMANIAN PEOPLE'S REPUBLIC

The number of types of locomotives and wagons of modern design turned out in Rumania is constantly increasing. In the category of high speed passenger train locomotives mention should be made of types *1 D2* and *2*CO. Both types are superheated steam locomotives with twin cylinders and tender. Their top speed is 110 and 100 km/h respectively. At an average speed of



Passenger Car.

60 km/h on a horizontal line they will pull trains of 1810 and 1230 tons respectively. In addition to the standard outfit for burning coal, facilities for burning fuel oil can also be provided.

Types *1ED* and *OEC* are two heavy locomotives of great power designed for goods traffic. These types are also superheated steam locomotives with twin cylinders and will pull 2600 and 3600 tons respectively. They have moreover a fairly high top speed for freight trains: 70—80 km/h. The equipment of these locomotives is in keeping with modern requirements and includes compressed air brakes, turbine for electric lighting, central greasing, train heating installation, closed driver cabin, etc.

Among the other items produced are also 50 ton covered freight trucks, tank cars for special fuel, 50 and 80 ton platform cars, 50 ton covered trucks for grain, 50 ton self-discharging trucks, 50 ton tank cars for petroleum products, 15 ton cooling cars, tipping cars, etc.

The Second Class Passenger Car with 9 compartments consists of a light metallic carcass which, together with the frame, forms a rigid tubular structure highly resistant and secure even in case of accidents. The bogies are of the Gorlitz type with soft suspension affording smooth and pleasant running. The brakes are of the automatic type combined with hand brakes. Two W. C. cabins are provided, one at each end of the car. The benches in the compartments are semi-upholstered with synthetic leather. The active lighting is by the Dick system; a wheel-driven generator and a voltage controller provide a uniform and bright light in the car. High quality timber—plywood and tegofilm—ensures durability and a pleasant aspect.

The Open Freight Truck on 4 Axles for 50 t effective load is a truck with high side walls on cast steel or pressed steel band bogies.

The fitted axle and springs are designed for a pressure of 20 tons per axle. The frame is completely welded. The design of the main beams is approximately that of a beam of uniform strength and allows the loads to be concentrated in the middle of the car, which thus becomes suitable for the transport of heavy and bulky machines.

The buffers, traction bearings and in general all the features of the truck are in keeping with the prescriptions of the International Railway Union. The automatic brake is of the Hildebrand-Knorr type; the hand brake is operated from a small platform located over the buffers.

The box of the truck is made of metal posts with wooden or full sheet metal side walls. The latter are removable, thus allowing the car to be changed into a platform. The stanchions, made of shaped sheet metal are also removable.

The 50 t Covered Freight Truck on 4 Axles has a completely welded frame. The H. K. brake is combined with a hand brake operated from a cabin. A passing through pipe makes it possible to couple these trucks to passenger cars. The box of this type of truck consists of metal posts and wooden side walls. The box has two sliding doors fitted with special fittings for complete or partial closing of the truck.

50 t Open Freight Truck on 4 Axles

The eight ventilation shutters are provided with grates and collapsible support bars.

The truck may also serve to transport livestock. To this end the side walls are provided with rings for straps and with sliding partitions. For the transport of grain traps in the floor of the truck make semi-automatic unloading possible, while for the transport of passengers an opening for a stove chimney is provided in the roof and special supports for benches in the side walls. On the outside there is a ladder with handles.

All the above facilities are also part of the equipment of the 28 ton covered freight truck on two axles.

The 50 t Open Self-Discharging Freight Truck is of completely welded metal construction and will hold 70 m³ of loose goods (coal, coke, ores, gravel, etc.) To this end the floor can be raised to form a saddle. When the lateral traps are opened the load is discharged without man's intervention. On the return journey the floor can be restored to a horizontal position and the truck used for the transport of machines, logs, etc. like any open truck.

The 50 m³ Tank Car is of welded construction with frame and is designed for the transport of petroleum products. The tank proper has a diameter of 2.6 m, is 9.6 m long and is mounted directly on type Diamond bogies. The tank car has automatic compressed air brakes combined with hand brakes. A steam heating device is provided for lessening the viscosity of products when unloaded.

ENQUIRIES FOR ROLLING STOCK ABROAD

Today wagons of all types are becoming an ever more important Rumanian export item: 35 per cent of the wagon output is sent abroad. At the "Gh. Dimitrov" works of Arad alone the orders received from abroad have increased by 573 per cent in 1957 as against 1950, and the orders received in 1957 by the "23 August" works will represent an increase of 400 per cent as compared with 1950.

The manufacture of new types such as self-discharging trucks, full metal trucks, trucks on bogies, mail vans, railway trailers, motor coaches, etc. and the development of the rolling stock industry will make it possible to fill to an ever greater extent the substantial orders received from abroad.

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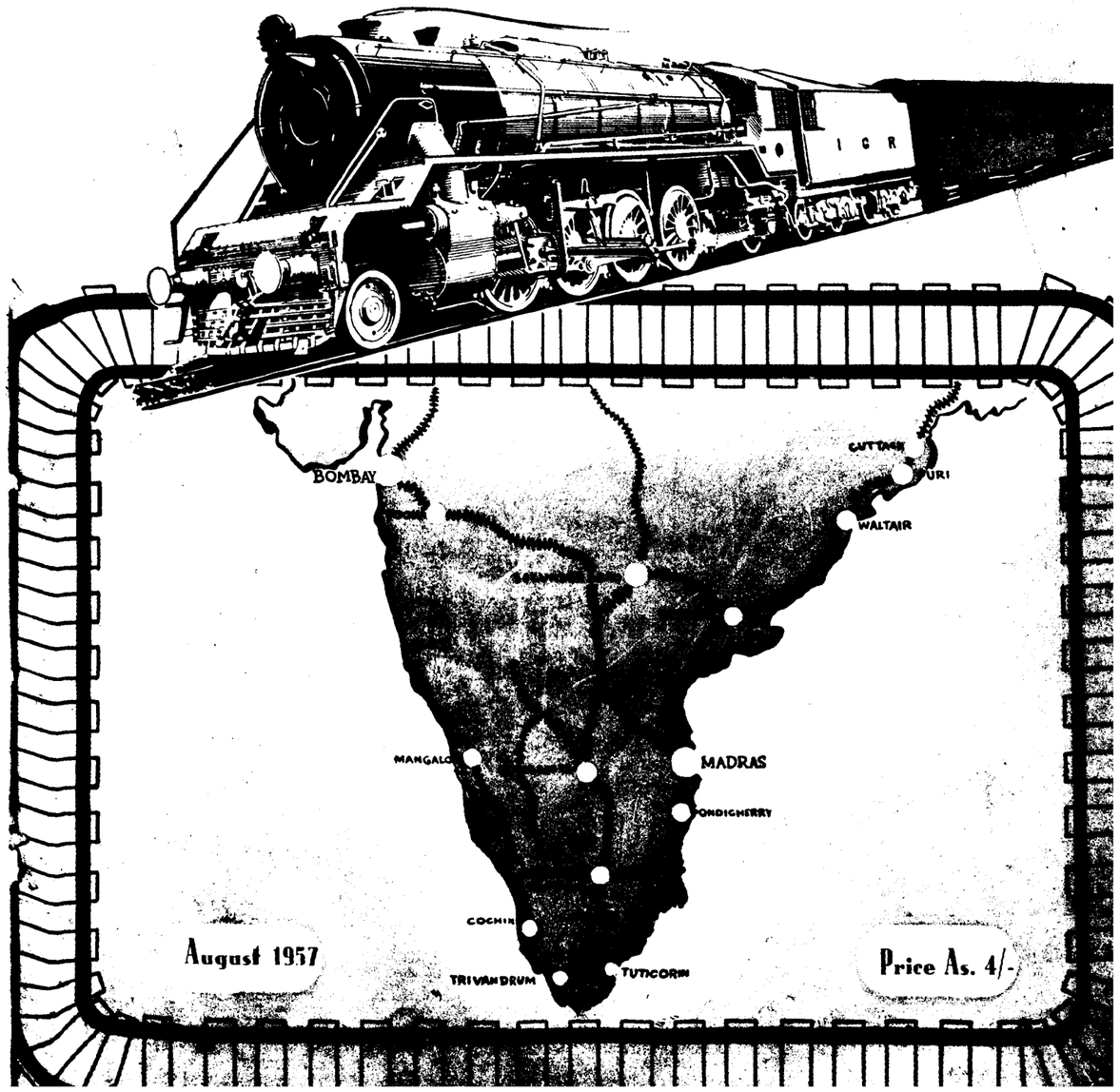


August 1957

Price As. 4/-

HOW TO RESERVE ACCOMMODATION

Unless you reserve your berth (I Class) or seats (II and IIIrd Class long distance) in advance, you may not be sure of getting accommodation on the train you wish to travel by.

Application should be made to the Station Master of your starting station at least 3 days in advance specifying the date and train by which you intend travelling and the tickets must be bought in advance. The reservation fee leviable is 8 Annas per seat or berth.

Reservation by I and II Class from intermediate stations by Express trains can also be made similarly, but reservation ticket can be issued only after getting an advice from the Reservation Centre that the reservation has been made.

Tickets will be issued only if accommodation is available.

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

Reservation fee is not refundable.

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

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

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

(Inserted in the interests of Travelling Public.)

Power Cars for Indian Railways
All Air-Conditioned Trains

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

THE introduction of all air-conditioned trains on Indian Railways is a big step forward in travel comfort They give experience that enriches life making the travelling public participate in a sort of railway rhapsody.

This is the first application in India of air-conditioning to a complete train including third class and restaurant cars and is a symbol of the progressive spirit of Indian Railways.

Each train is made up of two luggage, brake and Power Cars (one at either end), one first class sleeping car, one restaurant car and three third class chair cars making a total of seven coaches per rake.

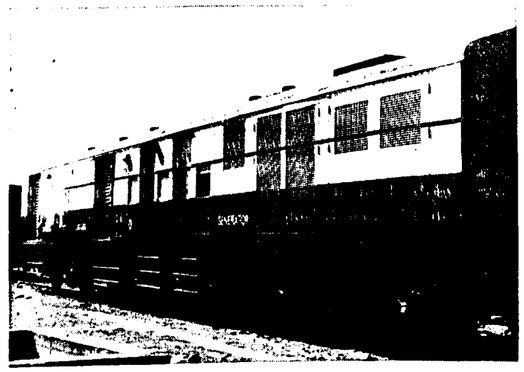
The air-conditioning of an entire train requires large amounts of electric power and the principle of 'end-on' generation has been applied in this case. The arrangement supplies 400 volts, 50 cycles, 3 phase A. C. supply for the air-conditioning equipment and 110 volts, 50 cycles A. C. Supply for use in compartments for lights, fans, kitchen appliances, etc.

The generation and distribution of this electric power calls for highly specialised knowledge and new methods and equipments. The main equipment is housed in the luggage, brake and power car, six of which have already been constructed and two are still under construction in the Eastern Railway Workshops at Kanchrapara. The cars built are of entirely new design and are the first of their kinds ever constructed in Indian Railway Workshops.

The equipment has been supplied by J. Stone & Co., who were also responsible for the installation of the air-conditioning plant in all the coaches of these trains. The Power cars are, however, not air-conditioned.

The principal dimensions of the car is as follows:

Length over buffers	72 ft. 2 in.
Length over headstocks	68 ft.
Width over bodyside panels	10 ft. 8 in.
Gauge	5 ft. 6 in.
Tare weight with fuel oil	56 Tons.



Exterior view of the power car.

LAY OUT

The lay out incorporates two luggage compartments at one end with the fuel tank chamber in between and the power compartment on the other end to house the generating equipments, alternators, switch gears, etc. This end is vestibuled.

Location of the fuel tanks within a separate compartment between the luggage compartments was arranged to give the most even weight distribution on bogie loading and also to obviate any fire risk from hot pit ashes. As a further safeguard all wooden members underneath the coach that are exposed around this compartment have been covered up with aluminium sheets and painted with fire resisting paint.

In the centre of the vehicle is located the guard's compartment and a small compartment for the staff who will attend on the generating equipments. Attached to the staff compartment is also a lavatory for use of the staff.

A 2 in. partition across the power compartment divides it into two sections, one housing the engine units, radiators and auxiliary fuel tanks, while the other containing the alternators and electric switchgears. This arrangement enables filtered air to be drawn into the electrical section of the compartments by means of the alternator fans and thus keeps that portion of the Power Compartment clean. Self-closing intercommunication door with transparent glass panels has been provided on the partition between the engine and alternator compartments. A chequered plate flooring has been fitted inside the power compartment centrally between the engines and also the alternators to provide the gangway leading to the vestibule.

The staff compartment has a 3-tier arrangements of berth, a table and a shelf. The lavatory has all fittings prescribed in the amenity standards for lower class coaches. The guard's compartment has similarly all accessories as are usually in vogue.

The bottom edges of the windows are located 2 ft. 6 in. from floor height and the window opening is 22 in. high. All window openings are 2 ft. wide. The shutters in these windows are the standard 'lift-to-open' type.

The Power compartment is fitted with body side aluminium louvred doors covered by wire mesh to allow a free exchange of air by normal ventilation. The sizes of these doors are comparatively larger to facilitate removal of the generating sets for servicing and repair. A work bench is placed inside this compartment. The engines and the alternators are positioned in the compartment in relation to the centre line of the bogie both longitudinally and transversely.

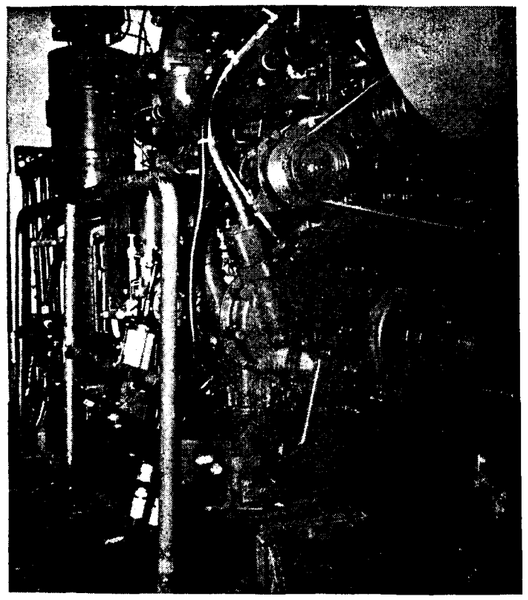
The power switch panels are arranged at one end of the electrical section of the power compartment where they are housed in suitable cupboards.

To match with other coaches to form the complete rake, the roof profile is of the raised type and a height of 13 ft. 0½ in. from the rail level to the top of the roof has been worked to while constructing these coaches.

The arrangements of the baggage compartments are of standard pattern with all steel sliding doors and luggage racks. The carrying capacity of each of these compartments is 2½ tons. For stable running and equal load distribution over the underframes and springs, the compartments have been ballasted with 4 tons of cast iron ballast weights suitably applied.

UNDERFRAMES & BOGIES

The underframes used are of Indian Railways standard mild steel type and the bogies are made up of high tensile steel sections and plates. FAG cylindrical type roller bearing axle boxes are fitted to these bogies.



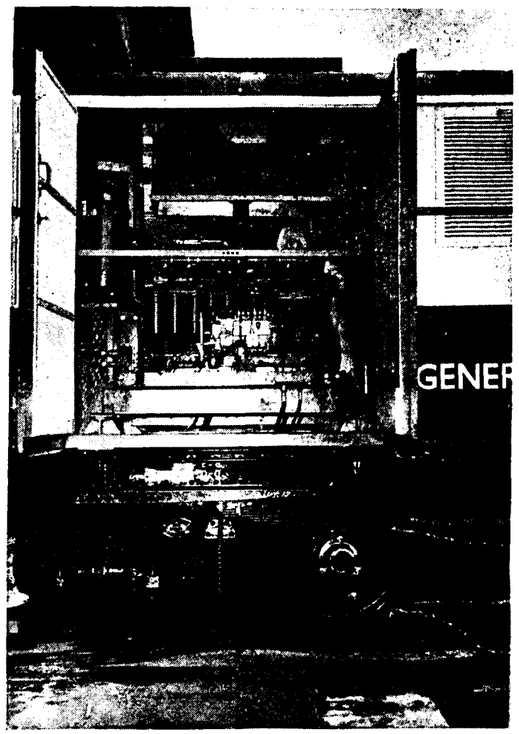
Close up view of the engine unit.

In view of the higher tare weights of the coaches, the following modifications had to be done to withstand the dynamic loading.

1. Camber of the underframe was increased from 1½" to 2½". Existing truss angles of 3½"×3½"×½" was replaced by 4"×4"×½" size.

2. Bolster arrangements altered by providing six nests of bolster springs comprising two in each per bogie in place of the conventional type of four nests of springs consisting of three springs in each to increase the bolster spring capacity. The other alteration made was to strengthen the bolster spring planks by manufacturing them from 6"×6"×5/8" angles suitably cut for the fitting of the rocker bar seating. This arrangement provided the clear space for the free movement of the anchor pins for Andre shock absorbers fitted on the bolsters.

3. Standard 10 plated springs were replaced by 11 plated bearing springs manufactured from 4"×5/8" spring steel flats. The auxiliary springs were also similarly replaced by helical steel springs in nests of two in each having higher load carrying capacity.



Engine Unit in the Power Car.

packing had another advantage in that they provided the clearance required between the lateral shock absorber suspension and the bolster spring plank and also ensured centre distances of the vertical type Woodhead Monroe shock absorbers being kept at 16.5/8 in.

4. The fixed type bolster hangers were dispensed with and in their places adjustable type bolster suspension links were fitted. This was done for maintaining the fundamental clearance of $2\frac{1}{2}$" between the bogie sole plate angle and the underframe transom and for obtaining the required buffer heights. In order to ensure, however, that such clearance and required buffer heights may be obtained without excessive tightening of the adjustable nuts, 1 in. thick timber packings with $\frac{1}{4}$ in. thick mild steel plates on them were introduced below the bolster springs seat plates. It is a well known fact that for good riding of heavy coaches, it is essential that full advantage is taken of the standard effective length of the bolster swing links. Excessive tightening of the nuts shortens this effective length with consequent increase in the periodicity of lateral movements and sets up thereby a high frequency roll. The introduction of these

The spring gear on the power cars was designed to obtain a natural frequency from the bogie bolster springs between 110 and 118 cycles per minute and an over-all natural frequency of the entire springing system of about 70 cycles per minute.

Other modifications carried out to the underframes owing to the location of the guard's compartment in the centre and for taking the generator equipments are as follows: (a) hand brake column shifted with necessary alterations to a few hand brake parts, (b) shifting of the train pipe, (c) provision of the trimmer and gusset for the fitting of the bell crank lever, (d) fixing 16 ft. × 9 ft. 3 in. × 5/16 in. mild steel plate on the underframe on the generator end with the removal of the existing top gusset coming on the way, (e) provision of additional angle trimmers for the transformer and radiator mountings, (f) fitting of robust type body brackets of supporting the extension beams for sliding the engine and alternator in and out, etc.

SPECIAL BRAKE RIGGING

These power cars are to run with high speed trains. Bearing in mind that the speed of a train is governed by its ability to stop, it was thought proper to improve the mechanical advantage of the brake rigging so as to raise the brake pressure from a mean value of approximately 36 tons to approximately 45 tons per coach by fitting a revised brake rigging in these cars with an increase in the maximum permissible piston travel to the extent of 6 in., and also by making provision of fitting automatic slack adjusters at a later date on receipt of their supply to give greater reliability and safety.

This entailed modification to the following standard brake parts: brake shaft pull rod arm, brake connecting link short, brake beam and brake vertical lever. The modifications done were in making them stronger to withstand the braking load.

The slack adjusters to be fitted as a trial measure on these power cars are to be of Stopex type, Gresham G. D. type and Westinghouse's Weslak type in three sets of the Power Cars forming three trains.

For efficient braking, Direct Admission Valves have been fitted in these cars. These valves are to ensure quick admission of air to the brake cylinders, and thus reduce the time lag in the brake application. The principle employed is that air entering the train pipe actuates the D. A. Valves and not the brake cylinder. Air direct from the atmosphere enters the brake cylinder through the direct admission valve, i. e., each brake cylinder has an independent air supply from the atmosphere, as a result of which the operation of the brake gear is speeded up in consequence.

POWER INSTALLATION

The power installation in each power car comprises two generator sets and consists principally of the following equipments—Diesel Engines of the Rolls-Royce type C. 6. SFL Model 131 B series supercharged developing 200 H. P. at 1500 R. P. M., 'Tonum' Alternator-Exciter sets of J. Stone & Co.'s manufacture having a capacity of 165 KVA with starter motor and exciter, Radiator and its fan with motor and A. C. contactors, Starter Battery of the lead acid type with transformer rectifier charger unit with ammeter for 24 nominal volts, Silencer, the exhaust, air filters, differential current transformers and a set of switch gear. The other equipments include tanks for fuel oil, inter-car couplings, Holset couplers between the engine and the alternator, engine control gear and supporting beam, puralators, water trap and stop cock assembly, radiator anti-vibration mountings, etc.

The attendant switch gear includes main and feeder control panels, master feeder line controller, automatic exciter and stabiliser regulator unit, automatic synchronising and load sharing apparatus, engine and alternator instrument panels for both engine and exciter control, and engine protection devices consisting of low oil pressure cut-out and indicator light, low water level cut-out and indicator light, water temperature cut-out and indicator light, pilot lights for 'fuel-on' and 'starting', 'Stop' push button with Mushroom Head and fuel control solenoid.

The engines are connected to the alternators through a "Holset" flexible coupling combined with a Hardy—spicer telescopic propeller shaft for reasons of simplicity with which either the engine or the alternator may be disconnected from each other for periodic servicing and repair without disturbing in any way the electrical installation. This arrangements also ensures the reasonable mal-alignment between the two units can easily be accommodated.

The electrical load of the train is divided between two separate groups of feeders running along each side of the coaches. Under normal full load conditions the two alternators may be run in parallel but with light loads one alternator can be arranged to supply both sets of feeders. When operating in parallel, load sharing can be effected automatically by governor servo motors acting upon the mechanical governors of the diesel engines in response to a 'signal' current received from a differential wattmeter. The same servo motors can be employed for the purpose of frequency control.

Engine starting is accomplished with the help of an axial type starter motor which provides the initial starting torque by engaging itself with the flywheel. A push button control panel installed in the electrical section of the generator compartment of the power car, controls the actual starting and stopping operation.

The starter motor and control circuit derive power from the 24 volt starter battery which remains in a charged condition by the battery charger unit of the transformer—rectifier type connected by means of switches to the main AC bus-bars.

EQUIPMENT MOUNTINGS

The engines are mounted on fabricated frames with suitable anti-vibration mountings arranged between the frames and the engines at each of the corners. The engine frames are in turn supported on two transverse runner members made up of 8″×6″ beams with machined top seating faces. These beams are complete with the brackets incorporating the devices for aligning the engine with the alternator. To these runners extensions can be bolted. These extensions are to extend outside the Car through the side doors and be supported on trestles. This arrangement enables the engine to be slid out sideways into the open where it can be lifted from the runner extensions by means of suitable lifting tackle and obviates the necessity for providing roof traps in the power compartment.

For draining the sumps with the engines in situ, suitable apertures have been provided in the Car floor. These apertures are covered by means of trays which are bolted on to the floor plate and meant for collecting any oil spillage. For manoeuvring the engines into position on the runners, jacking screws are provided to simplify the lining up of the four bolts which secure the engine sub-frame to the runners.

The scheme for mounting the alternators is generally similar to that described earlier for the engines. This also takes the form of two transverse members which in this case are 9″ × 3″ channel sections. They have machined pad surfaces to take on the alternator. Suitable jacking screws with their appropriate supports are incorporated in them for alternator alignment. A collapsible bellow connection between the floor and the alternator discharge outlet has been provided.

Radiators are mounted separately from the engine and have their own electrically driven fans which draw air from the outside of the car through suitable louvres and discharge the same through the roof. As the limitations of the gauge do not permit the inclusion of water proof cowls in the roof of the car, the top of the ducts has been left open and provision has been made at the bottom of the ducts to drain off rain water to the underframe. The radiator arrangement prevent hot air being blown into the power compartment. The radiator rests on rubber pads which sit on a longitudinal angle member forming part of the main supporting framework built up of angle sections.

The motors driving the fans are fully accessible through the louvred openings in the side walls of the Car and have the advantage of the streams of air at outside temperature being drawn through the body side and blown through the radiator coils. The switch gear for the power units have been kept separated as far as possible. In each case the alternator and the feeder control unit is accommodated on a steel framework above the alternator and supported from the underframe. Each steel framework contains three main panels — (a) Alternator inter-locking panel including radiator fan contactor, (b) alternator power panel mounting the main alternator contactor and protective devices and (c) the feeder power panel incorporating feeder contactor and protective devices.

The Isolating Link Box is mounted on a sub-frame between the two main alternator panels. The synchronising and load sharing panel together with differential current transformer is mounted on the electrical side of the partition between the engine compartment and the electrical compartment. The engine instrument panels are mounted on the engine room side of the partition with the projection which accommodates the dials projecting through the partition, so that they are visible from the electrical side. The battery junction box is accommodated under the cat walk between the engines in the engine compartment and is accessible through an enlarged cover plate in the cat-walk which also provides access to the bogie king pin. This junction box is the means of accommodating the main leads from the battery, the two starter isolating switches, from the battery charger and also the various leads which take their feed from the battery.

The warning and Indicator lights panel is accommodated over the door in the end bulk head of the electrical compartment. The battery charger rests on the floor against the end bulk head on the side of one of the power units. Other equipments for the generators like exciter control panel, stabiliser panel, reverse power relay, instrument panel are mounted inside the end bulk head of the electrical compartment.

SILENCER AND EXHAUST ARRANGEMENTS

The silencer and exhaust arrangements have been made in the centre of the roof to take advantage of the narrow extension of the loading gauge. Each silencer is accommodated within a protective cylinder which is open at the bottom and top to provide a free circuit of air for cooling and which automatically aids the ventilation of the engine Compartment.

A hood has been provided above the engine duct surrounding the silencer and cowl above the exhaust fishtail. The exhaust gases from the engine are taken through flexible piping and silencer straight to the roof and provision has been made to ensure against blow back and reverse draught to the engine compartment.

FUELING AND LUBRICATING

The fuel storage capacity provided in each power car is 520 gallons viz: 400 gallons in two main tanks and 120 gallons in two auxiliary tanks. This quantity is considered sufficient for 30 hours run on the basis of the estimated consumption of 8.4 gallons per hour per engine or 16.8 gallons per hour per power car. Facilities have been provided for filling the fuel tanks from either side of the vehicle, an equalising pipe being fitted between them.

Each tank is separately vented with a 3/4″ pipe to roof level. A 3/4″ O. S. dia. 16 Gauge Wall thickness copper pipe connection ensures supply of fuel oil from the main tanks to the auxiliary tanks. Stop cocks are provided to cut off fuel supply in the event of a damaged fuel pipe or other emergency.

The feed to the engine is taken from a 3/4″/3/8″ tee at the lowest level in the main pipe line through the puralator and water trap assembly via a suitable flexible fuel pipe connection to the engine mounting. There is also a fuel spill over return pipe from the engine to the breather pipe of the auxiliary fuel tank.

Each of the main fuel tanks is provided with a mechanically operated fuel gauge and in addition an electrical gauge with remote indicators in the power compartment. The electrical gauge indicates only when the engines are in operation.

Each engine requires 1/2 pint of lubricating oil per hour en-route for topping up.

FIRE EXTINGUISHING

To meet fire accidents, each power car is provided with three different types of fire extinguishers, viz: Soda-acid type, foam type and C. T. C. type, the latter two types being suitable for application against fire from oil & petrol and electric current respectively.

Because of the particular technical characteristics being required and the operating environment being different from other standard coaches, special attention has had to be paid to the constructional features and exterior finish of these power cars.

To improve riding qualities of these Cars, provision has been made for fitting 'Andre' shock absorbers to arrest lateral oscillations and 'Manroe' shock absorbers for controlling the vertical movements.

Aluminium alloy sheets 3/32" thick have been used for exterior panels throughout the coaches while the interior panelling in the guard's staff and engine compartments is of 3/8" plywood construction. To reduce the body weight, timber framings are all in first class Burma teak. Ceiling panels are of 1/8" plywood boards.

Basic colour schemes are white mat finish ceiling and enamel buff interior. The finish of the exterior is carried out in two shades with a green border line running over the windows. The lower panels below the waist rail have been painted in either Gulfred, Brunswick green or Royal blue depending on the regional operation areas to be served by them, while the top panels are painted in pale cream.

Planning and forthright execution of this programme which largely caters to the comfort of the travelling public, only indicates that Indian Railways are moving forward at unprecedented speed, entering new areas of development which were until now considered the preserves of more advanced railways in other countries.

ACKNOWLEDGEMENT

The author is indebted to Mr. D. J. Batliwala, Deputy Chief Mechanical Engineer/Shops, Eastern Railway, Kanchrapara for his kind permission to publish this article and reproduce the photographs showing the different views of the cars built.

INAUGURAL MEETING OF CLASS IV RAILWAY STAFF PROMOTIONS COMMITTEE

The Railway Minister inaugurated the Class IV Railway Staff Promotions Committee whose Chairman is Shri G. D. Tapase. The members include railway and government officials and representatives of railway labour.

Shri Jagjivan Ram in his inaugural address stated that in a large industrial undertaking, the well-being of the worker was a matter of prime concern. Railway gangmen and other categories of unskilled workers, who constituted a large band of loyal workmen had very little chances of advancement. The position may be regarded as somewhat better in the workshops and amongst the artisan category elsewhere on the Railways. Amongst large body of even unskilled railway workers, there should be a good amount of material fit for promotion to the higher categories of railway service.

Continuing his address, the Railway Minister said that he was anxious to do something immediately for this class of railwaymen, which was within his powers, without causing any repercussions on other sectors of employment by such expedients as a wage rise. A mere rise in wages would not give complete satisfaction to the employees. Every person should have the opportunity of advancement provided he was fit for such promotion, he added, and appropriate tests for fitness could be evolved and those who passed such tests should be able to go up even to the very top.

The Committee had also been entrusted with the task of prescribing appropriate tests and drawing up schemes for training courses for the various promotions that they may recommended. In many categories such tests are absolutely necessary in order that the efficiency of the service may be maintained. The tests need not necessarily be theoretical, but should be designed to ascertain whether the employee knew the duties of the job to which he aspired for promotion.

The Minister concluded his address with a request to the Committee to finish their work as quickly as possible so that their recommendations might be studied and implemented before the close of this year.

Manufacture of Telecommunications Equipment in India

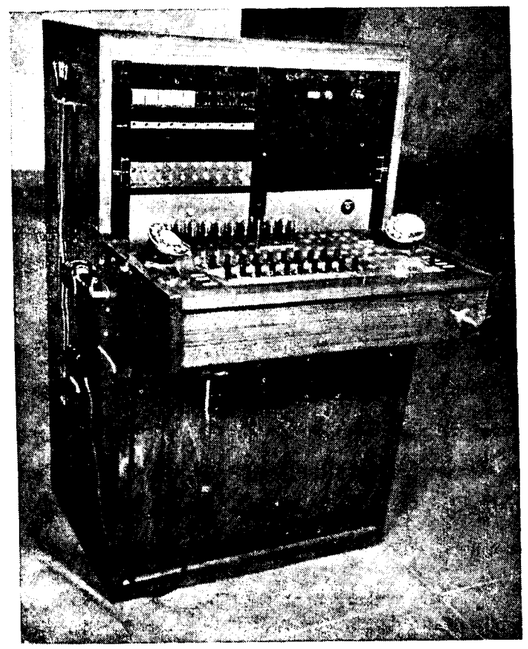
By H. C. Towers, M.I.E.E., M.I.R.S.E., M.Inst.T.

INDIA has a steady demand for telecommunication equipment. These requirements are increasing with the rapid extension of telecommunication facilities throughout the subcontinent. With the experience of the second world war and the obtaining of independence in August 1947, self-sufficiency in the matter of telecommunication equipment was keenly felt. The largest government user is the Post and Telegraph Department and next are the railways.

The Government of India gave this problem very detailed consideration and finally on 3rd May 1948 an agreement was concluded with the Automatic Telephone and Electric Company of Liverpool and the Government of India. The basis of this agreement was that the A. T. E. Company should provide technical aid and assist India in the manufacture of telephone apparatus according to the schedule of equipment agreed upon. In return the Government of India would purchase telecommunication equipment from the A. T. E. Company through the Indian Telephone Industries, the name given to the new undertaking, until production in India was established. The agreement holds good for fifteen years.

In February 1950 the industry was made into a private joint stock company with three shareholders, the Government of India, the Government of Mysore and the Automatic Telephone and Electric Company. The authorised capital was Rs. 4 crores most of the shares being held by the Central Government. It is anticipated that the increasing activities of the industry will necessitate further increase in the capital.

The Indian Telephone Industries started assembling telephones from parts imported from the Automatic Telephone and Electric Company. This work was commenced in two hangers 175 feet by 75 feet situated on a site not far from Bangalore in South India. These accommodated the tool room, raw material accommodation, machinery awaiting assembly, etc. At the present time these hangers are only used as a store. There are now eight factory units each 220 feet by 120 feet. Two of these have been provided with lean to accommodation 80 feet by 40 feet each. Each unit is self-contained and has four service rooms 55 feet by 20 feet, two at each end. Two are used for



C. B. Manual Switchboard.

washing and toilet and two for stores, switchboards, etc. The natural lighting in the factory is so good that even on dark, cloudy days no general artificial lighting is necessary. Exhaust fans provide adequate ventilation and overcrowding of workers has been avoided.

The offices are located in a three storied building in granite with a plinth area of about 13,300 square feet. Accommodation is provided for Administration, Accounts, Engineering, Purchasing and Sales Departments and there is generous room for extensions at both ends of the building. Houses are provided for a total of 1500 families. Amenities include schools, playing grounds, club, hospital, market and cinema. The factory ground covers an area of about 370 acres. Krishnarajapuram Railway Station is at the south east corner of the site and the works has siding facilities.

Relay adjustment.

In the first year of assembling telephones from imported parts, 15,000 telephones were completed. A production programme for manufacture in the initial stages was drawn up and tool making on a small scale was commenced. The staff consisted of 18 officers, 187 workers and 200 others. Five engineers were taken on loan from the Automatic Telephone and Electric Company.

By 1952—53 all the eight factory units had been completed and three canteens. The engineering of the exchanges, hitherto done by the A. T. E. was taken in hand. An order for thirty small channel carrier systems was received from the Post and Telegraph Department. The assembly of telephone exchange equipment was started. Plans were made for the manufacture of dials and condensers and the dial shop was laid out. There was a progressive increase in the sale of manufactured products and distinct from imported products. At the end of the year the staff consisted of 68 officers, 987 workers and 763 others. Psychological tests to ascertain the ability, talent and inclination of workers was further improved and a scheme was introduced for awarding prizes to employees making best suggestions for improvement to the factory and production. During the year 27,209 telephones were made and 8,000 lines of exchange equipment assembled. Recently, dials, uniselectors, uniselector banks and T 2000 selectro banks were new items of production taken up. Development work was carried out on (a) Fire alarm main control unit and sub-stations (b) railway control units (push button type) (c) railway control way station units and (d) magneto telephones. Manufacture of single channel telephone carrier systems was commenced and also a cheap type of 3 channel telephone carrier system was developed.

The factory is being gradually equipped with all classes of machinery. In June 1954 there were 1,050 machines in service. These vary in size from small, cord binding machines received as war reparations and most of these had to be entirely rebuilt. Bakelite moulding presses are installed and the capacity ranges from 27 to 150 tons pressure. All moulded parts for telephones and exchanges are being produced. 61 automatic lathes, capable of turning something like 30 million parts a year, are available. The smaller screws are made in machines capable of producing up to 130 a minute. The tropical climate is very severe on telephone equipment and every component has to be properly treated. The plating shop, which is remarkably free from fumes, provides chromium, cadmium, nickel, zinc and copy coatings. Heavy iron work is spray painted but first thoroughly cleansed from all rust and then bonderised. The rust is removed by spraying the material with steel shots under pressure.

A canteen run by the Employees' co-operative Society, supplies lunches, snacks, coffee and tea at reasonable rates. For those who bring their own food, suitable accommodation is provided for them to eat it in. A free supply of 8 ounces of milk per day is made to workers employed in certain operations such as plating, spray painting, polishing and moulding. A dispensary, with a full time medical officer, is available for first aid and out-patient treatment.

As already stated, the assembly work started early in 1949 and in 1950 the manufacture of parts commenced. The production rate was fixed at 25,000 telephones per annum to be increased as the demand arose. The present demand is somewhere in the region of 50,000 telephones per annum. The telephone consists of

265 items, without the dial, while the dial comprises 122 parts.

Other apparatus being manufactured are Central Battery, Automatic and Magneto exchanges, cable runways, protectors, arrestors and many other items essential for telecommunications. The progress in annual production can be seen from a few details given below :—

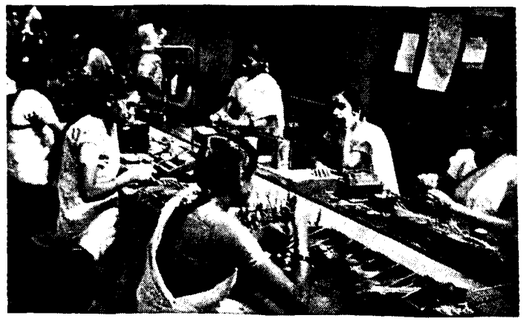
	1949-50	1951-52	1952-53
Telephones.	19,216	21,628	27,209
BPO 600 type relays.		11,300	23,277
BPO 2000 type relays.		2,900	46,387

The production programme for the coming years is far more ambitious than this and covers all classes of telecommunication apparatus including all types of railway traffic control equipment. Development is proceeding on transmission equipment. A single channel carrier system has been developed and is under field trial after prolonged laboratory tests. Voice frequency, ringing repeaters and transmission measuring sets are under laboratory tests. The first batch of 'Single channel Carrier Telephone system' has just been completed for supply to the Indian Posts and Telegraph Department. This type of equipment has hitherto been imported and for the first time carrier telephone equipment has been made in India based on the design and development work carried out by the engineers of the Indian Telephone Industries. The equipment has been designed to utilise indigenous material as far as possible and to have a high degree of reliability under the severe climatic conditions obtaining in India. The first batch of equipment was demonstrated to members of the press and the I. T. I. on 15 May 1953. A device working in conjunction with a loudspeaker demonstrated (i) speech on the voice frequency circuit (ii) speech on the carrier circuit separately and (iii) the effective transmission on the line of the two different talks, one being intelligible and the other not due to carrier technique.

Carrier telephone systems are for use between trunk telephone centres for increasing the number of telephone circuits between them. With a trunk line joining two stations the normal arrangement permits of only one conversation. The 'Single channel carrier telephone system', which comprises two terminal equipment, one of which is fitted at each end of the trunk line, increases the number of circuits from one to two thus making it possible to put through two calls at the same time. The maximum range of the system is 250 miles but by employing repeaters this range can be considerably increased. The additional speech circuit can only otherwise be obtained by the installation of a second trunk line. The cost of erecting a pole line of 100 miles with two copper wires would be over one lakh while the cost of 'Single Channel Carrier Equipment' giving the same facility would be about one sixth of this. The circuit provided by the carrier system is of better quality, less susceptible to weather disturbances and more flexible for operating requirements.

Carrier technique enables the simultaneous transmission of the message originated by two or more subscribers independently of each other at the same time. Taking the case of the 'Single Channel Carrier Telephone System', which permits two conversations at the same time, one of the conversations passes over the line in the usual manner while the signals corresponding to the second conversation passes through the carrier equipment to be modulated with a high frequency called 'carrier'. This modulated signal corresponds to the original signal with the only differences that the frequency is shifted into a higher range and passes over the line without interfering with the original conversation. The terminal arrangements at the other end is a selective circuit called a 'Filter' and restores the conversation to the original form by demodulation.

The I. T. I. have been keenly alive to the importance of Research and Development in long distance line communication equipment. By June 1950 a development section for line transmission equipment was established. The 'Single Channel Carrier' was taken



Assembling telephones.

up for development and quick progress was made. By January 1951 a working model was ready and this was exhibited in the Communication Engineering Laboratory of the Indian Institute of Science when opened by the Prime Minister of India. A complete system was ready by March 1952 and placed on field trial between Guntakal and Secunderabad. This system is still in service and working well. The Indian Posts and Telegraphs placed an order for 30 systems of this type. Other development work includes Voice frequency repeater, Secrephone and Transmission measuring set and prototypes are ready for field trial. Development of a three channel Carrier Telephone system is in an advanced stage.

To meet future demands for carrier and allied equipment in India, plans have been finalised for the early manufacture of such equipment on a large scale. Necessary buildings, machinery etc. have been arranged so that the bulk requirement of such equipment will be manufactured by I. T. I. The demand for new telephones is generally insatiable and it is recognised that in spite of the enormous expansion of the Indian Telephone Industries since its inception, the workshops will still have to undergo considerable development to meet the demands of the coming years. The objective is to make the country self-sufficient in telephones and long distance equipment in the shortest possible time.

INDO-SWEDISH TRADE AGREEMENT

According to an official announcement, the schedules attached to the Indo-Swedish trade agreement have been slightly modified for the current year. It may be mentioned that the agreement provides for revision of schedules every year. Important items included in the list, amongst others, for exports from India are : Manganese ore, magnesite, kyanite, chrome and iron ores, and for imports into India are : iron and steel including ferro alloys and stainless steel, metal manufactures and semi-manufactures, various machinery and industrial equipment e.g., diesel engines, metal and woodworking machinery, ball and roller bearings, electrical equipment e.g. generators, transformers, railway rolling stock and locomotives etc.

TRAVEL CONCESSION FOR BLIND AND T. B. PATIENTS

Travel Concessions in I, II and IIIrd classes for blind persons and tuberculosis patients announced by the Railway Minister in Parliament in June, came into force with effect from July 1, 1957.

Under these concessions, a blind person accompanied by one attendant can travel on payment of one single journey fare. A blind person travelling alone will be permitted to travel on payment of one-fourth of the normal fare. In either case the blind person will be required to produce a certificate from a registered medical practitioner.

Similarly, a T.B. patient accompanied by one attendant will be charged only one single fare, provided he is travelling for admission to or on discharge from a recognised T. B. hospital or sanatorium. When travelling alone for admission or on discharge a T. B. patient will be charged only one-fourth of the normal fare. A certificate from the officer in charge of the hospital or sanatorium concerned would have to be produced in either case.

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USERS CONSULTATIVE COMMITTEE MEETS

The Bombay Divisional Railway Users' Consultative Committee held its Meeting at Pandharpur on 16th June, 1957.

A proposal to make announcements on Loudspeakers at Dadar and Kalyan for the information of passengers giving the position of compartments for Dadar and Kalyan Passengers in the Down Mail and Express trains before the arrival of these trains at these stations was accepted. A suggestion to replace the present 'Blank Card' tickets with Blank paper tickets with three counterfoils, for audit, record and passenger to avoid any fraud being committed was also agreed to.

It was pointed out that it is only under extreme and unavoidable circumstances and sudden developments that the decision to cancel trains has to be taken quickly and thus there was absolutely no time to publicize such decisions. In all cases where cancellation of a train is decided upon much in advance, publicity in newspapers is invariably given.

Among other subjects discussed were, the placing of wagons at Mill Sidings, unloading of wagons by the Railway within the free time allowed, use of damaged wagons for loading grains and action taken against unauthorised passengers occupying reserved compartments.

KHANDWA-TAKAL LINE OPENS

JUNE 18, 1957 was the auspicious day on which the first 18½ mile line from Khandwa to Takal of the Khandwa-Hingoli Metre Gauge Rail Link was formally opened for goods and passenger traffic. Dr. Kailas Nath Katju, Chief Minister of Madhya Pradesh, performed the inaugural ceremony at Khandwa in the presence of a large and distinguished gathering.

The inspection of the guard of honour by the Chief Minister and presentation of officers to the Chief Minister was followed by the welcome address by Shri M. N. Chakravarti, General Manager of the Central Railway. The work of construction of this vital rail link began a bit over 3 years ago, Shri Chakravarti stated, the starting point having been Khandwa itself. The Central Railway served a number of States and out of its route mileage of 5,300 nearly 1,400 miles were in the State of Madhya Pradesh. Much of the coal, lime, lime-stone and cement and the abundant agricultural and forest produce of Madhya Pradesh was transported by the Central Railway to consuming centres all over the land, he added.

This Railway thus served very substantially the State of Madhya Pradesh through which it extended in the form of a closely integrated network and to all railwaymen working in this great State, it was a proud privilege to serve. Referring to the opening of the first section of the Khandwa-Hingoli railway line, Shri Chakravarti stated that the new link from Khandwa to Hingoli would be 187 miles long and about one fourth of this would lie in Madhya Pradesh, the remaining portion in the Bombay State. When this link was finally forged, the gap which at present existed between the Northern and the Southern metre gauge systems would be closed. The serious operational problems presented by the separated systems would end. The maintenance of two separate wagons and engine pools for the Northern and Southern metre gauge systems lacked flexibility in operation and handicapped the administration in the free movement of traffic. On completion of the link, this would be overcome and a metre gauge wagon would be able to travel right through from far off Tinsukia in the Northest corner of India down to Trivandrum or Tuticorin in the South.

The second section to be opened in the course of the next few weeks would be an 18-mile from the Hingoli end upto a station called Kanhergaon, he added. The lines would thus be progressed and before the end of 1959, subject to timely availability of the vital building materials, the entire line would have been completed.

The General Manager expressed special thanks to the Hon'ble Chief Minister and to his Government and its officers for the ready help afforded to the Railway in settling numerous problems both big and small. He thanked Pandit Babulal Tiwari and Sri Raichanda Nagda for all their co-operation and assistance. To the Western Railways, his thanks were due, he said, as they had arranged to run the metre gauge trains on this section. He also thanked his officers and staff who had worked hard to build the new line.

Sri Thadani, Engineer-in-Chief then gave the salient features of the new line. Its history dated back to 1882 when a proposal was mooted for constructing a railway line between Akola and Hingoli. As far back as 1903, the need for this link from the strategic point of view was stressed. In 1911 the final location survey of the route was made, the alignment selected being Via Akot, Akola and Basim which conforms broadly to the alignment now adopted.

The new line after leaving Khandwa passes through a fertile tract for the first 21 miles and then ascends the Satpura ranges making its way through deep cuttings over high embankments and by bridges across rivers. After passing Tukaithar station, almost 40 miles from Khandwa, the line enters Bombay State in a wild and mountainous region known as the Melghat. It is between this point and Akola that the only two tunnels with a combined length of half a mile and the longest bridge with 8 spans extending some 1050 feet across are located. There will be 26 new stations over the whole line.

Shri Mandloi, Revenue Minister of Madhya Pradesh then addressed the gathering. Our country had the highest railway mileage in Asia and we compared favourably with the rest of the world, he said. We would have to pay more and more attention to the railways and railwaymen in the country. In the last war, railway staff had played their part nobly and well. Much of the success of our First Plan was due to the Railways which had moved all the food needed and all the products of agriculture and industry to all parts of the country.

(*Continued on page 19*)

A New Range of Mechanical Lubricators

A new range of mechanical lubricating equipment is now being manufactured in Great Britain. This is the result of an agreement between Davies & Metcalfe Ltd., Romiley, Stockport, and Alex. Friedmann, Vienna. The latter company have manufactured high class mechanical lubricators and accessories for very many years and are well known in most parts of the world.

The firm of Davies & Metcalfe Ltd., are very old established Locomotive Engineers who have manufactured Exhaust Steam Injectors, Vacuum Brake Ejectors, and Live Steam Injectors, etc. for almost every railway company in the world. They therefore have all the engineering knowledge, both practical and theoretical, and all the design experience, to ensure that they can manufacture precision mechanical lubricators with that high degree of accuracy and finish that is so necessary.

A feature of this equipment is the very excellent design and general high class of workmanship throughout, and it will be noted that the pump units operate on a system which obviates the use of ball valves for the inlet and outlet ports, a point of utmost importance for reliable lubrication.

At present, this Company is concentrating on lubricating equipment for steam, diesel and electric locomotives, but it is their intention to widen their field almost immediately to include industrial and marine lubricating requirements generally.

In connection with locomotive lubrication, they manufacture the Metcalfe Automatic Steam Brake Cylinder Lubricator, the Friedmann type F. S. A. Valveless Mechanical Lubricator and D. V. Pattern Lubricator, which is a standard lubricator for many of the world's largest railways, also Wheel Flange Lubricators, in addition to a wide range of fittings and appliances for use in conjunction with mechanical lubricators such as low and high pressure terminal check valves, oil dividers, atomisers, unions, etc.

An entirely separate lubricator department has been constructed at the Romiley works and this will ensure that all lubricating equipment is assembled and tested under ideal conditions. When we recently visited these works, we were pleased to note that special steps had been taken to ensure perfect cleanliness throughout this new department.

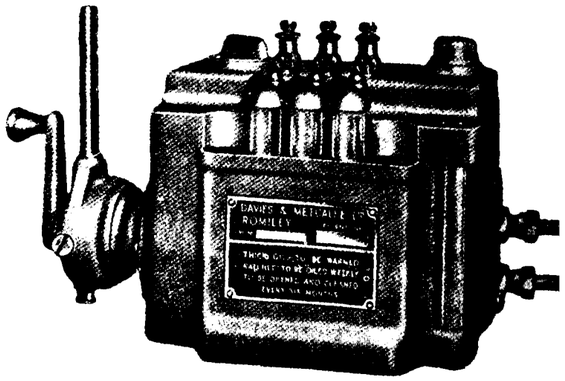

Fig. 1

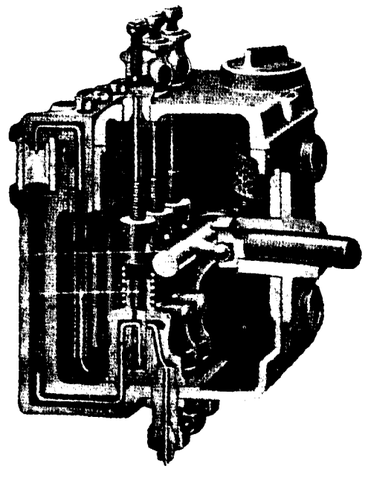

Fig. 2

Figs. 1 and 2. The Type D.S.I. Lubricator is very soundly designed and constructed and may be used for most industrial purposes.

THE TYPE D. S. I. MECHANICAL LUBRICATOR

This style of lubricator is suitable for general industrial and marine applications, and it is capable of using all normal grades of lubricating oil. Figure 1 shows the lubricator which, it will be noted, is equipped with sight glasses to each feed.

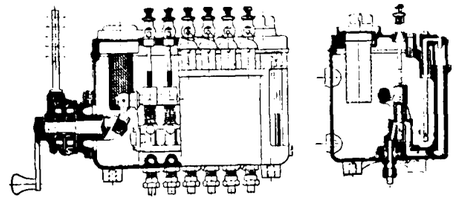

Fig. 3. Sectional drawing of the D.S.I. Lubricator.

The working of the lubricator may be seen from Figures 2 and 3, and the method of pump operation is by a shaft common to all pumps which lifts and simultaneously turns the plungers. This movement automatically opens and closes the suction and delivery ports of the pump units so that no ball valves are required in the operation of the lubricator which is thus free from the failures and troubles associated with lubricators employing ball valves. An additional advantage of this system is that it is safe to arrange the sight feed to be on the suction side of the pump without fear of the oil thus sighted not reaching the lubricating point.

The advantage of sight feeds of this type is that there is no need to pass the oil through water or glycerine, and thus the likelihood of broken sight glasses, freezing of water, displacement of water by oil, etc., are all eliminated. The makers claim that since there are no valves to interfere with the flow, all oil reaching the delivery side of the pump, must pass to the outlet side.

Rate of delivery for each plunger can be regulated by adjusting its stroke. Regulating screws are fitted to the top of the oil container and range of delivery is from 0 to 0.33 c. c. per stroke. As the tail end of each plunger rises, it passes through the top of the container to meet the regulator screw, thus visible observance of its motion is possible.

Should any oil accumulate in a sight feed glass, it is only necessary to loosen the top screw just above it, when surplus oil will at once disappear. A gauze filter is fitted under the filler cap, and a steam heating pipe, for use with very thick oils, or the ensure constant temperature of the oil at all times, can be fitted if required. Steam pipe connections can be seen in the unit illustrated. Fixing lugs or studs can be incorporated to suit the customer's requirements.

THE RATCHET DRIVE

The method of driving the lubricator may be by ratchet from reciprocating motion, or by chain or reduction worm gearing (standard ratio 38.1) from rotary motion and the drive may be arranged on the right or left underside of the body in addition to the front position which is shown in Figure 2. The type of ratchet drive employed attracted our attention, particularly when we were viewing the arrangements being made to produce these lubricators. One of the most frequent sources of trouble on ratchet driven lubricators is the ratchet itself, and is usually due to a faulty pawl, or to wearing of the ratchet wheel teeth. The fitting of a trouble-free ratchet is a valuable asset to any mechanical lubricator.

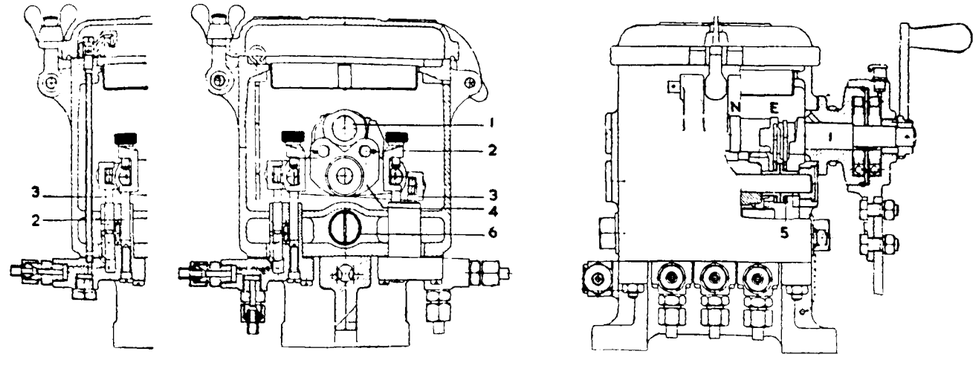

Fig. 4. Sectional drawing of the Type F.S.A. Lubricator. LH drawing shows method of converting pumping units to single feeds instead of double ones.

The arrangement of this ratchet assembly can eb followed from the sectional drawing of one included in Fig. 4. The drive consists of two discs each having five rollers which are spring loaded. One set of rollers and disc is for driving and the other set is to prevent backlash. The advantage of this system is that complete absence of backlash is maintained over prolonged service, a positive drive is ensured under all conditions no matter how short the stroke of the operating lever, there is freedom from wear, and operation is silent.

RANGE AVAILABLE

A full range of these lubricators to meet most industrial purposes is, or very shortly will be, available. There are to be seven sizes of container to hold from one to twenty-one pints of oil, and they may be divided into two or more compartments, if required, to separate differing grades of lubricant, e. g., cylinder and bearing oils. Any number of feeds from one to nineteen may be incorporated. Non-return valves, for fitting near to the points of lubrication, are provided when these lubricators have to feed against steam or air pressures.

THE TYPE 'D' MECHANICAL LUBRICATOR

This lubricator is identical in construction and operation with the type D. S. I. with the exception that it is not fitted with sight feed glasses, and is consequently somewhat simpler and cheaper.

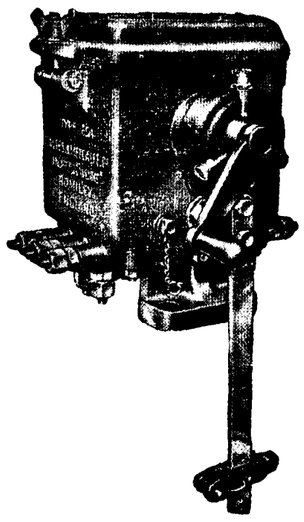

Fig. 5. The type F. S. A. Lubricator, designed primarily for locomotive work.

THE TYPE F. S. A. LUBRICATOR

This lubricator is designed for heavier duty, primarily for use with steam locomotives, and is illustrated in Figs. 4 and 5. This again, is a valveless lubricator and each pumping unit has a delivery and distributing piston. The pumping units are an exceptionally high class precision made job, the pistons being perfectly oil-tight up to a pressure of 3,000 lb./sq. in. and the delivery to oil is most accurate and reliable under any conditions of working. They are valuable lubricators for use on all types of steam engines.

Referring to Fig. 4. the driving shaft, 1, is supported in the body of the lubricator and has five cams formed on it, as illustrated. The cam marked "N" is a double one and operates the delivery pistons, 2, whilst the two sets of eccentric cams, item E, operate the distributing pistons, 3. The delivery pistons are operated through the delivery piston rocker, 4, and the distributing pistons by means of the distributing piston rockers, 5.

The arrangement of double and eccentric cams for delivery and distributing pistons is a feature of the design of this lubricator and enables each delivery piston to make two strokes per revolution of the driving shaft whilst at the same time, the distributing piston makes one single stroke. Thus, each pumping unit may be termed double acting and for a revolution of the driving shaft, oil may be delivered separately and independently from the two outlets provided on each pumping unit. There may, incidentally, be one or two outlets as required.

Regulation of total delivery is made by altering the travel of the operating lever, and also by varying the outlet of individual pumps by adjustment of the piston stroke. Since one regulating screw alters the output of two outlets, two similar points, e. g., pistons, valve guides, axle boxes, etc., may advantageously be connected to the two outlets of one pumping unit, thus ensuring identical quantities of oil being delivered to two similar points.

A filling strainer is provided but a further strainer, 6, ensures that only clean oil can reach the pumping units. This is an additional safeguard against some uninitiated person filling up the lubricator with the filler-strainer removed.

The F.S.A. lubricator is made in two sizes. The small one has up to twelve outlets and the larger one up to 24. The number of outlets in each case may be

varied by converting the pumping units to single feeds and substituting the internal drip pipe, as shown in Fig. 4.

A full range of accessories are available, as with all Davies & Metcalfe lubricators, including check valves, atomizers, unions, etc. Sight feed indicators for fitting in the delivery lines are also available. When the lubricator is employed for steam locomotive work, terminal check valves may be employed for feeding against steam pressure and as these incorporate feed test cocks, sight feed indicators may not be needed.

THE METCALFE OIL DIVIDER

Where it is desired to increase the number of points fed from a lubricator and where additional feeds are not available on the lubricator itself, the Metcalfe Oil Divider provides a solution. This is made with two or four outlets and the value of this piece of equipment is not so widely known as it should be, since its uses are very numerous throughout lubrication systems.

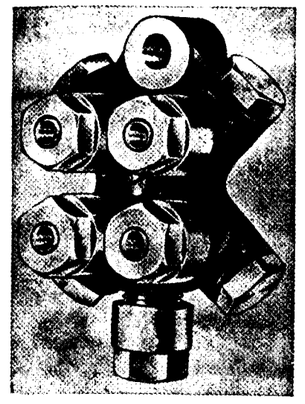

Fig. 6. The Oil Divider allows a lubricator pump to feed several points without the disadvantages of "split" feeds.

It is well known to Lubrication Engineers, that it is dangerous to employ split feeds for lubrication of important points because the oil always takes the line of least resistance and whenever one line gets partially choked, all the lubricant goes the one way. The Oil Divider allows a small sized lubricator to feed to a greater number of points than there are pumping units, without fear of starvation of any point. When connected in tandem, the Oil Dividers will still further increase the number of points that can be fed, providing it is borne in mind that the last points in such a circuit will only receive their "divided" supply. The Oil Divider is illustrated in Fig. 6, and Fig. 8 shows how it may be connected into a lubrication system. Fig. 7 is a sectional illustration.

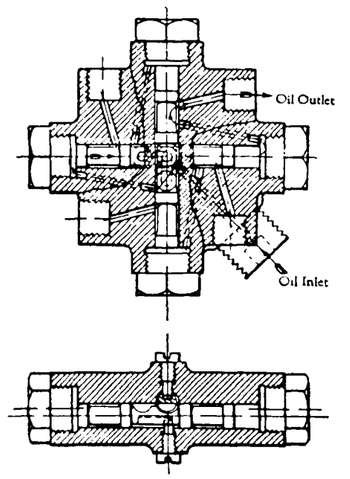

Fig. 7. Sectional drawings of the Metcalfe Oil Divider.

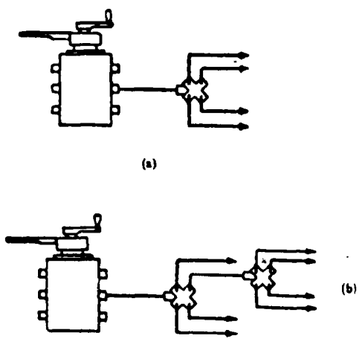

Fig. 8. Illustrating methods of connecting (a) one Oil Divider to feed to four points. (b) two or more Dividers to feed to seven or more points.

Oil is supplied to the Divider from a feed of the mechanical lubricator. The Divider has two pairs of oil-tight pistons which slide in cylinders formed in the body of the Divider. Each piston and cylinder has inlet and outlet ports, and the construction is such that the inlet port of only one piston is open at a time. In

operation, the pistons move in a cycle and oil is delivered from each outlet union in turn, under the same pressure as the delivery from the lubricator.

The advantages of the Divider may be summarized as follows :—

(1) A great number of points may be lubricated from comparatively few pumping units.

(2) Each point is fed with a positive supply of oil as soon as the lubricator commences to work, and supply is proportional to the speed of driving the lubricator.

(3) Regulation to a fine setting at the lubricator pump, ensures economical lubrication.

(4) Positive supply of oil to each point is irrespective of the difference in resistance to flow of each of these points.

(5) The use of Oil Dividers may save the cost of an expensive lubricator employing additional individual pumping units. In addition, a considerable saving in space and cost is effected since multi-feed lubricators can be large, unwieldy and costly.

CAN BE USED WITH SOFT GREASE

The Oil Divider is generally used in conjunction with a mechanical lubricator and requires a minimum of 75 lb./sq. in. pressure to operate it. It will work with all grades of oil and also with soft greases. Whilst primarily intended for use on low pressure lubricating points, using the Metcalfe standard low pressure terminal check valve, it is quite suitable for normal lubrication.

Adjustment of the delivery capacity of the pump feeding the Divider automatically increases or reduces the number of operating cycles of the pistons inside. Thus, whilst the amount of lubricant discharged per cycle is constant, the frequency of discharge is adjustable. The standard Divider discharges 0.028 cu. in. of lubricant from each piston per cycle. All Dividers are tested before delivery against a pressure of 500 lb./sq. in.

The Divider requires no maintenance beyond occasional dismantling and washing out with paraffin. Service life is claimed to be exceptionally long in view of the high grade materials employed and which always run in oil. Replacement pistons are not therefore supplied, and when wear does eventually take place, a new unit should be installed.

STEEL IN INDIA

Though India is second only to Brazil in the possession of the world's largest reserves of high-grade iron ore, her output constitutes only 2 per cent of the total world production—compared to U. S. A.'s 43 per cent and U. S. S. R.'s 18 per cent. India's annual output of steel is a little less than 1.5 million tons compared to 17 million tons in the U. K. and over 100 million tons in the United States. India consumes only 11 lbs. of steel ingots per head in comparison with U. S. A.'s 1,237 lbs., U. K.'s 628 lbs., Australia's 540 lbs. and Italy's 137 lbs.

The First Five-Year Plan accorded high priority to the expansion of the steel industry and laid down a target capacity of 1.65 million tons of steel (as against 1.01 million tons in 1950–51) to be attained by 1957–58. By the end of the First Plan, the Government of India decided to set up three steel plants of 1.0 million ton ingot capacity each in the public sector, located at Rourkela (Orissa), Bhilai (Madhya Pradesh) and Durgapur (West Bengal).

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COAL

According to a report, preliminary data collected by the Geological Survey of India and of the Indian Bureau of Mines coal resources in India are much in excess of what has been estimated so far. With 60 drilling machines secured by the Union Government from abroad—40 from Russia—extensive drilling operations have started recently in all prospective coalfields. Parties are working in West Bengal, Karnapura and East Bokharo in Bihar and in Rewa in Madhya Pradesh. Much of the new find is believed to be of selected grade. Drilling in the West Bengal coalfields near Ondal has shown that below a depth of 2,200 feet, there are big seams of coal. Boring in East Bokharo and Karnapura coalfields has proved conclusively that there are thick seams of number one and selected grade coal at shallow depths. Similarly, deposits of coal have been found in the Rewa coalfields. Drilling operations will soon begin in the Singaruli coalfield near Mirzapur in Uttar Pradesh, preliminary investigation into which indicates the existence of large seams of coal.

It is reported that output of coal in India during May last was higher at 3,794,092 tons compared with 3,726,290 tons in the previous month of April. It is learnt that the Union Government intend to introduce in Parliament some time in October a Bill seeking amalgamation of small colliery units on the lines suggested in the report of the Collieries Amalgamation Committee set up earlier under the chairmanship of Mr. Balwantrai Mehta. The basis of amalgamation recommended by the committee was that the output of any colliery should not be less than 10,000 tons p.m. for a period of 50 years.

(*Continued from page 13*)

" I am happy to note that to-day, the Khandwa-Hingoli rail link surveyed over 75 years ago, is becoming a reality, in the first lap of our Second Five-Year Plan ", Shri Mandloi said. Khandwa could be justly proud of this achievement—the linking of the North and the South. This link would now solve several complicated problems. He urged that all attention be paid to develop the regions of Madhya Pradesh. Shri Mandloi concluded with his heartiest thanks on behalf of the people of Khandwa to all railwaymen.

Shri Babulal Tiwari, M. P. then addressed the distinguished gathering. Recalling the turning of the first sod at Khandwa when the project was launched by Shri Lal Bahadur Shastri in 1954 he said, it was indeed gratifying to note that the completion of this link was no longer a dream but was a reality. This railway line passed through areas populated by the poorer and backward classes of Madhya Pradesh, and the provision of this rail link would ease their hardships. When this rail link was completed and opened to traffic it would increase the prosperity of the State of Madhya Pradesh.

Winding up the speeches before the inaugural address of the Chief Minister was Shri Siddiqui, Food Minister, Madhya Pradesh. The gap between the Northern and the Southern Metre Gauge systems was being linked up by the present construction he said. This line would serve the economic needs of the poor and illiterate masses in the area. It was said that the bowels of the earth stored great wealth and he expressed the hope that the linking up would enable the people to reap rich harvests.

The Chief Minister of Madhya Pradesh, Dr. Kailas Nath Katju then delivered his inaugural address. He was happy he said, to be in the midst of this distinguished gathering. Khandwa station was not new in him. As the General Manager had earlier pointed out, Dr. Katju said if one had to proceed to Kanyakumari, or to Kerala, it was the Metre Gauge system that took one there.

This rail link of 187 miles now being constructed way in the nation's interest. The brochure which had been circulated made interesting reading, the Chief Minister said. This linking up of the north with the south had engaged attention for well over 75 years but for one reason or the other it was shelved. In the wake of the freedom of our country this question again came to the fore and had now finally been taken in hand. He was very happy, he said, that the first section of 18 miles from Khandwa to Takal had been completed and was now ready for traffic.

Another section of equal length from the Hingoli end was being completed and would become ready for traffic in a couple of months. It was his earnest hope that within a couple of years the entire rail link between the north and the south would be completed. One could then make his home in a metre gauge compartment travelling from Gauhati to Kanyakumari without the bother of transhipment at any point. " I still remember the Grand Trunk Express train of old which ran from Peshawar to Mangalore and other train from far off Pathankot to Madras ", Dr. Katju stated. " How shall I describe this Link? It has linked up the entire country ", the Chief Minister said. Khandwa should be justly proud of this achievement and has the unique distinction of being the starting point of this unique vital link. He congratulated the General Manager, the Engineers and labourers for this achievement. Concluding his address he expressed the hope that more and more tracts of Madhya Pradesh would be linked up to improve the prosperity of this State.

Shri D. P. Mathur, Senior Deputy General Manager proposed the vote of thanks. He expressed the Administration's grateful thanks to the Hon'ble Chief Minister for having come all the way to Khandwa to perform the opening ceremony and to the Hon'ble Revenue and Food Ministers and to Shri Tiwari for having addressed the gathering. He thanked the distinguished guests for their presence and all those who had assisted with the arrangements from the Khandwa and Bhusawal Divisions.

It was a couple of minutes before the scheduled departure of the inaugural train. The General Manager then requested the Chief Minister to perform the inaugural ceremony by pulling the miniature lever on the table. And as Dr. Katju did so, to the lowering of the signal in the pandal and the starter signal for the train, the Protection Force band beat a trumpet call whilst the engine of the train let out a sharp, shrill blast. All heads were turned towards the inaugural train headed by a gaily decorated engine, which amidst clouds of steam and smoke, started out on the inaugural run bound for Takal.

The function concluded with the presentation to the Chief Minister by the General Manager of the lever used to perform the inaugural ceremony and the playing of the National Anthem.

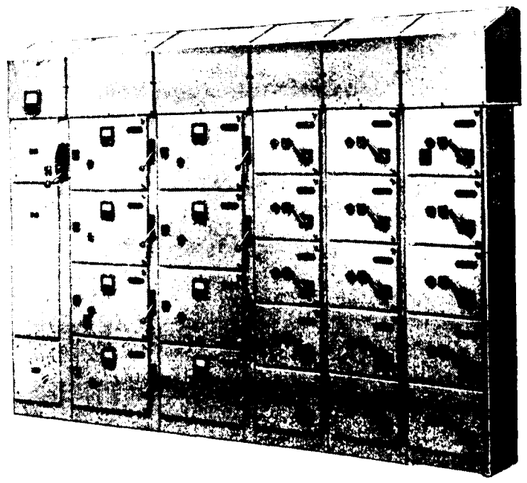
Belmos "G" Range Control Gear

A NEW Range of medium voltage a. c. Motor Control Gear Switchboards, designated the "G" Range, is now in full production by The Belmos Company Ltd. of Bellshill, Lanarkshire. This compact and attractive design in four and five tiers covers the many applications now arising in industry where a number of standard direct-on-line starters for three phase motors are best grouped together as a switchboard, with either local or remote control.

The space saved is 20 to 30% compared with a two and three tier construction, such as the well established BELMOS "D" Range which the new design supplements. Further space can be saved by using a version of the design which permits the switchboards to be mounted directly against a wall.

Individual isolation and back-up h.r.c. fuse protection are provided as standard, and other features which can be added include ammeter, indicating lamps, 110 volt control circuit, and sequence interlock between starters. Already several installations, each involving over two hundred and fifty starters, have been supplied for new continuous process plants; these have demonstrated the soundness and flexibility of the basic design which enables the gear to meet the differing requirements of a variety of users in the most modern applications. Simplification and standardisation enable the range to be offered on short delivery.

The flush-fronted switchboards exhibit the well known BELMOS attention to appearance, robustness and accessibility. A choice of five attractive stove-enamelled colours is offered as the standard finish. The five tier cubicles accommodate direct-switching starters up to 12½ h.p. at 440 volts, and the four tier up to 40 h.p. (and occasionally up to 70 h.p.). When larger horsepowers or multistep starters are also involved, housings of one or two tiers can be supplied to match. A new leaflet, reference K 450, describes and illustrates this new development from Scotland in some detail.



A typical [illegible] trunking at left

HINDUSTHAN MACHINE TOOLS

As a result of the reorganisation of production schedule, the Company was able to achieve an output of 135 machines in 1956–57, as against the original target of 57 machines. Production during 1957–58 is expected to exceed 400 machines as against the original target of 131 machines. The revised target for 1960–61 is double the original target of 400 machines, to be achieved by working multiple shifts and increased efficiency. A technical collaboration agreement with the West German firm of Fritz Werner was signed in January last for the manufacture of horizontal, universal and vertical milling machines. Negotiations for technical collaboration, it is stated, are in an advanced stage for the manufacture of radial drills and heavier lathes. In addition, the Government has approved in principle the establishment of a foundry estimated to cost Rs. 60 lakhs; the initial planning and layout of the foundry has been completed and tenders invited on a global basis.

IN YOUR OWN INTERESTS

HOW TO PURCHASE TICKETS

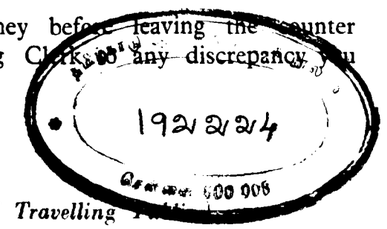
Buy your tickets only at the proper place. The authorised offices are (i) the Booking offices at the railway stations, (ii) the Town or City Booking Offices, (iii) the out-Agencies, (iv) Travel Agent. Never buy tickets from any other source as that may lead you to trouble. Please note that tickets are 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 [illegible]

SOUTHERN RAILWAYS MAGAZINE Regd. No. M. 5551 Vol. IX No. 2 August 1957

CLEANLINESS LEADS TO HEALTH AND HAPPINESS

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

Cleanliness prevents disease: medicine only attempts to cure.

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

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

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Managing Editor : T. S. KRISHNA RAO