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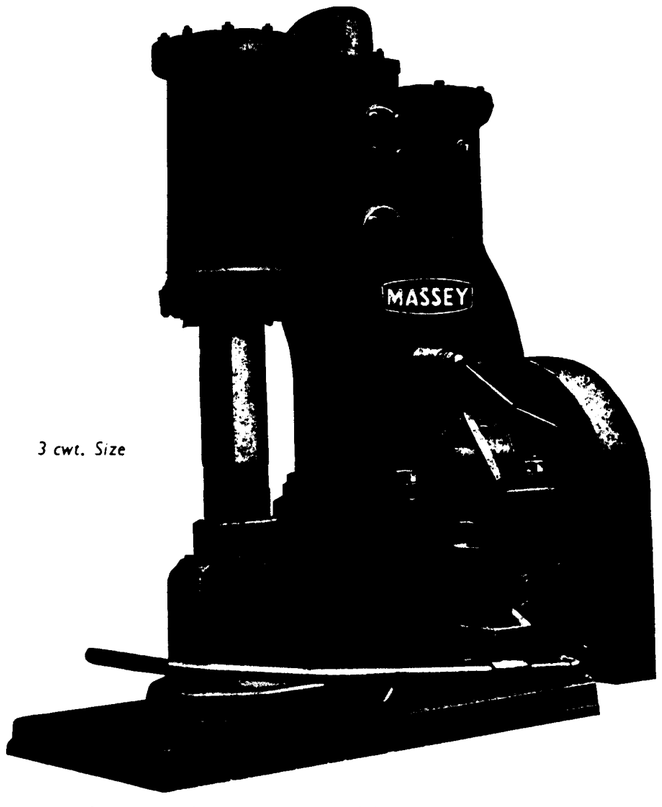

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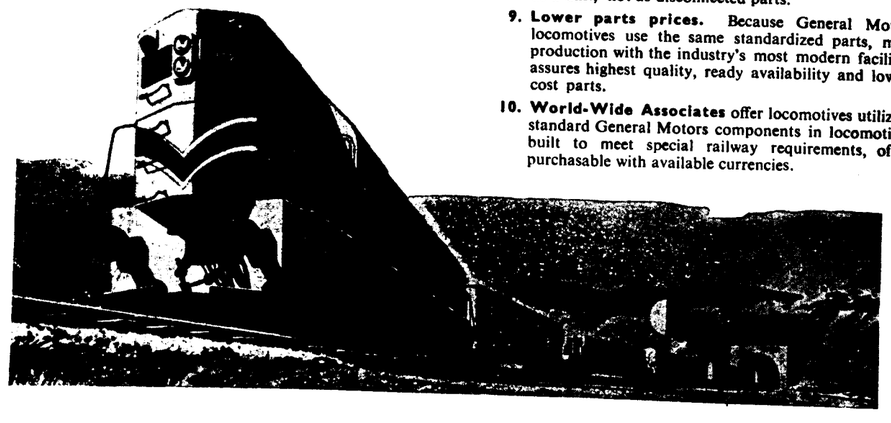

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Railway Workshops and the Young Generation

YOUTH is a period of activity and daring and for this reason we speak of the dynamism of youth. Young men generally want to be up and doing and nothing smothers and dampens their enthusiasm and initiative as inactivity. They often rebel and exhibit a spirit of intolerance if conditions are static for too long a period.

It is, therefore, good psychology and a matter of vital importance that young men in Railways whatever their status in their profession or trade, should be kept ever occupied doing something which will be profitable both to themselves and the Railway which they serve. Work only, with no play thrown in between can make Jack a dull boy and for this reason the Administration should encourage sports and games, technicians' associations, technical libraries, handicrafts and model making societies, which can divert in useful channels the energies of the young people.

It must be remembered that the young men of to-day are going to be the leaders of to-morrow, each in his respective field of work and on them will depend the future success or failure of our Railways.

It must be conceded that all young men who join the Railway service to-day come to it better qualified and better equipped to do the work imposed on them than their predecessors of 20 years ago. In spite of their youth, they appear to be more intelligent, better informed on all matters and more worldly-wise than their colleagues of an earlier generation.

Taking the young Mechanical Engineers for a start in the official grade of the Railway Service, they are selected as a result of a competitive examination after they have passed their Inter-Science. They are then given a seven years training as Special Grade Apprentices, where both their theoretical and practical syllabus is laid down to fit them in every way for superior service in Railway Workshops. In addition, before they are confirmed in any working post, they have to show their intelligence and aptitude to do railway mechanical engineering work for a period of 2 to 3 years by being attached to Senior Officers in various posts. By this time, they must win their spurs if they are to be retained in Railway service.

Compared with this, their English predecessors in workshops, were mostly practical men with hardly any theoretical qualifications. Many of them had risen from the stage of workmen, who had worked on various trades with their own hands. They came out to man the Indian Railways because there were no Indians either theoretically or practically qualified to hold charge of posts which they held. These Englishmen generally worked by the rule of thumb method, but they were endowed with both common sense and engineering sense. Their knowledge of Mathematics or Applied Mechanics, never reached beyond the apprentice stage, so that they could never work out a design problem using first principles. They had a very poor idea of stresses and strains to which locomotive or carriage and wagon parts were subjected. If a locomotive piston rod or connecting rod they increase the dimension by an eighth or a quarter of an inch without checking it for factor of safety theoretically. All they were concerned about was that the increase in dimension did not make the part foul any other.

It is reported in the annals of railway history that when a young theoretically well qualified Indian Officer was confronted with a failure of a locomotive detail, said to his Head of Department "but sir, I find that this particular part is weak in design working it out by the Euler Formula, it should be increased in diameter by 1/8th", he got the reply "sho is Euler anyway to give you these ideas, but you can increase the diameter by what you say provided that due to the increase the part will not foul anything else."

It must, however, be conceded that in spite of their lack of theoretical knowledge in engineering matters, these Englishmen, drew largely from their practical training and experience. It played the same role in their life as intuition is supposed to play in the life of a woman. They knew by a practical engineering sense, without being able to account for it by theoretical working that something was wrong and they knew what was to be done to put it right, although they could not give a theoretical explanation for their action.

They had a poor command of their own language and to write a coherent Report of more than 20 lines, on any aspect of railway working was to them really irksome and a severe penance.

Our young Engineers, when they reach the Official Grade of the railway ladder, do not suffer from the same disability and given the same opportunities, they would be able to outshine their English predecessors in all departments of railway mechanical engineering, except in the elusive faculty called 'engineering sense'.

It is because the young officers of to-day have such an excellent background of mechanical and mathematical knowledge they should be entrusted with greater engineering and management responsibility and it will be found that they can well shoulder it, as it was proved during the years of the 2nd World War. They should be given opportunities to gain practical knowledge and experience both in this country and abroad, so that with their basic engineering knowledge and training, they could observe and remember how things are done abroad and introduce suitable advance methods in their own workshops, where they hold certain charges. In this way they could rise to higher rungs of their departmental ladder of hierachy steadily and yet quickly.

So much for officers, but what about the men in the junior and senior supervisory grades? If a shopwise analysis is taken, it will be found that the old supervisors have developed certain fixed habits and find it difficult to contend with changes, modern supervision demands. Undoubtedly after years of working they know their jobs, but they have got into a rut of routine working and want to be left there in peace to pass the rest of their days. Some of them do not aspire to higher positions of responsibility and would be satisfied to retire from their present position without any additional exertion. Expansion in the scope of their activities leaves them cold and the introduction of new and up-to-date methods to increase production puts them into a flat spin. They find it extremely difficult to meet changed conditions of working or altered methods. They would, if they could get all their benefits of Provident Fund and Gratuity and retire before their time and eke out a peaceful existence rather than face the present exigencies of a dynamic supervision.

No so the younger supervisors who show a better flexibility in working and have a better control of the men who work under them, provided they have been good tradesmen themselves. They are ready to adapt themselves to the changes for the better which may be introduced by an elightened management. They have the courage to face difficulties and overcome them rather than run away from them. They can be relied upon to give better production in spite of the many handicaps that may be imposed upon them. They are not overcome by fatigue by the end of the day as their older colleagues and what is more, after due rest they have wonderful powers or recuperation. It is for this reason that younger supervisors are earmarked for supervision on overtime or night shift.

The younger supervisors start their apprenticeship to-day after passing the S. S. C. or Inter Science, which is indeed a higher standard of education when compared with their colleagues of 20 years standing. Hence their minds work more quickly and they are able to grasp an order of understand instructions without loss of time and execute them speedily. Many of them dare do things in times of emergency which their older colleagues would shudder to think of and get away with it. As the saying goes, it is fortune which favours the brave. Because of their initiative and ability, they naturally receive recognition from the management and in due course receive or are earmarked for promotion to higher grades on merit, which is exactly as it should be in the selection grades.

Having examined the position of Supervisors, let us examine the conditions of the workmen in various trades of the workshop. When it is a question of increased production, it will be found that properly trained

tradesmen can be expected to give a greater production or comparable machines or work done by hand. In the strenuous trades like those of blacksmiths, boilermakers, they show a greater stamina and are capable of working for longer hours, more willingly than the older tradesmen, who work if they are obliged to do so, very reluctantly.

Their youth and their freedom from encumbrances give them a different outlook of life and they are therefore generally more cheerful and enthusiastic in what they do. If approached in the by the management or their own supervisors, they are prepared to accept orders and execute them more promptly than the older men. Not having got into a rut and with the optimism of youth, they work hard to see recognition and so earn their promotion more quickly. It is in the interest of management to spot these young men and recognise their ability when the time comes for making a selection to the supervisory grades.

Good young workers show a certain lack of responsibility and are not always loyal to the Administration which they serve and unless thoroughly satisfied with wages, conditions of service and chances of promotion are likely to seek employment by which they can better their prospects. This was forcibly brought to the notice of the Railway Administrations during the war years, when their best young tradesmen left the railway service and went into private industry, attracted by the higher emoluments offered there, even if conditions of working were harder and the amenities not so many.

Some of these young workers show early signs of leadership and should be picked up when opportunity offers to fill supervisory grades and it is incumbent for railways to realise in the best interest of work that all supervisors should be chosen by a definite act of selection. Promotion by recognition of merit to the supervisory grades will act as an inducement to work hard, intelligently and conscientiously on tradesmen in general and improve the morale of railway working.

In times of strikes or labour disputes, it is the young men who create all the mischief and as they have nothing to lose, are more prone to hooliganism and intimidation of the older workers. The older workers, with much to lose, leave the workshops at the first sign of labour trouble and come back when a settlement is reached. The young workers do not act in a foolish manner because of malice, but by a sense of bravado where they want to show their antagonism to the management and defiance to railway authority. Here again the study of the psychological make up of these budding leaders and handling them in the right way in a firm but concialatory manner.

Before concluding, I must pay a tribute to the older Anglo-Indian Supervisors as one who has worked with them for many years. They were generally excellent tradesmen and may be because of their fairer skin, had a masterly control over their men. In the early days, they may have been a bit arrogant, but after the Indianisation of the official grades, they worked co-operatively with Indian Officers. They were both knowledgeable and obedient, without being subservient or psycophantic. They could be trusted to do a job on time if they gave their word. The information they supplied and the reports they submitted were reliable and could be acted upon with confidence. In loosing this class of Supervisors, India has lost quality workshop supervision which will take many years to build up.

If the Railways of India are to progress and hold their own in the India of the future, it is necessary and incumbent that youth should be at the helm of affairs and for this reason, young men of promise should be watched, encouraged and given such positions in every rung of the ladder, which will test their initiative, ability, responsibility and sense of judgment, which will enable the Railways to undertake the enormous tasks which are likely to be imposed upon them when the country develops her resources in agriculture, industry and oil and mineral wealth.

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Worthington Corporation enters Transportation Field announces New Self-Starting Automatic Unit

WORTHINGTON Corporation (U.S.A.), one of the nation's largest suppliers of air conditioning, refrigeration and heavy industrial equipment, has announced its entry into the transportation field with the introduction of a refrigeration-heating unit engineered for truck, railroad and trailer use.

The unit is also adaptable for use on smaller boats carrying fish or other perishable commodities.

Export sales of Worthington's new transportation equipment will be handled through the firm's International Operations Air Conditioning Products department.

The new truck unit incorporates a number of attractive benefits, according to Worthington sources. It is provided with a self-starter and thus requires no external starting power. It is exceptionally light in weight, weighing as much as 300 pounds less than other units of similar capacity. It requires 50 percent less space than other units.

The Worthington refrigeration-heating unit is completely automatic. Temperatures anywhere from minus ten degrees (F) to 75 degrees above can be automatically maintained regardless of changing ambients. The unit was completely tested for a year prior to its introduction.

The entire unit consists of a diesel-engine-driven condenser section and a separate evaporator section. A Mercedes Benz 108 cu. in. 1,800 r.p.m. high speed—1,200 r.p.m. low speed engine is used. A 40-gallon fuel tank is standard equipment and a 75-gallon tank is available.

The whole condensing unit including the diesel engine can be removed from its housing for ease of servicing. The unit slides out on rails.

The condensing unit can be mounted below a trailer body longitudinally or transversely on either the curb or road side. It may also be mounted internally for container-type applications. The evaporator unit is mounted at the front of the trailer.

Air circulation is provided by two fans with separate 12-volt DC motors assuring high volume under all conditions. The dual fan design also provides a safety factor. Failure of one fan or motor will not affect the other fan.

An automatic defrost system is controlled by thermostat setting and is triggered by frost build up on the evaporator coil. When it goes into operation, the fans are stopped and the refrigeration system works as a heating unit until the frost is melted.

All components are designed to give the lowest possible center of gravity when installed. This eliminates the need for special trailer reinforcements to carry the additional weight.

The new Worthington unit can also be used independent of a trailer as a stationary, emergency or temporary source of refrigeration for cold storage facilities.

Purchase of Rail Sleepers from Kashmir

It is a fact that the Northern Railway has negotiated with the Forest Department of Kashmir for the purchase of 10 lakh sleepers, said the Deputy Minister of Railways, Shri S. V. Ramaswamy in a written reply to a question by Shrimati Krishna Mehta in the Lok Sabha on 23rd November, 1960.

The Deputy Minister added that the Railway Board had approved of the proposal to purchase 10 lakh broad gauge units from Jammu and Kashmir during the period November 1, 1960 to October 31, 1961 at the existing rates. However, formal approval of the Jammu and Kashmir Government was awaited.

Tests to determine the most suitable Type of Air Filter for Electric & Diesel Electric Railway Locomotive use in Industrial Areas

By An Engineering Correspondent

ELECTRIC and diesel-electric locomotives possess many characteristics making their use preferable to that of steam traction but their introduction has raised certain additional problems. Not the least of these is the necessity to supply a considerable volume of clean air for cooling and intake supply. Preliminary assessment of the requirements suggested that a number of aspects of the problem were not fully understood and the best approach seemed to be a series of controlled tests in service conditions with filters of varying characteristics.

It was necessary to narrow down the field, firstly on the basis of a theoretical assessment, and secondly, to those types shown by Laboratory tests to hold most promise. These aspects will be covered briefly in this report before proceeding to describe the field trials which were conducted on a series of electric locomotives running over the recently electrified Manchester-Sheffield-Wath extension.

THEORETICAL CONSIDERATIONS

The dust arresting performance of an oil wetted filter is dependent on two processes :

(a) effective impingement of dust on a large area of oily surface, and

(b) adequate retention properties to obviate subsequent re-entrainment of particles as the oil is "dried up" by collected solids.

If the oily surfaces are separated by relatively small passages, accumulation of dust causes appreciable reduction in flow area ; ultimately the spaces will be occupied by a porous bed of solids having the effect of maintaining filter efficiency even after the oil has been absorbed, at the cost of increased pressure loss.

Such filters are termed the "constant efficiency type", and possess the advantage that solids "carry-through" does not occur, and need for servicing is positively indicated by increased back pressure.

However, it may not always be convenient to effect servicing immediately, and alternative filter arrangements are possible in which the spaces between oil wetted surfaces within the filter medium are purposely increased. Usually steps are taken to maintain adequate wetted area despite the increased voids by disposing the collecting surfaces in greater depth. It is possible to devise such filters with internal surface spacing sufficiently large to ensure adequate flow passage without this "bridging" tendency. During this process, the rise of pressure loss is small, at the expense of steadily reducing efficiency until ultimately the air passes through substantially uncleaned.

Although this may be advantageous where maintenance of full airflow is more important than transmission of solids if servicing is delayed or overlooked, dangers exist in that dislodgement of "cakes" of previously arrested dust may occur under conditions where vibration can accompany sudden surges of air flow, as for example when entering a tunnel at speed. Consequently, the use of filters with such "reducing efficiency" characteristics cannot be recommended.

The "herringbone" crimped wire mesh panels referred to later represent an improved version of this type, but even a short period of running following servicing suffices to show a marked reduction in efficiency, this continues progressively during subsequent running. This was later confirmed by the relatively dusty internal condition of the locomotive after test.

A prime aim of these tests was to ascertain the feasibility of combining both characteristics to a degree permitting full protection to be afforded in emergencies, over service intervals double that normally recommended. For a given pressure loss, more positive arrestation of particles is secured by employing the minimum possible spacing between wetted surfaces, and then securing maximum total open area by deploying the filter medium in deeply pleated formation. Oil wetted filters of this type include the

Vokes 3-ply and 5-ply panels and so these both figured in subsequent tests.

Other types of filter which held promise employed various configurations of oil wetted surface, including knitted wire, variable density woven wire, herringbone crimped sheet metal, and neoprene bonded hair. All these were submitted to Laboratory testing as described below :

Laboratory Testing

Panels were made up of suitable dimensions for test, employing the following arrangements :

1. *Vokes 5-Ply :* The medium consists of three layers of wire mesh interspersed with two layers of cotton gauze. The latter serves the dual purpose of decreasing the average air passage dimensions, and acts as an absorbent to increase the effective mass of oil the panel can accommodate. The whole is deeply pleated to increase the total developed area to a maximum.

2. *Vokes 3-Ply :* Similar to 5-Ply but with only two layers of wire mesh and a single layer of cotton gauze between.

3. Wire mesh screens of variable bulk density, the more open mesh being upstream.

4. Neoprene bonded hair.

5. Woven wire screen; material similar to conventional oil bath scrubber pack.

6. Herringbone crimped wire; alternate layers with flutes in opposition.

7. Herringbone crimped sheet, with similar arrangement of layers.

Complete discussion of the Laboratory results is outside the scope of this report, but the following figures, indicating efficiency on test dust to B.S. Specification 1701 will indicate the trend :

Filter Medium	Efficiency %		Pressure Loss ins. W. G.	
	initial	600 gms/ft.² load	initial	600 gms/ft.² load
Vokes 5-ply (oil wetted)	99	98.9	0.13	0.73
Vokes 3-ply (oil wetted)	99	98.8	0.06	0.48
Variable Density wire	93	74	0.13	0.62
Neoprene bonded hair	99	98.5	0.18	0.32
Woven wire	97	82	0.22	0.50
Herringbone Crimped wire	99	55	0.04	0.05
Herringbone crimped sheet	75	50	0.08	0.09

Inspection of these figures, indicates a marked variation in performance up to a considerable dust load, but it is possible to observe the fundamental differences between the virtually constant efficiency media such as the 5-ply and 3-ply, and the reducing efficiency types such as the herringbone crimped wires and sheets. Some types obviously possessed poor overall performance, and so were deleted from further work.

SERVICE TESTS

Although not covered in the Laboratory tests, some past experience on the 5-ply filter had been obtained in the dry state, and it seemed logical to include a number of these.

Practical limitations on service tests and desirability of obtaining fullest information on those chosen, made it necessary to exclude certain types with intermediate performance, such as the woven wire screen. However, from the service results it is possible by interpolation to estimate the performance to be expected from this pattern; efficiency would be considerably lower than with the 3-ply type but better than the herringbone crimped wire. Dust load capacity on the other hand would normally be rather inferior to either of the other varieties, but good pressure loss regulation would be achieved, in conjunction with substantially non-clogging characteristics.

Finally, therefore, the following were chosen for test :

(a) The Vokes 5-ply filter (dry).

(b) The Vokes 5-ply filter (oil wetted).

(c) The Vokes 3-ply filter (oil wetted).

(d) Oil wetted Neoprene bonded hair panels.

(e) Panels consisting of layers of wire mesh corrugated in herringbone formation with channels of adjacent layers running in opposition.

The prime aim of the investigation was to ascertain the most suitable type of filter for use in average conditions including those experienced in highly industrialised areas of the United Kingdom. Past experience in certain overseas markets had proved the 5-ply dry filter to be capable of satisfactory performance in conditions where dry inorganic dust predominated, but application of this type of filter for use in industrial areas had not met with such complete success and conventional reducing-efficiency oil wetted panels were equally open to criticism on account of low dust separating efficiency.

For the purpose of the tests, the recently electrified line between Manchester, Sheffield and Wath was chosen as this encountered a fair cross-section of conditions including areas where much soot and potentially corrosive contamination would be experienced. The tests were carried out on four locomotives of the Bo+Bo type used for both light goods and passenger transport. Each locomotive requires 18 panel filters passing a nominal 600 c. f. m. each, 17 being installed in the side walls and one to the H. T. compartment, which is an internal unit.

One type of filter only was fitted to a single locomotive but in some cases, opportunity was taken to employ alternative wetting oils and with the 5-ply filters, four dry units were employed with 13 of the wetted variety, to act as controls. Previous running had already been effected with the 5-ply filters in their dry state and criticism incurred through corrosion and difficulty in cleaning. It was in order to compare directly these effects with those experienced on the various oil wetted panels that the four dry filters were employed. Examination of used dry 5-ply panels had indicated that corrosion of the metallic parts had occurred and this assisted in the formation of a bond between the metal gauze and the tarry deposits, which was difficult to break down by normal solvent cleaning. There is little doubt also that this effect was aggravated by the inefficient performance of water separating louvres in front of the filters which had allowed rain to penetrate and assist in corrosion effects, particularly when other atmospheric agents were available.

Attempts were made to check the performance of the filters in terms of depression inside the locomotive at monthly intervals and in most cases, the filters were removed after operating for 60 days and returned to the Laboratory for individual pressure loss testing and assessment of collected solids. In certain cases, through service limitations, it was necessary to carry out this exercise at an earlier or later stage with the result that occasionally filters were left in situ for as long as 150 days.

Previous experience on the dry type 5-ply panels was largely reproduced in that rise of pressure loss with solids accumulation occurred more rapidly than with the oil wetted version of the same filter, and servicing by normal solvent processes was considerably more difficult. Also, performance of the bonded hair fibre panels showed a marked tendency in the same direction regarding pressure loss increase with dust load.

The oil wetted 5-ply panels exhibited quite good characteristics in respect of pressure loss rise and this has previously been proved due to the considerable quantity of oil which can be absorbed by the two layers of cotton scrim, allied to the large developed area of the deeply pleated 5-ply panel. These tests have proved that the oil wetted version is capable of retaining a larger quantity of solids than the dry version for a given rise in pressure loss.

Of all the types tested, the 3-ply oil wetted panel stood out as possessing the best combination of characteristics, with an efficiency assessed on the basis of locomotive cleanliness very little short of the 5-ply but with the capacity to operate for a considerably longer period without excessive rise of pressure loss. In one case, service contingencies made it impossible to clean the filters on the 3-ply fitted locomotive for 150 days and over this period the depression inside the cabin increased only from 0.09" w.g. to 0.28" w.g. Perhaps of even greater interest is that up to 120 days, only a very small increase to 0.12" had occurred.

Assessment of dust arresting efficiency was not directly possible but on the basis of internal cleanliness of the locomotive, these tests have shown that the 5-ply and 3-ply oil wetted filters maintained a cleaner condition than that possible with the other varieties of which the Neoprene bonded hair was considerably better than the herringbone wire.

DISCUSSION OF RESULTS

The Vokes 5-Ply (Dry) Filter

Past experience has shown this type to give good performance in certain overseas conditions, but this series of tests has confirmed that difficulty in servicing may be experienced with a combination of industrial pollution and rain ingress to promote corrosive bonding of contaminant to the filter.

Furthermore, whereas the oil wetted versions of this filter could retain over 200 grams of atmospheric contaminant for a pressure loss rise (on average) from 0.16" w. g. to 0.20" w. g. the dry 5-ply showed an increase from 0.13 to 0.46" w. g. under the same conditions.

This indicates that the presence of oil on the filter assists rather than inhibits the formation of a highly porous bed of solids.

Experience showed that on an average, between 3,000 and 4,000 grams of solids (up to 9 lbs.) would be collected by the 17 main filters on a locomotive in 60 days average running.

If 60 days is accepted as a satisfactory filter servicing interval, the 5-ply *dry* filter would be excluded on grounds on excessive pressure loss increase, allied to difficulty in cleaning.

The Vokes 5-Ply Oil Wetted Filter

A few figures were quoted as comparisons under "5-ply dry filter", and it has been shown that this filter, despite its "constant efficiency" characteristics, can accommodate a remarkably large dust load for a modest increase in back pressure. Regular 60 day servicing by the means described later would ensure satisfactory performance under any circumstances likely to be experienced in other than dust storm conditions, and some latitude would exist to accommodate limited abuse due to delayed servicing.

The extent of this could not be determined, as the one extended test with the 5-ply filters to 130 days was rendered abortive through servicing having been effected on site without the filters first being returned to our Laboratory for testing in the loaded condition; however, a final depression in the loco of 0.7" w. g. was recorded, and this is considered excessive. We would suggest the maximum emergency interval with 5-ply oil wetted filters should not exceed 90 days.

These filters maintained the locomotive interior in exceptionally clean condition throughout.

The Vokes 3-Ply Oil Wetted Filter

Owing to operating contingencies, it was not possible to effect servicing of the 3-ply filters until 150 days operation had been completed. Over this period, a solids weight of 8,580 grams was recorded on return of the panels to VOKES' Laboratory and as some would inevitably be lost in transit, the total collected must have been considerably greater.

This represents a loading of approximately 500 grams, or well over 1 lb. of solids per filter, and it is interesting to record that the locomotive depression only rose from 0.09 to 0.28" w. g. over the whole period. At 120 HRS. a depression of 0.12" w. g. was recorded, suggesting that approximately 1 lb. of atmospheric solids per panel can be accommodated on each oil wetted 3-ply filter panel for a very small increase in restriction. Allowing for contingencies, a normal servicing interval of 60 days would provide at least a 2 : 1 factor of safety against neglect or inability to service at the correct time.

The locomotive cabin condition was but little inferior to that noted following the 5-ply oil wetted filter tests.

The Neoprene Bonded Fibre Filter

Performance on laboratory tests had suggested that this type was a good intermediate between the constant efficiency 5-ply on the one hand and the reducing efficiency herringbone crimped types on the other. It was disappointing therefore, to record on the field trials, that these hopes were not borne out in practice.

Unfortunately, the first series of tests over a period of 60 days proved inconclusive due to a tendency for the expanded metal facing to the hair pack to choke prematurely; as a consequence, an unduly rapid restriction rise was recorded, being 0.23 to 0.61" w. g. for a period of 60 days and dust load of 3,337 grams (7 lb.).

The test was repeated with the offending facing replaced by a suitably open mesh, and results improved considerably over the ensuing 60 days. For some reason not fully understood, the weight of dust collected during the second period fell to just under 2,000 grams (4.5 lb.), for which load the restriction rose from 0.21" w. g. to 0.27" w. g.

Test results for later running periods of longer duration are not yet complete, but the indicated pattern to date is similar.

The conclusion to be drawn so far is that this type of filter possesses a reasonably flat pressure loss/dust load characteristic, but this is at a generally higher level—over double—that recorded for the 3-ply type filter.

Examination of the locomotive interior during and after test revealed that more solids had penetrated this filter than was the case with the 3 and 5-ply varieties, and the overall balance was considerably in favour of the latter types.

It was subsequently learned that use of this type of filter would be excluded from locomotive wall service on account of excessive fire risk from hot cinders, etc.

The Herringbone Wire Panels

Although a considerable running period has been effected with these panels in situ (115 days), unfortunately servicing had been effected on site, and it was not possible to carry out the usual inspection and pressure loss tests at our Laboratory.

However, a surprisingly rapid locomotive depression rise was recorded, from 0.10" w. g. initial, to 0.7" w. g. at 115 days. This was considerably in excess of that noted for the 3-ply filters after 150 days, despite the positive retention characteristics of the latter. In view of the markedly dirtier condition of the locomotive during and after test, this type of filter is definitely not favoured, especially as the hoped for non-clogging characteristics were not realised in practice to an extent justifying the observed rapid efficiency reduction with increasing dust load.

FILTER SERVICING

For the purpose of these tests, the filter panels were returned after use to VOKES Laboratory so that inspection and pressure loss tests at standard airflow could be effected before cleaning; washing off and re-oiling were then carried out in a special machine devised to facilitate these operations. One such machine has now been installed at Reddish Depot, Manchester, by British Railways, and is in regular use.

The machine includes suitable washing and wetting tanks disposed around a centrifuge to accelerate drainage of excess fluids from the panels. The most effective cleansing agent has proved to be "Liquid Solvex", a product of the Fletcher Miller Company, and one tank contains this hydrocarbon base, water soluble solvent, and emulsifying agent.

A second tank contains hot water (60—70°C.) for the purpose of wetting out the solvent and removing the collected solids, and the third tank holds the wetting oil.

WETTING OILS

Opportunity was taken of the field trials to compare two wetting fluids, a straight mineral/vegetable blend oil in wide use for the purpose, and a water soluble emulsified oil of generally similar characteristics.

Performance of these two fluids as filter wetting agents proved to be very similar, and no conclusions can be drawn to favour one or the other. However, the water soluble oil proved of great advantage for servicing as soaking times in the solvent and water tanks could be usefully reduced for equal effectiveness. We tend therefore to favour use of the soluble oil for wetting filter panels for this service.

A word should be added regarding the special air filter wetting oils recently made available in Great Britain. Test results have been quoted by the sponsors indicating a usefully improved performance when applied to "reducing-efficiency" filters in certain overseas service.

The special oils were not available in time to permit inclusion in the field trials, but Laboratory tests have been carried out by us in co-operation with the suppliers. Briefly, the object of these fluids is to secure at once the good wetting and wicking characteristics of a light mineral oil, together with

anti-draining properties offered by the presence of a semi-soluble additive. The effect is to increase substantially the mass of oil a given filter can retain after servicing, and so provide good surface wetting of the accumulated dust pack beyond the point at which a conventional oil would be fully absorbed.

The advantages are greatest with the "reducing efficiency" type of open pack filter which is enabled to operate for a longer period before serious deterioration of collecting performance sets in. Applied to filters such as the 5-ply and and 3-ply however, which are themselves designed to possess good wicking and anti-draining properties, the advantages are not so marked, and unless due precautions in draining at an adequately high temperature are observed, a possibility of excessive oil retention exists, which could cause abnormally high back pressure. Experimental work is continuing in cooperation with the suppliers. Advantages are greatest when applied to filters possessing poor retention characteristics.

EXCLUSION OF RAIN WATER

Comment has already been passed on the effects experienced due to water ingress on the dry 5-ply filters. Presence of water on any dry or viscous panels is obviously disadvantageous and if the recommended water soluble wetting oils are employed, long term performance would be affected due to removal of wetting fluid.

The VOKES "Monsoon" type louvre has been expressly designed to exclude rain water, which it does most efficiently, and irrespective of the type of filter employed, fitment of these or equivalent louvres is highly desirable to secure optimum filter performance.

CONCLUSIONS

The field trials show one type of panel filter, namely the VOKES 3-ply (oil wetted) to be markedly superior to all the alternatives, and using the ratings applied during these tests—i. e., a face velocity of approximately 300 feet/minute—excellent performance, with neither efficiency fall off nor premature choking, can be achieved over a period of 120 days average operation under industrial conditions in the U. K.

Allowing for emergencies and service contingencies, a nominal service interval of 60 days, would provide a factor of safety of over 2 : 1. Such performance could not be achieved with any of the other filters, including the herringbone crimped wire mesh and Neoprene bonded hair panels.

(Vokes Limited wish to express their gratitude to Mr. K J. Cook, O.B.E., Chief Mechanical and Electrical Engineer, Eastern Region, British Railways and his staff for their co-operation during these tests.)

INDIA ORDERS MACHINE TOOLS FROM U. K. FIRM

Craven Bros. (Manchester) Ltd., the Stockport (England) firm of machine-tool makers, have been awarded orders from India valued at more than £600,000.

The firm were told by cable of the order, the precise value of which will not be known until they receive details of the additional equipment required with the machines.

Craven Bros. specialize in large, heavy machine tools for general purposes.

This latest order brings the intake of new work since the beginning of this year to well above £1,000,000, and further substantial contracts are at present being negotiated.

Craven Bros. have already fulfilled a number of orders in India.

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ELECTRIC TRAINS— I. C. F. TO MAKE COACHES

The Integral Coach Factory, Perambur, have undertaken a new line of production—electric multiple unit coaches for the Calcutta Railway Electrification Project authorities.

The Railway Board have placed orders for the supply of 64 E.M.U. four-unit trains at a cost of about Rs. 15 crores and the first unit is expected to be delivered by the last quarter of 1962 or the beginning of 1963.

Mr. K. Swarup, Chief Administrative Officer, Integral Coach Factory, said that production of an electric multiple unit coaches was an entirely new line of production. With the help of the French collaborators of the Calcutta Electrification Project as well as the factory's own Swiss collaborators, they hoped to meet this urgent request on an emergency basis.

Lubrication of Rails and wheel flanges

By Hans Ablassmeyer, Munich

THE wear of flanges and rails through dry friction in curves is a source of constant and heavy expenditure to railway companies and, in addition, very often the reason for avoidable breakdowns and out-of-service periods of engines.

In order to reduce this wear by using suitable lubricating systems, a number of lubricating devices have been developed over the years, installed either on engines or on rails. The usefulness of these various lubricating means was however limited until, not long ago, a solution was found to the many and involved problems governing the efficient lubrication between wheel and rail.

The following report is a synopsis of the various solutions of these problems and of the experience gained from the use of a variety of lubrication systems for rail and flanges respectively. In addition, performance data available to date is included.

There is no fundamental difference between the lubrication of flanges and that of rails, as far as the ultimate effect is concerned, since both flange and head of rail are subject to the same friction which must be reduced by suitable lubrication. Judging from experience, it can be said that the lubrication of flanges. as compared with the lubrication of the rail itself, offers special advantages as regards economy, safety and efficiency.

In the following paragraphs two typical cases are described, illustrating the difficulties that have to be overcome when the system of direct lubrication of the rails or of the edge of the head of the rails is adopted.

The fundamental principle of the PAEHLER Lubricating System is based on the fact that the weight of the wheel, when passing the rail, causes a certain sagging of the rail. This sagging operates an oil pump that supplies oil to a brush which, in turn, is pressed downwards at the moment when the wheel passes over the rail, and in so doing, lubricates the head of the rail over a length of twenty inches. This device, when first installed, must be inspected once a day and subsequently once a week.

Some other systems, including some of foreign design, are based on the same principle. To ensure sufficient lubrication of the rail three complete lubricating units must be installed in each curve. Their satisfactory operation depends on the condition of the track, e. g. tight or loose sleepers etc. Furthermore, oil, pump, joints and brushes are all subjected to the influence of climatic conditions, e. g. water, frost, cold, and the injurious effect of foreign matter, e. g. dust, grit, stones. This equipment cannot be used where sand is employed to prevent slipping. In addition, initial expense and upkeep and maintenance costs are high. The Railway Company of Western Germany have limited the use of this system to a few applications only.

A British solution to the problem, operating independently of the track provides a closed-in lubricant container on the rail and thus obviates the use of brush or wiper.

This system too requires the installation of several units in each curve. There is no information available about the results obtained from its use.

Another method lubricates the rail by means of a lubricator installed on the engine. The extremely complicated mechanism is set in motion by the movement of a pendulum, which—in curves—swings and at the end of its swing touches an electric contact, thereby causing electrically controlled distributing valves to spray, through a pipe of telescopic design, oil and compressed air on to the edge of the head of the rail. This system is used on a number of French Railway Lines. As already pointed out it is very complicated and in addition has the disadvantage of not lubricating the beginning of a curve.

On the question of lubrication equipment for flanges, for a long time no solution was found that could be used successfully under all conditions. The following report outlines these conditions and the requirements that have to be satisfied when an attempt is made to develop on efficient flange lubricator.

At the same time, a summary is given of the different methods, their advantages and disadvantages.

The older systems provide for the lubricating medium to be directly applied to the flange through rollers, balls or pins, which slide on the radius between tyre flange and tyre tread. The lubricant is fed either from a reservoir (by gravity) or by means of a pump.

If the lubricant fed from the reservoir is oil, the latter will also drip during periods of stoppage of the engine and is likely to spread on to the tread of the wheel.

All these systems however, did not successfully solve the problem posed. In the case of the pin, the oil groove filled with brake-dust; when the spring pressure exerted on the pin was too great the former mounted the flange; conversely, when it was too small the pin dragged on the tread. In the case of rollers and balls, these were worn flat and thereafter no longer able to revolve. All these designs therefore required continuous inspection by experienced men. Within this group of lubricating devices was one developed by the German Railway Company operating on the principle of a cartridge of stiff grease pressed against the flange of the wheel.

The results obtained by this method are given elsewhere in this article.

Modern lubricating systems, however, prefer the indirect transmission of the lubricant by means of compressed air. For this purpose nozzles are attached to the flange of the engine just in front of the wheels and are supplied simultaneously with compressed air and lubricant. The lubricant is atomised by the nozzles and is spurted on to the rotating flange in the form of a powerful jet. The jet is directed accurately on to the flange even in case of vertical or axial displacement of the axles. Vertical movement is of no consequence as the nozzle is installed approximately level with the axle, whereas axle movement only alters the length of the jet. Consumption of compressed air is low, and both cost and volume of compressed air are negligible.

To supply a lubricant to the flange, depending on the wheels passing over a curve, is obviously desirable. Some methods devised to meet this problem make use of the swing of the pendulum, or of the inclination of the engine bogie when travelling in curves, to operate the nozzle by means of a lever or similar system.

Such systems however, have the disadvantage of a time lag between the moment the engine starts passing over the curved rails and the application of the jet. As a result the considerable forces that are set up when, at the beginning of the curve, on engine alters its course, are taken up by ungreased rails and the friction thus created is the cause of comparatively heavy wear. In place of lubricating systems depending on curves the system in which the distance travelled by the wheel forms the basis for lubrication can be employed.

In this case, the lubricating pump is actuated by the driving mechanism of the engine or by a wheel axle. At intervals of a given number of axle revolutions, i. e. each time a certain track distance has been covered, the pump mechanism is set in motion and the flanges are lubricated, the process being therefore entirely independent of curves.

Each lubricating process takes place after the completion of a certain number of revolutions by the wheels, and the film of grease is therefore renewed at track distances of equal length. Furthermore, when the engine enters a curve the wheel flanges are already covered with an adequate film of grease. This ever-present film reduces also friction and wear on straight lines.

The leading engine wheels only are greased. Engines running always in one direction, e. g. engines with tenders, are lubricated on two flanges only, whereas four flanges are lubricated where engines often change direction, e. g. tank engines and electric locomotives. In the case of four flange lubrication provisions are made to cut out the lubrication equipment of the rear wheels.

In addition to the lubrication requirements, as discussed above, the actual lubricators must be of a design that embodies all the features which guarantee their satisfactory in operation service. They must be unaffected by frost, moisture, dust and dirt, and must also withstand the hard knocks and shocks of every day railway service. They must be fully automatic and require a minimum of attention and maintenance only. Above all however, they must prevent the lubricant from reaching the tread of rail or wheel as this inevitable results in slipping. The surface to be lubricated is a very small area and located immediately next to the tread. When oil is used to lubricate the flange there is a danger that it will spread to the tread; this is particularly likely on hot days or when the wheels are hot.

This potential source of trouble can be avoided by the use of grease as lubricant. Due to its highly adhesive quality, the film of grease adheres to the flange and to the side face of the rail and does not spread to the tread.

The use of grease lubrication of flanges is dependent on the existence of a grease pump which is capable of conveying, under high pressure, to the points of application, small and precisely determined quantities of comparatively stiff grease.

Railway line	*Total length of track in miles*	*Number of curves*	*Total length of curves in miles*	*Percentage of curves to track*	*No. of turns*	*Average dia. curves in yds.*
Schwarzach–St. Veit–Spittal	52	235	25	48%	18	388
Insbruck–Brenner	23	130	12	53%	8.5	396
Landeck–Bludenz	40	200	16	40%	12.9	344
Freilassing–Berchtesgaden	21	115	9	42%	8	308
Freiburg–Titisee–Seebrugg	31	180	11	35%	7	428

These requirements necessitated the systematic further development of existing grease pumps, as used on machinery.

As the grease pump industry in Germany had been in the forefront for some time, the conditions for the development of a special flange grease pump were very favourable. It soon became evident that the method of grease lubrication offered a number of important advantages as compared with that of oil lubrication, which had hitherto been adopted at home and abroad.

A system of flange lubrication which takes into account all the requirements mentioned above, from both technical and practical points of view, has been developed by Messrs. De Limon Fluhme & Co., Engineers of Dusseldorf. The design of this system is characterised by the following features:

1. The Lubricating Medium is Grease, which is supplied from a Pump and is squirted by compressed air on to the flange in the form of a jet.

2. The brief squirting process is regularly repeated at given track distances. The simultaneous supply to the nozzle of both grease and compressed air is controlled by the pump which is actuated by the driving mechanism of the engine or by a wheel axle.

3. During the lubricating process, compressed air is supplied from the small air receiver of the pump which is recharged after each application.

4. The pump is equipped with a micrometer feed knob.

5. The grease inlet of the nozzle is controlled by a spring loaded diaphragm valve which exerts a constant pressure of 335 lbs. per square inch on the grease, thereby ensuring a constant pressure supply.

6. The pump supplies two or four nozzles in rotation.

Before the end of the war German Railways employed the method of rail and flange lubrication to a limited extent only. As regards lubrication of rails, lubricating devices of the Paehler type were mainly used.

Some electric locomotives had been fitted with Heyder type flange greasing equipment. This applies the lubricating medium to the flange by a roller running on the wheel circumference between flange and tread. The lubricant is supplied by means of a pump. Stiff grease cartridges, previously described, were also used on BO-BO Engines, e. g. on the Schwarzach St. Veit-Spittal Line (Tauern Railway) Bludenz-Landeck Line (Arlberg Railway) Freilassing-Berchtesgaden Line and Titisee-Seebrugg Line (Hollental Railway). The above table shows the percentage of curved track on these lines which gives the reader some idea of the wear that must be expected.

Yet another system, called R. Z. A. Lubrication, employs a cylinder of stiff grease in a cardboard cartridge which is pressed against the wheel by means of a spring, thereby producing a film of grease on the flange. Both cartridge and spring are housed in a tubular holder which is attached to the locomotive frame. This device has the advantage of simplicity and low initial cost. In addition, the installation to already existent engines does not present any difficulty. The grease cartridges can be made from waste materials. The dimensions of the cylinder, cartridge casing included, are 2″ diameter by 8″ long. Each engine is fitted with four cartridges but the leading wheels only are greased. The cartridges require daily adjustment, and in the case of unfavourable track conditions, must be sharpened daily, for which purpose the cartridge cases have to be removed. It has been established that this system of flange lubrication operates efficiently only when it is attended by a man, specially employed to look after it, to inspect the grease cartridges and to replace them in good time. The effectiveness of the system depends entirely on the reliability of this man.

It must here be added that in winter when there is deep snow on the ground, the cartridge cases are liable to be torn off and it is therefore advisable to remove them during these periods.

After the war other means of lubrication had therefore to be adopted and flange greasing equipment of the De Limon type, as described above, was fitted on the Freilassing - Berchtesgaden Line. These Lubricators have now been in use for two years and have shown startling results. No attention to this equipment is necessary during service, except to re-charge the pumps with grease every 2,500 to 3,500 miles. The total cost for about 2,500 engine miles (including depreciation, maintenance and service) was found to be half that of the R. Z. A. System. It can be said that, without taking into account the saving in wear of wheels and rails, the initial expense of a complete installation will be recovered within four months.

The Freilassing-Berchtesgaden Line has a large number of curves. Previously, it was necessary to fit new tyres to the wheels every 22,000 miles on the eight engines in service on this line. After a trial unit of the De Limon Lubrication System had been installed and found satisfactory, four engines were fitted with this type of equipment. The result was an increase in mileage from 22,000 to 77,000 miles. A true comparison between engines with wheel flange lubrication equipment and those without is no longer possible as the latter benefit from the grease film which is already on the rails.

In order to reduce the wear of rails on this line, the Company decided therefore, to equip all their engines with flange lubricators which was found to be by far the cheapest method of greasing rails. Developed for the purpose of lubricating flanges, this lubricator turned out to be a combined flange rail lubricator; it was also ascertained that the engine wheel flanges did not show any wear at all. The tyres have to be removed solely on account of wear on the tread, which actually makes the flanges appear to increase in thickness. Investigations into the wear of rails are at present being conducted.

The primary condition for the satisfactory functioning of this greasing system is the use of a suitable grease. This grease must be of soft consistency, of short texture, and in addition must be atomisable. It should be suitable for temperatures from 4° Fah. to 140° Fah. in all respects. A lime base H. P. grease water-proof with a dropping point of approximately 210° Fah. can be used. Any addition of Graphite whether in flake or Colloidal form would destroy the pump.

The consumption of grease per engine varies between 5 to 10 lbs., per 1000 miles. It is advisable to keep checking the consumption of the grease, as this is the best way to ascertain the satisfactory functioning of the whole installation. As a further check, a sharp hissing sound must be heard in turn from each of the four nozzles when the pump is cranked.

Lubrication takes place at each nozzle, according to the adjustment of the pump gear ratio, after track distances between ranging from 390 ft. to 490 ft., in the case of a 50 diameter wheel it covers a length of approximately 27 ft., which is equivalent to two revolutions of the wheel. The consumption of compressed air per application is 0,265 cu. ft. at a speed of 19 miles per hour and 0,177 cu. ft. at a speed of 25 miles per hour.

The maximum output of the pump per stroke (No. 5 setting of the adjustment micrometer knob) is 0.012 cubic inches.

When the adjustment micrometer is set to zero no grease will be fed. The apparatus should be installed in such a way that both left and right hand curves

are lubricated where the head of the rail contacts the wheel flange.

The advantages of this system led to its introduction on other railway lines (all of which operate in mountainous districts) e. g., engines with this equipment are running on the Freilassing-Berchtesgaden line, the Traunstein-Ruhpolding line, the Muenchen-Garmisch line, on the "Geislinger Steige" railway, the "Hoellental" railway, the "Tegernsee" railway, the "Regentalbahn" and on some other privately operated railway lines.

Previously the life of the wheels on the engines operated on the "Geislinger Steige" varied from 9,000 to 34,000 miles, with an average of about 20,000 miles. After one out of the three engines had been fitted with this flange lubricating equipment, the figure for this particular engine increased to over 69,000 miles; at the same time the figure for the two other engines that had not yet been fitted, was found to be 49,700 miles. Since then all three engines have been fitted with this equipment and it is expected that the figure for wheel life will be in the region of 125,000 miles.

Experimental tests have ascertained that the De Limon system works satisfactorily when installed on larger type engines and on high speed engines. It was found immaterial whether the supply pipe is of 6 ft. or 36 ft. length; or whether the engine is running at fast or slow speeds, the grease-air atomisation still being satisfactory at pump speeds equivalent to engine speeds of 124 miles per hour. No deviation of the jet was discernable even when the grease was spurted against a glass plate revolving at a speed of 87 miles per hour.

In conclusion, it must be mentioned that this greasing system has given good service in summer as well as in winter, and that in no case has a film of grease spread from the flange to the tread, which was always found free from grease, and on no occasion was wheel-slip observed, as a result of grease on the tread. At the same time, the grease film on the rail was found to be in the form of a small band only.

The problems of a satisfactory method of flange lubrication can therefore, be regarded as having been solved.

[By Courtesy: De Limon Fluhme & Co., Dusseldorf.]

TENSILE TESTING OF STEEL PRODUCTS

The latest addition to the series of Indian Standards for mechanical testing of metals is IS : 1608–1960 Method for Tensile Testing of Steel Products other than Sheet, Strip, Wire and Tube. This Indian Standard is based on the draft ISO Recommendation No. 133 Tensile Testing of Steel which represents the consensus of international opinion on the subject. This standard applies only to products of diameters equal to or greater than 4 mm (or 0.157 in.) or thicknesses equal to or greater than 3 mm (or 0.118 in.) For the tensile testing of other products, such as sheet, strip, wire and tube, other standards are under preparation.

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I, S. M. Sivaprakasam, hereby declare that the particulars given above are true to the best of my knowledge and belief.

(Sd.) S. M. Sivaprakasam
Signature of Publisher

High-Speed Diesel Engines for Industry

By An Engineering Correspondent

THE LICENCE AGREEMENT signed two years ago with Maybach Motorenbau GmbH, to enable Bristol Siddeley to manufacture the Maybach MD range of diesel engines, has brought together two Companies which have each earned a world-wide reputation for the quality of their products. Maybach Motorenbau have over 40 years' diesel experience and Bristol Siddeley also have an extensive background of diesel engine design and manufacture.

Maybach high-speed diesel engines are well known to rail traction engineers both in the United Kingdom and overseas, and British Railways' Western Region have chosen Bristol Siddeley Maybach engines to power the new locomotives which form a substantial part of their modernisation programme. Encouraged by their experience with the first of these in service, British Railways have placed additional orders for over 200 Bristol Siddeley Maybach engines.

The operational requirements of industrial and marine engines differ considerably from traction applications in that they have long periods of continuous running at high loads, whereas a railway locomotive rarely operates for more than 18 hours a day and then only at full power for a part of the time.

The ability of the Maybach MD range of engines to meet the exacting conditions of continuous running at full load was well demonstrated during tests carried out in 1955. In the town of Minden, an aqueduct carries the Mitteland canal over the river Weser and this canal must be continuously fed with water from the river in order to maintain the level. Normally this is done by a series of electrically driven centrifugal pumps, but for the purposes of the tests a 6-cylinder Maybach engine delivering 600 HP at 1500 rpm took over the work of the electric motors.

From May to October 1955, the engine ran at full load and, apart from periodic oil changes, was only shut down on one occasion for maintenance. The only trouble experienced was caused by the hardness of the engine's cooling water and by an eel which had found its way into the cooling system and blocked the flow!

After 3500 hours' running, the engine was stripped and a full inspection carried out. Wear was imperceptible and the unit was re-built and run for a further 2500 hours on a lower grade of fuel. Even after the total 6000 hours had been run, all at full load, inspection again showed that component wear was, in the main, insignificant—the highest measured wear being about 0.1 mm on the lower portion of the exhaust valve guides.

The official report on these tests makes very interesting reading. Most of the criticism is levelled, not at the engine, but at the hardness of the Mitteland canal water and at the salinity of the river Weser. At one point, in his summing up, the test engineer reported, 'As far as the behaviour of the engine is concerned, it should be pointed out that no trouble whatever arose of a mechanical nature or in connection with combustion'.

Since these tests a number of ships, such as the ferry *Theodor Heuss*, the trawler *Zephyros* and the coaster *Walter Korte*, have been built which use Maybach diesels as their main propulsion units. In each case the engines have performed well.

The small dimensions of Maybach diesel engines means that the floor space needed is very much less than that required for lower speed industrial or marine, engines, and furthermore installation is simpler and quicker. A lightweight mounting, with rubber pads to damp out the very small amount of vibration generated by the engine, provides an adequate foundation without resort to special beds with reinforced flooring.

The use of a simple foundation is a remarkable feature of the Maybach engines, as it reduces the cost of marine and industrial installations and also makes them ideally suitable for mobile power units. In this latter respect it is now possible to construct electrical generator sets, compressors, and auxiliary power units of over 1700 HP which really are transportable.

The design of the engine is such that all components are readily accessible and so may be inspected and, if necessary, replaced during the periodic checks. The Bristol Siddeley Maybach diesel engine is operated on the principle of regular routine maintenance and overhaul, the work being carried out at set periods in relation to the number of engine running hours. This maintenance ensures the regular examination of parts and reduces the likelihood of trouble. Each part can be easily handled without the use of cranes and the small overall dimensions of even the largest engine makes it a simple matter to remove the entire unit for a complete overhaul. An exchange engine may, therefore, be substituted and the shut-down associated with slow and medium-speed engines, which are invariably overhauled in their working position, may be avoided.

The sale of Bristol Siddeley Maybach diesels is backed by a highly efficient spares organisation. Large stocks are maintained of all components, each of which is fully interchangeable. Spares are, therefore, immediately available, and, if stocks are not held locally, they can be flown to any part of the world within hours of a requirement arising. Service engineers, too, are always on call to operators.

The design of the Maybach MD series permits a large number of parts to be interchanged between engines throughout the range. Cylinder heads, valves, pistons and cylinder liners, to mention only a few, are identical on all engines, regardless of their size and power.

Component interchangeability is not confined to Bristol Siddeley built engines. Components, whether manufactured in Britain or in Germany, are mutually interchangeable.

The Bristol Siddeley Maybach MD engines for industrial applications cover a power range of between 445 and 1728 HP. They are available as either 4 or 6 cylinder in-line engines or with 8, 12 or 16 cylinders in Vee formation. Each is pressure charged and an intercooler can be incorporated if required.

The pressure charging is effected by a turbo-blower driven by a turbine in the exhaust stream. This has the ultimate effect of reducing the cost per horse-power at little additional cost to the engine. For example, the 16 cylinder MD 870 would, if normally aspirated, deliver 1055 HP. In its two production forms, however, it delivers 1382 HP if pressure charged, and 1728 HP if pressure charged with intercooling. This represents a horsepower increase of 31 per cent from the unblown to pressure charged unit and a further 25 per cent when intercooling is introduced. The increased power from the same basic engine is not accompanied by any significant increase in wear.

The MD 870, pressure charged and intercooled, weighs as little as 13,162 lb. At the lower end of the power range the MD 225 weighs 6220 lb and delivers 445 HP.

The size, power/weight ratio and high speed of these engines represent a revolutionary step forward in diesel design and their record in service, and on the special tests at Minden, furnish conclusive proof that for reliability they are in no way inferior to the best slow running engines.

The success of the Maybach represents many years of painstaking development and the present state of the engines is not, in any way, indicative of the final stage. To take an example, the MD 655 engine has been developed from 800 HP to 1400 HP over the past 8 years and the potential for yet higher powers is still considerable.

Close technical collaboration is maintained between Bristol Siddeley and the Maybach centre in Friedrichshafen, which ensures that the British manufactured engines are of the very latest standard. The Maybach MD series are generally acknowledged as being in the forefront of high-speed diesel engine design and unceasing development ensures that this position will be maintained.

[By Courtesy: Bristol Siddeley Journal]

FURTHER CUT IN IMPORT OF RAILWAY EQUIPMENT

Preliminary reports regarding purchases made by the Indian Railways during 1959–60 indicate that the imported content was further reduced from 9.6 per cent to 8.6 per cent. The value of purchases made during the period by the Railways from Small Scale Industry amounted to Rs. 1,94,00,000. This was disclosed by Shri S. V. Ramaswamy, Deputy Minister for Railways, while addressing the eighth meeting of the Indian Railways Equipment Advisory Committee held at New Delhi on 26th November 1960.

Shri Ramaswamy expected further reduction in the imported content of rolling stock and equipment in future with the commencement of electric locomotives manufacture in the country as also the electrical equipment for electric multiple unit coaches.

Automatic Hydraulic Transmissions manufactured by Bristol Siddeley

By An Engineering Correspondent

TORQUE CONVERTERS

THE already wide range of Bristol Siddeley products has recently been extended still further with the signing of a licence agreement with Svenska Rotor Maskiner AB of Stockholm for the manufacture of a series of very high efficiency hydraulic torque converters.

The Swedish company, known briefly as SRM, is a design and research organisation of world-wide repute which exists solely for the development of advanced engineering ideas to the point at which a manufacturing licence can be granted to an engineering company. Apart from the necessary work to support development, SRM carries out no manufacture, its policy being to leave this to a small number of first-class licensees.

Bristol Siddeley are licensed to produce the whole range of SRM hydraulic transmissions for use in two principal fields: in town and cross-country buses and coaches, and in railway locomotives for both express and shunting purposes. The range includes units designed to operate at high speeds and to transmit from 80 up to 1800 horsepower.

The peak efficiency of all models has the very high value of 87 per cent. The units have a very small volume in relation to their power capacity; their weight, too, is low, although highly-stressed parts are avoided.

There are three elements which are essential to a torque converter: an input source, an output which is related to the input and which is dependent on their relative speeds, and a fixed reaction member. The principle is therefore analogous to the law of the lever, namely that a given load at a given distance from a reaction point, or fulcrum, can be used to move a larger load placed at a smaller distance from the fulcrum. The application of a load about a fixed reaction point produces a torque about the point. The loads and distances are interrelated: if the larger load is twice that of the smaller, its distance from the fulcrum would in theory be half that of the smaller load which just moves it. The speeds at which the loads move would be in the same proportion, that of the larger load being half that of the smaller.

A train of gears may be considered as a number of levers operating in series, with the difference that the proportionality now applies to the angle through which each turns and not to the linear speed of the engaging teeth. Each wheel is in fact a rotating lever whose radius represents the lever arm. The spindle on which it is mounted forms the reaction member. The output from one pair of wheels becomes the input to the next and in the case of reduction gearing this results in a corresponding decrease in the angle turned through. The cumulative effect of all the levers is to produce a notably larger torque than the original input, but to deliver it at a lower rotational speed.

The gear train is therefore a mechanical torque converter. Any given sequence of gears produces a fixed ratio of output speed to input speed, and provided 100 per cent efficiency is assumed, the same ratio of input torque to output torque. It is therefore easy to draw a graph of the torque ratio that can be achieved with a hypothetical drive which gives any specified speed ratio, and the upper curve represents these values over a suitable range of speed ratios.

Now in respect of torque multiplication a train of gears has certain disadvantages. The fact that the number of speed ratios obtainable is restricted—normally to three or four—is a severe limitation. If the load on the output shaft is increased while the engine is running the engine speed and hence the output speed tend to fall. To restore the original output speed, either engine torque must be increased by augmenting the supply of fuel or a lower gear ratio must be engaged to produce a higher multiplication of engine torque. This is a rather general statement of the conditions and assumes that the increase in the load is small enough to allow the desired conditions to be obtained. The significant fact is that fluctuations of load introduce the need for a clutch to disengage the engine from the transmission; this results in momentary interruptions of the drive and probably a sudden take-up of power on re-engagement. Its use also requires a certain dexterity and constant attention on the part of the operator.

A further disadvantage of the mechanical converter concerns the amount by which attainable efficiencies depart from the ideal line already mentioned. An engine operates most efficiently at only one condition for any of the transmission ratios and any change in land or engine speed will cause the engine to depart from the optimum point.

These disadvantages can be overcome by the use of a fluid to transmit the drive from an engine. A hydraulic transmission system relies on the fact that kinetic energy may be imparted by the drive shaft to the fluid and that this energy may then be reconverted to mechanical energy and used to drive the output shaft.

It is appropriate first of all to consider the simple fluid coupling, which utilises this hydro-kinetic principle to transmit torque. A fluid coupling consists of two similar bowl-shaped members, each of which contains a number of radial vanes that divide it into compartments shaped like the portions of an orange. The members are mounted coaxially face to face, one on the engine shaft and one on the driven shaft, and are enclosed in an oil-tight container. The container is completely or partially filled with oil, which forms the only connection between the input and output members. The two members are known as the pump and turbine respectively.

When a drive is applied to the pump its rotation causes the oil in the compartments to be thrown outwards by the centrifugal force acting on it. The oil is guided by the vanes on its outward path and then deflected by the configuration of the outer part of the member until the radial component of its velocity becomes an axial one. The oil is thus directed towards the turbine and, having also a strong tangential velocity component, it strikes the faces of the turbine vanes. In this way, the kinetic energy of the oil is reconverted into useful mechanical work by causing the turbine to rotate. The oil then flows inwards and back to the pump, whence it is recirculated.

The fluid coupling closely resembles the hydraulic torque converter without, however, actually being one. When the turbine is runing at a speed which is close to that of the pump, the coupling is transmitting the engine torque very efficiently, but multiplication of the torque is impossible because the coupling has no reaction member. In a torque converter this reaction member is normally supplied in the form of a row of stator blades.

The essential elements of a hydraulic torque converter are therefore: the pump and turbine, which are the input and output members respectively, the fluid which couples them together and the necessary reaction member. The SRM range includes a simple basic transmission of this type, having two turbine stages and one stator stage.

It will be seen that the curve follows closely the ideal line throughout much of the middle range of speed ratios but falls away at each extreme. Now it is convenient to assume that the engine input speed and torque remain constant, so that the speed ratio becomes a direct measure of road or rail speed and varies with the load. An increase in the load, therefore, will cause a decrease in speed which is compensated for by the increase in the torque multiplication achieved. The hydraulic transmission is thus a reduction gear having an infinite number of speed ratios, at each of which the maximum power of the engine is, in general, being used.

The hydraulic torque converter has therefore a number of clear advantages over the mechanical transmission. In the first place its operating line, at least over the middle speed range, remains consistently close to the ideal line and is automatically adjusted to the requirements of the vehicle; this could be emulated by a conventional gearbox only if the number of available speed ratios were large—seven or eight at least. Such a large number of speed ratios would create quite a serious practical difficulty in operating the engine at its optimum point for any vehicle speed.

By virtue of its great flexibility, the hydraulic transmission is able to cope with rapid fluctuations of load without introducing the necessity of changing gear. However, a simple transmission as described above operates most efficiently in the medium speed range. It is evident that when the speed ratio reaches a value a little below 0.8 the torque ratio has fallen to unity and any further increase in output speed results in a very rapid decrease in efficiency. At the other end of the range, when there is a large difference in the input and output speeds, the torque ratio curve attains a maximum value of about 4 : 1. It is in this lower range, representing heavy loads on the output side of the transmission, that the greatest torque demands have to be met.

The transmissions now being manufactured by Bristol Siddeley include additional features by which these difficulties are overcome. For optimum performance in the high-speed range a direct drive is provided by a multi-plate friction clutch which is engaged when the output speed has reached the point where torque multiplication is no longer being achieved. Once engaged, the drive maintains the transmission efficiency at the extremely high figure of 98 per cent.

For applications where it is especially desirable to obtain a high torque multiplication in the lower speed range a particularly elegant solution is employed in some models. In these, as in all the transmissions of the series, there are three rows of blades, the second row normally being the stators. In the high torque multiplication transmissions this row of blades is connected to the sun gear of an epicyclic reduction unit, the internal gear of which is splined to the output shaft. A pair of independently operating brake bands around the epicyclic unit enable either the sun gear or the planet carrier, or both, to be held stationary when desired.

In the medium speed range, the sun gear is restrained by one of the brakes and the second row of blades act as stators. When the load increases and the output speed falls below a predetermined value, the sun gear is released and the planet carrier is held by the other brake. The blades of the second row now rotate in the opposite direction to the first and third row blades. The torque absorbed by the second row blades is reversed in direction through the epicyclic unit and fed into the output shaft, thus increasing the torque produced by the first and third rows alone.

It may perhaps not be immediately apparent that although the stator blades no longer form the reaction member during low-speed operation, torque multiplication is still possible. The reason is that the planet carrier, which is held stationary, now becomes the necessary reaction member.

The multi-plate clutch, for direct drive at high speeds, may also be incorporated in transmissions of this type, thus providing optimum conditions for operation in all three speed ranges. In this case, when the clutch is engaged at high speeds, both brake bands are released and there is no reaction member. Such a member is obviously unnecessary, however, since no torque multiplication would be taking place, the transmission now acting in effect as a solid flywheel. In this model, the change from one operating regime to another is entirely automatic.

A feature of this series of hydraulic transmissions which is probably unique is that hydraulic braking may be achieved with direct gear engaged by allowing the second row of blades to rotate against the rest of the system. Continuous braking of up to 30 per cent of maximum input power can be obtained, thus relieving the vehicle brakes of a large part of their duty.

A hydro-static clutch may be used to operate in series with the direct drive clutch and so to provide a full hydraulic drive when direct drive is engaged. Another feature is that free-wheeling action is possible by releasing the direct drive and allowing the engine to run at its idling speed. Smooth re-engagement can be obtained when required.

There is great scope for the use of hydraulic transmissions in all kinds of traction vehicles, where frequent changes in load are encountered and where ease of operation is as attractive to the driver as is a smooth ride to the passenger. Bristol Siddeley can offer transmissions to suit the requirements of high, medium and low speed operation over a wide range of powers.

(By Courtesy: Bristol Siddeley Journal)

Facilitating Movement of Oil from Assam

The Deputy Minister of Railways, Shri Shah Nawaz Khan, informed the Rajya Sabha during question hour on 29th November 1960 that the construction of a new broad gauge line from Khejuriaghat to Malda was nearing completion and its further extension up to Siliguri was likely to be completed some time next year, depending upon receipt of permanent way materials.

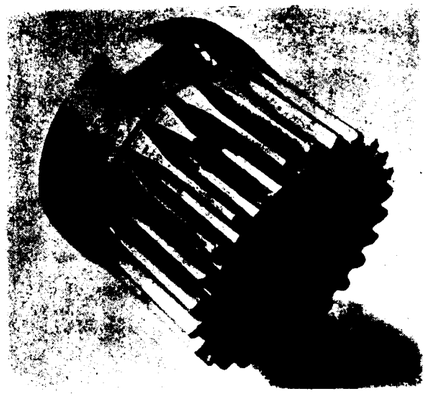
Replying to further questions, Shri Shah Nawaz Khan said that it was not a fact that a new alignment between Khejuriaghat and Siliguri had been made abandoning the old one. He added that the project had been undertaken to develop capacity for movement of oil from Assam. Incidentally, the new route was expected to be shortened by about 14 miles than the existing one via Sakrigalighat-Maniharighat.

Welding Repairs in Railway Maintenance

By E. Christie, M. INST. W.

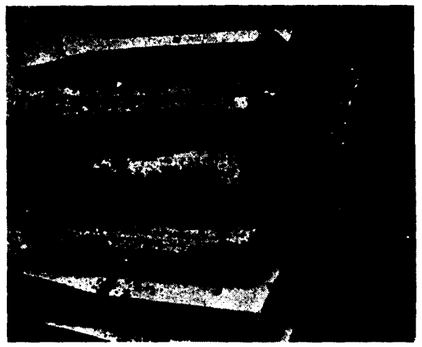
OXY-ACETYLENE Gas Welding and Cutting are essential features in all engineering and maintenance workshops. The value of a skilled welder is always very high but in emergencies, when broken or damaged parts may involve schedule delays, he and his plant can effect reliable repairs which not only keep the wheels turning but are very economical in both time and money.

The track and rolling stock is made up of many parts and many metals and alloys. Almost without exception the Oxy-Acetylene process can be used to weld steel, cast iron, malleable iron, S. G. iron, aluminium, stainless steel, copper, brass and a host of other commercial metals.



Heavy cast iron pinion showing broken tooth.

In general terms most steels and alloy steels are subject to wear in railway service and the welder's work involves the building up of worn sections to restore original dimensions. Such building up is common practice on rail track frogs, points and crossings, where SIFSTEEL No. 12 (wear resisting) alloy steel welding rods, containing Silicon, Manganese and Chromium, are deposited by the Oxy-Acetylene flame. The rebuilding is carried out on the track during normal services and causes no delay in train schedules.



Tooth rebuilt by welding with Super-Silicon No. 9 welding rods. Deposit metal is soft and Machinable.

Other steel parts such as shackles, hooks, links and pins can be salvaged in the workshops using the same rods and technique. The reclaimation of these parts is sound practice and a very economical procedure.

Castings in all shapes and sizes may break under abnormal shock loading and in this field of activity, the Oxy-Acetylene welder can be of immense value by reason of his ability to effect speedy repairs at a fraction of the cost of new replacements.

Two welding methods are available. First, the full fusion method which employs grey cast iron

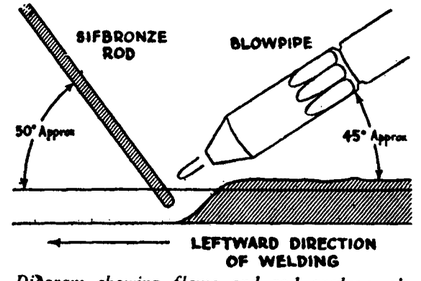
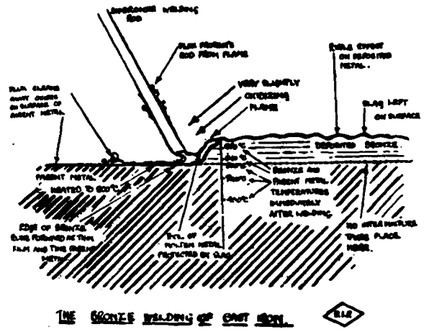


Diagram showing flame and rod angles; also direction of welding.

Super-Silicon welding rods and, when correctly used, will produce a welded repair with full physical properties of the parent metal. The structure of the deposited weld metal is high grade grey iron with average tensile strength of 14—16 T. P. S. I.



Diagrammatic sketch showing special features in the bronze welding technique.

This method of fusion welding iron castings generally requires that the whole casting should be preheated to a red temperature of 700—800°C. and, after welding is completed, the whole repaired unit should be allowed to cool as slowly as possible, preferably inside the preheating muffle, and the average cooling time should be about 24 hours.

The second method for welding castings is the LOW TEMPERATURE BRONZE WELDING PROCESS. This is a process which does not always require preheating of the casting and many repairs can be effected without any preheating at all. Some may require partial or local preheating and, in rare cases, general preheating but, in any case, the preheat temperature need never go beyond 400°C. (Black Heat).

The advantages of bronze welding lie in the fact that bonding of the SIFBRONZE filler rod takes place at a temperature of 850-900°C. This is far below the melting temperature of the cast iron and, in consequence, the parent casting does not expand to the same degree as when using the higher temperatures. The lower expansion means lower contraction too and as the Sifbronze deposit metal has some ductility, any stresses created by temperature changes can usually be absorbed by the bronze.

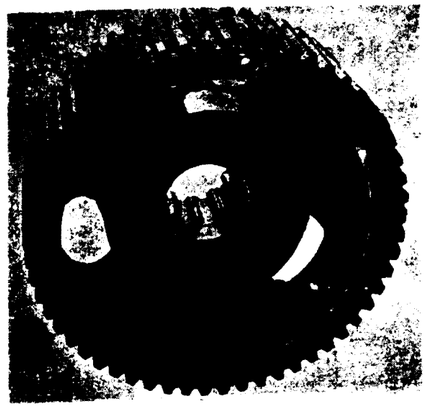
The strength of Sifbronze deposit metal is from 28 T. P. S. I. to 35 T. P. S. I. according to grade, the nickel bearing Sifbronze rods being the stronger.

The main disadvantage of bronze welding is that of colour, for the deposit metal is usually a yellow colour which shows up against the grey cast iron but, when set against the ease of welding and the high strength and reliability of the welded joints, such a disadvantage is of little consequence.

In the case of malleable iron castings of which a great number are used on railway rolling stock, bronze welding is generally acknowledged to be the best and most reliable method. Malleable iron castings have been subjected during manufacture to a special heat treatment which imparts a degree of ductility and special physical properties to the castings. Any fusion welding method which may be used to repair malleable castings has a tendency to destroy the special properties and produce a weld that may be brittle and spongy.

Bronze welding by reason of its LOW TEMPERATURE application maintains the full high

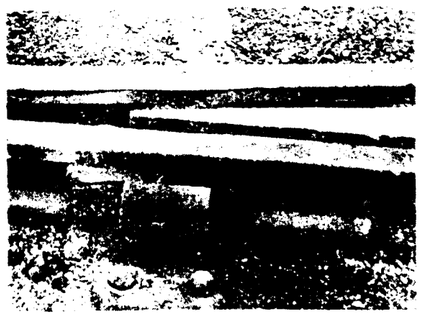
Action Picture of a Welder Rebuilding Worn Rail Track.



3½ teeth were broken from this gear wheel. They have been rebuilt with Sifbronze nickel bronze rods and machined to correct dimensions.

strength of the malleable casting and in no way impairs these special properties. The Sifbronze joint is strong and reliable, giving complete satisfaction in most cases.

Rebuilding and replacing gear wheel teeth are applications for Oxy-Acetylene welding which frequently brings maximum return for minimum of labour. Sometimes a valuable machine may be disabled because of one or two broken gear wheel teeth. It makes no difference if they are cast iron teeth, alloy steel teeth or even mild steel teeth, all can be repaired by welding using either cast iron Super-Silicon filler rods, alloy steel rods or Sifbronze rods.



Rail track showing worn section BEFORE rebuilding with Sifsteel No. 12 wear resisting rods.

The rebuilding or replacement can be carried out speedily, sometimes without dismantling the machine, and the welded teeth can be relied upon to give many years of good service.

Generally speaking, the nickel Sifbronze filler rods are ideally suited to this class of welding work. They will bond a low temperature on all classes of ferrous metals, the deposit metal is soft enough to be shaped and dressed to accurate dimensions and due to the Nickel and Manganese content in the deposit metal, they have a high degree of wear resistance and a low frictional ratio.

Rail track AFTER rebuilding by gas welding. The deposit metal work hardens in service.

Some measure of the reliance placed upon bronze welding may be gauged from the fact that one railway system alone uses upwards of 1 ton of bronze welding rods each month in the various maintenance workshops. The rods are used for a great variety of repair welding and, without doubt, they are a most valuable economic factor in the whole system.

Widney Windows for Rail Transport

By An Engineering Correspondent

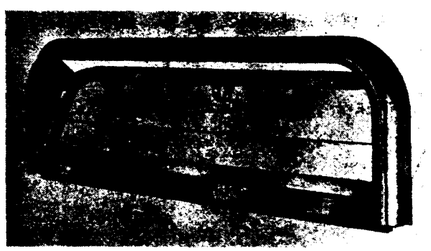
THE selection of the right window for a particular type of Railway Carriage is the problem of the Railway Engineer. He is offered a considerable variety of types, styles, in different materials and finish, the advantages and disadvantages of which must be thoroughly assessed before placing his contract.

This is the task of his technical staff, who will carefully examine and consider the characteristics of the available types in relation to the carriage body structure, the customary, or preferred method of opening and closing by the travelling public, the ease of maintenance and broken glass replacement, bearing in mind the service facilities available in the Railway Repair Depots.

In addition before placing the contract consideration must obviously be taken of the initial cost per window, plus the cost of its installation.

The Company of Hallam, Sleigh & Cheston Limited, founded 1898 were early pioneers in the development and production of windows for Passenger Service Vehicles. Over 60 years of specialised knowledge in the production of windows for the strenuous service called for by users is embodied in the present day design of this Company's products.

The registered trade mark 'WIDNEY' is used throughout the world on all manufactured articles.



Widney Phantom Mark IV Ventilating Window with Outside Glass Louvre.

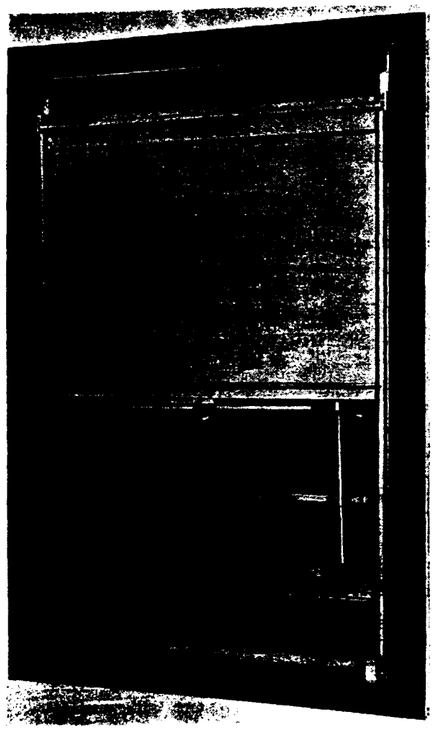
Types of windows available in their range include—Half-Drop, Half-Lift, Full-lift, Full-Depth Sliding, Top Sliding and Hinged Windows all suitable to practically any condition of coach structure. The

Widney Twin Slider with Lower Portion Double Glazed.

materials used in forming the window frame is now mainly Aluminium Alloy, which has been carefully selected to offer the maximum resistance to corrosion within an economic commercial possibility.

Some windows are available in Stainless Steel, which is polished and retains its appearance for the normal life of the unit. Stronger than Aluminium, it is completely free from corrosion and virtually trouble free in service.

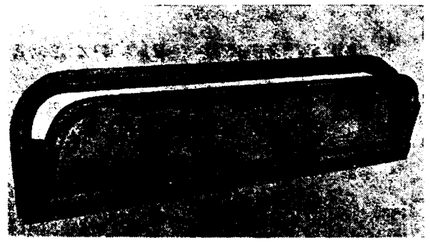
Toughened Glass manufactured to British Standard Specification No. 857/1954 is normally used, and is acceptable to all known transport regulations. This



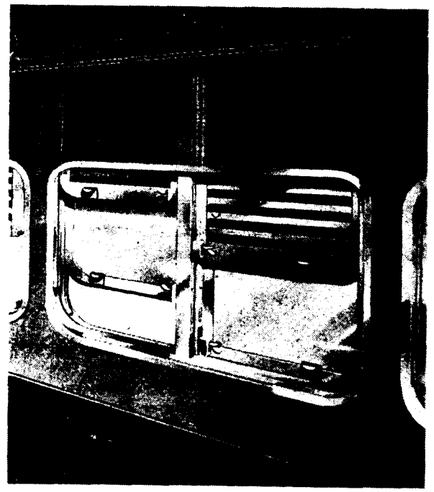
Widney Full-Drop Window.

is similar to the European Glass 'Securit' and when smashed breakes into a honeycomb pattern of not less than twenty particles per square inch. Various types of toughened Glass with resistance properties against Ultra Violet Rays is also available.

The chief method of glazing used today by 'WIDNEY' is their patented 'Simplastic' System. The glass is completely framed in a Mild Steel, or Aluminium Pan of special section, by using a preformed rubber glazing, strip, so designed that when glass and rubber is fitted into the section the rubber is compressed to give a perfect water seal without the aids of screws, fillets or mouldings. The complete frame is now ready for fitting to the structure, the need for outside finishers is eliminated. This



Widney Phantom Mark III Ventilating Window.



Widney Full-Lift Window Combined with Jalousie.

method can be adapted to suit either outside or inside glazing, i. e. the glass being fitted from the outside or inside of vehicle as preferred.

The various windows illustrated from the 'Phantom' Ventilator to the Full Drop Window show the wide application available to the modern coach designer.

Hallam, Sleigh & Cheston maintain a large technical staff to solve any problems in ventilation.

Torque Converters for Railway Traction Applications

By Lt. Col. L. F. R. Fell
Manager - Railway Traction Department

AS projects involving torque converters are now becoming more numerous and wide-spread, so more and more people in Service and Sales departments throughout the world are finding themselves concerned with this new equipment. Whilst it is obviously impossible to circulate detailed design and experimental reports to all who might be interested, it was felt that a need could be served by publishing at regular intervals a Newsletter giving a brief resume of the work which has been carried out, or is in progress, in the various departments at Crewe.

It will be assumed that the reader is familiar with our publication TSD 710 and hence can appreciate the distinction between the CF, DF and CO types of converter. These machines are, in general, similar to the original Twin Disc converters; Twin Disc adhere to the same nomenclature of designation as ourselves.

CONVERTERS FOR RAILCARS

Design Work

This machine was designed originally for use on British Railways railcars. It is based on the Twin Disc DF design and is similar to the DF machine back to the rear turbine bearing.

The double freewheel assembly was designed by Rolls-Royce. It will be seen that the forward freewheel serves the same purpose as the freewheel in the DF machine, that is to say it allows the turbine member of the converter to remain stationary when running in direct drive, the rear freewheel is in the output drive and permits the output shaft to over-run the engine and converter. The freewheel units themselves are of robust design and are of the cam and roller type, having eleven individually sprung rollers each. The ordinary DF machine has one freewheel only; this has twenty-two rollers set in a sprung cage.

Since our first entry into railway business we have fervently advocated the use of the double freewheel for the following very good reasons. It allows economical operation through judicious costing, it prevents engine damage due to overspeeding down gradients, it provides a safety disconnection in the unlikely event of engine failure or seizure and finally it enables a much easier change to be made from hydraulic to direct drive. The change can be made with the engine at idle and with the output freewheel over-running, hence the duty demanded of the clutch plates is mild in the extreme.

As a result of both our own running experience and the experience of operators, we have made some detailed design changes to the DF and DFR types of machine. In the main these consist of niceties such as changes of hardness and material and reducing stress raisers wherever possible. Whilst such alterations are not spectacular in themselves they contribute to the increased reliability of our products. Experimental work has shown that it is desirable to maintain the clutch application oil pressure at about 140 p.s.i.; thus ensuring a slipfree drive at very low engine speeds and also providing a rapid take-up of the clutch during changes from converter to direct drive. The increase pressure was achieved by making a modification to the relief valve in the clutch oil pump supply line.

In applications where a reverse gearbox is attached to the rear of the converter we now install an oil cooler to ensure that the clutch oil is not heated to an objectionable temperature by the gearing. The converter has been modified to provide an inlet and outlet to an oil cooler and the cooler itself can be supplied as an appendage to the main converter fluid heat exchanger.

REVERSE GEARBOX

It has become clear that operators are by no means agreed on the most suitable type of reversing gearbox for railcar use. For those adherents of the frame mounted reverse box we have recently designed a unit which can be bolted directly on to the back of a converter. The prototype box has been built and is undergoing test at the Crewe factory.

In the design of this new reverser we have sought to produce a robust and reliable unit. Before the design was commenced a close study was made of the failures experienced by users of similar reversers by other manufacturers.

The designed capacity of the box is 300 h.p. at 2000 r.p.m. Lapped spiral bevel gears are mounted in pressure lubricated bearings. Large diameter pinions have been used so as to give modest rotational speeds. At the rear of the box gear drives are provided for a Woodward Governor and tachometer.

OUTPUT SHAFT GOVERNOR

In applications using the F, CF or CO types of converter where the vehicle has a low rolling resistance there is a danger that the converter might be run at an output speed beyond the upper 70% efficiency limit with the engine rack fully open There are cases where this could occur and it would be difficult for the driver to appreciate that anything was amiss. In conjunction with C.A.V. we have designed an output shaft governor which will begin to close the engine rack at some predetermined output speed and hence prevent damage by overheating. The governor is essentially a gear type oil pump driven by the output shaft of the converter. Oil from this pump is fed to a unit mounted on the engine fuel pump governor and is arranged so that at some predetermined pressure the rack will begin to close.

This governor is being designed so that it can be used as an output shaft speed controller. A duty could arise where it would be desirable that the driver should be able to select a fixed output shaft speed regardless of the fluctuating load. In this case the driver would control the governor setting and the governor would adjust the rack to give a constant output speed within the capacity of the engine. Such a device could be useful on a hump shunting locomotive.

The first output shaft governor unit received from C.A.V. is now running on the test beds at Crewe.

CLUTCH DEVELOPMENT

Much work has been done in testing the clutches of the DF converter. Continuous periods of 'Hot Shifting" have been carried out in order to ascertain the effect on the clutch plates. Tests have been very encouraging and are continuing.

As a result of this development work we have now increased the maximum torque ratings for our DF and DFR machines as follows:

For the 10,000 series DF machine we now limit the maximum input torque to 750 lb. ft. This limit is subject to the proviso that the clutch oil is cooled if a reverser is fitted and that some indicating device is used to ensure that clutch oil pressure is always present. Further, for the DFR machines we are prepared to raise the limit to 800 lb. ft. for 10,000 series converter and to 900 lb. ft. for an 11,500 converter provided the machine is protected from torsional vibrations by a suitably damped spring drive.

We have for some time been running experimental converters at 1000 lb. ft. input torque.

We are now able to consider individual applications which require 'Hot Shifting' of the converter clutches. However, these must be referred to the Railway Traction Department for consideration by our engineers at Crewe who will deal with each case on its merits.

* * *

PROTOTYPE RAILCAR

We have now had a torque converter railcar in regular passenger service for some months. This vehicle was built as the prototype to a production batch of railcars. On completion, it was made available to Rolls-Royce for a specialised development and to allow us to gain some running experience. As a result of this, several modifications have been made. The control system has been modified in details and further attention was necessary to achieve a desirable degree of silence and smoothness. The engine mountings were changed and the exhaust system modified.

Throughout the initial projecting stages of the prototype vehicle, we kept in mind the high vertical accelerations imposed at railjoints and crossings. Later, we were able to measure these accelerations, together with the effect they had in inducing torque variations in the prop-shaft.

A maximum vertical acceleration of 40g was obtained at the bearing cap of the driving axle; A

propeller shaft fitted with strain gauges was used to measure the torsional variations within the shaft. It was found that a very high torsional of constant frequency was excited at each rail joint. Damping in the system was small and the whole transmission vibrated at the one node natural frequency. The vibration persisted almost without decay between impulses, and its frequency was of course, independent of railspeed, although its magnitude increased as the railspeed increased and hence the forcing impulses became greater.

It was immediately apparent that a means of isolating the impulses from the clutches and free-wheels of the converter unit must be sought.

A flexible rubber coupling was introduced at the end of the prop-shaft. This reduced the stiffness of the system and hence the frequency, but had little damping effect. Weights were added to the final drive in order to move the centre of percussion over the axle. This had little effect.

Finally, a propeller shaft of very low stiffness was used. The shaft was a torsion bar surrounded by unstressed tube; The relative angular movement between the shaft and its sheath was used to provide the required amount of damping by filling the annular space with a viscous fluid.

This reduced the amplitude of the vibration to 20% of its original value and was considered to be a satisfactory solution to the problem and will be used in a refined production form on future installations.

Doubling of Line Between Ratlam and Nagda Stations on Western Railway

Partial doubling of Ratlam-Nagda line consisting of two sections viz. Ratlam to Bangrod (six miles) and Birwania to Nagda (five miles) was sanctioned in March 1958 at an estimated cost of Rs. 79.79 lakhs. The work on the remaining portion between Bangrod and Birwania (14.5 miles) was also sanctioned in October 1960 at an estimated cost of Rs. 101.55 lakhs. The former has already been opened to goods traffic and is expected to be opened to passenger traffic in March 1961. The latter work is expected to be completed by December 1962. This information was given by the Deputy Minister for Railways, Shri S. V. Ramaswamy, in a written reply to a question by Shri Damar, in the Lok Sabha, on 18th November 1960.

FIRES

By R. G. Hardikar
Dt. Electrical Engineer (Steel Foundry)
CHITTARANJAN LOCOMOTIVE WORKS, CHITTARANJAN

HAD I taken a couple of minutes longer to emerge out of the carriage bathroom I might not have lived all these 20 odd years to write this article. It was a hot April morning. Nearing beer time. The carriage in which I was travelling, at full speed, was the 5th or 6th from the engine of the mail train. I started doing my bed, bending by the lower berth of the coupe with my back towards the two 12" wall-mounted fans. I heard a sudden "ting" from behind. I turned round and was attracted by a lighted cinder flying out of the fan at the back of my left shoulder. It landed on the pillow. The pillow slip started smouldering. I smothered it with my wet face towel. I had just then finished my shave and wash. I was the sole occupant. The glowing cinder from the loco entered through one of the slots of the ventilator and struck the revolving blades and fell on the pillow below.

Some couple of years ago an armed sentry outside a locked Cash Office noticed an electric light go out. This happened a little before changing guard at zero hour (Saturday/Sunday). The outgoing company had entered this fusing of the lamp in their Log Book. Some three hours later another sentry from the second company reported emergence of thick smoke from the strong room (also locked) inside the Cash Office. The fire fighting squad, led by two Gazetted Officers, discovered a biri stump deep in the pile of heavily card-board bound Registers inside the strong room. Could the biri have been planted there? The strong room was locked at 16.45 hours on Saturday. Over 10 hours before the emergence of the smoke and 2¾ hours after the fusion of the metal filament and bursting of the electric lamp.

Just imagine what would have happened either to the carriage or to the Cash Office had there been no eye witness available to smother the burning matter and timely put out what would have been a blazing fire in a matter of minutes. Being one of the members of the 3-man Fact Finding Enquiry Committee which enquired into the second of the two incidents narrated hereabove, I have no doubts in classifying the causes of these two fires as purely "accidental".

But the cause of fire that gutted a motor garage in Bhowanipore (Calcutta) some years ago because one of its mechanics was fool hardy enough to locate or look for trouble under the bonet with a naked light, most certainly cannot be argued by any defence counsel however clever and smart to be as "purely accidental". A well trained and properly recruited mechanic would never have given cause for this fire resulting in loss of life and valuable property. More serious from the point of view of sheer negligence, than this garage fire was the fire which broke out round about 02.00 hrs. in an IOW's godown in a Divisional Headquarter. The officially estimated damage due to this fire, also detected in time, luckily was a little under four figures. The fire was attributed to charging of automotive batteries without the knowledge of the electrical department. In this engineering department's godown there was timber (scantlings), cotton waste, umbrellas and benches for push trolleys, empty and half empty tins of ready mixed paints, oils, varnishes and methylated spirit. There was understandable unwillingness on the part of the engineering department to hand over this battery charging to the electrical department. The accredited specialists for such work. And what excuse can there be for a similar fire on the very same organization, but at another headquarter's station, after a span of hardly half-a-dozen years? By this fire inside a motor garage, where battery charging was being done within 100 feet of petrol tins, a lac of rupees-or-more worth of assets were gutted and had to be written off. The responsibility for these two fires can most certainly be fixed. It rested with the inspecting authorities. Not only that; but one has to admit that these two fires ought never have been given the cause to occur. They have been caused both by ignorance and lack of forethought.

Ignorance has to be eradicated by a high powered drive and campaign at all levels. On being asked by

a breathless Works Manager who had run fast 200 yards or so to put out a rising fire inside a boiler shop the Nepali watchman standing there on the spot calmly answered that he did not press the fire alarm as he thought "It was meant for Fire Drills only". And meant not to be pressed in the event of actual fire. In another instance a Foreman, transferred from Power House to Workshops replied that he did not seggregate inflamables from combustibles in his Stores as the orders to do so were received by him when he was in the Power House. He did not think that those orders were applicable to Workshops as well. Official records will bear me out that a Divisional Operating Superintendent (Class II) on being called upon to report by his Senior Deputy General Manager on the Fire Fighting facilities available in Goods Sheds and Parcel Godowns in his Division mentioned that "the water was green" at a certain Station but failed to report on the distance, quantity available in summer and winter, etc.

The experience gained during the war years as a civilian railwayman in A. R. P. duties first in Chittagong and later on in Trans-Brahmaputra Danger Zone has left no doubt in me that men give better account of themselves if they are first trained in their specific duties in a language they understand. Supervisors are trained in First Aid and their increment is withheld if they fail to pass the First Aid Examinations. Why not train all supervisors, and not necessarily only those of Fire Fighting squads, in fire fighting too. Advanced countries educate school children in how to cross roads in big metropolitan cities so that they can stand up to the inevitable hazards of the road. Training in fire fighting can be begun in schools & carried on to Trade Apprentices & Apprentice Mechanics. They must be taught how to prevent & fight fire.

Doubling of Balharshah - Vijayawada Line

The deputy Minister of Railways, Shri Shah Nawaz Khan said in a written reply to a question by Shri T. B. Vittal Rao in the Lok Sabha, that the doubling of 25 miles portion between Vijayawada and Yerupalayam had been approved at an anticipated cost of Rs. 265 lakhs. Shri Shah Nawaz Khan added that the necessity of further doubling would be considered when the pattern of traffic development became clear.

Diesel Engine Ratings for Locomotives and Railcars

By An Engineering Correspondent

ROLLS-ROYCE diesel engines have been specially developed for railway traction applications, and experience in service has demonstrated that this development has been successful in conferring long reliable life. We recommend that our railway traction engines be overhauled when 9000 hours have registered on the engine service counter.

On shunting duties these 9,000 engine service counter hours (or mobile hours) are equivalent to about 16,500 shift hours, during which a locomotive would have a driver allocated to it; or to about 13,750 hours if deductions are made for meal breaks and light running to and from the sheds. On single-shift working this represents seven years' service, or proportionately less for two- or three- shift working.

In railcars on ordinary services with maximum speeds of 70 m.h.p. and gradients of up to 1 in 50, these 9000 engine service counter hours are equivalent to 250,000 miles.

The engines can be left working longer than 9,000 e.s.c. hours. However, we recommend overhauls at 9,000 hours to ensure a satisfactory life without unexpected breakdowns. Engines can be overhauled an indefinite number of times, and certain parts such as crankshafts can last up to the third overhaul.

Normal attention is required during the 9,000 e.s.c. hours, but this is limited to top decarbonizing at 3,000 e.s.c. hours, changing the injectors at 1200 e.s.c. hours and to periodically replenishing oil and cleaning filters and so on. All of this can be done whilst the engine remains in the locomotive or railcar.

To give this life of 9000 e.s.c. hours in railway traction service, our diesel engines are adjusted to give the output powers. These power ratings, which are shown for 85°F and 500 ft. above sea level, are well below the powers at which we supply similar engines for automotive and other less arduous duties.

REDUCTION OF POWER IN ADVERSE CONDITIONS

Increases in temperature, humidity or altitude decrease the weight of air drawn in by the engine. The first effect of this would be to give an over-rich combustion mixture, reducing the power and raising the thermal stresses. However, a commensurate reduction in the supply of fuel is made by adjusting the engine at the factory to suit the conditions foreseen. This further affects the power output, and the total reductions of horse-power for different conditions are :—

1. Naturally Aspirated (C4N, C6N & C8N) or Supercharged (C4S, C6S & C8S) Engines

   (a) Air Inlet Temperature: deduct 2% for each 10°F (5.6°C) above 85°F (29.4°C)

   (b) Altitude: deduct an additional 3.5% for each 1000 ft. (305 m.) above 500 ft. (152.5 m.)

2. Turbocharged (C6T & C8T) Engines

   (a) Air Inlet Temperature: deduct 3% for each 10°F (5.6°C) above 85°F (29.4°C).

   (b) Altitude: deduct an additional 0.7% for each 1000 ft. (305 m) above 500 ft. (152.5 m.)

The reduction for turbocharged engines at altitude is less because the turbocharger is not mechanically coupled to the engine, so it can speed up when the air is less dense. Turbocharged engines are therefore particularly suitable for use at high altitudes.

The additional deductions for humidity can be read from the tables. More than 6% reduction for humidity is rarely justified by conditions anywhere.

It is usually unnecessary to make a deduction for both the maximum altitude and the maximum temperature together, because the highest temperatures usually occur only in the lowlands.

An engine that has been adjusted for the worst conditions foreseen can still be used at 85°F and 500 ft. The power will be found to be then reduced by only about half the amount of the reduction to be expected under the worst condition.

Percentage Reduction of Power for Atmospheric Humidity at Various Temperatures

Ambient Temp. °F	Percentage Humidity 10	20	30	40	50	60	70	80	90	100
85						0.5	1.0	1.5	2.0	2.4
90					0.4	1.0	1 6	2.2	2.7	3.3
95				0.2	0.9	1.6	2.2	2.9	3.6	4.2
100				0.7	1.5	2.2	3.0	3.8	4.6	5.3
105			0.3	1.2	2.1	3.0	3.9	4.8	5.7	6.6
110			0.7	1.8	2.8	3.8	4.9	5.9	6.9	8.0
115			1.2	2.4	3.6	4.8	6.0	7.2	8.4	9.6
120		0.4	1.7	3.1	4.5	5.9	7.3	8.6	10.0	11.4
125		0.8	2.3	3.9	5.5	7.1	8.7	10.2	11.8	13.4

Ambient Temp. °C	Percentage Humidity 10	20	30	40	50	60	70	80	90	100
30					0.1	0.6	1.2	1.7	2.2	2.7
32					0.4	1.0	1.6	2.1	2.7	3.3
34				0.1	0.8	1.4	2.1	2.7	3.3	4.0
36				0.4	1.2	1.9	2.6	3.3	4.0	4.7
38				0.8	1.6	2.4	3.1	3.9	4.7	5.5
40			0.2	1.1	2.0	2.9	3.8	4.7	5.5	6.4
42			0.5	1 5	2.5	3.5	4.5	5.4	6.4	7.4
44			0.9	2.0	3.0	4.1	5.2	6.3	7.4	8.5
46			1.2	2.4	3.6	4.8	6.0	7.3	8.5	9.7
48		0.3	1.6	2.9	4.3	5.6	7.0	8.3	9.6	11.0
50		0.6	2.0	3.5	5.0	6.5	7.9	9.4	10.9	12.4
52		0.9	2.5	4.1	5.8	7.4	9.0	10.6	12.3	13.9

HIGH-SPEED COMPUTER

Assembly of a high-speed BESM–2 electronic computer has been completed at the computing centre of the Leningrad branch of the USSR Academy of Sciences' Institute of Mathematics.

One of the best of its kind in the USSR, this computer does nearly 10,000 arithmetical operations per second on an average, which is 100 times faster than the widely-used Ural mathematical machine. The experimental computer can with the aid of an arithmometer complete up to 2,000 arithmetic operations in a 7-hour workday.

The new machine will shortly be adjusted. It will go into operation next year.

Electrical-Resistance Welded Steel Tube Industry in India

By An Engineering Correspondent

THE adaptability of Steel, the basic material of Modern Industry, has been nowhere more effectively proved than in the manufacture of Steel Tubes. With the rapid growth of new Industries, and the expansion of existing ones, the need for Steel Tubes of all varieties in India, has considerably increased; hence, the evolvement of the two large scale Plants engaged in the manufacture of Tubes, and it is no accident that the two leading British Manufacturers are behind these ventures; neither would it be an exaggeration to remark that it is to mutual and infinite advantage that British technique and 'know-how' have been combined with Indian skill, capital and management.

In the past, Steel Tubing was considered as a material used primarily in the manufacture of Bicycles and Bedsteads, but since 1928, many developments and much research have taken place in Industry generally. These developments have involved the use of manipulated and formed tubes for a very much wider variety of purposes.

At the beginning of the Twentieth Century, a demand for Steel Tubes of high quality arose in the West, particularly from the Bicycle Industry, and the Boiler Trade. It came to be realised that the potentialities for demand would indeed be enormous, provided the Manufacturers could ensure a constant supply, together with a uniform quality at a reasonably low price. A solution was ultimately found by using the continuous electric-resistance welding process. An idea of the enormous importance of this new process, can be gained from the fact that Tube Products, Oldbury, (the pioneers of this type of tubing in Britain and Europe), have increased their output from a few thousand feet a week in the early 1930's, to five million feet per week, today. Tube Products of India, situated at Avadi, near Madras, is an associate of this famous British Tube Manufacturing Firm. A second Factory, located in Jamshedpur, engaged in the production of E.R.W. tubing, is that of Messrs. Tata, the well-known Industrial Concern of this Country, operating in association with Messrs. Stewarts and Lloyds, of the U.K.

Tubes are made by very many different process, so designed that the end product will be suitable for its eventual application. Although the E.R.W. tube is a relatively new product, welding as such, is not a new thing. All over the world, a common feature of any village economy is the Blacksmith carrying out manual welding in his smithy. This he does by heating two pieces of steel until red hot, and then hammering them together so that a weld is effected. This is the basis of the E.R.W. process, except that the steel is heated electrically. The E.R.W. tube is a precision made tube, with all its dimensions kept within precise limits, and with the bore being maintained concentric with the outside diameter. It also has a high grade surface finish and the best qualities of the E.R.W. tube need only the lightest of polishing processes, to render them suitable for chromium plating. The E.R.W. tube is used widely for the manufacture of bicycles, transformers, tubular furniture, automobile and motor cycle components, boilers, flush pipes, pumps, ladders, hospital equipment, tubular structures, etc., and is today even being used for the heat exchangers in the atomic power stations.

The E.R.W. tubing is produced from coiled strips; long coils of strips are fed through a series of rolls, and whilst passing, they assume the shape of 'U' and then 'O', with an eventual narrow gap at the meeting of the two edges. The actual welding of the seams is done by raising the temperature through a pair of rotating discs which feed electric current across the gap, heating it locally to welding temperature. Simultaneously, pressure is applied to close the gap and forge the weld. Any surplus metal known as upset, is removed and the tube is then straightened and cut into convenient lengths. All the operations are continuous and automatic.

After manufacture, tests are carried out to ensure that the weld is in all respects, stronger than the

parent material. These tests take the form of expanding the tube over a cone and observing that the point where the tube bursts is away from the weld, subjecting the tube to high internal hydraulic pressures, sometimes to the point of bursting and again noting that bursts take place away from the weld. There are many more tests generally used in the E.R.W. tube trade, which are designed to ensure that the tube will be satisfactory for its eventual use.

For special applications where a particularly hard tube may be needed, the welded tubes are subsequently cold drawn on a draw bench.

Different qualities of steel may be used in the E.R.W. process. If a high grade finish is required in the tube, cold rolled steel is used. Tubes of this description would be used for high grade work, requiring enamelling or chromium plating. These tubes are called Bright tubes. In addition to Bright and semi-bright qualities, steels of various carbon contents can be used to give different mechanical properties. If a tube is required to be completely soft for further manipulation, e.g., bending, flattening, tapering, etc., tubes are generally annealed after manufacture. For a tube of equal mechanical strength, but whose surface finish is of less importance, e.g. automobile exhaust pipes, hot rolled stripe is pickled and then subsequently made into E.R.W. tubing, which is known as semi-bright tubing.

E.R.W. tubes are extremely versatile. They can be bent, flattened, tapered, shaped and jointed, either by mechanical or welding processes. Joining by mechanical means can be effected by using threaded sections, bolts, rivets, compressed or sweated types of fittings, self-tapping screws, clip fastenings and various other methods dependent upon the form and material to which the tubes are to be joined. Welding methods are controlled largely by the thickness of the tube walls and design of the joint; Argon arc, Oxyacetylene, brazing or arc welding are the usual means employed.

The properties of the welded steel tubes today, have enlarged the demand and the scope, and tubes upto 60 ft. long are prepared for special purpose applications.

A major advantage offered by the E.R.W. Tube, apart from its relative cheapness, is its freedom from eccentricity. The nature of the process makes it simple to produce a concentric tube as this depends on the accuracy of the rolling of a flat strip, which is normally within close limits. Concentricity is valuable in many ways; first of all, when high speed rotation is involved, as in the making of motor car propeller shafts, there is no need to secure individual balancing in order to obtain smooth running. This means a substantial saving in time and labour. Rockets now require tubes, and the speed or accuracy of flight is attributable to the material used.

Continuous practical research has yielded results calculated to inspire faith in E.R.W. Tubes, for which the demand is still growing. Customers' needs are taken into account by the Manufacturers, who, with their background of years of technical experience in tubing, are able to advise a customer on the best type and quality tubing for his particular needs.

Amongst the numerous and diversified Industrial uses to which tubing can be applied, its adaptability for use in the Sports sphere also, is quite well-known and cannot be discounted. All over the world there is a greater use of tubular sports equipment, such as tubular billiard cues, tubular bows and arrows, tubular golf shafts, etc., all these items of sports equipment have been used by the respective champions.

The development to date, of the Tubular Steel Industry in India, can be said to be very satisfactory. In fact, it is keeping pace with the ever-increasing demand of the other Industries. The indigenous manufacturers are in a position to meet the present and future requirements for E.R.W. Tubes, and with the expansion schemes under implementation, they are more than assured that it will be possible to serve the Industries' requirements fully. It is also certain that with the availability of good, cheap E.R.W. tubing, Indian Engineers will find far wider uses for this tubing, than they have found in the past, thus repeating the pattern of E.R.W. tube development, which has been witnessed in other parts of the world during the last thirty years.

[By Courtesy: The Indian Railway Engineer, Bombay]

Lading Damage from Slack Travel in Draft Gears

By W. D. Wallace, Member ASME
Vice President – Engineering & Research, W.H. Miner, Incorporated
Chicago, Illinois

SLACK in railway freight trains has always been an operating hazard because if it is excessive the runs between groups of cars cause break-in-two's, or, short of that, can cause repeated impacts which, because of frequency of occurrence, are a source of cumulative lading damage. There are several elements of present-day train operation which indicate the great importance of an accelerated program to get rid of slack. These include compliance with and tightening of the present rules for removal of free slack, the retirement of defective draft gears, and maintenance of only those types which are characteristically efficient in cushioning impacts and able to permanently prevent development of slack action in the draft gear pocket.

A certain amount of slack is fundamental to economy because a given locomotive can start twice as many cars by picking up the total drag car by car, thereby overcoming starting resistance by mild dynamic impact. Ample slack is found in the standard 3/4 inch play between cars coupled with two Type E coupler knuckles. With efficient draft gears this amount of play, plus attachment slack not to exceed 1/4 inch per car end, is harmless. It is excessive attachment slack added to draft gear pocket slack that causes the trouble. Free slack at each car end is determined by pulling the coupler out with a bar, then sledging it back solid. Proper maintenance should call for correction when the total slack from coupler horn to striking casting exceeds 1 inch.

However, manual procedure cannot determine the responsibility of the draft gear action for undesirable slack action when the car is running in the train and is subjected to the alternate buff and draft forces set up by varying air brake pressures and other effects, such as passing over humps in the track gradient. Most draft gears, regardless of design or condition, will not respond to manual slack tests. Therefore it is necessary to know which draft gears have reliable efficiency and to avoid the use of any type which, because of deficient initial action, fails to properly resist these running impacts until its travel is almost or completely exhausted. If in bad enough condition, the draft gear will have a train slack potential of twice its travel free to solid, about 5-1/2 inches per end (assuming a gear travel of 2-3/4 inches), or about 11 inches per car. Such "flat tire" gears are not only a serious source of train slack, but have insufficient cushioning capacity at the end of the slack run. The longer the run of slack in any part of the train, the greater the relative velocity attainable between the adjacent groups of cars. This means that draft and buff impacts, although usually of secondary magnitude as compared with those of coupling, are repetitious, thus providing a cumulative source of damage to certain types of lading.

Cars equipped with the better approved types of draft gears are free of slack, give up little of their travel during the slack runs, and make no contribution to unnecessary total slack. They have high reserves of capacity to cushion the bad effects of neighbouring cars equipped with poor draft gears. It is obvious, therefore, that it is of the greatest importance to get rid of any "flat tire" draft gears.

The current trend is to equip new cars with all-rubber draft gears. Until recently not many owners realized that the requirements of Association of American Railroads Specifications M-901A-53 for all-rubber gears were not nearly as exacting as those of Specifications M-901-53 governing friction gears. It should be pointed out that an all-rubber gear, which costs about one and a half times as much as a friction gear, has investment value only when it is capable of meeting the friction gear specifications.

The two most important waivers incorporated in the original all-rubber draft gear Specifications M-901-53 were directly related to slack. There was no requirement for the minimum amount of work to be done by an all-rubber gear in the first half of its travel, and proper requirements for half travel and total capacity efficiency after the endurance and sturdiness tests were missing. Most manufacturers found it impossible to make an all-rubber gear for the standard draft gear pocket and come anywhere near the friction gear requirement which stated that the capacity at half travel should not be less than 25 per cent and should not be less than 20 per cent of the capacity at full travel, to say nothing of the 40 per cent average of the approved friction gears.

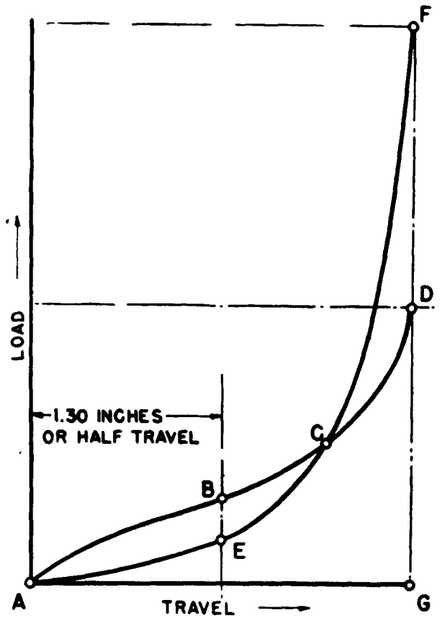


Fig. 1

Since there were no requirements in Specifications M-901A-53 for capacity at half travel for all-rubber gears, there were no official figures for this item. This situation as regards train slack can be easily explained by the amount of movement in the draft gear resulting from the very lowest of the impact unit used in A. A. R. testing, namely, the 0 inch free fall of the 27,000 pound hammer. The hammer just touches the gear at the exact pocket length, with none of its weight imposed thereon. When the hammer is released the extent to which the resistance of the gear is less than the 27,000 pound force of the hammer will determine the amount of movement. The wise owner interested in an all-rubber gear will be sure to specify a design which does not travel excessively when subjected to this test.

This important consideration is evident from a study of Figure 1 which shows how the gear with positive initial action (line A B C D) increases its resistance from left to right through full travel to develop total capacity. This action is far superior to that characteristic of rubber (line A E C F) because the final pounds of load G D are much more tolerable to lading and car structure than load G F. The action represented by line A B C D does exactly the same amount of work as line A E C F, the areas under each line being the same. It will be noted that the gear with line A B C D gets much more work done at half travel, consequently it will effect a desired minimum of movement under the 0 inch drop and prevent slack. The low initial work performance characteristic of line A E C F means maximum hammer movement and maximum contribution to slack. Since the actions of the graph are on the basis of equal work for the same impact value, it is evident that the gear with positive initial action will have much less final pressure than the gear with the negative initial action, therefore gears with poor initial action are poor shock absorbers.

Because of "from service" reports on different makes of all-rubber draft gears, the A. A. R. very wisely made obsolete the separate set of specifications governing all-rubber draft gears. Proper performance characteristics, regardless of the make of the draft gear, should be the same. In May 1959 the A. A. R. passed new Specifications M-901 D for draft gears—friction, rubber, and combinations thereof—with standard 24-5/8 inch pockets. This means that all draft gears, regardless of design, must meet the same specifications. This new specification covers gears having a 2-3/4 inch nominal travel, and a minimum capacity in buff of 18,000 foot pounds as provided in the obsolete Specifications M-901 and M-901A. There is also a very valuable requirement in this new specification which states, "As a further requirement, each gear must develop a minimum capacity of 4,500 foot pounds at 1-5/16 inches travel in both draft and buff."

There is another specification governing high capacity draft gears having a minimum capacity of 36,000 foot pounds. This specification, too, includes friction gears, rubber gears, and combinations thereof. There is also a valuable like requirement in this specification which states, "As a further requirement of this test, each gear must develop a minimum capacity of 6,000 foot pounds at 1-5/16 inches travel in both draft and buff."

Rubber gears are generally promoted for their effectiveness in reducing the shocks of ultra-high speed switching. But it is time that owners realize that it is poor economy to use rubber or any other kind of gear *unless it has a permanent positive initial action to prevent the damaging effects of slack action.*

TELCO to supply 325 mg locos During Third Plan

The Deputy Minister of Railways, Shri S. V. Ramaswamy said in reply to a question by Shri Ajit Singh Sarhadi in the Lok Sabha that the negotiations had been finalised and a supply contract would shortly be concluded with TELCO for the supply of 325 metre gauge locomotives to Indian Railways during the period from June 1, 1961 to March 31, 1966 covering more or less the Third Plan period that is, after the expiry of the present 16-year contract with the TELCO which would terminate on May 31, 1961.

The Deputy Minister laid the following statement on the table of the Lok Sabha explaining the nature of the future agreement with the TELCO from June 1, 1961 and the prices fixed for each locomotive.

"The agreement which, in draft form, is in the final stages of scrutiny before formal execution, is in the nature of a simple supply agreement, containing the usual safeguards applicable to purchase agreements, such as, phasing of deliveries, penalty for delayed deliveries or for default, inspection, progress payments, and agreed prices.

"The agreed prices are Rs. 3,80,750 per YG locomotive and Rs. 3,78,750 per YP locomotive. These prices are below the price of Rs. 3,80,717 per YG locomotive settled by the last arbitration award for the period 1958—60 covering the supply of 200 locomotives or an average annual supply of 100 locomotives whereas the average annual supply by TELCO in 1961—66 will be only about 65 locomotives."

BETTER RAIL TRAVEL

By K. Swarup

(Chief Administrative Officer, Integral Coach Factory, Madras)

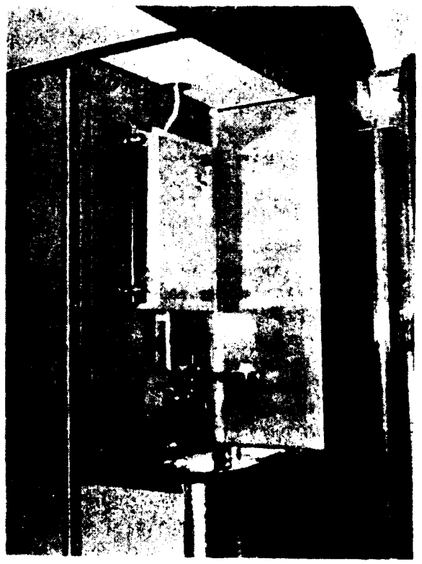
ONE of the results of World War II was an increase in traffic making abnormal demands on transport capacity. Faced with the problem of coping with the unprecedented increase in passenger traffic, accentuated by the depleted and overaged stock and the inadequacy of capacity in railway workshops for manufacture of coaching stock, the Government of India decided that a separate railway coach building factory should be established to enable the Indian Railways to become self-sufficient in the matter of passenger coaches. The Integral Coach Factory at Perambur was accordingly set up as a commitment under the First Five-Year Plan, with technical collaboration of the Swiss Car & Elevator Manufacturing Corporation, Ltd., Switzerland. The initial capital outlay for the Shell Factory was Rs. 7.35 crores and a further sum of Rs. 3.69 crores was sanctioned during the Second Five Year Plan for putting up a Furnishing Annexe. The Factory including its furnishing annexe and the township covers an area of about 500 acres and at present employs over 7,000 workers.

DESIGN OF THE COACH

In the earlier years the design of railway stock was inspired by the road vehicles of that period. It was soon found, however, that the railways could cope with heavier loads, and the evolution of railway rolling stock tended towards increased capacity together with the provision of comfort—a factor which was ignored till then. The constantly increasing speeds also made greater strength of coaches imperative. The growing competition from road and air transport forced the railway to revise its passenger service policy, which has resulted in the appearance of passenger coaches of light construction.

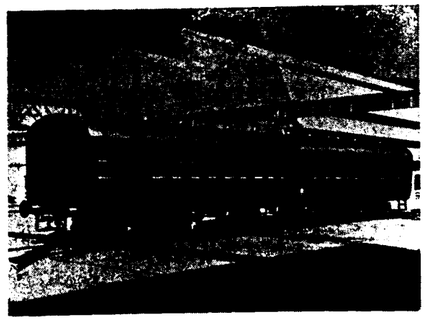
The Integral coaches produced in this Factory are of the modern light-weight all-welded steel construction, designed to give the maximum comfort and safety to the railway passengers. Being 7 tons lighter than the conventional coaches of 42 tons, considerable economy is effected in operational costs, as more number of integral coaches can be hauled per train, thus reducing the overcrowding in trains. Another important feature of this coach is its anti-telescopic end construction. The ends being plastic, i. e. designed to carry less stresses and strains, get buckled in the event of an accident, thus absorbing most of the collision energy and reducing the possibility of the carriages telescoping and causing risk to passengers. This special feature has been subjected to trials and the two photographs below will illustrate what happens in the event of collision or telescoping. The carriage is also designed for improved riding by provision of shock absorbers, spherical roller bearings, special design of springs, etc. The inside of the coach is sprayed with limpet asbestos to provide insulation against heat and sound.

The interior design is so planned as to afford maximum comfort to passengers. Unlike the previous



Some of the amenity fittings provided in our Third Class Sleeper Coach.

third classes, the integral coach has been split up into 8 compartments, each compartment providing seating capacity for 10 passengers. The upper luggage rack provides enough room for carrying luggage that our passengers are accustomed to carry. On the top is again a light luggage rack, where small articles could be kept. Similarly, luggage racks have been provided on the corridor side. The provision of these extensive luggage racks would ensure that the floor and the seats will be free for occupation and moving about, thereby giving more comfort to the passengers.



Third Class Integral Coach ready for despatch.

Each compartment has been provided with two fans to give sufficient air to all the passengers. The compartments are well-lit to enable passengers to read at night time if so desired.

The seats and back rests were originally well curved to provide comfort to long distance passengers, but have now been made flat increasing the width from 19" to 22" to enable passengers to spread their bedding and make themselves more comfortable.

Lavatories are also well equipped and have all the modern amenities like wash hand basins, mirrors, squatting pans, lotah holders, towel racks, etc.

PERFORMANCE DURING THE SECOND PLAN PERIOD

(i) *Increased Output*: According to the Technical Aid Agreement with the Swiss collaborators, this Factory was to achieve its maximum production of 350 coach shells a year, in progressive stages, in the 5th year from the start of production. Production was inaugurated by the Prime Minister on the 2nd October, 1955 and since then, year after year, the performance improved and in each year the record of the previous year was broken. The 1000th coach was turned out early in 1960—far ahead of schedule. The comparison of the targets and the actual output during the five years of production is indicated in a chart given below.

(ii) *Improved efficiency*: The efficiency of the Shops has been increasing from year to year as the men have been gaining experience and skill. The manhours spent on each coach shell have come down steadily from about 19600 at the start of production to about 8600 in the latest batch. The present manhours compare very favourably to those taken for similar coach production in Europe. Efficiency is expected to further increase as a result of the Incentive system of payment which has been introduced in I. C. F. from January, 1960.

(iii) *Reduced cost*: The unit production costs in the I. C. F. have been coming down steadliy from the initial Rs. 186 thousands to the present about Rs. 80 thousands inclusive of overheads and depreciation.

(iv) *Self-sufficiency*: Before the I. C. F. went into production, most of our coaches and underframes were imported from abroad and considerable amount of foreign exchange was required to meet the demands of the Indian Railways. In the 13 years since our Independence, the Indian Railways have become self-sufficient in their railway coach requirements and not a single coach is now imported.

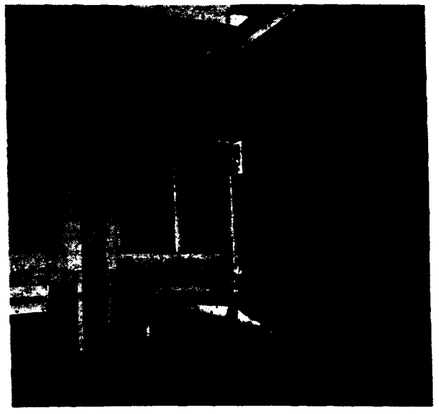
(v) *Diversified production*: The original idea was that the I. C. F. would produce only a standard shell, which could be furnished to any class of coach required. With the rapid industrialisation of the country and resulting higher standard of living of the masses, the demand for better amenities and comforts also increased. While laying stress on the improvement of amenities and comforts to third class passengers who constitute the bulk of the traffic on the

Indian Railways, this Factory has also now geared up for meeting the varied requirements and standards of the travelling public by designing different types of coaches. The types of coaches produced till the end of the Second Five Year Plan are indicated below :

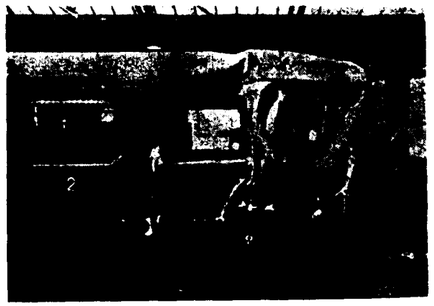
Type of coach	Number
'T' (Integral)	1047
'TLR' (Integral)	121
'TCN' (Integral)	150
'T' (Conventional)	115
'TLR' (Conventional)	150
'F' (Integral)	155

To give an idea of the amenities and comforts provided in these coaches, the interior layout of the various classes of coaches is shown in the sketches.

(vi) *Export market*: Having achieved self-sufficiency for the Indian Railways, this Factory is now tapping the export markets. The I. C. F. has already quoted against Pakistan and Argentine Tenders for coaches. In Pakistan, we were the lowest out of the 7 countries that competed in the global tenders and in the case of Argentina, quotation for I. C. F. coaches was the second lowest out of 28 tenders received from 15 different countries. The results of these tenders are not yet known, but the very fact that the cost of I. C. F. coaches is competitive in the world-market proves that the Government undertakings can run efficiently and earn the badly needed foreign exchange for the country.



An interior view of a First Class Coach recently built by I.C.F.



The two photographs above will illustrate what happens in the event of collision or telescoping.

PROPOSALS FOR THE THIRD FIVE-YEAR PLAN

(i) Encouraged by the excellent performance during the Second Plan Period and the good teamspirit existing amongst all grades of staff at I. C. F. this Factory has embarked on the ambitious plan to produce 3735 coaches during the Third Five-Year Plan commencing from April 1961. This programme includes coaches even for the Metre Gauge, Electric Multiple Unit Stock and also Diesel Railcars required for the Indian Railways. The proposed programme is as follows :

Type	B. G.	M. G.	N. G.	Total
Ts.	23	1198	—	1221
TLRs	235	—	—	235
Fs.	462	—	—	462
FTs.	592	—	—	592
Motor & Parcel Vans	—	343	—	343
Motor Vans	—	73	—	73
EMU (12 ft. wide trailers)	612	—	—	612
Railcars	67	120	10	197
Total	1991	1734	10	3735

(ii) The construction of the Permanent Furnishing Factory is now in full swing. Rs. 1.5 crores out of Rs. 3.69 crores has already been spent in the II Plan and the balance of Rs. 2.19 crores will be spent during the III Plan to complete the Permanent Furnishing Unit. By providing a furnishing unit, all the shells that would be turned out from the Shell Unit will be furnished and made available to the Railways without any loss of time. It will also enable standardisation and providing better comforts to the passengers.

(iii) For full working of the Second Shift which will enable obtaining further increases in production, extension of certain workshops and additions in machinery and plant at a total cost of Rs. 45 lakhs is envisaged during the III Plan.

(iv) The factory has built a Staff Colony provided with about 841 units of quarters. Another 257 units are programmed to be built in the Second Shift scheme. Further, in view of the acute shortage of accommodation in this part of the Madras City it is proposed to build 500 more staff quarters during the III Plan at the rate of 100 per year at a total cost of Rs. 52.5 lakhs. Thus, the number of quarters provided in the Staff Colony would be nearly doubled at the end of the III Plan.

(v) Since October 1955 when this Integral Coach Factory first stirred into productive life, its story has been one of continuous development and growing productivity. The object with which this factory was set up has been more than fulfilled. Having achieved self-sufficiency in matters of passenger coaches for the Indian Railways this factory is now looking forward to building coaches for the export market. Our cost as well as quality in production is very competitive and we have full hope that very soon we will be able to get orders from some foreign countries for their coach requirements and thus become one among the foreign exchange earners for India.

PUBLIC ENCOURAGEMENT AND CO-OPERATION

It is not for me to indulge in self-praise, but it can perhaps be said with a measure of truth that this factory has already come to be looked upon as a shining symbol of India's industrial development in post-Independence period. Thousands of visitors from this country and from abroad went their way through this factory in appreciation of our efforts. We are continually striving to improve the layouts and provide more and more comforts and amenities to the passengers, and hope that our efforts in this direction will also be appreciated by the public and they will co-operate with the railways in maintaining these integral coaches well. Our experience of today when costly fittings and improved finishes are removed or spoiled by vandalism discourages us from further improving our finish. I, therefore, beseech the public to treat these coaches as their own property and look after them well.

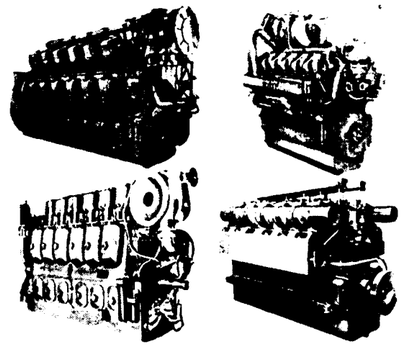
Paxman—Alco Agreement

ON the 18th November 1960, it was announced in a statement about the agreement reached between Davey, Paxman & Co., Ltd. of Colchester, England (a member of the Ruston Group), and Alco Products Inc. of New York, which will be made public on November 28th. In this statement the reciprocal agreement which has been made between these two Companies for the manufacture and sale of each other's diesel engines in certain markets is outlined. We are now able, however, to give you some additional background to this announcement and further details of how this agreement will operate in practice.

Alco Products Inc. (formerly known as the American Locomotive Co.) is one of the largest builders of locomotives and locomotive diesel engines in the U.S.A. Alco locomotives have played a major part in the dieselisation of American Railways and have also found a ready sale in other parts of the World. Apart from their use in locomotives, Alco diesel engines have found numerous industrial, oilfield and marine applications, and have reached a very high state of development covering a power range of from 900 to over 3000 b.h.p. in 6, 12 and 16 cylinder models of 9 in. bore. Alco engines can also operate as dual fuel engines burning natural gas (or other gaseous fuel) with pilot injection.

Davey, Paxman & Co., Ltd., of Colchester has specialised for many years in compact medium and high speed, vee form, diesel engines. The Paxman 7 in. bore range of diesel engines, and the high specific output 7¾ in. bore Ventura range developed from it, have established a world-wide reputation in traction, industrial, marine and oilfield applications and cover a power range from 150 to 2300 b.h.p.

The agreement between these two Companies has been inspired by their mutual appreciation of the emphasis that present day conditions give to the need for co-operation between Companies whose products and markets are complementary. Such co-operation is not only advantageous from a selling point of view but also enables the product range of the collaborating Companies to be extended without involving duplicated costs in design and development.



Top left: ALCO 12 CYL. 9 in. Bore Engine Series 251

Top right: PAXMAN 12 CYL. 7¾ in. Bore Engine Ventura

Bottom left: ALCO 6 CYL. 9 in. Bore Engine Series 251

Bottom right: PAXMAN 12 CYL. 7 in. Bore Engine Series Rph

Paxmans will therefore manufacture and sell Alco designed engines in their traditional world markets, as covered by the Ruston Paxman sales organisation.

Correspondingly, Alco will have the right to sell and make Paxman engines of the Ventura and other types in the U.S.A. for all purposes, including applications in American equipment for export and in locomotives of sizes other than now manufactured by Alco.

DIAL GAUGES

The Indian Standards Institution has prepared a draft specification for Dial Gauges. The draft standard deals with commonly-used dial gauges of unit of measurement 0.01 mm. and also gives information on high accuracy dial gauges required in the inspection of machine tools. The draft specification will shortly be put into wide circulation to manufacturers, consumers, technologists and others interested, for their critical comments and suggestions for improvement. The comment will be given due consideration before finalizing the draft as an Indian Standard.

N. F. Railway to eliminate Traffic Bottlenecks

By Rattan Lall
General Manager, North-east Frontier Railway

The author explains how despite initial difficulties and setbacks, the N. F. Railway has marched forward to undertake development of line capacity works and other improvements to break transport bottlenecks in the region. Reference is also made to the construction of the massive rail-cum-road Brahmaputra Bridge which will provide for speedier movement of men and material from the border state of Assam to the rest of India on its completion in 1962.

ALTHOUGH the North-east Frontier Railway is the smallest of all the Zonal Railways its problems are by no means small. Created in 1958 to tackle the special needs of the frontier region and to provide effective means of transport for men and material between Assam and the rest of the country, the Railway Zone claims five per cent of the total route mileage of the Indian Railways.

This portion of the Indian Railways has passed through various ordeals. Wear and tear of its permanent way and rolling stock was considerable during the last war. This was followed by partition which severed the rail link to Assam and a portion of West Bengal from rest of the country. Devastating floods raged in 1954 and 1955 affected the new Assam Link route, dislocating traffic for months together.

The Railway has successfully tackled the initial problems that once beset its path. With the completion of work on the Assam Link Route and opening of the Brahmaputra Bridge as well as the coming of broadgauge to Siliguri, it is hoped, that the major bottlenecks in the Railway will be eliminated.

Carved out from the bifurcated North Eastern Railway, the new Railway serves 300 tea gardens in West Bengal and 800 in Assam and constitutes their main mode of transport. Besides, it is the only outlet for petroleum and its products from the Digboi Oil Refinery.

The other principal commodities carried by the Railway are coal and timber from Assam and jute from Bihar and Weat Bengal. Its chief inward traffic is sugar, salt, food grains, pulses, tea garden stores and piece-goods.

ASSAM RAIL LINK

The Partition led to the formation of Assam Railway which had to begin from a scratch. The severance of rail links to Assam and West Bengal as a result of partition necessitated construction of Assam Rail links.

The alternative link was opened to goods traffic in December 1949 and passenger traffic in January 1950.

With the regrouping in April 1952 the Assam Railway became a part of the North Eastern Railway.

SET BACK AGAIN

The First Five Year Plan was mainly devoted to the task of absorbing the shock of the Partition. But just when the Railway was on its way to recovery, there was a fresh setback from the devastating floods mentioned earlier.

During the successive rainy seasons also the Link Route was ravaged by floods though not as seriously as those in 1954 and 1955.

Topographical conditions of the region are peculiar to itself and constitute a challenge to the ingenuity of those responsible for maintaining the train services. For most of its length, the line passes through submontane region and cuts across the drainage of the country at many places where a number of turbulent rivers from the Himalayans rush into the plains in their maiden fury, sometimes with a velocity of as much as 26 to 28 ft. per second.

Due to this factor, the railway track had always been subjected to repeated breaches. But whatever

might be the obstacles, stabilisation of this Link Route, which is the lifeline to Assam, has been a vital condition precedent to the development of its economy.

STRENGTHENING THE LINK ROUTE

To prevent recurrence of breaches, extensive work has been undertaken at an estimated cost of about Rs. 6 crores. The idea is not been to fight the rivers but to tame them. The main item of work required, therefore, is effecting improvement to about 42 bridges by providing increased waterways and deeper foundation. Guiding of some of the turbulent water courses through the bridges is another important aspect of the programme. The Bridge works involve construction of 24 spans of 150′, 31 spans of 100′, 34 spans of 60′, 54 spans of 40′ and 128 spans of 20′ and less. Thirty two of these bridges are on well foundation.

IMPROVEMENT IN WAGON MOVEMENT

The strengthening of the Assam Link Route is almost complete except girdering of a few bridges. The frequent interruption and continual trouble to communications on the Link Route would, it is hoped, soon become a thing of the past.

BETTER WAGON MOVEMENT

There has been considerable improvement in movement of traffic East of Siliguri Jn. The daily average movement progressively increased from 132 wagons in 1955 to 257 in 1960.

Rated against 1955 performance as 100, the performance during 1956 to 1960 has been respectively 112 (1956), 133 (1957), 150 (1958) 169 (1959) and 195 (1960). During January and February 1961, the daily average has been 291 wagons or 120.5 per cent of the figure in 1955. The Railway also moved 238 and 126 coaching vehicles respectively by important specials during this period.

BRAHMAPUTRA BRIDGE

At present a passenger and wagon ferry ply between Amingaon and Pandu with a capacity of about 250 wagons a day. During high waters in the rainy season this also becomes difficult. It, therefore, constitutes a bottleneck to speedier movement of wagons and inconvenience to the travelling public. To overcome this, the construction of a combined rail-road bridge was undertaken in October 1958. The estimated cost of the entire project is Rs. 10.79 crores. The bridge will consist of 10 spans of 403′—4½″, centre to centre of piers with a shore span of 108′—11″, centre to centre of piers, at each end.

Out of 11 main piers, 8 piers have already been completed and the pier superstructures are ready to receive the girders. The work on the remaining piers is expected to be completed soon. Fabricated materials for the girders have started arriving at the work site.

The project also covers remodelling of Narangi Yard (next station east of Gauhati) which will replace the yards at Amingaon and Pandu and also serve the proposed Oil Refinery at Noonmati (Gauhati) and other ancillary works. The new yard is designed to handle 300 wagons each way for the present and provision has been made for its expansion to cater for 500 wagons or more each way.

The Bridge is likely to be brought into commission by about the middle of 1962.

INCREASING LINE CAPACITY

The single line Main Line section between Katihar and Amingaon is already saturated and will not be able to handle the increased traffic expected during the Third Five Year Plan. In order to break the bottleneck, Master plans for the development of the carrying capacity of this Railway have already been drawn up and are being progressively executed.

A Metre Gauge route of 15.53 miles from Kumedpur to Mukuria (near Barsoi) was opened to goods traffic in July, 1959 and to passenger traffic in December, 1959.

A 20 mile Broad Gauge line from Khajuriaghat to Malda Town with wagon ferry between Farakka and Khajuriaghat was opened to public goods traffic in December, 1960.

Work for provision of 94 mile Broad Gauge line from Barsoi to Siliguri Junction is in progress and is likely to be completed in a short time. Conversion of the Metre Gauge Sections from Katihar to Singhabad linking Malda Town (approximately 69 miles) and from Mukuria near Barsoi to Kumedpur (15.53 miles) into Broad Gauge Line will provide for transhipment of Broad Gauge to Metre Gauge and Narrow Gauge and vice-versa traffic.

There will thus be a direct Broad Gauge connection between Calcutta and Siliguri with wagon ferry across the Ganga between Farakka and Khejuriaghat. This route will provide for movement of about 100 Broad Gauge wagons per day and will serve North Bengal requirements.

NEW M. G. LINES

Construction of metre gauge from Rangapara North to North Lakhimpur covering about 107 mile, running along the stretch of the country between the Brahmaputra and the Himalayan foothills has been taken in hand. The first stretch of 12 miles including the construction of the Jia Bhareli Bridge consisting of 9 spans of 200 ft. commenced in February 1960. Railway materials have started moving over it since December 1960 upto Jia Bhareli and across the Bridge from February, 1961.

Construction of a new metre gauge line from Kalkalighat to Dharamnagar (10.48 miles), which will link Tripura with Assam has been sanctioned and the project is in progress.

TRACK RENEWALS AND SIGNALLING

Due to worn out rails, trains had to be run at a restricted speed and for this reason complete renewal of track for 262 miles at an estimated cost of Rs. 3 crores has been programmed. Up till now about 190 miles of track have been renewed.

Realignment between Mal and Banarhat, to reduce the gradient, has been undertaken. This and other regrading works now in progress will increase the lead capacity of the locomotives.

To increase safety and to permit higher speeds through station yards all the stations on the main line from Katihar to Tinsukia except Tinsukia, Chaparmukh, Simaluguri Junction and Sripuriagaon have already been included for interlocking in various works programmes. The interlocking work at all the stations on the Katihar-Siliguri Junction section has been completed and that between Tandu and Tinsukia is in hand.

CENTRALISED TRAFFIC CONTROL

The Ministry of Railways has decided to introduce Centralised Traffic Control system over the 258 mile single line section between Amingaon and Siliguri, the first of its kind on the Indian Railways, at a cost of about Rs. 5 crores.

The work is expected to be completed within about two years. The line capacity will also be increased to 24 trains each way instead of 15.

It is also proposed to dieselise goods train services over the Barauni-Katihar-Amingaon section and on the Lumding-Badarpur section. The first lot of diesels is expected to be put in service about the middle of this year.

HELPING THE INDUSTRIES

The oil Refinery located at Digboi with a capacity of .43 million tons was established there in 1900, about 60 years ago. The Railway has a fleet of 720 tankwagons for movement of this oil which goes to different parts of the country. The Oil Refinery at Gauhati is likely to go into production by December 1961 with a capacity of .75 million tons. Additional tankwagons of 38.5 tons carrying capacity have been ordered to meet the anticipated demand.

Coal is found in Margherita and Ledo areas in Assam. Coal mining process here is different from what obtains in Bengal and Bihar Coalfields. In the Assam coalfields, the coal seems are in the shape of hills and the approach to the coal bearing strata is through a horizontal tunnel, or more correctly, one which slopes almost imperceptibly upwards from the pit mouth.

On an average, about 120 coal wagons were loaded every day on this Railway during 1960—61 (upto January) as compared to 80 and 88 wagons in 1958–59 and 1959—60 respectively.

WORKSHOPS & SHEDS

Since the partition left this portion of the Railway without any workshop worth the name, provisions have been made for the setting up of carriage and wagon workshops at Bongaigaon at an estimated cost of about Rs. 5½ crores along with expansion of the capacity of the workshop at Dibrugarh at an estimate of Rs. 10 lakhs (approximately).

Further, a new Diesel Shed at Siliguri Jn. for housing 40 Metre Gauge Locos and another at New Siliguri Jn. for accommodating 25 Narrow Gauge locos

are also proposed to be constructed in the Third Plan. At Narangi a diesel shed for 40 locos has been included in the Brahmaputra Bridge Project.

MOVEMENT OF TRAFFIC

The N. F. Railway's effort to improve, expand and modernise. The system has already borne fruit. From April 1960 to January 1961—Wagon loading has been about 10 per cent more than what was done in the corresponding period of 1958–59. The movement of traffic over the Katihar–Siliguri–Alipurduar–Amingaon section showed an improvement ranging from 14 per cent to 20 per cent as compared to previous year. Marked improvement has also been noticed on the Lumding–Badarpur section to serve the Cachar district.

Other statistics of performance are as under :—

(PERIOD APRIL TO JANUARY 10 MONTHS)

	1958—59	1959—60	1960—61	Percentage increase in 1960—61 over 1958—59
1. Daily average No. of wagons loaded	960	985	1047	9.1
2. Tons lifted (in thousands)	3423	4324	4105	19.9
3. Net Ton miles (in millions)	788	774	886	12.4
4. Passengers carried (in millions)	27.5	25.5	29.9	8.7
5. Passenger miles (in millions)	1100	1037	1283	16.6

AMENITIES FOR RAILWAY USERS

Since the inception of this Railway, nearly Rs. 52 lakhs have been spent towards passenger amenities which included provision of platform coverings, foot overbridges, refreshment rooms, tea stalls, waiting rooms, waiting halls at 13 stations and bath-rooms cubicles at a number of stations. Besides, 19 stations had been electrified and 6 water coolers provided at 4 stations.

Arrangements for sale of cheap food packets have been made. Departmental catering has also been introduced at Gauhati, Pandu and on the passenger ferry plying between Pandu and Amingaon.

Another important facility introduced since December last is the provision of one 3-tier sleeper coach on the Kamrup Express trains twice a week.

Twenty-one out agencies to afford more booking facilities to the mercantile community, have been opened and public address equipments have been installed at 8 stations to assist the travelling public.

A sum of Rs. 1.03 crores is proposed to be spent during the Third Plan period on passenger amenity works.

SCHOOLS FOR RAILWAYMEN'S CHILDREN

Provision of educational facilities to the children of the Railway staff is receiving close attention and is being made on a programmed basis. The Railway is running: Five English High Schools and 4 more English High Schools will be taken over by the Railway during the Third Plan. Thirty-two single teacher free primary schools have been sanctioned of which 29 are now functioning. The remaining three will be opened shortly. Besides the Railway Schools, capitation grant is given to non-Railway schools situated at some important stations. A vocational training centre has recently been started at Maligaon for imparting technical training to staff and their children.

Super-powerful Open-hearth Furnace

A super-powerfull open-hearth furnace has been laid at the giant Magnitogorsk Steel Mill. It will produce 50 per cent more steel than any of the country's biggest furnaces at present. Under the Seven-Year Plan, the Magnitogorsk Mill, built in the thirties under the first Five Year Plan, will almost double its output, increasing it to 12 million tons a year. This increase will be achieved both through enlargement of furnaces and an intensification of the production processes through the use of high-calory fuel natural gas. Scientists are now working on a plan of the comprehensive mechanization and automation of the mill's open-hearth section.

FROM STEAM TO ELECTRICITY

By H. D. Awasty
General Manager & Chief Engineer
Railway Electrification, Calcutta

Shri Awasty outlines the progress made by the Railway Electrification, Calcutta, in the execution of its Electrification Scheme on certain sections of the Indian Railways.

The main purpose of electric traction is to provide increased line capacity on the sections serving steel plants at Rourkhela, Tatanagar, Burnpur and Durgapur to carry raw materials including coal and iron ore to the plants and take away the finished products.

THE Ministry of Railways have taken a bold decision to replace steam with electric traction to the maximum extent possible within their financial and technical man-power resources.

An independent administration known as the Railway Electrification has been set up for executing the scheme on the railways.

To move the growing traffic on our trunk routes, either new lines have to be constructed or facilities provided on existing lines to quicken the movement. One way of increasing line capacity is to replace steam by electric traction.

Increase in line capacity means that on a given section more passengers and more goods can be carried than is normally possible in the existing conditions. Railways, elsewhere having large mileage under electric traction, estimate the consequent increase in their line capacity of 50 per cent. The actual increase realized depends upon a large number of local factors.

ADVANTAGES OF ELECTRIC TRACTION

Electric traction is cheaper than steam traction in running and maintenance costs. A steam locomotive requires good coal. On the other hand, a large thermal stations supplying power to electric locomotives is specially designed to use low grade coal.

An electric locomotive can draw almost an unlimited supply of energy from the overhead electric conductors while negotiating a rise, whereas a steam or diesel locomotive must wholly depend on its own limited capacity. An electric locomotive makes full use of its weight for the purpose of developing adhesion between all its wheels and rails and therefore draws much heavier loads than a steam locomotive of a similar weight, but which cannot make use of its full weight for the purpose of developing adhesion between wheels and rails.

A steam engine has an overall thermal efficiency of 4½ per cent as against an overall efficiency of 14 per cent of an electric locomotive. In other words, coal consumption in steam traction is about three times more than that used to produce power for electric traction.

LOWER RUNNING COST

The cost of maintenance of an electric locomotive is generally about 1/3rd of the maintenance cost of steam locomotive. As regards the running costs, an electric locomotive not doing any useful work on line does not draw any electric current, but an idling steam locomotive on line cannot but use coal and lubricants.

As regards the comparative cost of operation much depends on the cost of coal in the tender and the cost of electric energy from power station. This comparison is already favourable to the use of electric energy in most parts of India. As more hydro electric plants get commissioned, the cost of energy will reduce still further.

A lot of working time in a steam locomotive is spent in coaling and watering. It takes time to get up steam while an electric locomotive can pick up speed almost immediately. All things considered, the availability of an electric locomotive may be as high as 2½ times that of a steam locomotive. While a steam locomotive may on an average earn 100

miles a day, an electric locomotive on an average will earn 250 miles.

These being some of the considerations, all progressive railways in the World are replacing steam by diesel or electric traction, depending upon the availability of oil or electric energy in their countries.

DIFFERENT TRACTION SYSTEMS

There are a number of electric traction systems some using direct current, others employing alternating current. There are various voltages and in the case of alternating current, different frequencies and either single phase or three phases.

We have 1500 V direct current, 3000 V direct current, 20,000 V. a. c. 50 or 60 cycles per second or $16\frac{2}{3}$ cycles per second frequency and 25,000 V a. c. single phase on industrial frequency of 50 cycles per second.

The last system has now been adopted as standard by a number of West European countries, the United Kingdom, U. S S. R. and China. The Indian Railways have also standardised on this system.

The Railways have satisfied themselves about its technical soundness as well as their ability to take remedial measures in connection with its adverse effects on neighbouring telecommunication systems. The problem of harmonics and degree of unbalance due to single phase load on the 3 phase supply system was thoroughly investigated by net work analysers in U. K. and France and found to be well within the limits acceptable to power supply authorities.

HIGH VOLTAGE CURRENT

High Voltage enables conductors of small cross-section area to be used. Their own weight as well as the wind load is comparatively light. Consequently the supporting masts and their foundations are also light. An alternating current loco, weight for weight, can draw more load than a direct current loco due to its better adhesive characteristics.

The alternating current substations are simpler and less in number over a given length than in the case of direct current. The cost of power supply arrangements is, therefore, much less. As against this, high voltage needs better insulation between live conductors and structures.

Bigger clearances for structures and better insulations cost additional money. High voltage a'ternating current has greater adverse effect on neighbouring telecom. Circuits which have, therefore, to be immunised by screening or removal to a safe distance.

The single phase traction load, unless within certain limits, leads to unbalance between different phases of the supply system. Even with regard to the choice of frequencies, there are arguments in favour of both sides.

The German Federal Railways still consider $16\frac{2}{3}$ cycles per second frequency as satisfactory but almost all other advanced railways are adopting 50 cycles per second. The main advantage of using the standard industrial frequency of 50 cycles per second is that it completely eliminates costly converting equipment at the substations.

These and many other factors had to be taken into account by the Indian Railways before deciding upon the future standard. It was a most difficult decision but the growing consensus of opinion amongst the highest technical authorities favours 25,000 alternating current single phase 50 cycles per second system.

PROGRESS OF ELECTRIFICATION

In India, upto the end of the First Plan, electric traction on 1500 V direct current obtained on 246 route miles around Bombay and Madras, mainly to carry suburban traffic. By 1958, Howrah to Burdwan on the Eastern Railway main line together with Sheoraphuli-Tarakeswar branch with a route mileage of 88 was electrified on 3000 V direct current. This was thus the first section to be completed in the Second Plan.

In July 1958, the Planning Commission approved of electrification on the new alternating current system of about 674 route miles during the Second Plan on the Eastern and South Eastern Railways. The section approved on the Eastern Railway was Durgapur to Moghalsarai on the Grand Chord. The sections approved on the South Eastern Railway were Asansol to Sini; Kharagpur–Tatanagar–Rourkela and Dangoaposi to Rajkharswan.

The Sealdah Division of the Eastern Railway with about 200 route miles approximately was also approved for electrification but early in the Third Plan.

STEEL PLANTS

The main purpose of electric traction is to provide increased line capacity on sections serving our steel plants at Rourkela, Tatanagar, Burnpur, and Durgapur to carry raw materials, that is, coal, iron ore etc. to the plants and take away the finished products.

The setting up of two new steel plants, at Durgapur and Rourkela and the proposed increase in the outturn of the two existing steel plants at Burnpur and Tatanagar, has imposed an appreciable strain on the transport capacity of the Eastern and South Eastern Railways in this area.

The finished products to be transported by rail from these four plants are expected to be about 4.47 million tons per annum by the end of the Second Plan. By the end of the Third Plan period, one more steel plant would be set up at Bokaro and the anticipated traffic offering would increase to 7.39 million tons per annum.

Each ton of finished steel requires about $4\frac{1}{2}$ tons of iron ore, coal, lime stone and other materials. The resulting strain on the two Railway systems with steam traction would have been so great that electrification of the railways was the only practical and economical solution.

It has been decided that for the time being only freight trains would be hauled electrically. Later, when more locos become available, passenger trains will also be run electrically.

COORDINATION WITH OTHER AGENCIES

In this colossal task, some other Ministries are closely associated with the Railways. The Posts & Telegraphs, under the Ministry of Communications, is responsible for replacement of aerial circuits along the railway lines to be electrified. The safe working of these circuits which serve the country and not only the railways is of prime importance.

It is only after the Posts & Telegraphs Department complete the transfer of aerial circuits into screened underground cables that the overhead traction conductors can be energised.

The responsibility for supply to the railway of power at 25,000 V alternating current is that of a number of independent power supply authorities like Damodar Valley Corporation and State Electricity Boards of Uttar Pradesh, Bihar, Bengal and Orissa Government.

The Central Water & Power Commission, under the Ministry of Irrigation & Power, coordinates the different power supply authorities. The final progress of electrification thus depends not only on the Railway Electrification and the open line railways but also on a large number of agencies outside the control of railways.

JOB WELL DONE

After about two years of study by the Railway Board Engineer an organisation for carrying out field work known as Railway Electrification was started in 1958–59.

The position of work, a little less than three years afterwards, that is, by March 31, 1961, was that the Railway Electrification had completed their work on the sections Durgapur to Nimiaghat a little beyond Gomoh on the Eastern Railway; Asansol to Sini; Bondamunda (Rourkela) to Adityapur (Tatanagar) and Dangoaposi to Rajkharswan on the South Eastern Railway.

Of these, Durgapur to Gomoh on the Eastern Railway and Dangoaposi to Rajkharswan on the South Eastern Railway are already in commercial operation.

The sections Chakradharpur to Adityapur (Tatanagar) and Sini to Asansol and Gomoh to Gaya would be energised in stages within the next three to four months. Once this is done, the steel plants at Tatanagar, Burnpur and Durgapur would be served by electrically hauled trains.

The work is not so advanced on the remaining sections Gaya to Mughalsarai on the Eastern and Tatanagar to Kharagpur on the South Eastern Railway. However most of the ancillary works are complete including yard remodellings, staff quarters, loco sheds and remote control centres.

Survey and design of overhead traction equipment and most of the layout plans of overhead traction equipment have been finalised. About 50 percent of foundations and masts have been put up. Stringing of copper conductors which is in hand, if could have been done much copper conductors much earlier but we presume it was proposed to keep this phase of work in step with power supply and replacement of aerial circuits by P. & T. cables. There are obvious difficul-

ties in leaving long lengths of copper conductors unenergised over long periods.

ELECTRIFICATION DURING THIRD PLAN

The Railways carry forward electrification of a number of lines to the Third Plan; for instance 400 track miles of Sealdah Division of the Eastern Railway, on which, as scheduled, considerable preliminary work has been done. The sections from Sealdah to Ranaghat and Dum Dum to Bongaon have been given priority.

Similarly, civil engineering works have been carried out on Madras—Villupuram Section of the Southern Railway. Igatpuri—Bhusaval section of the Central Railway has been surveyed and the question of unbalance on the supply system due to traction load on single phase is under investigation.

An entirely new section is the long Mughalsarai—Kanpur section. Here too, the Civil Engineering Survey is in hand. Coordination between Power Supply authorities and the Posts & Telegraphs Department, both at the Ministry level and Railway Administration level has been established; our requirements have been advised.

Our Chittaranjan Loco Works and the Integral Coach Factory, Madras are engaged in establishing manufacturing capacity of a.c. locos and a.c. EMUS, respectively.

Targets of completion will now be mutually decided upon but once again we shall fix for ourselves targets which will need all our capacity to attain them.

We are admittedly behind our targets of the Second Plan which were, as they should be, very high. We were out to do in three years what would have been adjudged on many foreign railways as a remarkable feat, if accomplished in 5 years. Had these targets been attained our rate of work would have been higher than any other railway in the World including the French Railways who are pioneers in this system and who have a lead of about 10 years over us.

Our country is far less advanced industrially than others with whom we tend to compare ourselves. It takes almost a year to import vital components of our equipment.

Erection of overhead traction equipment needs track occupation. The proposed rate of progress in our targets would have needed about 8 hours of daylight blocking of lines which would have severely handicapped rail movement on our vital trunk routes.

RELIANCE ON INDIGENOUS SOURCES

Another point which should be borne in mind is that progress of electrification depends on the matching of work by many independent authorities and not by railways alone.

Perhaps a turnkey job by a foreign agency and under one Ministry may have made the targets attainable but at the cost of carriage of a few million tons of railway goods, crores of rupees and huge foreign exchange and at the cost of our growing indigenous industry supporting electrification schemes.

It may confidently be asserted that, unlike in many other projects of this nature, the indigenous manufacturers, big or small, were given full encouragement to develop themselves.

Indian manufacturers have already made d.c. electric multiple units for suburban traffic. Bhopal Heavy Electricals are busy manufacturing traction equipment. India would now soon be making its own a.c. electric locomotives and electric multiple units coaches.

METRIC SCALES FOR USE WITH DRAFTING MACHINES

The latest edition to the series of Indian Standard Specifications on Metric Scales being prepared by ISI in connection with the changeover to the metric system is IS: 1482–1960 Specification for Metric Scales for Use with Drafting Machines. Other standards published in the series cover metric scales for general purposes and metric scales for architectural purposes.

The present specification covers the requirements for metric scales of 50 cm and 30 cm lengths with four ratios, namely, 1:1, 1:2.5, 1:5 and 1:20, for use with drafting machines, A 50 cm scales and a 30 cm Scale constitute a set. The specification does not cover the design and dimensions of the device meant for fixing the Scales to the drafting machines

Research on Railways RDSO'S Contribution to self-sufficiency

By Qurban Singh
(Former Director General, R.D.S.O.)

The article indicates how the R.D.S.O. has rendered signal service to the Indian Railways in their efforts for progressive replacement of imported items of railway stores and equipment by indigenous products.

Functioning as the repository of the "know-how" of the technical departments under the Railways, that organisation has already prepared designs of a wide range of items from rolling stock and railway sleepers to massive bridges which have either been completed or are under construction. Its extensive research conducted in collaboration with a number of national scientific institutes in a number of fields has helped the Railways in becoming increasingly self-reliant in equipment and stores.

THE rapid strides made by the Indian Railways in research design and development has aroused considerable interest even in most advanced countries.

The recent visit of foreign railway experts organised by Economic Commission for Asia and Far East to study the Brahmaputra bridge construction involving several unique features, is an indication of the recognition of Indian Railways' advance in technical fields.

The Research, Designs and Standards Organisation is the repository of the 'know-how' of technical departments of Indian Railways.

The organisation has helped the Indian Railways in the production of railway materials and equipment, in accordance with standard designs, specifications and codes of practice. It has found solutions to numerous specific problems referred to it.

ORGANISATIONAL SET UP

The Research, Designs and Standards Organisation in its present form, with its three permanent wings, the Mechanical, the Civil and the Research, each under a Director, came into being in March 1957.

Its evolution as the central Standards Office dates back, however, to 1930. There were also the still earlier phases of the various standards committees under the Indian Railway Conference Association. These mostly concentrated on evolving standards of moving dimensions and clearances of fixed structures, strength of bridges and track any types of locomotives, rolling stock and equipment, acceptable to Railways, a large number of them were Company managed. The Central Standard Office was called upon to prepare tender documents, specifications, schedules and drawings, when, in 1931, the tenders for rolling stock and equipment started being invited simultaneously in England and India.

FIRST RESEARCH WORK

The first research work undertaken was in 1935, which brought out the "Track Stress Research Report". Later, after the Pacific Locomotive Enquiry Committee had recommended extension of research work and dynamo meter car and oscillograph equipment and cars had been acquired by the Central Standards Office, the research and experimenting activities were extended, an initial Research Centre was set-up, followed by a comprehensive Research Centre at Lucknow, under a separate Director of Research in 1952.

The Committee of Engineers, presided over by Dr. A. N. Khosla, recommended the collection and analysis of a large volume of hydrological, meteorological and topographical data from Railways and other institutions in the country as well as the information regarding the practices obtaining in other countries. A fourth Wing has, therefore, been added, temporarily, to the R. D. S. O., since March 1960 for

these studies by putting under observation a number of railway bridges.

CENTRAL BOARD OF RESEARCH

The Ministry of Railways constituted last year a Central Board of Railway Research consisting of eminent scientists, engineers and industrialists of the country to advise on the programme of the railway research and development and to ensure coordination and cooperation with other sister institutions and manufacturers.

The achievements of the National Research stations and other research organisations are freely used for application on railways and any subject of original research, which Railways will like to be studied, are formed out to these research organisations. This will complete the set-up for ensuring full coordination in research and in advancement of technical knowledge, both for making India self-sufficient, to the maximum extent, in production of railway equipment and for achieving high efficiency and economy in the equipment produced.

In addition, a close contact is maintained with Research Institutions, Railway systems and leading manufacturers of railway equipment in all progressive countries of the world. Opportunity is also taken to send Railway Officers abroad to have first hand knowledge of work being done in other countries.

Officers of R. D. S. O. represent the Railways as members of a number of Committees set up by the Indian Standards Institution, National Buildings Organisation, other Government bodies and Ministries, on matters in which Railways may be interested. They thus get first hand knowledge of the view of experts from other branches, organisations and industrial undertakings on the subjects discussed.

RAIL SUB-COMMITTEE OF ECAFE

The Railway sub-committee of the Inland Transport Committee of the ECAFE, set up by the U. N. O. has so far made studies on important aspects of railway operation. These cover improved turn round of rolling stock, working of diesel locomotives, incidence and prevention of railway accidents, improved system of signalling in relation to speed, safety and increase in line capacity construction and maintenance of welded track.

These studies include collection and synthesis of data received from the member countries and the discussions at the Railway Sub-Committee by experts representing the various countries and also for their final recommendations for adoption or trial in the constitutent countries.

COLLABORATION WITH OTHER COUNTRIES

Indian Railways have the largest net work in Asia, with a well developed research and design organisation which has been working in close association and coordinating the work of the Indian Railways on the ECA FE

Indian Railways have offered facilities in its various institutions for training and also for undertaking research on problems of railway systems in South East Asia.

NEW DESIGNS ISSUED

The Mechanical wing of the RDSO is preparing completely new designs of rolling stock, a large number of which have already been issued to the indigenous builders. Locomotives, carriages and wagons of these designs are already under manufacture and in service.

The R. D. S. O. has started functioning as consultants to various public bodies in the country, such as Port Trust, large industrial corporations, ship-yards etc. Advice is being regularly given to them regarding the design, selection and purchase of rolling stock.

R. D. S. O. has also sent out teams of engineers to foreign countries offering them the technical 'know-how' pertaining to the design and manufacture of the rolling stock. The new standards locomotives have been designed to burn lower grade coals, so as to make the higher grade coal available for metallurgical use. Designs are also in progress for fitment of mechanical stockers and burning of oil fuel in our standard locomotives.

DIESELISATION WING

New diesel and electrical wings have been created in the R. D. S. O. The officers in these new wings are engaged in studying the developments abroad and building up basic data with regard to diesel and electric traction as also the salient features of different designs of diesel and electric locomotives.

These studies have proved to be of great value in framing our purchase specification for diesel and electric locomotives so as to obtain the most efficient and yet economical locomotives, with due regard to their future standardization.

SURI TRANSMISSION

Original work has also been done in respect of the hydraulic transmission used in diesel locomotives.

Seven prototype diesel locomotives incorporating our patented "Suri Transmission" are under manufacture in West Germany and the first locomotive has already been shipped.

The R. D. S. O. have already furnished a design for D. C. electric locomotives of 3600 H. P. which is under manufacture in Chittaranjan Locomotive Works. The design and manufacture of A. C. electric locomotives are also in hand.

DESIGNING RAIL COACHES

For over a century, the design of passenger coaches on the Indian Railways was on conventional lines: a wooden body on a separate steel underframe.

In line with the contemporary technological advance, the R. D. S. O. have developed integral designs of steel bodies coaches, which are now being produced in large numbers by mass production units like Integral Coach Factory, Hindustan Aircraft and Jessops. The Integral steel coaches are much lighter in weight, afford a far greater measure of safety to passengers during accidents, cost less in operation, repairs and maintenance and with the increase in the carrying capacity would mitigate overcrowding in passenger trains.

THIRD CLASS SLEEPERS

Considerable progress has also been made in the design of Electric Multiple Unit stock and diesel railcars, refrigerator fish vans and the III Class Sleeper Coaches. Similarly, the amenity of air-conditioning has also been extended to the III Class travelling public. Studies are in progress to provide even better travelling comforts and amenities to the travelling public at optimum train speeds.

BOX TYPE WAGONS

The rapid industrial development of the country can only proceed if the movement of bulk materials and finished industrial products continues steadily at the required pace.

The tonnage to be moved during 1960—61 has increased by about one and a half times as compared to the position at the end of the First Plan. The increase in the volume of goods traffic to be moved during the Third Five Year Plan would be even greater.

It is not practicable to increase the line capacity at this rate and the only practical alternative is to increase the throughput from the available line capacity. This calls for heavier goods trains to be accommodated within the existing lengths of loops and higher speed for the goods vehicles.

Accordingly, the design of BOX type of wagons for the movement of bulk materials was developed, which permitted about one third extra train load over the existing length of loops.

Prototype of a gondola version of the BOX wagon is also being manufactured, which would permit the optimum intensity of track loading being achieved.

These gondolas would be employed exclusively for the transport of ore, particularly on the Kiriburu-Vizag and Bailadilla-Vizag sections for the export of iron ore to Japan, which is estimated to reach the target figure of 6 million tons per annum.

TANK WAGONS

The same principle of higher intensity of track loading has also been applied in the transport of oil and the type of Bogie Petrol Tank has been designed for transport of oil from Gauhati to Barauni over the metre gauge section, to ensure the maximum throughput from the available line capacity.

OTHER ITEMS IN HAND

In view of its significance in saving idle time of rolling stock, reducing loading and unloading costs and minimising damage to goods under transport, it is proposed to undertake the design of mechanical handling equipment in the R. D. S. O. and extend applications thereof for the particular requirements of the industry and at transhipment points.

It is also proposed to take up the formulation of standard specifications for machinery and plant,

particularly, machine tools, in order to ensure that the capital investment for a given production, operation or repair and maintenance task, is the minimum possible.

DESIGN FOR CAST IRON SLEEPER

India being very short of the conventional material, timber, for making railway sleepers, a sustained effort has been made, during the past few decades, to develop design of an efficient and economical cast iron sleeper. At present, about half the track mileage in India is laid with cast iron sleepers.

To meet the requirements of sleepers for the Third Plan, substantial quantities of steel sleepers will also be available from the new plant at Durgapur. Trials are also being made with several alternative designs of reinforced concrete sleepers, both plain concrete and prestressed.

I. R. S. RAILS

This organisation evolved the 90 lb. IRS section, giving greater strength vertically as well as laterally and some 82 track miles rails rolled to this section, in India, have been under trial for the last six years.

To handle the much heavier traffic densities, generated on trunk routes by rapid industrialisation of the country under the Five Year Plans, and also to meet the persistant pressure for speeds higher than the present maximum of 60 m. p. h., a new design of 105 lbs. IRS rail has been evolved.

Another modern development introduced is the extensive use of welded rails, of which nearly 2,000 track miles, with upto 210 ft. long rail panels, have already been laid.

Trials are also being conducted with half mile long welded rail panels, with special expansion joints at ends.

To enable non-stopping trains to negotiate station loops at 25 to 30 mph. speeds, cast-manganese steel crossings of 1 in 16 and 1 in 20 have been designed and arrangements are in hand for the progressive manufacture of these crossing indigenously.

PRE-STRESSED CONCRETE FOR RAIL BRIDGES

The newly developed techniques of making pre-stressed reinforeed concrete for girders, for use on railway bridges, have been successfully adopted on Indian Railways in the Second Plan period, particularly when steel was in short supply. To date, pre-stressed reinforced concrete girder spans, totalling nearly 30,000 linear feet, have been used on Indian Railways (B. G. and M. G.) or are in the process of being made.

The Bridges and Structures Section actively collaborated with the Engineers Incharge to finalise the design for the Rajendra Pul over the Ganga at Mokameh, which was opened in 1959.

Similar collaboration in design and in checking the data has been given for the Brahmaputra Bridge construction involving several unique features.

DESIGNS FOR STATION BUILDINGS

The Architectural Section designed a number of imposing station buildings built on Indian Railways during the two Plan periods. The New Delhi Stations, with its red sand stone facade, internal garden-courts and pools, spacious circling areas and modern amenities, presents a pleasing blend of Mughal architecture and current construction practices.

The 8-storeyed Churchgate Station of the Western Railway, the new station buildings at Ahmedabad and Jaipur are other examples of good aesthetic appearance, combined with functional efficiency and reasonable costs.

At present, a 14-storeyed office building for Eastern and South-Eastern Railway offices at Calcutta is being designed.

SIGNALLING EQUIPMENT

The reorganised Signal & Telecommunication section of R. D. S. O. has been engaged, since 1955, in the evolution of standard signalling equipments for Indian Railways.

Under the Second Plan, a special drive for maximum self-sufficiency in railway signalling equipment became necessary and so far as mechanical signalling equipment is concerned, a large measure of success in achieving self-sufficiency has already been attained.

Considerable progress has also been made in respect of electrical signalling equipment and

investigation of numerous designs and prototypes and some pilot installations have been made to permit detailed studies. Tokenless block instruments, double-line block instruments using coded impulses, high-frequency track circuits, power signalling and relay interlocking are some of the items under test.

For developing the capacity needed for the Third Plan at relatively less costs, about 250 track miles are to be equipped in the first instance with the imported Centralised Traffic Control, based on one of the most advanced systems of signalling so far evolved anywhere.

PERFORMANCE TRIALS

The Research Directorate also carried out extensive trials, both in laboratories and in the field, to determine the performance of locomotives, rolling stock, track, bridges, etc. and their components, and also of different fuels, lubricants and preservatives.

OTHER ITEMS UNDER RESEARCH

Progressive replacement of imported items of railway stores by indigenous products has also been the subject of research. An important example is the formulation of a cheap bitumen emulsion paint which has been found to be an effective preservative of steel against corrosion even in trying climatic conditions.

Waste products like coal ash, saw dust and lubricants are released by railways in abundant quantities and their utilisation or reclamation is an important item of research.

The utilisation of coal ash in place of sand, where good sand is not available or is costly, is being progressively adopted for the preparation of lime mortar. Efforts are also continuing for manufacture of hard boards from saw dust in collaboration with the Forest Research Institute.

Reclamation of axle oil, which is released in large quantities, has also been taken up for study and a pilot plant is expected to be shortly erected at Chittaranjan for this purpose. The study of reclamation of lubricating oil from diesel engines has been started, in collaboration with the Defence Research Laboratory.

SOIL MECHANICS

Railway research has made satisfactory progress in the study of soil mechanics, which involves the determination of conditions for stability of banks, cuttings, and foundations of structures in the vast area served by the Indian Railways with widely varying types of soil.

A well-equipped laboratory has been established in Lucknow for studying soil characteristics and their safe bearing load.

Indian Railways have to cater for vast expansion and development to meet the requirements of the Third Plan and the Research, Designs & Standards Organisation has been keeping step with its contribution by evolving designs and processes which will make for greater efficiency.

NEW RANGE OF ACTIVATED CHARCOAL FILTERS

Alfred Bullows & Sons Ltd., of Long Street, Walsall, announce the introduction of a range of activated charcoal filters. These have been designed for use in compressed air systems where oil in the air stream is not acceptable. They are so effective that they not only remove all traces of oil from the air, but they also eliminate the smell generally associated with oil in aerosol form.

Each filter consists of an outer case and lid with a cartridge of activated charcoal and conforms to British Standards where applicable. Provision is made on all filters for four-point wall mounting.

The cartridge of activated charcoal removes oil from the air stream by adsorption and is therefore an expendable item which requires changing at intervals, dependant upon operating conditions. An average normal life of a cartridge element is 1,000 to 1,500 working hours.

Quick and easy cartridge replacement is one of the key design features. Air inlets are located in the bottom and air outlets at the side of the filters, so that when changing the cartridge it is not necessary to break the air connections. The lid, which is sealed with an 'O' ring is removed, cartridge changed and lid replaced.

STANDARDIZATION IN THE FIELD OF STRUCTURES AND METALS

The fifth meeting of the Structural & Metal Division Council of the Indian Standards Institution was held on 24 March 1961 in Manak Bhavan, under the chairmanship of Sir Jehangir Ghandy, Director-in-Charge, Tata Iron & Steel Co. Ltd. The meeting was attended by representatives drawn from the Ministries of the Government of India. State Governments, Trade, Industry and other Research and Technological Institutions. Representatives from the States participated for the first time.

Welcoming the members to the meeting, Sir Jehangir mentioned that as a result of rapid industrialization programme undertaken by the Government of India through Five Year Plans, the work of this Division had assumed greater national importance, and the demand for standards in the structural and metallurgical fields had continued to increase year after year.

Highlighting the achievements of this Division during the year under review, the Chairman particularly made a mention about standardization and rationalization of Carbon and Alloy Steels which would go a long way in establishing an alloy steels production industry in India on a sound footing.

Reviewing the work accomplished under the Steel Economy Programme undertaken earlier by ISI on the recommendation of the Planning Commission, Sir Jehangir disclosed that the work done in India on the preparation of Handbooks for structural Engineers and the formulation of dimensional standards for steel sheets, plates, strips, bars and bulb-plates had been highly commended. He pointed out that the work done by ISI in the field of welding had gone a long way in popularizing welding in this country. The unit set up at the Government Test House for testing and certifying welders would greatly assist the Indian Industry to get trained welders for their work.

Concluding, the Chairman mentioned that broad agreement had been reached the steel products manufactured by major steel producers in this country would be covered under the ISI Certification Mark wherever Indian Standards exist. This, he added, was an effective step forward to the popularization of ISI Certification Mark and the recognition of the value of work done by ISI.

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Increasing Line Capacity on Southern Railway to meet New Traffic Demands

By F. P. Warrior
Engineer-in-Chief (Southern Railway)

The author furnishes details in regard to the various engineering works either completed or are under completion on the Southern Railway to increase line capacity. The sole objective to these efforts has been to cope with the increased traffic demands as a result of the developing economy of the country.

PROGRESS of industries and general rise in the economic level is best reflected in the demands on transportation. The demands on rail trasportation in India has been heavy, indeed, necessitating various measures for increasing line capacity.

The Southern Railway has undertaken a big engineering programme which includes doubling of lines in congested sections, conversions from metre to broad gauge line, regrading lines to tackle heavier and longer trains and bridge construction works.

TRAFFIC PROBLEMS

The busiest sections on the Southern Railway are from Waltair to Madras, Madras to Jalarpet, Jalarpet to Erode and Raichur to Arkonam. Of these, the north-east line from Waltair to Madras is the main artery for the movement of traffic from north to south.

The demand for intake of wagons at Waltair has steadily been on the increase. Coupled with this the demand for loading in the Krishna and Godavari deltas have also been going up. As the intake from the Central Railway at Bezwada had also to be enlarged, large scale measures like doubling and regrading were necessary on the north-east line from Waltair to Gudur for the movement of traffic.

The Gudur-Renigunta metre gauge line had already been converted to broad gauge early in the Second Plan and as a result of this, diversion of some of the loads from Gudur to Arkonam *via*, Renigunta was envisaged.

This, in turn, together with the increased intake from Raichur threw a heavy burden on the section from Renigunta to Arkonam for which purpose, doubling to the extent of 23 miles between Renigunta to Arkonam was also planned in the Second Plan.

DOUBLING OF LINES

Beyond Arkonam, with the two streams of traffic converging from Renigunta side and from Madras side, the intensity of traffic on the Arkonam-Jalarpet and on the Jalarpet-Erode section was expected to be heavy and for this purpose, doubling and regradings have been undertaken between Arkonam-Jalarpet and Jalarpet-Erode also.

The laying of a double line entails almost the same work as that of a new line especially when the present line is fully saturated with traffic and cannot be made use of for movement of construction materials for the new line.

In fact, now-a-days, with the heavy and continuous movement on the existing line, the laying of the double line with suitable connections at stations and junctions and signalling arrangements has become more complicated than that of laying a new line.

The need for careful planning is all the more apparent since not the least delay or interruption for traffic on the existing line can be allowed. Speed restrictions are also avoided to the utmost by keeping the line away where major bridges are to be constructed, so that the existing bridge foundations are not affected.

Still, in certain places, speed restrictions do become necessary, but this is kept down to the utmost.

On the Southern Railway, a total at 244 miles have been programmed for doubling during the Second Plan and of these, 144 miles were opened by 31-3-61. It is also expected that out of the balance, another 55 miles will be opened by middle of 1961. The work on the remaining sections are also on hand and in good progress.

BUILDING BRIDGE WORKS

In connection with these doublings, a total of about 1,000 new bridges have to be built, some of which are very major and difficult ones with deep well foundations, going upto 50 and 60 and below bed level, where divers have to work under water to feet the well seated on firm soil.

In view of the scarcity for steel in the early part of the Second Plan, particularly in respect of wide plates required for girders, pre-stressed concrete girder construction was adopted on a fairly large scale. They are all getting completed and the last one is expected to be opened by June, 1961. Amongst long pre-stressed concrete bridges the Bridge across Poiney river between Thiruvalam and Katpadi (length 1954') and the Bridge across Paillar river between Ulavappadu and Surareddipalayam (length 1480') deserve special mention.

BENEFITS OF CONVERSIONS

Some of the rich rice-growing areas in the Krishna delta are at present served only by the metre gauge. These sections are from Gudivada to Bhimavaram and Bezwada to Masulipatam. The growing needs of the rice traffic in this area made it necessary to improve the transportation by converting two sections into broad gauge.

In addition to improving the demands of the local traffic, this conversion will also provide an alternative route for the portion on the north-east line between Nidadavolu and Bezwada. Simultaneously with this conversion, an additional broad gauge line is also being laid between Guntur and Tadappalli so that the heavy passenger traffic between Guntur and Masulipatnam can be catered to by the broad gauge trains.

The provision of this broad gauge facility in the rich rice bowl of Andhra will be of great assistance to the people. This will also help in making the Bezwada yard more effective where already considerable improvement has been made with the provision of a hump yard for easy marshalling.

As a result of this conversion, the present metre gauge platforms will get converted into broad gauge platforms. This will provide increased reception and despatch facilities for passenger trains in the Bezwada yard.

OTHER ENGINEERING TASKS

The Gudivada-Bhimavaram conversion is expected to be completed by the middle of 1961 and Bezwada—Masulipatam by middle of 1962.

The laying of the broad gauge line from Guntur to Tadappalli together with a chord line between Tsunduru and Venundla is also in progress. When these works are completed early in the Third Plan, alternative routes for the existing north east line between Nidadavolu and Tenali will be available easing considerably the traffic position.

In addition to these conversions, certain lengths on the north-east line in Waltair and Rajahmundry have been regraded to remove the stiff gradients. This has enabled working of longer and heavier trains.

PROPOSALS UNDER THIRD PLAN

An intake of 600 waltair at Wagons and 500 wagons at Bezwada has been planned for the Third Plan with this end in view, remaining patches between Tenali and Gudur are being doubled and so also the patches between Arkonam and Jalarpet.

On the West Coast line too, certain difficult portions which are at present proving to be bottlenecks are being doubled.

Air Filtration as Applied to Diesel Locomotives

By D. Bennel

Chief Engineer, Air and Liquid Filtration
Division of Locker Industries Ltd.

THE filtration of air as required by the modern diesel electric locomotive can be classified into two groups, viz. Air required by the traction motors and auxiliaries and air required by the diesel engine.

The choice of filtration equipment varies with individual designers and conditions under which the locomotive may have to work, but, basically, the following are the types of filters which can be reasonably applied.

(1) Dry Type Panel filters.
(2) Viscous Type Panel filters.
(3) Oil Bath Air filters.
(4) Panel Bath Air filters.
(5) Cyclone Type filters.
(6) Combination of 5 with oil bath filter.

Locker Industries Ltd. manufacture "AIR-MAZE" filters of all types, but for reasons of economics and maintenance, advise types Nos. 2, 3 and 4 for locomotives.

Type No. 2, Fig. 1, is commercially known as the PSR and is of the herringbone or chevron construction. Technically a high velocity range between 500—600 f.p.m. for optimum efficiency. It can be manufactured in both 2" and 4" thickness. It is so designed that in the event of poor or indifferent servicing it will unload its collected dirt through the filter. This is based on the assumption that dirty air to the auxiliaries is better than no air. Scheduled maintenance, however, makes this type of filter the ideal unit for the traction motors, etc., as apart from its unloading characteristics it has many desirable features.

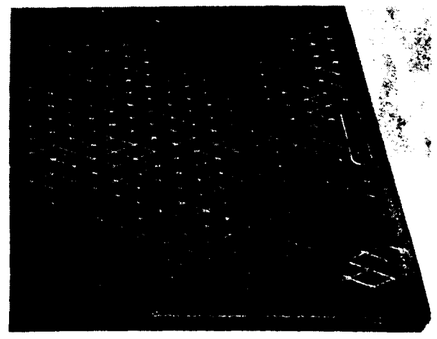


Fig. 1 Herringbone or Chevron Construction air filter panel.

Fig. 2 shows a cross crimp, progressive density filter panel. This panel has a somewhat higher initial pressure drop but has the advantage of holding its high efficiency over a wide range of air flows. It will not unload and therefore requires a frequent and fixed cleaning schedule.

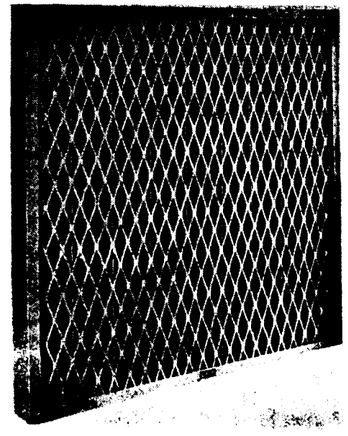


Fig. 2 Cross Crimp progressive density panel.

Fig. 3 shows a conventional oil bath air filter. This type of filter has been used, with considerable success, for many years on stationary engines

and air compressors. Recently, an adaptation of this filter has been designed solely for incorporating in the diesel locomotive, see Fig. 4. Whilst both the conventional and modified filter work in the same manner, it will be seen that there is a physical difference in so much as the locomotive oil bath has no hood and an exceptionally short body length. The reason for this is that, due to the streamlining of the

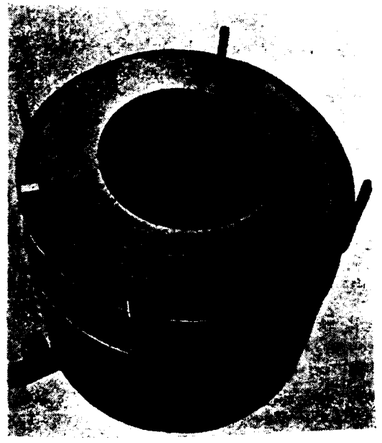


Fig. 3. Conventional oil bath without hood.

modern locomotive, very little space is available inside the body shell for mounting the filter units which, depending on the horse power of the main line express, may require as much as 6,000 to 8,000 C.F.M. air. This oil bath has also a new design of filter element which enables us to still further reduce the overall size of the oil bath without impairing dirt holding capacity. The oil bath filter is without doubt the most efficient permanent type filter that can be applied to the air intake of the diesel engine. One reason for this high efficiency is that the highly efficient screen of woven wire filter media is continuously receiving an adequate supply of oil to wet the dirt, and the dirt intercepted by the filter media is constantly removed by the oil washing action and retained in the oil sump. A further advantage being that the changing air velocities do not effect the efficiency to any marked degree, the oil washing action being effective from 10% capacity to full capacity. Furthermore, the oil bath is inherently a silencing unit and thus saves, in many cases, the additional cost of a separate air intake silencer.

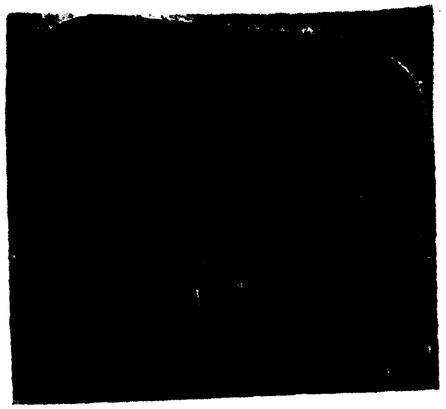


Fig. 4. Showing twin assembly locomotive oil bath 2000 C.F.M.

Fig. 5 is known as the "Panel bath" air filter. This unit is a hybrid or cross between a panel filter and an oil bath filter. This type of filter was designed to meet the ever-increasing demand for smaller units with higher air flows. Whilst it is not as efficient as the oil bath filter it has a higher efficiency than the static panel type, and is capable of handling a remarkable range of air flows which neither the static panel nor the oil bath can achieve. Technical details of the "Panel bath" which is manufactured in one size only, are as follows :

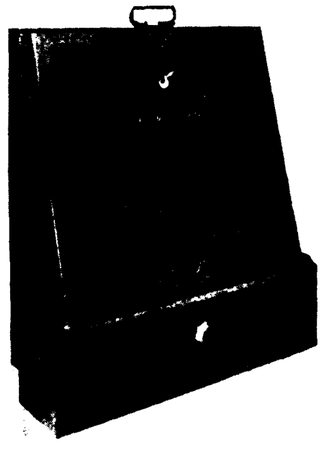


Fig. 5. Panel bath filter.

Operating Range	400 to 1750 C.F.M.
Pressure drop	4.6" w.g.
Efficiency	90%.
Lump oil capacity	1.25 imp. galls.

The operation of the panel bath is quite simple and there is only one moving part, the baffle. As to operation, air is drawn through the front grill where the air stream divides into two parts, one part going directly to the filter panel surface, which has previously been oil wetted, and the second part to the oil control trough where the oil is picked up and carried to the panel filter media. The baffle automatically controls the air flow to the oil control trough; at engine idling speeds the baffle is closed, thus directing all the air to the oil trough. At higher air flows the baffle opens and directs a greater part of the air to the filter Panel, thus providing effective oil wetting at all engine speeds.

From the foregoing it will be obvious that the choice of air filters will be determined by engine location. It is therefore an economic study on a particular railway to determine on a long range basis, taking into account initial cost, maintenance, expense of each type, protection to the engine and typical air-borne dirt conditions which is the better filter for a particular locomotive in its operating district.

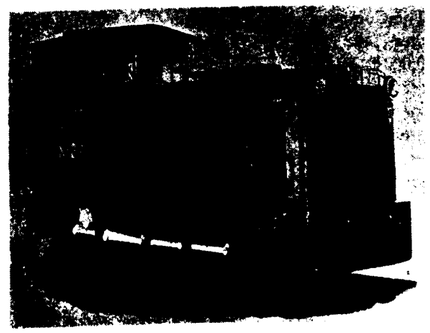
No one filter will give the complete answer to all working conditions.

'HUNSLET' again supplies Sudan with locomotives

Against strong foreign competition the Hunslet Engine Co. Ltd., has received a further order from The Sudan Gezira Board, (Consulting Engineers, Messrs. Livesey & Henderson, 1–2, Finsbury Square, London, E.C.2) for eighteen 135 h. p. 0–8–0 type diesel-mechanical locomotives required for the Managil extension.

This is the sixth repeat order received from The Sudan Gezira Board, for 'Hunslet' locomotives specially designed for their cotton plantation narrow gauge railway system.

The 'Hunslet' 17½ ton 8-wheel locomotives are powered by Gardner diesel engines. Transmission is through a 'Hunslet' multiplate friction clutch and a flexible coupling to a 'Hunslet' constant mesh gearbox giving four speeds of 5, 8¾, 14½ and 20 m.p.h. in either direction of travel. Maximum tractive effort at site is 8620 lbs.



'HUNSLET' 0–8–0 Type Diesel Locomotive 18 of which are now on order for the Sudan Gezira Board

The first diesel locomotives were supplied over thirty years ago and still continue to give good service.

During the last ten years, a complete locomotive fleet has been developed comprising fast main line 0–8–0 locomotives and smaller 0–6–0 units for local lines and shunting operations.

The photograph shows the class of 0–8–0 locomotive to be supplied against the current order.

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HOUSEHOLD SEWING MACHINES

The Indian Standards Institution has published IS: 1610–1960 General Requirements for Sewing Machines (Household Model) which covers requirements for two types of household model sewing machines of cam-take-up and link-take-up classes, with round bobbin, oscillating sewing mechanism, and designed for operation by hand, foot or motor. The two types are designated as type A with speed of 1000 stitches per minute and type B with speed of 800 stitches per minute. This standard has been prepared at the instance of the Development Commissioner for Small Scale Industries, Government of India, and also on the recommendation of the Tariff Commission.

Dragonair Oil Fired Air Heating

FIVE models, with outputs ranging from 100,000 B. T. U. / Hr. to 1,000,000 B. T. U. / Hr., make up the recently introduced series of Dragonair Heaters.

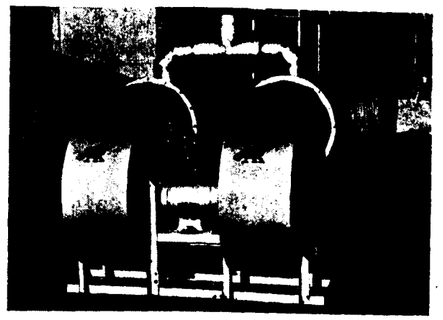
Claimed to be the most efficient and economical method of heating by providing heat where and when it is required at an efficiency of 85%, the Dragonair method of heating is by Direct-to-Air heat exchange with the warm air supply distributed through a system of ducting. Air flow rates range from 600 c.f.m. with the smallest model to 8,000 c.f.m. with the largest model. Each Dragonair heating system is scientifically designed and tailor-made to heat individual premises for minimum fuel cost and yet it can be done at a very moderate capital cost.

A pressure atomising burner, of the Company's own design, with flame failure and overheat safety devices, together with welded stainless steel heat exchanger, is contained in a steel casing to form the heater unit.

DVLA. 500 (Heat output 500,000 BTUs/hr.)

The multi-vane impeller is mounted direct onto the motor shaft from which a two-stage gear pump is belt-driven. Fuel is fed to the burner, strained and filtered; its pressure is measured and the supply is controlled by an electro-magnetic valve. The control box is mounted on a panel which may, if necessary, be remote from the heater. This box has a 'heat-off-ventilate' switch that provides the means of summer ventilation without heat by isolating the burner.

The air supply can be variable from 100% recirculation of the air inside the premises concerned to 100% fresh air supply to give either maximum economy or maximum ventilation to remove odours etc. Thermostatic control ensures that fuel is only consumed when



DVLA. 1000 (Heat output 1,000,000 BTUs/hr.)

heat is actually required. Time-switching can be provided for initial start-up and shut-down of the plant each day, and Night Anti-Frost control is available if required.

The outputs of these heaters have been so designed that almost any combination can be supplied by harnessing two or more models to operate as one.

The Company also manufactures Mobile Dragonair heaters, the DVLB. 100 being a standard unit of 100,000 B.T.U./Hr. This is basically a DVLA. 100 heater mounted on a 2-wheeled frame incorporating its own fuel tank. The other mobile unit is a self-contained 250,000 B.T.U./Hr. heater powered by a Diesel engine. It is primarily designed for aerodrome use and is built to order.

Other products include the Dragonfly airborne heater for aircraft and helicopter heating and the DVLA. 80 Railcar Heater as supplied to British Railways. Equipment has also been designed and supplied for specific uses such as tea withering in Assam.

The World of the Future—How It Looked in 1880

Eighty years ago an experimental electric locomotive built by the electrical wizard, Thomas A. Edison, was the very latest word in modern railroading—a look into the future of land transportation.

This was the first electric locomotive to draw power from a trackside power station—110 volts worth. Earlier models used batteries mounted right on the locomotive. The Edison unit was thus the prototype of today's mammoth electric locomotives which get their power from overhead wires.

The Edison locomotive was purely experimental. It ran on a short stretch of track at Edison's Menlo Park, New Jersey, laboratory. It was not until 1892 that the first electric locomotive practical for railroad application was built. Manufactured by General Electric Company (U.S.A.), this first commercial model was exhibited at the Chicago World's Fair in 1893 and later sold to the Manufacturers Railroad of New Haven, Connecticut.

The first G. E. electric locomotive now stands in front of the locomotive test building at the company's Locomotive & Car Equipment Department in Erie, Pennsylvania. Not far from where the old locomotive is located, G. E. is testing new locomotives utilizing gas turbine electric drive—a concept unknown in Edison's time—which will develop 8,500 horsepower. No wonder they say "Progress is our most important product", at General Electric.

* * *

WEST GERMAN CONTRIBUTION TO I.C.F.

In 1955, when the INTEGRAL FACTORY was erected the WILHELMSBURGER MASCHINEN-FABRIK, Hinrichs & Sohn, Geesthacht, Germany, supplied several Press Brakes and Guillotine Shears, which have contributed to the remarkable progress of the Perambur Workshop during the following years.

Today numerous additional machines are installed in many leading metal working factories of India. WILHELMSBURGER Press Brakes are of high technical standard made in all steel welded construction for capacities from 12 to 1500 tons. There are various designs available for different productions, Brakes with mechanical one or two speed drive or oilhydraulic drive for bending heavy plate. Recently a patent was granted for a special control system, which permits a control of the ram of mechanical brakes as sensitive as it may be possible with hydraulically driven machines. This new control was first shown at the German Machine Tool Exhibition at Hanover in September 1960 and orders are booked presently from many places in the world.

Another new design, also introduced during the year 1960 is the WILHELMSBURGER Plate Guillotine Shear, Type TSK, which features a small constant cutting angle, and efficient worm gear driven and a counter balanced shearing beam. This machine is designed for high production output and available in all capacities.

Particular characteristics of WILHELMSBURGER Three Rolls Plate Bending Machines are the symmetrically arranged bending rolls and the vertical adjustment of the bottom rolls. This system results in most accurate rolling of tubes and boilers. In addition the plate edges can be pre-bent at both ends without removing the plates from the machine and turning them.

Agents in India are Messrs. Francis Klein & Co. Private Ltd., 1, India Exchange Place, P. O. Box 2267, Calcutta-1, who are well equipped to advise on all plate working problems.

* * *

HENSCHEL STEAM GENERATING PLANT GOES TO SEA

A Henschel fast-steaming generator model HK 1000 for heating public rooms and passenger cabins was installed in June 1960 in the pleasure cruiser "Bremerhaven" plying between North Sea seaside resorts. Built at the Adler yards in Bremen, the racy modern vessel of 2,694 tons was designed to provide maximum comfort for the 1,400 passengers, and this includes comfortable heating by Henschel boiler.

Before approving the boiler for marine service, the German Lloyds submitted it to rigorous tests. Of special design, with steam chamber of greatly increased size, the boiler must at all times have an

adequate water level even when the vessel lists in heavy seas.

In view of the exceptionally strict safety requirements in marine duty, the boiler has to be inspected at frequent intervals. Our designers provided a special tilting arrangement, so that the boiler can easily be swung on its side for internal inspection, despite the proverbial lack of space on board ship. The highly compact design of Henschel steam-generating plant makes it possible to use every available inch of space in the engine room.

In carrying out this contract, Henschel designer have proved how well they can adapt any plant to the given working conditions. Although it involved many departures from standard production, the generator was delivered within six weeks.

* * *

HENSCHEL AT THE 1960 HANNOVER MACHINE TOOL EXHIBITION

Eager to find out what is new in the machine tool world and to look over the latest designs, thousands of businessmen, engineers and members of the general public crowded the halls of the 1960 Hannover Machine Tool Fair, rightly known everywhere as the shop window of Germany's engineering industry, showing the country's major export commodity.

Henschel exhibited the following examples from their wide production range in Hall 1, stand 1203:

1. Henschel-Ryder No. 8 Vertical Multi-spindle Automatic—particularly suitable for mass production, which calls for compact, easily operated, versatile machines for long runs of such components as flywheels, brake drums, differential housings, multi-stage pulleys, etc. The Henschel-Ryder which can be equipped with numerous attachments for turning, copy-turning, drilling, reaming, thread-cutting, milling, facing and shaping, aroused considerable interest among visitors.

2. The improved version of the Henschel Gear Shaper, Roeber design, for generating gears up to 17$\frac{1}{8}$" dia., tooth thickness up to 3$\frac{1}{2}$", modulus 7. Its special feature is the new cam control which greatly increases the flexibility of the electro-hydraulic controls to suit the properties of each workpiece. This, as well as other improvements to filters and hydraulic system and better vibration-free running, further shorten the gear shaping cycle.

3. The "URSOMAT" Double-Spindle Taper-Cutting and Copying Lathe whose central swivelling headstock permits the turning of inner and outer tapers of equal included angles in the production of valves and fittings to a degree of precision which frequently does away with the need for re-grinding valve plug and housing seating faces.

4. A special-purpose machine for drilling cycle hubs with two-multi-spindle worksheads drilling into the workpiece from either side. Components are automatically fed from a magazine to the indexing drum where they are automatically clamped. Finished workpieces are discharged via a chute. Brief interruption of feed produces short swarf lengths.

5. A machine assembled from the wide range of Henschel standard units, built on the unit construction system, incorporating: spindle unit, rotary table unit and base unit. This standard assembly forms the basis for many versatile combinations to suit a large variety of applications and can be built up into fully-automatic special-purpose machines and complete transfer lines.

6. Four spindle units in various sizes, seated in robust, generously-dimensioned bearings to permit drilling from the solid, opening out, milling and similar work.

* * *

HARD-DRAWN STEEL WIRE FABRIC FOR CONCRETE REINFORCEMENT

The Indian Standard Specification for Hard-Drawn Steel Wire Fabric for Concrete Reinforcement (IS: 1566—1960) covers the requirements and the methods of test for steel wire fabric consisting of hard-drawn steel wire with cross wires electrically welded to them.

The requirements covered are with regard to material, manufacture, dimensions, sizes of sheets or rolls, weight, tolerences, mechanical properties, tests, and marking and delivery.

Steel wire fabric is being extensively used in the country as reinforcement in reinforced concrete work and there exists a great potential for its further development and use.