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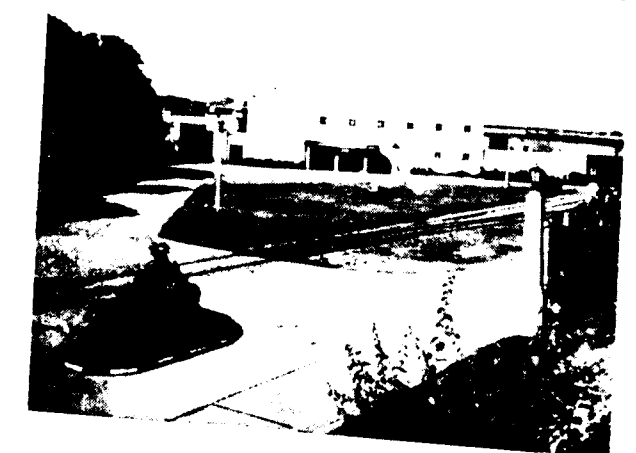
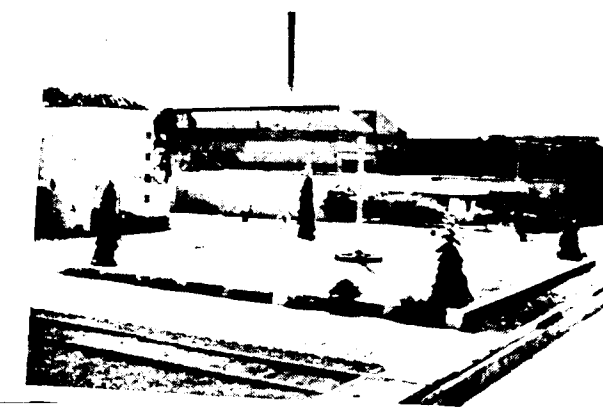
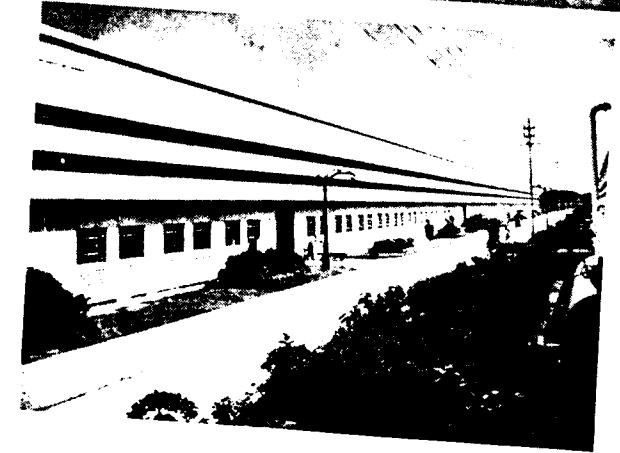
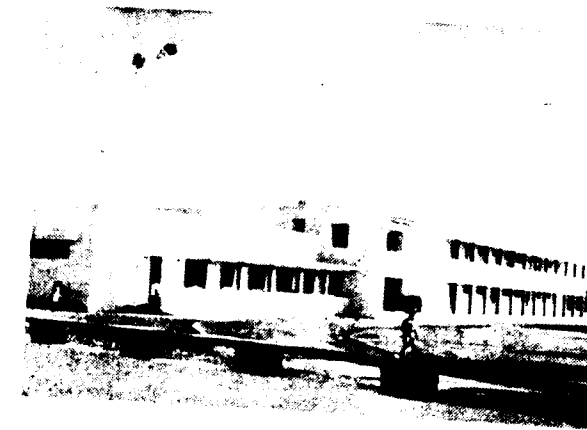
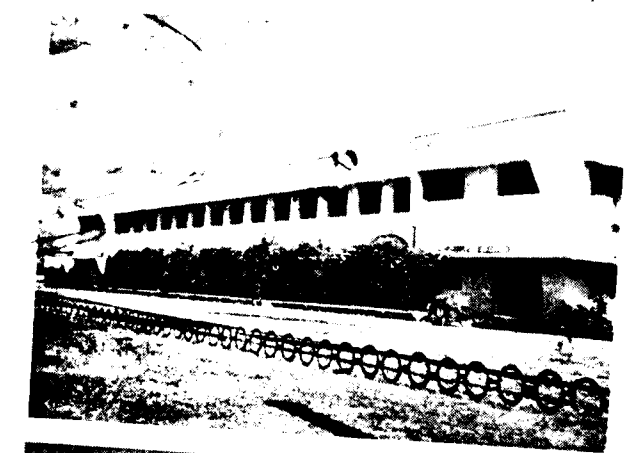
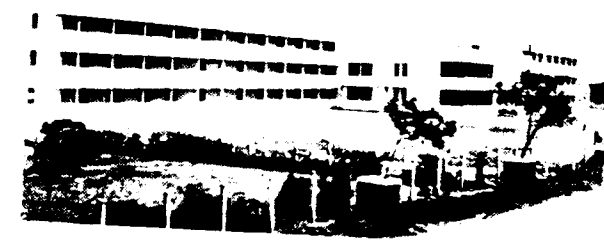
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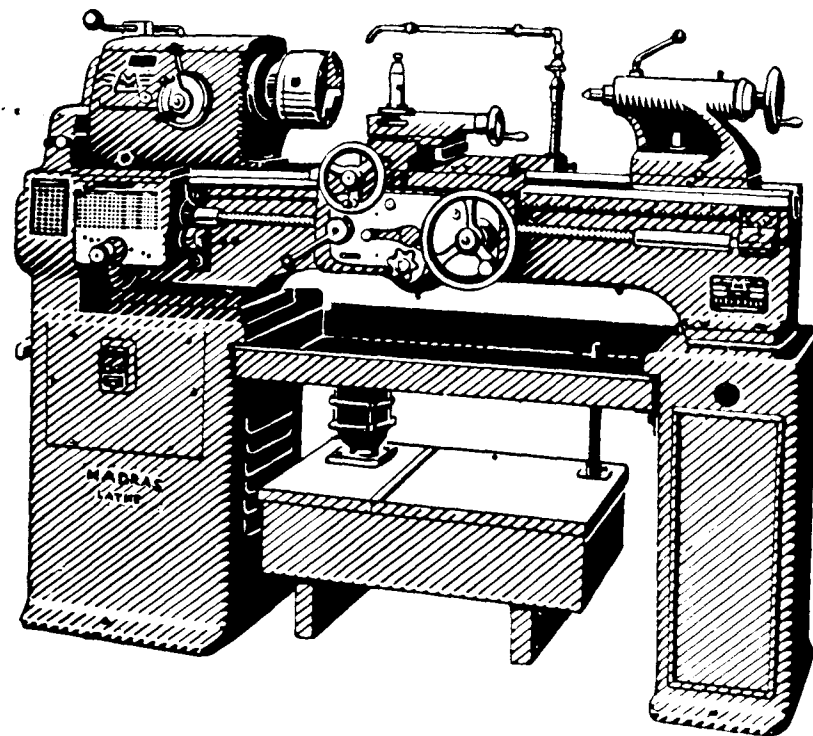


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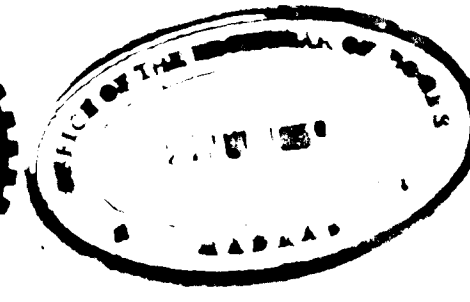
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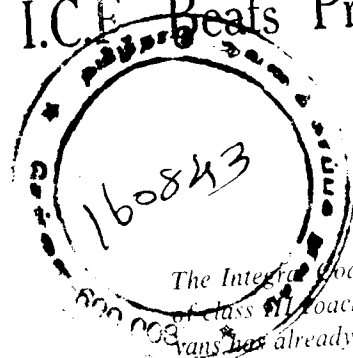
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I.C.F. Beats Production Targets — Begins New Types of Coach Manufacture

By K. Swarup

Chief Mechanical Engineer, Integral Coach Factory.



The Integral Coach Factory at Perambur, near Madras, formerly confined to the production of class III coaches only, has broken new ground. The manufacture of third class-cum-luggage vans has already commenced, while that of first class coaches will begin at the end of the current year. I.C.F. will later take up designing of postal vans and air-conditioned coaches in light weight. Four prototypes of welded bogie wagons are also under construction, preliminary to their mass production later in the private sector. Costs have come down and quality compares favourably with imported coaches.

THE country is making rapid progress under the national Government and the standards of living are coming up. As standards go up, railway users also demand better comforts in carriages. The Integral Coach Factory at Perambur, near Madras, plays a leading part in providing better and more comfortable coaches.

The performance of I. C. F. from October 2, 1955, when the production in the Factory was inaugurated by the Prime Minister, can be described as most satisfactory. In the very first year, against the original target of 20 and the increased target of 40, I. C. F. produced 43 unfurnished coaches. In the second year, against the increased target of 120, 150 unfurnished shells were produced, and in the third production year which ended on October 1, 1958, I. C. F. produced 300 shells against the target of 240. From June last year, all the coaches produced are manufactured from raw materials and fittings obtained from the trade. There is no more assembly of knocked-down coaches.

In the last financial year, (April 1958 to March 1959) I. C. F. was to have produced 380 shells against the maximum of 350 originally planned to be produced in its fourth year.

FOUR I. C. F. DISTINCTIONS

Though the permanent furnishing annexe is yet to materialise, furnishing of the shells has been started with temporary arrangements and I. C. F. is now turning out 16 coaches per month from the temporary furnishing unit.

The performance of I. C. F. can be considered satisfactory from the following angles also :

- (i) The cost of the shell has been showing a downward tendency and from the original cost of Rs. 186,000 it has now come down to Rs. 83,000. The Schlieren Ex-Works price for a similar shell is Rs. 107,000 and the imported landed cost amounted to Rs. 187,000 ;
- (ii) The man hours for shell manufacture have gradually come down from 19,600 to 9,692. The present figure compares very favourably with the Schlieren man-hours ;
- (iii) The quality of the shells and furnished coaches produced in I. C. F. compares very favourably with the imported coaches. According to the Swiss experts the quality of coaches produced in I. C. F. is better than that of the imported ones.

NEW LINES OF MANUFACTURE

So far I. C. F. was producing III classes only, but now it is going to produce first class coaches and TLRs (third class-cum-luggage vans) to meet the increasing requirements of these classes of traffic. In the remaining two years of the second Plan, it is proposed to produce 355 TLRs, and 305 first class coaches, besides 1162 III classes. In the second Five Year I. C. F. will produce 1822 coaches against 1137 according to the original targets. This increase is attributable to the larger out-turn obtained and further increases are expected to result from the introduction of the second Shift which has been recently sanctioned.

The first third class-cum-luggage van was launched

by the Deputy Railway Minister, Sri S. V. Ramaswamy, on January 3, 1959. Soon we shall be completing the design of the first class coach also.

The Factory, it is hoped will turn out the first class coach by the end of this year. It would then be designing postal vans and air conditioned coaches in light-weight construction.

I have been referring so much to light-weight construction. Probably an explanation of what is meant by it would be appropriate. In light-weight construction, principles of integral design shell are followed. In these shells, the underframe, sidewalls, roof and floor are all stress-bearing members and carry their own share of stresses and strains, unlike the conventional design in which the underframe carries all the stresses and strains while the body is only a shelter for the passengers. By adopting this design, about 20 to 25 per cent weight is saved and it has been possible to reduce the weight of a furnished coach from 42 tons to 35 tons.

Besides the designing of these different classes of coaches, an all-coiled bogie for the power-cars of deluxe trains has been designed. The fully air conditioned trains which have been so popular carry two power cars and the bogies of such cars call for special design, as the coaches are heavily loaded by the air conditioning equipment they carry. The design evolved by I. C. F. has made possible a great reduction in the weight of the bogies. The estimated weight of the new bogie is only 5.7 tons against 8 tons of the existing ones. In the design of the bogie the laminated springs have been replaced by coiled springs and vertical shock absorbers have been provided for absorbing vertical oscillations of the bogie. Roller bearings have also been fitted on the bogies which will reduce the incidence of hot boxes and ensure smooth running of the coach.

WELDED BOGIE WAGONS

Welding has now been accepted as the best process for fabricated structures and it has been replacing riveting to a very large extent. Welded structures have the advantage of being lighter in weight and having no corrosion pockets. It has also been estimated that the welded structures are cheaper than riveted structures. It is because of these advantages that the Indian railways adopted welded design for coach construction and are now going ahead in adopting welded design for the new heavy traffic bogie wagons required for moving iron and ore traffic in the Eastern region.

Four prototypes of such bogie wagons are now under construction in I. C. F. After they have been finalised and tested, the private sector will be asked to manufacture them on mass production scale.

CONSULTANTS FOR M. G. COACH FACTORY

In view of the success in the manufacture of broad gauge coaches in all-welded, light weight construction at I. C. F., the Ministry of Railways have now decided not to seek foreign technical collaboration in the establishment of the metre gauge coach factory. As and when that project materialises, I. C. F. would act as the technical consultants of that project.

I. C. F. had 4,800 employees on its rolls in April 1958. On account of its increasing activities, the number on its pay roll increased to 6,200 by February 1959. With the introduction of the second shift, there will be further potentiality of employment in I. C. F. for engineering graduates, engineering diploma holders and other technical and non-technical men.

The temporary furnishing unit has increased its out-turn from 7 or 8 coaches in March 1958 to 16 in January this year. By March 1959, the capacity was scheduled to be stepped up to 20 coaches per month. Within a year, it has more than doubled its out-turn with limited facilities for a good production flow. They will now be furnishing TLRs and in the year 1960-61 it has been decided that all the 305 first class coaches should be furnished in the temporary furnishing unit.

The permanent furnishing unit is also taking shape, though still a decision on the global tenders for steel structures is awaited. Two hundred more quarters are being built for the staff of the furnishing annexe.

HUMAN RELATIONSHIP

The employees at the factory are a happy, well-knit family dedicated to the sole task of producing more and more coaches to help in the industrial growth of the country, and a patriotic spirit imbues all the staff. There is no class distinction in the Factory, and officers, supervisors, and men mix freely to help each other, not only in their day to day tasks in the Factory but also in their general well-being.

These are fostered by various means. Besides a good welfare organisation that exists to look after the welfare of the men, the Factory has established a guardianship scheme by which each supervisor in the

shops takes charge of 25 to 30 men and looks after their grievances, training, behaviour and discipline. They also go out on picnics once or twice a month, which enables them to come together and discuss their problems informally. The works managers along with the welfare officer also make a point of meeting the staff in the shops frequently to listen to their grievances and to redress them as far as possible.

A staff council has also been formed in which elected representatives of different categories of staff represent their grievances and suggest ways and means of improving the working conditions and production.

A Suggestions and Inventions Committee invites and screens suggestions put forward by the staff. This committee in the last three years received over 500 suggestions, and prizes amounting to Rs. 1,700 were awarded to the staff for suggestions likely to improve methods or result in savings.

Besides, a workers' canteen is provided which supplies wholesome food at nominal rate and serves them snacks at their places of work.

TEAM SPIRIT VIA SPORTS

As a matter of policy, sports are encouraged in the Factory, as it is felt that they develop team spirit and *esprit de corps* among the staff. I. C. F. has organised an I. C. F. Sports Club, which has been able to build up formidable football and hockey elevens. Last year, the I. C. F. team won all the four major football tournaments conducted in Madras and were the winners of the semi-finals in the Inter-Railway Football Tournament. In Hockey, too, they have had success in the two major hockey tournaments in Madras. In athletics, laurels have been won in events for women and the I. C. F. representative hold three inter-railway records. In other spheres of sports also, namely, cricket, badminton, table tennis etc., our players are faring well.

The key to success in I. C. F. has been the team spirit and enthusiasm that prevails. It has been our experience that our workman is second to none when he is given equal opportunities and facilities. The detailed planning and instructions on methods to be employed have been mostly responsible for the good results so far obtained.

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Electrification of Railways

BY PROF. ALEXANDER ALEXEYEV

Corresponding Member of the USSR Academy of Sciences, Head of the electric traction laboratory of the Academy of Sciences' Institute of Electromechanics.

HAVING served mankind faithfully for 130 years, the steam engine is being retired in favour of more progressive traction by electric and diesel locomotives. The main reason for this is the steam engine's extremely low efficiency, which rates at only 3-5 per cent as against 70 per cent for electric locos.

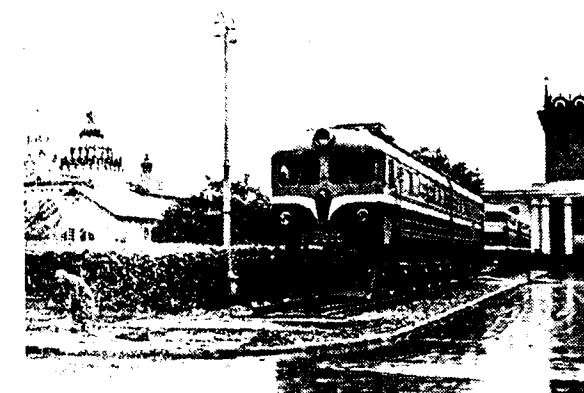
In their lifetime, steam engines have reduced to smoke enormous quantities of coal and petroleum. An idea of their wastefulness can be gained from the following comparison: where a steam engine requires 400 tons of coal to cover a certain distance, an electric locomotive would require electric energy produced by only 150 tons of coal to run the same distance.

Electric traction increases the traffic handling capacity of railways by 50 to 100 per cent. Electric locos negotiate steep inclines much better than steam engines, which means that in building lines for electric traction, much money can be saved by doing away with embankments, cuts and other expensive grading facilities. Finally, unlike its steam predecessor, an electric locomotive, far from fearing low temperatures, works even more efficiently in sub-zero weather, as losses due to heating of coils are reduced.

The target figures of the Soviet Seven-Year Plan provide for electric and diesel locomotives to handle 85-87 of total railway freight shipments in 1965. The length of electrified lines is to treble.

Scientists are at present elaborating a number of problems which will promote the electrification of Soviet railways. Most interesting among these is the utilization of alternating current for electric traction instead of the conventional direct current. Without going deeply into technical details, let us explain why this question has arisen and why it is to be solved in the course of the current seven-year period.

It is an established fact that the higher the voltage, the more economical is power transmission. With D. C. it has proved impossible to raise the voltage in the trolley wire above 3,000-4,000 volts. On lines with heavy traffic the trolley wire has a cross section of 400-500 square millimetres, while high voltage D. C. motors are very heavy.



N-8 electric locomotive

The tension in an A. C. trolley wire will be 25,000 volts, and the wire will be much thinner, which on the Far-Eastern line alone will make possible an economy of 80,000 tons of copper. In the locomotive itself, the high-tension A. C. will be transformed into D. C. of the voltage most suitable from the point of view of engine power and weight. As a result, in the new electric locos the capacity of the motors will be doubled while overall weight will be considerably reduced. An A. C. loco will be 60 tons lighter than a D. C. engine of the same capacity.

Scientists are working in close co-operation with workers in the industry. For example, representatives of the USSR Academy of Sciences' Institute of Electromechanics, the Polytechnical Institute and the Institute of Railway Engineers are working jointly with designers of electric locomotive plants in order to produce an 8,000-h. p. A. C. engine.

The Riga REZ plant has begun manufacturing A. C. motors designed by Leningrad engineers for suburban electric trains.

A uniform motor suitable for both electric and diesel engines is being produced in Leningrad. It will provide great opportunities for the railway transport. Still more important is work going on in Leningrad on squirrel-cage asynchronous motors for electric locos. These motors, which have neither commutators nor slip rings, require no overhauling beyond bearing checks.

The day is not far when electric locomotives will run over the entire length and breadth of the Soviet Union.

Power Distribution and Lighting in the I.C.F. Furnishing Annexe

By D. R. NAHA

Integral Coach Factory, Madras

ORIGINALLY the Integral Coach Factory was designed to manufacture passenger coach shells of the Integral design and it was the intention that the furnishing work would be economically distributed over the existing Railway Carriage Workshops. With the ever increasing traffic demand for more coaching stock, it was later on found not possible to spare any of the coach building capacity of railway workshops for the furnishing of the Integral shells. Further valuable time would be lost between the turning out of the shells from I. C. F. and their furnishing on some other Railways, with the result that the shells would have lost many days of earning capacity.

Hence, a Furnishing Annexe for interior furnishing and provision of lights and fans in the shell coaches is being built on the southern side of the existing Shell Factory at an approximate distance of one mile. The proposed factory will have an area of approximately 104 acres and the same will be connected with the I. C. F. by rail, for moving coach shells from the I. C. F., for furnishing and turn out of finished coaches to traffic. The Shell and the Furnishing factories are connected by a road also.

(a) **Power Supply.** Power requirements of the Furnishing Project are proposed to be catered for by the available 11 K. V. supply in the Main Receiving Station of I. C. F. by extending the aerial High Tension ring mains to the Furnishing unit, with the prospective result of considerable increase in the overall monthly unit consumption and combined KVA maximum demand of the both units, thereby giving the benefit of lowering the energy rates as provided in the slab system of tariff of the Madras Electricity System.

(b) **Load Details.** The connected load of the furnishing unit is visualised to the tune of about 6,000 H. P. taking into account the possible extension of the staff colony, with a peak power demand of about 1,200 K. W. and 4 million units yearly consumption.

The break up of the load is as under :—

	Anticipated load in K. W.
(1) Timber Mill and Ward	700
(2) Carpentry Shop	250
(3) Assembly Shop	450
(4) Fitting Shop	750
(5) Compressors	400
(6) Train Lighting Shop, etc.	600
(7) Paint Shop	80
(8) Cranes, Traversers, Lifts, etc.	180
(9) Other miscellaneous loads and external lighting	90
(10) Works Office and other service buildings etc., outside factory	200
	3,800
(11) Future developments.	700
	4,500 K.W.- 6,000 H.P.
Total	

(c) **Sub-station and Distribution.** The schematic diagram appended gives the details of the proposals. A substation inside the factory with provision for a second one to meet the additional load of Air Compressors, when installed, and a sub-station for the Staff Colony are proposed to be erected covering probable extension of the Staff Colony in future. The total installed transformer capacity will be 2,250 KVA for the factory and 300 KVA for the Colony.

(d) **Cranes and Traversers.** The electrical haulage equipment as provided in the abstract

estimate of the Project, comprises of 2 Nos.—75 ton Pit type Traversers, 3 Nos.—2 ton Overhead Travelling Cranes and Hoists of various sizes.

These Cranes and Traversers will be fed from the respective Shop L. T. Feeders and the total connected load will be about 180 H. P. as brought out in the schedule.

(e) Factory Lighting

(i) **Shop Lighting.** This, in line with I. C. F., will be generally of Fluorescent light fittings of industrial type. The standard of illumination aimed at is 8 to 10 ft. candle. The total connected lighting load will be 200 K. W. approximately.

(ii) **External Lighting.** The external lighting of the factory consists of boundary lights with incandescent lamps and double cone reflectors, directional and mercury vapour street light fittings, small Duoflux type flood lights for ramp and traverser illumination etc. In addition, there will be standard flood light towers with projectors for yard illumination.

(f) **Train Lighting Shop.** The Train Lighting Shop is a production unit, where the Train Lighting batteries have to be assembled, charged, tested and commissioned. Provision is made for Battery charging including such plant as may be necessary for manufacture of distilled water for the battery and also apparatus for testing electrical equipments pertaining to Train Lighting.

The Train Lighting Dynamos and electrical equipment have to be tested in this shop before putting into commission. It is, therefore, considered essential to render the shop self-sufficient with battery charging equipment with capacity 400 Amps., 6/75 volts, Test arm dynamos for testing and fan testing equipment cell washing and testing tables, racks, electrolyte storage arrangements, etc.

Provision is also made for a self-contained small workshop and electrical maintenance section and hand tools for general maintenance of the Furnishing Factory on the electrical side.

(g) **Communications.** The planning of the factory includes provision of Railway Telephones and Public Telephones for the production shops, offices and residential quarters, including announcing equipment partly a necessity and partly an amenity, providing "Music while at rest" facility.

Train Lighting. The train lighting of the Integral Coach employs the 24 V double battery system with two batteries each comprising of 12 lead acid cells of 300 AH capacity housed in metallic battery boxes suspended from the underframe, one section being charged from the dynamo whilst the other floats at requisite voltage for the lighting and fan loads. In recent days there has been considerable increase in the amenities to the passengers and hence heavier and variable electric loads have to be catered to. The third brush generator in conjunction with the special control equipments combines the function of automatically controlling the generator output, lamp voltage and precludes battery over-charge.

The generator is of shunt wound totally enclosed reversible type, 24/32 V, 100 A capacity specially designed to take up the hazards of working on a fast moving Railway vehicle with advantages of minimum weight and bulk.

Adequate lights are provided inside the coach for good illumination and external lights are provided for safety of passengers.

The cost of furnishing of an integral shell is estimated at Rs. 66,900/— (this cost is expected to come down to Rs. 63,260 when full production is attained) of which electrical equipment and wiring alone will cost about Rs. 26,000/— as compared with the difference in cost of Rs. 1.17 lakhs between the furnishing and unfurnished imported Schlieren coaches; with the saving of idle time in the movement of unfurnished coaches away from I. C. F. the additional saving anticipated is to the tune of about Rs. 5,000/— and this clearly justifies the putting up of the Furnishing Factory.

Estimated Cost. The total estimated cost for the electrical portion of Furnishing

Quality Control in Integral Coach Factory

By Dr. G. Mukherjee and G. Doraiswamy

QUALITY control is an essential and significant aspect of every industry and its nature and extent depends on the scope in view and the standard which is desired to be maintained in the product. Especially this shall be helpful to trace and prevent defective quality in a factory which has a mass-production programme.

The Integral Coach Factory produces an average of 40 Coaches per month from raw-material steel and other fabricated and purchased components and other raw materials. It has a large forging and heat-treatment section to manufacture the components for the Coaches and a well-equipped Tool-Room and Machine Shop. Some major castings as axle box, draft casting etc., Aluminium profile and rubber profile for the windows and doors, other non-ferrous materials as brass and bronzes are used in the Coaches. Further, the major work of the factory consists of welding to fabricate the Coaches and painting for protection of steel coaches from corrosion. Light gauge steel and heavily stressed members go into the making of the coach. All these need a control for the quality to ensure the manufacture of coaches with a standard quality giving a comfortable ride and safety for the passengers. A well-designed laboratory which is well-equipped has come into being to serve the needs of the organisation, which keeps a watch and helps to improve the quality by constant research and trials and to locate indigenous supplies in place of imported ones, keeping stress on quality.

The main branches of the section are divided into three, besides the inspection section, which keeps control on the physical size of the material :—

1. Non-destructive testing section.
2. Physical Testing and Metallography section.
3. Paints & Chemical Section.

NON-DESTRUCTIVE TESTING SECTION

The X-Ray testing section has got a very important role to play. The bogies which are fabricated by welding have highly stressed members, which need a careful and thorough check for the soundness of welded parts and on these load-bearing members depend the safety of the coach. Other vital com-

ponents as the axle box on which the whole load of the coach acts have also to be checked up closely besides the physical tests for the strength of weld. Each and every bogie shall be tested with the X-Ray machine and also is subjected to a mechanical load test by a Bogie Tester. For locating surface-cracks on weldings etc. magnetic crack detector is under use. Thus great care is taken to ensure high quality and safety for the coaches.

PHYSICAL TESTING SECTION

The physical testing section is well equipped with a number of testing machines for testing steel, iron and other non-ferrous articles. A 100-ton universal Testing machine is installed for tensile, compression, bending and cupping tests. Fatigue properties of the materials can be ascertained by a 25 ton pulsating type of machine. Other equipments include Brinell Hardness Tester, 'Briviskop', Portable hardness testers as 'Bohler' and 'Shore Scleroscope', Ductility Tester etc.



This section checks up the quality of raw material purchases, keeps a control on the forged and heat-treated components, finished articles as tools die-blocks etc. and on the welding carried out in the Factory. Electrodes, which is the chief Raw material for welding are assessed for their characteristics and for suitability by deposition and physical tests. A useful addition of machines for testing plastics, rubber etc., is also being made to complement the existing needs.

A metallographic section is being equipped with a metallographic microscope and dark-room facilities for

microscopic and microscopic study of the structures of metal which is one of the important factor to determine the quality of ferrous and non-ferrous metals.

PAINTS & CHEMICAL SECTION

Painting of coaches is another major operation in this Factory and different varieties of paints are being tested in the Paint Wing of the laboratory. Their physical & chemical characteristics and their protective properties are being assessed continually at the time of purchase and use on the shop floor. The Laboratory is equipped with modern aids such as glossmeter, tintometer etc. A salt-spray cabinet and a humidity chest are being added and they will help to evaluate paint films by accelerated tests. It is intended to include a Weather-O-Meter which shall evaluate the paint films by accelerated tests under a suitably programmed simulation of natural climate as sunlight, humidity and rain conditions and these will greatly help to evolve better standards by constant research and trials and to keep in touch with the modern trends.

Chemical analyses of steel etc., are being done in the Chemical section. Among the equipments a Strohelein's Carbon Determinator for rapid estimations of carbon in steel and a Sulphur Determination Apparatus for rapid estimation of sulphur by photo-electric method are important. Since nitrogen has been recognised to be an important significant factor affecting the ductility and deep-drawing quality of sheet steels an apparatus for 'Rapid Estimation of Nitrogen' is also included.

Apart from the quality control, improvement of quality by research and trials and location of suitable indigenous substitutes also form the part of the work

of the laboratory. Among these can be mentioned the following problems as Blueing of steel for increasing the life of tool steel, rectification of die-blocks by welding, selection of suitable welding primer for spot welding have been taken up and become successful. Trials to ascertain the suitability of certain indigenous steels in place of imported variety for Coach construction are in progress and nearing completion. Trials are in progress for collecting data regarding different systems of interior painting of coaches which may perhaps help to evolve a better system in keeping with the modern technological trends. Pre-treatment by degreasing and pickling of minor parts by a conveyorised system is also engaging the attention. Location and development of indigenous castings by technical advice has yielded significant results which will help to save considerable foreign exchange.

Besides the above, this has a major role to play in co-ordination with the Design Department since proper execution of a carefully worked out design is ensured by only a proper quality control. The Integral Coach is quite a new feature in this Country and it incorporates many modern trends of designing by a variety of welding processes. Since welding is the major factor contributing to the safety of the coaches, the welders are being tested at frequent intervals for their efficiency by a qualifying test, to maintain the standard at a high level.

Evidently, a laboratory by its keenness, alertness and promptness to serve the needs of the organisation by laying stress on proper quality and with a view to

"Not a having and a resting
But a growing and a Becoming"

—will help to ensure good quality coaches with good riding facilities under safe condition.

Consumer Co-operative Societies on Railways

One out of every 20 railwaymen in India is a member of a railway consumer co-operative society.

This is disclosed in the latest half-yearly report on the functioning of co-operative societies on Indian railways, covering the period ending June 1958.

At the end of June, there were 121 consumer co-operative societies on the railways, with a total membership of 58,338. While the Western Railway had the largest number of societies, the Southern Railway claimed the highest membership, almost one-fifth of the total all-India membership. The Western and Central Railways came after the Southern Rail-

way, each with more than 10,000 members.

The half-yearly report reveals all-round progress made by the societies. Total sales rose from Rs. 40.79 lakhs during the previous half year to Rs. 41.32 lakhs during the period under review, the Western Railway leading with more than one-fourth of total sales. The share capital also increased from Rs. 8.64 lakhs to Rs. 9.50 lakhs, the Western Railway again being the highest contributor.

The Railway Board has requested various Railway Administration to take further steps to promote the development of co-operative societies on sound lines.

Maybach Diesel Engines

THE Maybach MD range of high speed diesel engines, manufactured in the United Kingdom by Armstrong Siddeley Motors Limited under licence from Maybach Motorenbau G. m. b. H., is the culmination of continuous development of high speed railway traction engines carried on for more than 35 years by Maybach Motorenbau G. m. b. H. coupled to the vast experience of Armstrong Siddeley Motors Limited in precision engineering.

Armstrong Siddeley Motors Limited—part of the Hawker Siddeley group—have designed and produced high class motor cars for 50 years, aero engines for over 40 years and diesel engines for over 10 years. Now this wealth of craftsmanship is directed also towards the production of Maybach high power light

weight diesel engines. These MD engines, direct descendants of the GTO tunnel type, so well known for lengthy operating periods between overhauls and low maintenance costs, are characterised by additional features designed to further reduce wear and increase reliability. Also, since all models have the same cylinder bore and stroke as well as many identical components, interchangeability of parts is readily achieved—a vital servicing factor.

The power ratings shown below are based on International rail traction specifications and the conservative nature of these figures is apparent from the fact that corresponding outputs for other applications are up to 50% higher.

ENGINE TYPE	NO. OF CYLINDERS	B. H. P. BRITISH STANDARD	METRIC H. P. U. I. C. STANDARD	RPM	DESIGN	FUEL CONSUMPTION		WEIGHT LBS.
						LB./B.H.P./HR. FULL LOAD	* $\frac{3}{4}$ LOAD	
MD. 220 ..	4	384	400	1600	In-line	0.398	0.373	5500
MD. 325 ..	6	576	600	1600	In-line	0.394	0.369	6950
MD. 435 ..	8	768	800	1500	Vee	0.373	0.364	7100
MD. 440 ..	8	960	1000	1500	Vee	0.369	0.362	7600
MD. 650 ..	12	1152	1200	1500	Vee	0.376	0.360	10250
MD. 655 ..	12	1440	1500	1500	Vee	0.364	0.358	10700
MD. 865 ..	16	1536	1600	1500	Vee	0.385	0.369	12100
MD. 870 ..	16	1920	2000	1500	Vee	0.380	0.369	12650

* According to propeller Curve

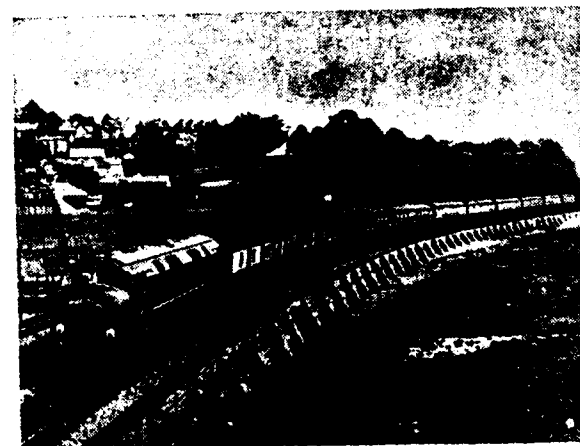
PISTONS

The pistons—which are of the divided type, *i. e.*, the crown is bolted to the skirt, are cooled by a continuous flow of oil through a cavity between each piston skirt and crown. The oil supply is via telescopic pipes mounted on spherical joints within the engine and a special heat exchanger is provided for oil cooling. As a result of this continuous cooling, piston clearance can be reduced to a fraction of that necessary for uncooled pistons and the combination of these two features *viz.* positive cooling and minimum clearance, means that these engines have an extraordinarily low rate of piston wear. In practice, a

full load test run of several thousand hours showed a wear rate of .0002 in. per thousand operating hours. Servicing of pistons and cylinders is made extremely simple in view of the fact that after removal of the cylinder head, the piston crown is detachable on withdrawing six bolts without taking the piston and connecting rod out of the cylinder; also the fact that the wet cylinder liners are interchangeable.

CRANKCASE AND CRANKSHAFT

The foundation of all the excellent features to be found in Armstrong Siddeley Maybach engines is the crankcase—a single structure—and its discwebbed



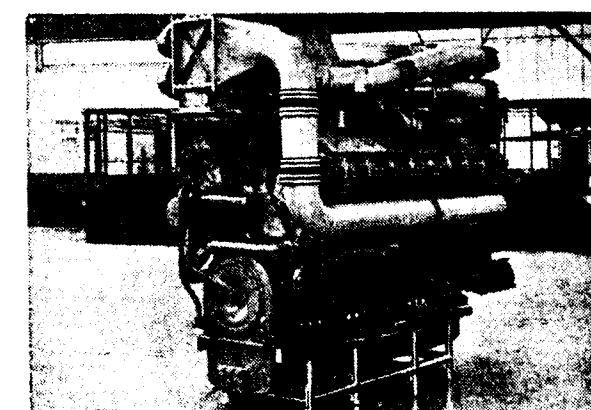
detachable as a single unit. Obviously, this arrangement is most convenient for routine inspection purposes.

INJECTION EQUIPMENT

To avoid high pressure fuel lines, each cylinder has its own injector unit combining both pump and valve, the latter having a single hole nozzle of large diameter. Each unit is pre-set and requires no adjustment in service.

GOVERNOR

The engine governor is of the centrifugal flyweight type and can be supplied as a speed or fuel injection regulator as required. For operation of the adjustable mechanical linkage to the unit injectors, the governor utilizes a powerful servo system hydraulically operated by engine lubricating oil pressure. It therefore acts also as a safety device for the lubricating system.



Bristol Siddeley Maybach MD Engines.

Maybach type MD 871/30 engine with sixteen cylinders in Vee formation. Turbo-charged and intercooled this engine is rated at 2,880 h.p. at 1,800 r.p.m. (British Standard) for marine applications.

The rail traction and industrial power generation versions of this engine, designated MD 870 give up to 1,920 h.p. at 1,500 r.p.m. (British Standard rating)

Made under licence from Maybach Motorenbau G.m.b.H.

crankshaft. This crankshaft is so called because its formation is based on the principle of replacing each pair of webs and the associated journal of an orthodox crankshaft design by one large disc around which is fitted a roller type main bearing. By so doing, almost the entire length is made available for main and connecting rod bearings.

CONNECTING RODS

A further inherent advantage is the ability to make the connecting rod bearings very wide without incurring the risk of excessive end pressure, whilst the special design of connecting rod and bearings ensures uniform distribution of pressure over the entire supporting area. Proof of the durability of these bearings is to be found in the fact that, in railway service 600,000 miles between general overhauls is widely accepted.

CYLINDER HEAD AND VALVES

All Armstrong Siddeley Maybach MD type engines have individual detachable cylinder heads, each having three inlet and three outlet valves arranged concentrically around the combustion chamber which is cast centrally in the head. This arrangement provides small, well cooled, lowly stressed valves, each provided with sliding guide covers to protect the valve itself from side thrust. For sealing the cylinder head gas joints, metallic rings are used and as these are under compression from long cylinder head studs, there is no need to retighten in service.

CAMSHAFTS

Two camshafts—one for inlet valves, the other for outlet—are contained in a common valve gear housing together with the entire control mechanism for one bank of cylinders; the housing and mechanism are

LUBRICATING SYSTEM

Forced-feed engine lubrication is utilised and to ensure ample bearing lubrication immediately on starting, a priming pump is included in the system. This pump functions immediately the engine starting switch is thrown and only when sufficient pressure is built up is the engine starter brought into operation. Oil

consumption is very low, amounting to 0.0035—0.0045 lb. per horse power-hour at full load for all engines.

SUPERCHARGING

Single stage exhaust gas turbo-chargers with vertical shaft axis are used for supercharging. In this way the optimum design of exhaust piping is obtained with resultant maximum utilization of exhaust gas energy. It should be noted that the 8, 12 and 16 cylinder

engines designated MD 440, 655 and 870 respectively, are special types having a higher degree of supercharging with inter-cooling. In these engines, air compressed in the blower and heated in the process is re-cooled before entering the cylinders. By this means, an increased weight of air is available for combustion with correspondingly increased performance at equal temperature levels. (*Maybach MD type engines are manufactured in the United Kingdom by Armstrong Siddeley Motors Limited under licence from Maybach Motorenbau G. m. b. H.*)

INDIAN RAILWAYS — 1957-58

A popular hand-book, entitled 'Indian Railways—1957—58' has just been published by the Ministry of Railways, presenting in readable style the different aspects of the working of the Indian railways during the financial year 1957—58.

The publication, which is available from the Manager of Government Publications, Delhi, presents

in simple, non-technical language a brief account of the operations of India's largest nationalised undertaking. Besides comparative figures relating to the year's performance, as against that of a few preceding years, there are a number of useful appendices. There are 28 charts, 22 statistical tables giving statistics from 1938—39 onwards and a small scale Railway map of India.

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Proof of the Pudding

By A. V. Sugavaneswaran, B.E.

District Controller of Stores, Integral Coach Factory, Madras

IN every family it is the housewife that has to work hard to keep the home fires burning. If the family is a big one such as a joint Hindu family or a Chinese family of the olden days the responsibility of the housewife is all the greater. She has to work hard remaining in the background all the time and run the home efficiently. It is the bread-winner of the family who comes to limelight but without the efficient housewife in the background he will not be able to play a successful part. The functions of the Stores Department in a big industrial unit are rather similar to those of a housewife. When a house is as big as that of the Integral Coach Factory the responsibilities of the housewife can be imagined.

The Stores Department had to cater to the exacting needs of the construction Engineers whose requirements were always extremely urgent. The department can look back with satisfaction on its performance in feeding the construction Engineers which has enabled them to complete the Project in record time and to schedule. But it was in the field of development of indigenous capacity to meet the needs of coach construction that the Stores Department had to play a vital role.

The integral coach has been developed by Swiss coach builders. As the watch-makers of the world the Swiss Engineers are the most precise among modern technologists and their standards are exacting. With highly industrialised Germany as the next door neighbour the Swiss coach builders had the benefit of the most advanced ideas, designs, specifications and manufactures knocking at their doors. With decades of experience in coach building Messrs. Swiss Car and Elevator Manufacturing Corporation, Schlieren-Zurich, developed the most modern integral coach in recent years. This was accepted as the standard by the Indian Railways and the Coach Factory was started for the mass production of integral coaches.

Till the advent of freedom in 1947, India remained an essentially agricultural country. Except for the textile industry which had made some progress there was hardly any major technical development in the country. After freedom the industrialisation of the country no doubt got impetus but the process

had to be necessarily very slow. At the time of the commencement of the manufacture of the integral coach the position was therefore that India was far behind countries like Germany in the industrial field.

The design of the integral coach incorporated the latest manufacturing techniques, specifications and rigid tolerances to which German technologists were accustomed. It was almost impossible for the Stores Department of the Integral Coach Factory to attempt procurement to these rigid standards and tolerances in the Indian market which was accustomed to only production of commercial standards. It was a challenge to the Officers of the Stores Department of the Integral Coach Factory to develop indigenous capacity for the various items. The challenge was accepted and efforts were directed towards the development of indigenous capacity.

Steel castings offered a problem. There were only four steel castings in the integral coach but they were very important. Educational orders were placed on existing steel foundries in India which numbered only a few. The steel foundries had enough orders on hand for conventional steel castings which they had been manufacturing for some time. They were not therefore very keen to take up new castings. Further, our specifications for these castings were very rigid and it was soon found that even with considerable effort the steel foundries could not produce our requirements. We had therefore to continue importation. However, our efforts to develop indigenous capacity continued and ultimately it met with success. The newly established steel foundry in TELCO as well as one or two other firms have started manufacturing these steel castings successfully.

There were fourteen items of rubber profiles required for the integral coach. There were considerable difficulties in developing capacity for these profiles in the early stages as the rubber manufacturers in India found the tolerances as well as the shore hardness very rigid. By mutual consultations and the appreciation of each other's point of view we have been able to develop capacity in collaboration with the leading rubber manufacturers for these items.

Aluminium alloy castings also offered considerable difficulties in the early stages. It was found sand casting technique did not give satisfactory results and die casting was almost unknown in the early stages. Fortunately several factories have sprung up in recent years for die casting of non-ferrous metals and we have been able to develop adequate capacity for our requirements.

There are a large number of aluminium extrusions numbering about 38 which are required for the integral coach. Fortunately, just when we commenced production Messrs. Indian Aluminium Co's extrusion presses at Alwaye also started production and we have been able to get our requirements from this Factory. There was a two-way traffic of Engineers between Alwaye and Perambur to sort out the initial difficulties in the supply of aluminium extrusions to the Integral Coach Factory; with this consultation and co-operation we have now been able to get the extrusions to our requirements from Alwaye.

Malleable casting technique is far advanced in European countries and the integral coach incorporated several items of malleable castings. Grey castings are not strong enough for the purpose and forgings or fabricated steel would be more costly. In India however the factories manufacturing malleable castings are extremely limited. It was found that we could not obtain our requirements of malleable castings in India and so we had to change over to fabrication. Simultaneously attempts continued to develop capacity for malleable castings and it is gratifying that one or two firms have been able to successfully make these castings in the past few months.

Axle box helical springs were imported in the first few instances. Our efforts to locate indigenous capacity for this item proved successful and TELCO as well as Chittaranjan Locomotive Works have offered to manufacture and supply these helical springs. Our headache did not end here. We had to find the spring steel rounds to enable these two Factories to manufacture springs. Messrs. Guest Keen Williams readily agreed to roll the rounds for us from which these Factories could make the springs. Again the problem was to get the spring steel billets from which Messrs. Guest Keen Williams could roll the rounds. We have been able to enlist the co-operation of the Ordnance Factories to supply the spring steel billets.

The integral coach is an all-welded design. As the entire shell is stressed it is very important to ensure that there is absolutely no rusting anywhere. While the exterior of the coach is always open for inspection and care can be taken to prevent corrosion,

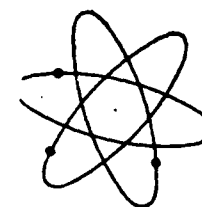
it is not so in the case of the inside of the shell. Once the panelling materials are fitted up and the entire coach is furnished and put on the line it is very difficult to know what is happening under the panels. The interior of the shell therefore has to be protected very carefully from the ravages of corrosion. Messrs. Swiss Car and Elevator Manufacturing Corporation, Schlieren, who are our Technical Advisers have found from practical experience that 'Inertol' manufactured in West Germany give excellent results and can be depended upon. Inertol paints are petroleum based and are manufactured to secret special formulae to give hundred per cent protection from corrosion. We were fortunate in this instance also to discover that a paint manufacturing firm in Calcutta had just then started manufacturing Inertol paints under a licence from the West German firm. We have been able to obtain these Inertol paints from this Indian firm from the very beginning.

Even bolts, nuts, screws, washers and pipe connections gave us considerable anxiety. Almost all the manufacturers of these items in India make them only to commercial specifications. It was found difficult to get even a single firm to make them to our specifications. In fact the position was so bad that for the first few coaches that were turned out we had to manufacture even these small items in the workshops as all the samples obtained from firms were not found up to specifications. By persistent effort and contacting a very large number of manufacturers all over India we have been successful in obtaining these materials to our specifications.

In the space of a small article like this it is only possible to give a bird's eye view of our efforts during the past four to five years in the direction of developing indigenous quality to meet the exacting standards we set to ourselves in the manufacture of integral coaches. It is not possible to describe in detail the various problems that confronted us, our tribulations, the anxious moments when hold-up to work stared us in the face, the deep understanding and co-operation that existed between the various departments in the Integral Coach Factory, the united front that was put up to face the problems and solve them and the joy of ultimate success.

They say that the proof of the pudding is in the eating. If any proof is required of the successful and efficient working of the Stores Department of the Integral Coach Factory the excellent out-turn that has been made possible by proper planning of procurement will supply the proof.

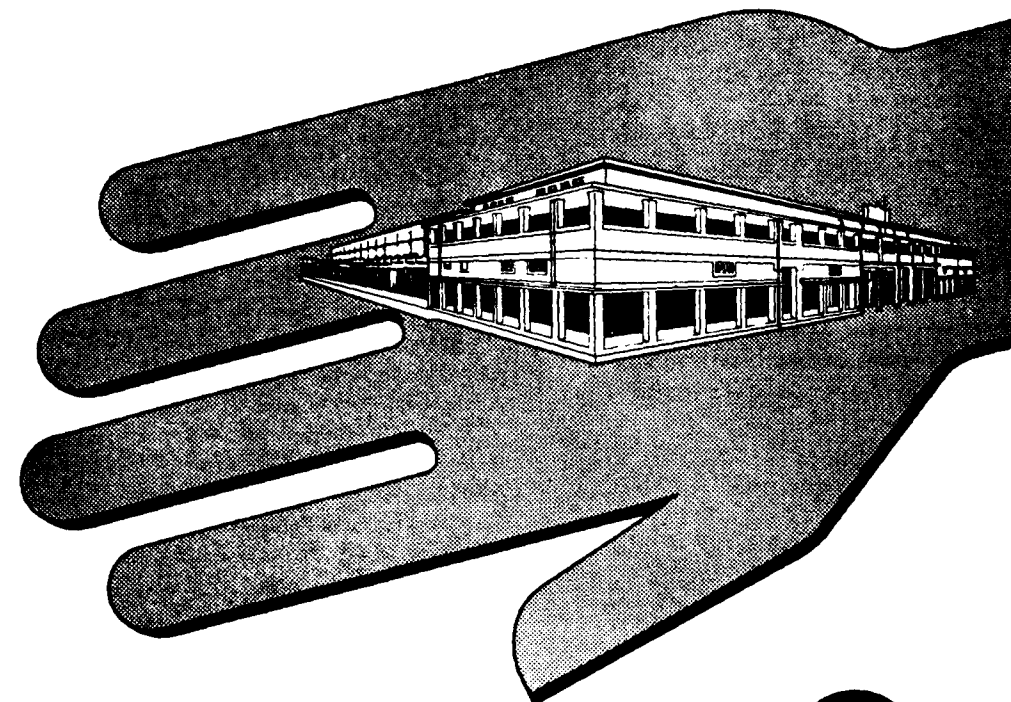
—(Courtesy: The Indian Railway Engineer, Bombay)



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Technical Training School—Integral Coach Factory

By M. Lal

Principal, Technical School

THE Technical Training School of the Integral Coach Factory, which was started sometime before the start of production for training skilled workers for the factory, was inaugurated on the 20th March, 1954 by the then Deputy Minister for Railways, Shri O. V. Alagesan.

At the start, training was given to Trade Apprentices mainly in the three trades, Fitting, Machining and Welding. Recently these trades have been augmented by the Plumber, Carpenter and Electrical Fitter trades. Training courses have also been started for Apprentice Mechanics and Graduate Apprentices. The latest additions to the curriculum of the School are a Promotion Course for Unskilled staff and a Refresher Course for the Supervisors of the factory.

TRAINING OF TRADE APPRENTICES

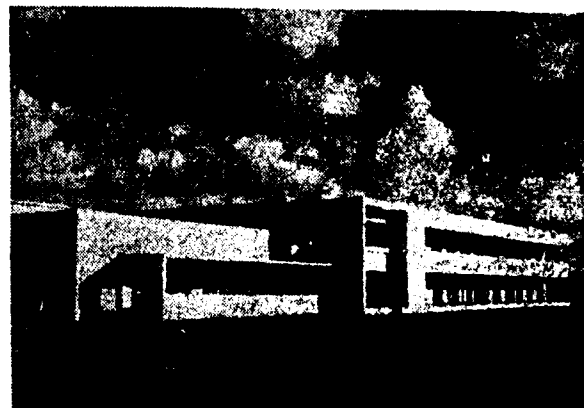
The Integral Coach being of a design different from the conventional coach and the work involved in the manufacture being of a specialised nature, the administration decided at an early stage that at least 80% of the skilled artisans required for the factory should be those who have undergone a regular intensive course of training. The bulk of the skilled artisans required for the manufacture of integral coaches belong to the 3 main trades, viz. Fitting, Machining and Welding. Generally, it takes about 3½ years for a worker to become proficient in a particular trade, but in view of the limited time available before the factory went into production, a special training scheme of 18 months duration was drawn up. The scheme envisages the selection of suitable boys from those who have passed at least IV Form and undergone a minimum of 18 months practical training. The apprentices are given a training for 18 months and those found fit are absorbed as Skilled Artisans in the factory.

This phase of training is styled the intensive phase and will be replaced in due course by the conventional 3½ years course perhaps late in 1959 or in 1960, as from then on recruitment of fresh workers will be made only to meet the annual wastage.

The 18 months training is made up of 6 months of

basic training in the Technical School and 12 months of further training in the Coach Factory.

Origin of the Technical School: The Technical Training School started functioning with a small Basic Training Workshop of 9,792 sq. ft. floor area and with 70 Trade Apprentices on its rolls. The Technical Training School was planned to have capacity to train 260 apprentices at a time, 100 in the fitting trade, 60 in the machinist trade and 100 in the welding trade and with that end in view it was decided that the Basic Training Workshop should be



A view of the Technical Training School.

expanded, a proper building for holding theory classes should be constructed and a hostel to hold 261 apprentices should also be built. The work was taken in hand and the plans drawn up for the School came into fruition during the year 1956—57.

Basic Training: This training is intended to give the trainee a thorough grounding in the trade so that he is sure of the basic principles and he is in a position to derive maximum benefit from the factory training and attain the requisite skill within the 18 months training period. Advantage is taken of the basic training to create in the trainee the desirable habits for him to perform his work in a proper and methodical manner and also to become a worthy citizen of the state.

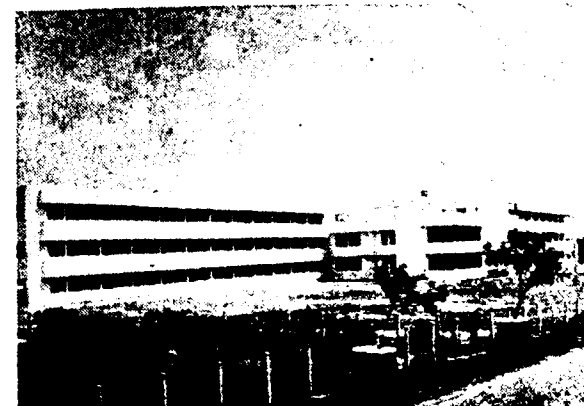
Each trainee puts in 47½ hours of work per week. The boys undergo practical training for 24 hours in a

week and during the remaining 23½ hours they receive theoretical instructions, attend physical training classes and do community work.

The basic training courses start in May and November each year and during apprenticeship the trade apprentices receive a stipend of Rs. 36/- and a Dearness Allowance of Rs. 45/-, making a total of Rs. 81/-.

Practical Training: Practical training is given in the Basic Training Workshop, which has a floor area of 19,600 sq. ft. and 105 machines installed in it. The B. T. Workshop consists of 3 departments, viz. Fitting, Machining and Welding. During practical training each apprentice has to work with his own hands and for that purpose he is allotted a fully equipped workplace in each department. In the fitter department, each trainee has a vice and set of tools allotted to him, in the machinist department a machine and in the welding department a welding booth with complete welding equipment. Similar arrangements have also been made for the 3 new trades, Carpenter, Plumber and Electrical Fitter. Each exercise is discussed in advance in the class room and when the trainee comes on to the shop floor he is fully aware of what he has to do, the raw materials and tools required, the sequence of operations, etc. To minimise fatigue and to avoid unnecessary waste of time, special tool cabinets with swing-out shelves have been provided for machinist trainees.

During basic training each trainee has to complete a number of graded basic exercises starting from the



A view of the Apprentices' Hostel.

simplest. The basic exercises are designed to develop the ability required to do all the skilled jobs

encountered in day to day work. To cut down the cost of training, scrap material is used for basic exercises to the extent possible and in some cases the same workpiece is used for more than 2 to 3 exercises.



A view of the Interior of the Basic Training Workshop.

In the case of fitters, besides giving training in fitting techniques, training is given in smithy and sheet metal working. In the case of the machinists, as the time available is limited, the trainees specialise in any one of the four sub-trades, viz. turning, shaping, milling or drilling and boring. In the case of welders training is given in arc welding, gas welding, gas cutting and spot welding, a technique adopted largely in the manufacture of integral coaches. Similarly, for the Carpenters, Plumbers and Electrical Fitters, the exercises have been so planned that the apprentices will be fit to do the different types of furnishing required on the coach.

Each workpiece done by the apprentices is evaluated and marks are allotted for "Accuracy", "Finish" and special features such as fits, etc. The evaluation is done by specially trained men and the defects in workmanship or the methods employed are systematically shown to the boys.

The progress of the trainees is carefully watched and for this purpose a practical test is held every 6 weeks. This test indicates as to how much of training each apprentice has assimilated, whether he is sure of his ground and whether he is fit to go on to the next set of exercises. Corrective action is taken as indicated by the results. In the case of test jobs, marks are allotted for the working method followed, order on

the work bench, time taken, planning, accuracy and finish.

During practical training, particular attention is paid to the adherence to safety regulations and the use of safety appliances to ensure that the apprentices do not fight shy of using the safety appliances later on.

Theoretical instructions: For imparting theoretical instructions a magnificent building with well lit and well ventilated 11 class rooms, an auditorium capable of accommodating 300 persons, a Library and Laboratory has been built. The total floor area is 21,906 sq. ft. The School building is fitted with modern sanitary fittings and has been adequately furnished.

The lectures are so planned that each trainee understands the theory underlying each operation. Besides lectures on technical subjects, connected with the trade, lectures on Citizenship, Personal Hygiene are also given. Opportunity is taken to teach Hindi to those who do not know that language. Film shows are also arranged on important technical subjects.

Each apprentice has to attend physical training classes for 2 hours a week and has to become a member of the Auxiliary Cadet Corps. Weekly parades are held to instil a sense of discipline in the apprentices. Time has been set apart for community work also to develop *esprit-de-corps*.

Theoretical tests are held once every 2 months.

Prizes: To serve as an incentive for the apprentices to give off their best, attractive prizes have been instituted for the basic training course. Two prizes (a first and a second) for General Proficiency and one prize for the practical training are awarded in all trades. A prize for proficiency in theory is awarded for all trades together.

Factory Training: During the factory training, which lasts for 12 months, the boys are first attached to experienced workers and then work independently as skilled artisans. On completion of the 18 months training they are trade tested and on being found fit absorbed as skilled artizans. The Factory Instructor attached to the Technical School follows up the progress of the boys.

Hostel: A two storeyed building with 87 rooms, 2 dining halls, 2 recreation rooms and fitted with modern sanitary fittings has been built to accommodate 261 boys. Each room is equipped to accommodate 3 boys and each boy is provided with a cot, a table, a chair, a book rack and a coat stand. The rooms are well lit and well ventilated. The hostel has a total floor area of 60,329 sq. ft. A vegetarian and a non-vegetarian mess are run on a co-operative basis, under the supervision of a Mess Committee, elected by the apprentices. The recreation and reading rooms are also managed by the apprentices themselves.

TRAINING OF APPRENTICE MECHANICS

To fill up the vacancies likely to arise in the supervisory cadre, a special Apprentice Mechanics scheme of 2 years duration (as against the conventional 5 years course) has been drawn up and was introduced in February, 1957. For this purpose a selection was made from the trade apprentices, who had completed their training with credit and who had passed S. S. L. C. and were below 25 years of age. The course commenced with 20 trainees comprising of 10 Fitters, 4 Machinists and 6 Welders. At present there are 31 boys under training. These apprentices receive advanced trade training and allied trade training in the Technical Training School and receive factory training on the floor of the shops. Whilst in the School they are given theoretical instructions to bring their knowledge upto the standard prescribed for Apprentice Mechanics in the Technical Training Committee Report. These boys also receive training in Jig and Tool Design, the Drawing and Design Office, and in the production and Planning Office.

Later on, Diploma holders were also recruited from the open market for the post of Apprentice Mechanics. The duration of their training is 2½ years. Under this course 14 Apprentice Mechanics are under training.

TRAINING OF GRADUATE APPRENTICES

A special training scheme of 2 years duration has been drawn up to train Engineering Graduates to fill up vacancies likely to arise in the intermediate stage of the supervisory set up. During training they receive a stipend of Rs. 250/- plus Rs. 70/- as Dearness Allowance per mensem. These apprentices

spend 7 months in the Technical School, the major portion of the time in receiving practical training, theoretical instruction being confined only to factory administration and general subjects. They receive 16 months training in the factory of which 5 months are spent in the Jig and Tool Design Office, Drawing Office and Planning Office. The last month of their training is spent in the Technical School in undergoing a refresher course after which they are tested and absorbed as Chargemen in grade Rs. 260-350. This scheme was introduced on the 2nd April, 1957 and on date 18 apprentices are under different stages of training.

PROMOTION AND REFRESHER COURSES

After the work came into full swing in the factory, the need was felt for providing instructional courses for the Unskilled staff and for providing Refresher courses for the supervisors in the factory. These courses were started recently. For the Unskilled staff

the training given is similar to the training given to the Trade Apprentices during the first 6 months of their training and consists of basic exercises in the B. T. Workshop and a series of lectures in the School. The exercises, however, are simpler and the lectures also are of a more elementary nature and are delivered in regional language. The duration of the training is 3 months.

The Refresher Course consists of lectures by Officers of the Factory on various subjects such as Production and Planning Control, Time and Motion Study, Principles of Supervision, Machine Tools, Stores Procedure, etc. These lectures are so planned that the supervisors learn what they miss in the daily rush of work and thus are helped to understand how the factory is administered. They also acquire a basic fund of knowledge on important topics, which it is hoped will be an asset in the execution of their duties.

—(Courtesy: The Indian Railway Engineer, Bombay)

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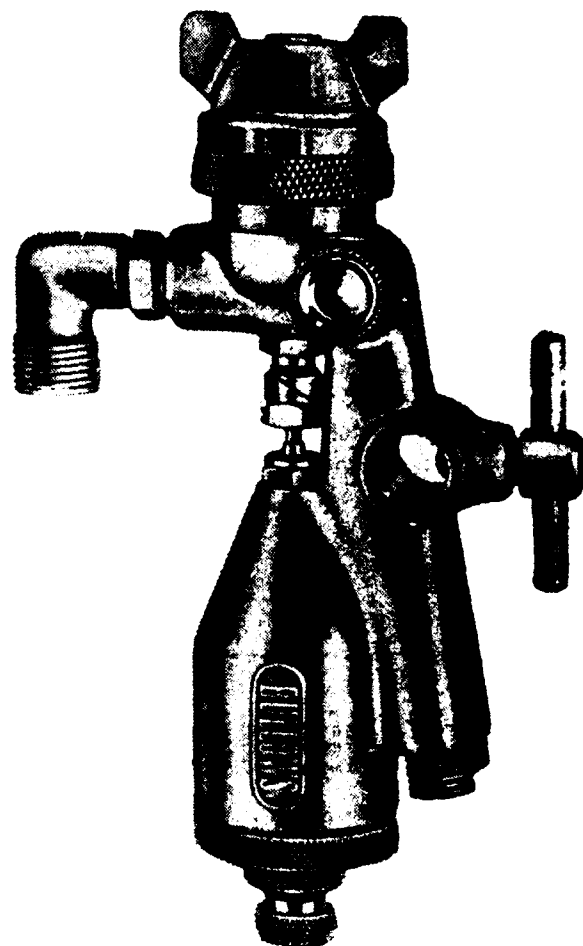
ALFRID Bullows & Sons Ltd., Long Street, Walsall, announce the introduction of a new automatic spray gun, the L540, which supercedes their well-known L500 automatic spray gun.

Years of experience in the use of automatic spray guns in all branches of industry have influenced the design of the L540, which represents an interesting advance in this field.

By using a forged aluminium alloy body, Bullows have reduced the weight of the L540 to less than half that of the L500—19½ ounces as opposed to 41 ounces—without reducing efficiency or hard wearing characteristics. At the same time, they have retained interchangeability of internal component parts.

For added ease of operation, all hoses come away in the line of the gun. This feature, combined with the startling reduction in weight, will allow the new Bullows gun to be used in positions and at speeds previously considered impossible.

Nozzle set-ups are interchangeable with those used on the Bullows-Binks L1900 spray gun, which is standard equipment both in this country and the U. S. A. to almost every major mass production manufacturer of motor cars, refrigerators and similar products which call for a finish of the highest possible class to be produced at a high speed. The result is that the L540 becomes probably the lightest and certainly the fastest high performance automatic spray gun available.



The price of this gun is £10/15/0 plus 20% and delivery is seven days.

D. R. U. C. C. MEETS IN BOMBAY

The sixth meeting of the Divisional Railway Users' Consultative Committee of the Bombay Division of the Western Railway for the years 1958-59 was held in the office of the Divisional Superintendent, Western Railway, Bombay Central, at 11-00 hours on Tuesday, the 7th April, 1959, under the chairmanship of Sri R. N. Chaudharie, Divisional Superintendent, Western Railway, Bombay Central. Members, representing the various Chambers of Commerce & Industries in Bombay, Surat, Amalner and also representatives of Passen-

ger & Traffic Relief Association were present

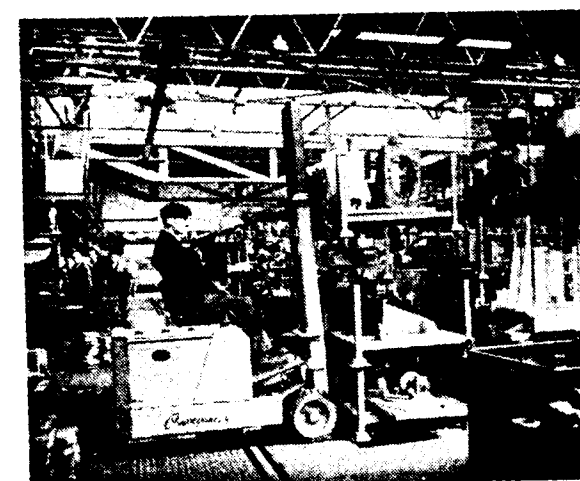
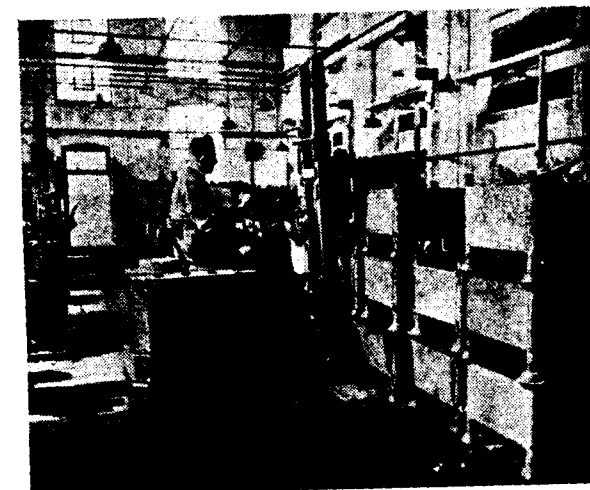
Various matters connected with catering arrangements, difficulties experienced by public at booking windows at certain stations, proposals to attract more traffic to the Railway, were discussed and action proposed to be taken was explained to the members. Statements in respect of provision of passenger amenities, punctuality of passenger trains and inspection of food-stuffs for sale for the quarter ending 31-3-59 were also taken up for discussion.

British Railways, Swindon

SWINDON—the town on the hill—dates back at least eight centuries and is mentioned in the Domesday Book. It was an ancient market town of some note when the Great Western Railway came into being.

Parliament had sanctioned the construction of the railway between Bristol and London in August, 1835, and, thanks largely to the energies of its indomitable engineer, Isambard Kingdom Brunel, construction was commenced three months later and the first completed section of his famous broad (7 ft.) gauge railway—Paddington to Maidenhead Riverside Station (now Taplow)—was opened in June, 1838.

By December, 1840, the line had been extended through Swindon, and June of the following year saw the whole line between London and Bristol, including the Box Tunnel, in use.

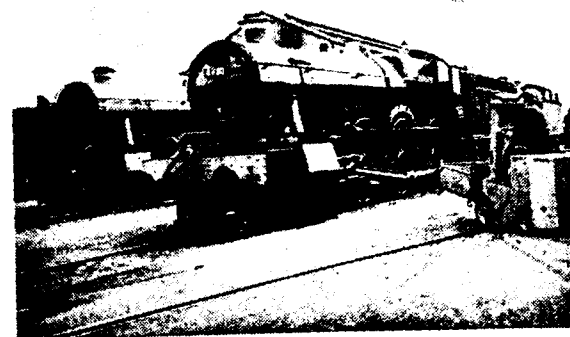


Brunel, who had been appointed engineer to the undertaking when but 27 years of age, selected as his Locomotive Superintendent a young man then scarcely in his majority, one Daniel Gooch, who had been trained with Messrs. Robert Stephenson and Company.

With the rapid growth of the railway arose the necessity for the provision of a central repair depot for the maintenance of the locomotive stock and Mr. Gooch was asked to investigate and report on the most desirable location for such a depot.

In this connection an extract from Mr. Gooch's diary is interesting :

“1840. During this year further portions of the Great Western were opened and agreements





for the purpose of passengers taking refreshment.... The establishment there would also comprehend the large repairing shops for the Locomotive Department."

The erection of workshops for the repair of locomotives was commenced without delay. The machinery was started in November, 1842, but the Works were not in regular operation until January 2nd, 1843.

Ultimately, Swindon was chosen for the Carriage and Wagon Works, and these were authorised by the Directors in October, 1867. The Works were commenced in June 1868, and completed the following year.

The effect of the Company's selection of the town of Swindon is disclosed by reference to the census returns, which in 1841 gave a total population for the town of 2,459. To-day the population is about 70,000 whilst the number of employees in the Works has increased from 4,500 in 1876 to 10,000.

From those early days in the history of the Great Western Railway, the Company has maintained a proud position in the van of British railway development and operation. To-day the name is different but British Railways (Western Division) has lost none of the magic of its earlier name, and its great record continues to be upheld in every field of railway endeavour.



were made for leasing the Bristol and Exeter and the Swindon and Cheltenham Railways, and it became necessary to furnish large works for the repair, etc., of our stock. I was called upon to report on the best situation to build these works, and on full consideration I reported in favour of Swindon, it being the junction with the Cheltenham branch and also a convenient division of the Great Western line for the engine working. Mr. Brunel and I went to look at the ground, then only green fields and he agreed with me as to its being the best place."

This recommendation of the locomotive Superintendent was endorsed by the Directors, who on February 25th, 1841, authorised the construction of such a depot at Swindon in the following words:

"Decide to provide an engine establishment at Swindon commensurate with the wants of the Company, where a change of engines may be advantageously made and the trains stopped



The Locomotive and Carriage and Wagon Works at Swindon are second to none. Their great tradition is the basis for continuous reassessment and improvement to maintain their lead in changing modern conditions.

It is not surprising that the Engineers at Swindon have given a great deal of attention to the handling of



materials throughout the vast works, since few industrial changes have taken place in recent years so rapidly as those of materials handling techniques and facilities.

THE TASK

Unlike many establishments where standardisation of product simplifies the problem, the construction of locomotives and rolling stock involves the handling and storage of an enormous variety of shapes and sizes, weights and types of material. It was apparent that large-scale improvements in handling methods were necessary and the task was recognised as being one of considerable magnitude. The degree of necessity for improvement and an accurate assessment of the extent of the problem were not known.

The approach to the problem was typical of the efficiency that one expects of the Swindon Works, and the first stage was to determine the necessity and the extent. An analysis of overhead costs revealed that the movement of materials throughout the works accounted for a good proportion of the total costs. This figure was substantiated by further analysis of the overhead costs of one large Shop. The cost of crane facilities was not included.

Having thus proved the financial necessity for improvements there remained the extent of the problems yet to be ascertained. A complete survey of all handling throughout the Swindon Works was then undertaken, in order to provide answers to a number of questions. How much material is moved? How is it moved? In what quantities is it handled? Over what distance is it moved?

A census was made of all movements of material throughout the works for a period of two full weeks



(excluding Sundays), and the following information was obtained for every movement:

- (i) Despatch Point. } Any one of 269 possible
- (ii) Destination. } situations.
- (iii) Nature of material (solid or liquid, wood or metal, glass, etc.).
- (iv) Process stage of material (whether raw, part finished, finished or scrap).
- (v) Size of unit of material.
- (vi) Weight of unit of material.
- (vii) Shape of unit of material
- (viii) Characteristics of material (whether fragile, robust or intermediate).
- (ix) Type of transport (by hand or vehicle, hand-operated or power driven).
- (x) Method of loading vehicles for transport.
- (xi) Weight of load and whether complete or part-load.

A five-figure code was devised to give all necessary information concerning size, nature, etc., of the material. Other necessary information was similarly coded.

The mass of information thus obtained was recorded on punch-cards and tabulated by machine. The master-set of cards could now be used to give a complete and detailed analysis of the problem. Any particular item of information relating to the material or movement could be readily extracted, summed and related to any other factor. For instance, it now became possible to determine how many fragile parts of a certain size and shape are conveyed by any particular means of transport between any two points

in the works, and by what means they were loaded and unloaded.

It was found that over 44% of all material was moved by hand; that overhead cranes handled 13%; that 10% was handled by mobile crane and 2% by chain blocks.

Of the various types of transport in use, 60% of all material was moved by rail vehicle, and 25% by road trailer. It was also found that, on a basis of vehicle usage, road trailers had a "usage" figure of 42% compared with 9% for rail vehicles.

It was thus observed that handling by hand was largely accounted for by the loading and unloading of trailers.

The average weight of a load was found to be 0.85 tons and the average daily tonnage moved was almost 2,000 tons.

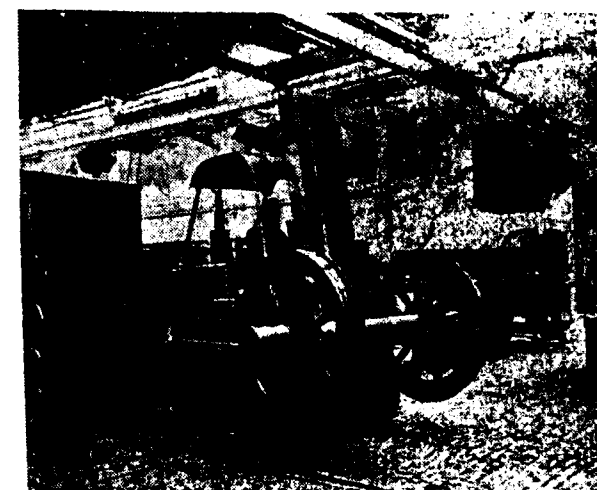
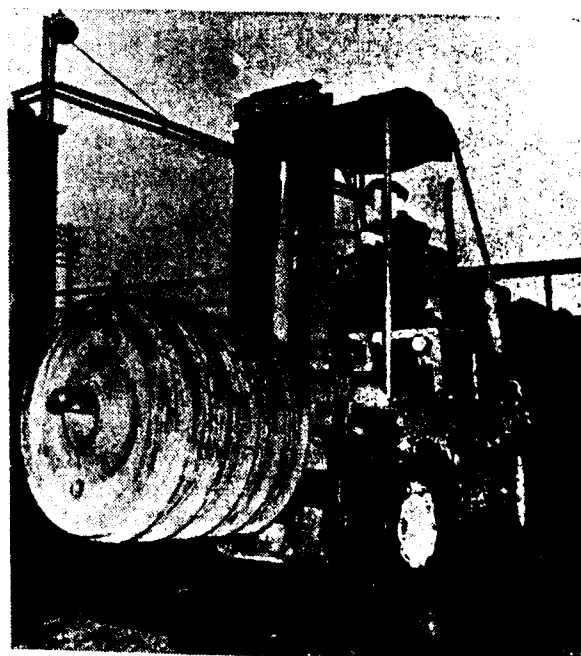
These facts alone substantiated the evidence of the overheads analysis that there was a necessity for improvement. Furthermore, they clearly indicated the extent of the problem and the scope for improvement. They were also to form the basis on which to develop an overall scheme for a revised mechanical handling development programme.

Even at the first brief assessment of the census certain undesirable features became apparent. Internal movement of material by railway rolling stock is slower, and less flexible than by tractor and trailer. It is also more costly, even in a railway works. There are a large number of cases, of course, where the nature and size of the material necessitates the use of rail vehicles, but it has been estimated that, at Swindon, the introduction of additional trailers and reduction in internal rail traffic would present considerable economies.

However, the census also revealed that the use of trailers involves greater use of manual labour for loading and unloading. The reduction of manual labour was, therefore, indicated as a major source of savings.

THE MEANS

The next stage was to decide upon the type of equipment whereby to effect optimum savings, and to consider any re-organisation of form or size of load which the introduction of such equipment would require.



Three main basic handling techniques were extensively examined :

- (i) Overhead equipment.
- (ii) Conveyors.
- (iii) Mobile vehicles.

There are a number of instances where either technique is the sole answer to a particular problem, or where none has any great advantage over the others. Generally, however, the latter is more flexible. The census showed very clearly that flexibility and universality must be major factors in any decision with regard to equipment in the Swindon Works. On the other hand, maximum standardisation is very desirable in any organisation. Flexibility with

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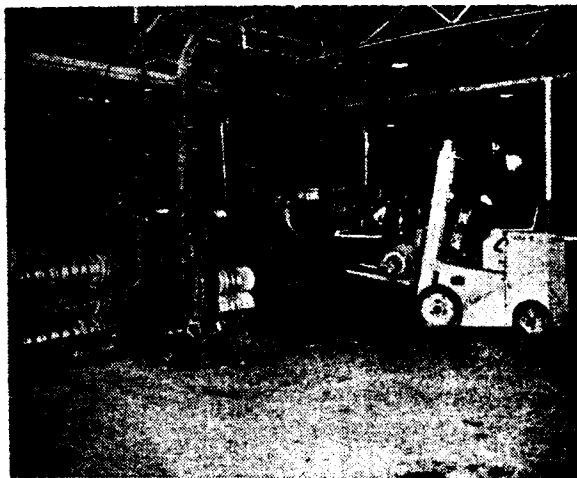
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standardisation were considered to be the basic requirements of the new handling system. The fork lift truck was recognised as the type of equipment best suited to these requirements. Most of the general handling applications could be dealt with by an orthodox machine, and a standard machine could be fitted with standard attachments to accommodate particular requirements.

Also in the category of mobile vehicles are special types such as straddle-carriers, side-loaders and reach-trucks.

It was decided that the fork lift truck and pallets would be the basis of the new handling system at Swindon.

The next stage was the operation of one or more pilot test schemes.

Two "Conveyancer" fork lift trucks, an E2/20 and an E3/20 and a number of pallets were introduced into "AM" Shop. A large number of items are handled in unit pallet-loads in this shop, and whenever

possible, material is delivered to the shop and despatched from the shop in this form. Swarf is also handled in pallets.

A "Conveyancer" E3/20 was installed in the Rolling Mill for handling heavy billets.

Two E2/20 trucks have subsequently been introduced into "R" Machine Shop. Here, on account of space-restrictions and narrow gangways, a highly manoeuvrable truck and small-size pallets were necessary.

The results have been readily apparent and are of considerable gratification even to those, who, by such careful planning, ensured the success of the scheme from the start.

Savings of about 15% on original materials handling overheads costs have already been attained in both Locomotive and Carriage & Wagon Departments.

The system is proving itself to be the answer to the problem. Large-scale expansion of the system is now envisaged, and it is planned that, eventually, all departments in the Works will be linked by an integrated pallet-trailer and tractor transport service. The trailers will be loaded and off-loaded by fork lift truck, and the bulk of internal shop handling will also be performed by fork lift truck. Manual handling will be largely eliminated and movement by railway wagon will be restricted to very large and bulky material for which it is best suited.

A great deal yet remains to be done. It might even be true to say that a mechanical handling system is never so perfect that it cannot be further improved. But the foundations of a sound system have been well and truly laid in the Swindon Works, and we of Conveyancer are proud to have had Swindon engineers place such faith in our products.

ELECTRIC & DIESEL LOCOMOTIVE MANUFACTURE IN INDIA

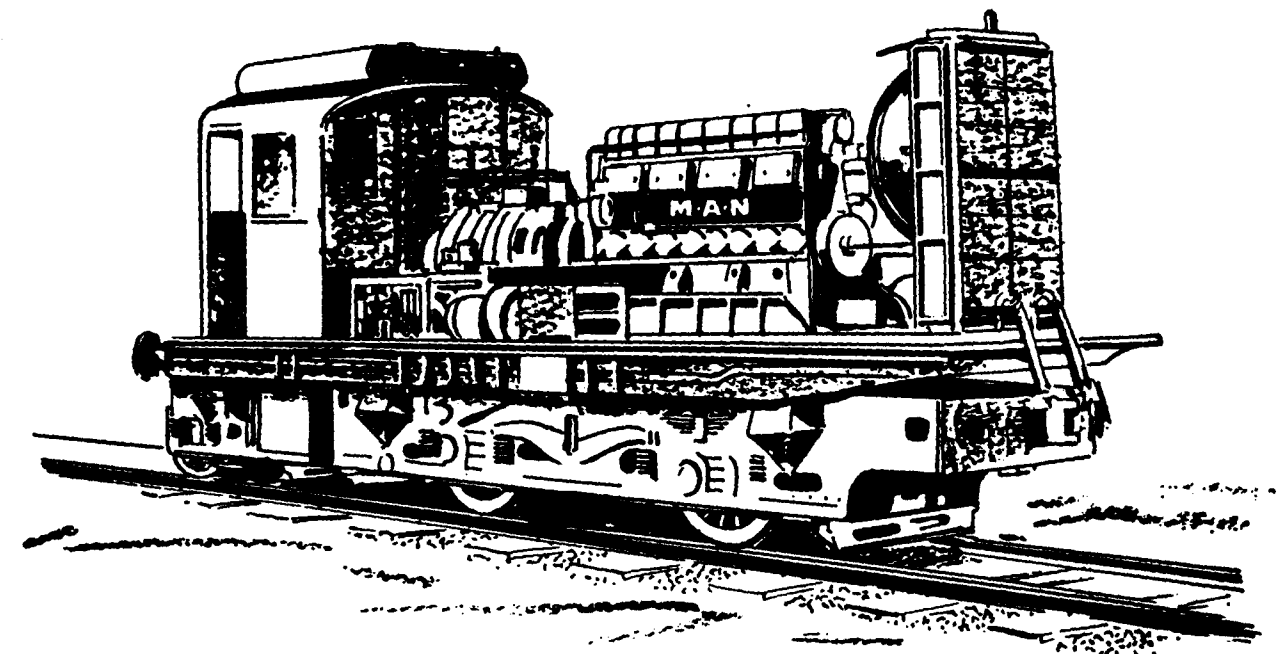
Proposals for the progressive manufacture in the country of the mechanical components of electric locomotives starting with the assembly of knocked-down locomotives have been sought from the manufacturers who supply electric locomotives on the Eastern and South Eastern Railways. This was stated by the Railway Minister, Shri Jagjivan Ram in the Lok Sabha.

He said that the electric components for the indigenously manufactured electric locomotives may have to be imported in the initial stages, until these can be supplied by the Heavy Electricals Plant, Bhopal.

The development of indigenous capacity for the manufacture of diesel locomotives has also been taken up, he said.

Dealing with the progress made towards the objective of self-sufficiency in the manufacture of steam locomotives, carriages, underframes and wagons, the Minister disclosed that during the budget year, out of a total provision of about Rs. 80 crores for rolling stock, about Rs. 68 crores would be spent in the country and only about Rs. 12 crores (including sea freight) on imports.

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Bombay Port Trust	11 engines
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Production Planning and Control in Integral Coach Factory

By Sri D. R. R. Sastri

Production Engineer, Integral Coach Factory, Madras.

A study of the growth of industry will show that in the past several factories were managed by a single person who was the Salesman, the Director, the Planner and the Executive all combined in one. Then came the stage when a body of men undertook the various functions separately, but till quite recently a system was being followed where orders for manufacture were issued to workshops and the complete execution left to the shop foreman. With further growth of Industry the foreman was called upon to perform multifarious duties and it was at this stage that a separate production Planning and Control Organisation was set up to assist the foreman in the execution of the work. This Production Planning and Control Organisation is now recognised as one of the main sections of the Management for ensuring economic and efficient production.

In a commercial firm, the Production Office receives the orders for the work to be undertaken from the Sales department, and in the case of I. C. F. similar orders are received from the Railway Board. In both cases, however, the transactions are almost identical since the I. C. F. supplies passenger coaches to the open railways on a payment basis.

The function of the Production Control organisation is similar to that of the nervous system of the body. Just as impulses of the nervous system are co-ordinated with the useful physical movements for obtaining the desired activity, so also should a continuous and complex stream of impulses (directions) be given by the Production Control Office to the workshops to achieve complete and co-ordinated working. For achieving this, the Production Office is divided broadly into the Production Planning Section and the Production Control section.

PRODUCTION PLANNING

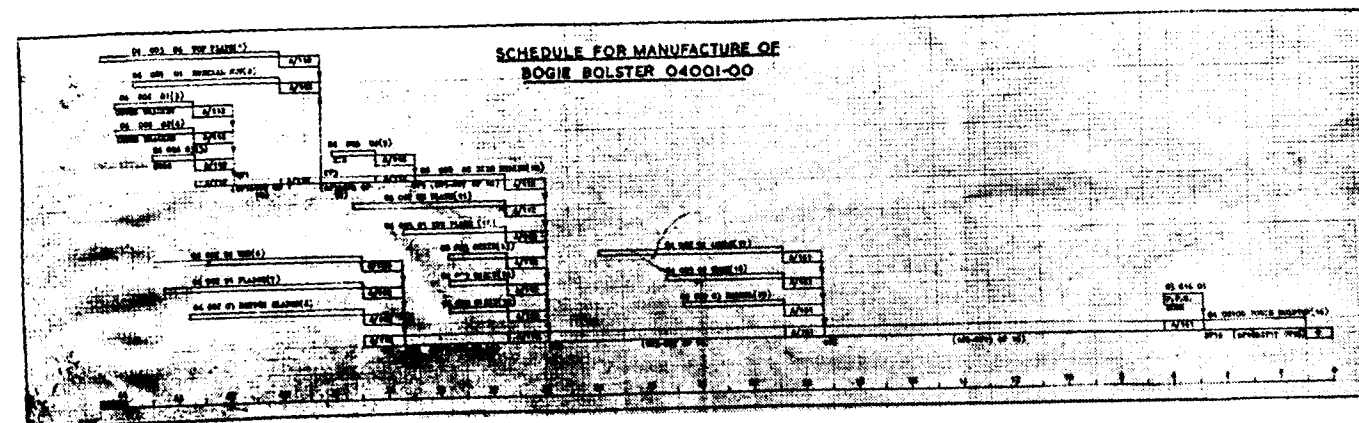
The production of jobs in a factory can be compared to rail road working, where several trains are running on pre-determined routes at laid down schedules. Separate time tables are drawn up for mails, passengers or goods and not only are the number of stops en route different for each train but also the period of

stoppage at each station varies considerably. The object in rail road control is to pass over the available track the maximum transport that it can carry within the safety limits. Exactly similar to this is the function of management in a factory i. e. it ensures that the maximum amount of work is processed through the available plant and machinery within the regulations and limits of safety. In assisting the management to achieve this objective, Production Planning plays an important role; it having been decided by the management as to WHAT to produce, the Production Planning decides on HOW, WHERE and WHEN to produce the job. It is remembered that the results can be no better than as planned.

The Production Planning is sub-divided into other sub-sections viz. the Processes and Estimate Section the Scheduling Section and the Machine loading Section.

The Processes Section decides as to how and where to manufacture the job. For this in the I. C. F., the coach is broken down into details which are classified under groups and sub-groups, for example the bogie is classified as Group-0, under which sub-groups 01—represents axles, wheels, axle-box guides and springs; 02—represents roller bearings with axle-box including covers etc. On the basis of this classification a list of all details required to be manufactured for coach construction is drawn up and is referred to as the List of Parts. For each such item, the method of manufacture is planned and is entered on a Scroll Sheet.

Again for indicating as to where to do the job the factory is divided into shops and sections each shop and section bearing a distinctive number. The plant and machinery in the factory is also divided into loadcentres, each loadcentre representing a distinctive machine or group of machines with a particular capacity. Thus for indicating as to where the job is to be done the loadcentre and the shop section no. is also shown on the Scroll Sheet. Therefore by following the instructions contained in the Scroll Sheet each and every part required for the coach is manufactured in the proper manner and at the proper place and the



assembly completed according to the assembly scroll sheet.

The final delivery is also indicated on the Scroll itself i. e. whether the material should be delivered to another shop or section (in which case the shop or section No. is entered on the scroll.) or to stores. Here again therefore the stores is classified as the General Stores, Custody Stores, the finished parts Stores and the Progress Stores.

The estimating section which is a part of the Processes

Section estimates the cost of works to be undertaken for outside bodies and also works out costs of items required for coach production so as to enable a decision being taken as to whether the item should be manufactured in shops or purchased from trade.

The Scheduling section finally decides as to when to do the job. For this purpose a Master Production Schedule as shown here is drawn up. The schedule shows the date on which each batch order is to be released and completed, the period for which the

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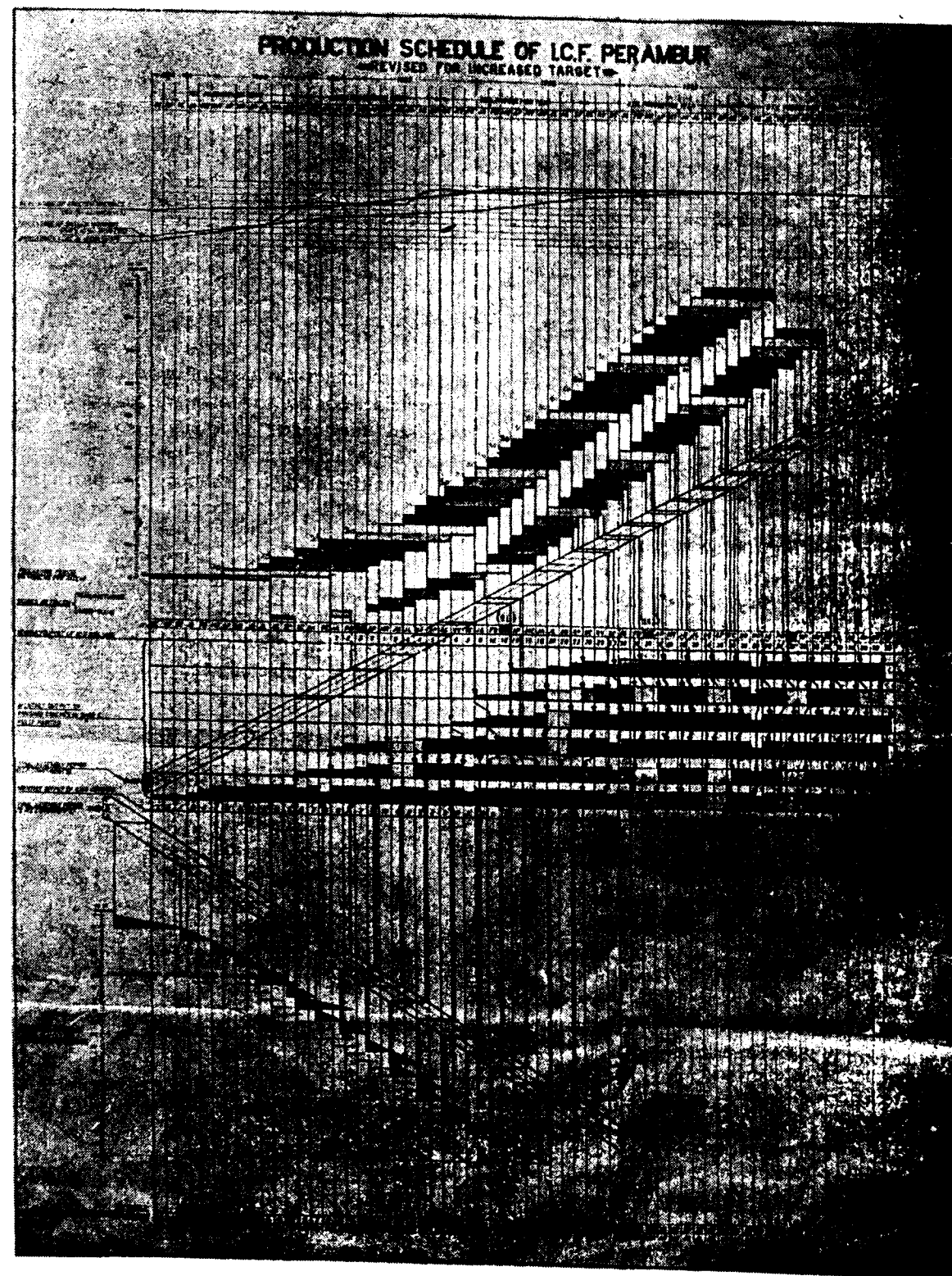


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materials will be in storage and finally the programme of assembly of coaches. The dates on which the various coaches are expected to be turned out of the I.C.F. can therefore be read off directly from the chart.

This chart after receiving administrative approval,

is taken as the basis for detail scheduling. There the schedule is worked backwards from the date the coach is to be turned out to the date where each detail has to be separately taken in hand for manufacture. A sample chart as to how this is done is also shown below. It will be noticed that the period of manu-

facture has been divided into units, this having been done for the convenience of calculations.

The above mentioned work of the Planning Section virtually completes all that is required to be done in the planning stage, but an important part is also played by the machine loading section, which advises, the Processes section as to which loadcentres will be overloaded, according to which the process may have to be at times, altered. If such a course is not possible, greater utilisation of the machinery has to be called for by working it beyond the normal hours of single shift working.

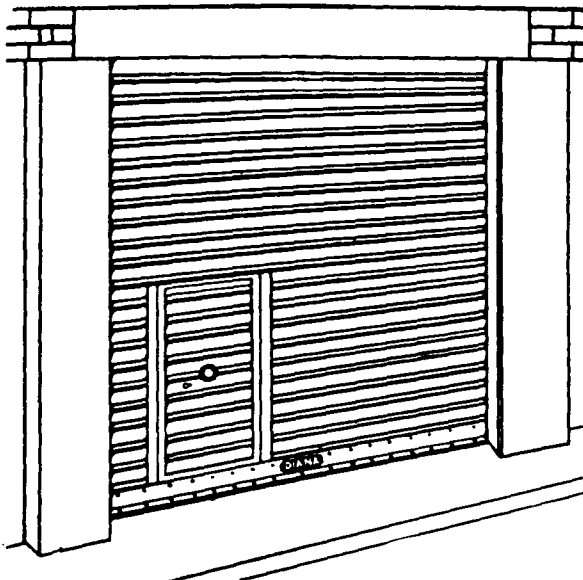
PRODUCTION CONTROL

This section is considered to be essentially a Service department to the shops and it watches the progress of each work order from the time it is issued to the time of completion. It highlights the delays and assists the shops in ironing out difficulties with the primary object of ensuring that the planned schedule is followed.

The Production Control is divided into the despatch

section and the follow-up section. The despatch section releases work orders as per the pre-determined schedule and in accordance with the work order system laid down in the I. C. F. As per this system, Standing Work Orders are assigned to different repetitive works, for example, Standing Work Order 32 is meant for the manufacture of Third Class shells, Standing Work Order 33 for the manufacture of TLR shells etc. This Standing Work Order Number is followed by a three digit number which indicates the batch order. Each batch order comprises of one month's out-turn of shells and each such batch order is required to be completed within the period as given on the Master Production Schedule. The despatch section therefore issues, for the manufacture of each detail, a route card which is a reproduction of the scroll sheet, job-cards for booking of labour and material requisitions for the drawal of the correct material and to the correct quantity.

From the time the work order is thus released the follow-up section keeps a watchful eye on it and by means of documents maintained in the production office follows the progress of each job. Weekly state-



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ments of items that are likely to run behind schedule are made out and handed to the shop foreman for giving special attention. Special watch is also kept on movement of materials between one manufacturing section and another and in all cases it is endeavoured to point out delays that are likely to occur in advance so that preventive action could be taken instead of pointing out the delays after they have actually occurred. Staff of the follow-up section are therefore in constant touch with the shops and help shop foreman to take prompt remedial action. Fortnightly meetings at which shop foremen are present are also held to discuss the difficulties and find solutions.

The Production Control therefore plays an important roll in stimulating activity where necessary in the workshops so that the planned schedule could be worked to.

OTHER CONTROLS

The Production department also assists the Works and other departments in maintaining the following important controls.

(a) Machinery Idle Time

Production Office issues blank idle time cards (for each machinery and plant on the shop floor) and on each occasion when the machinery or plant is enforced to idle, the card is clocked on and the reason for idle time is assigned by the Section Chargeman. The Production office and the Works together strive to keep this idle time to a minimum. Machinery breakdowns are also kept to a minimum by following the Preventive Maintenance Schedule.

(b) Labour Utilisation

Man hours spent per batch order are watched as each batch order is closed and increases if any from one batch to another are investigated and where avoidable leakages are discovered, suitable action is taken.

Idle time for labour is also recorded in the same way as for machinery and is carefully kept to a minimum.

THE VICE PRESIDENT ARRIVES IN BOMBAY

The Vice-President of India arrived in Bombay from Jalgaon on the morning of Sunday 22nd March, 1959 in a special carriage attached to the Pathankot Express. He was received at the Victoria Terminus station by the Managing Committee of the Indian and Eastern Engineer over whose Centenary celebrations Dr. Radhakrishnan presided. Shri D. P. Mathur, Senior Deputy General Manager, Shri P. B. Aibara, Divisional Superintendent, Bombay and Shri B. Natarajan, Public Relations Officer were among those who received the Vice-President.

(c) Materials Control

The Production Office is closely associated in controlling the procurement and utilisation of materials. A schedule is drawn out in consultation with the Stores department for the procurement of raw materials and in making issues to shops the requirements of each item are carefully worked out. Likely hold-ups that may occur for want of materials are also forecast and periodical meetings held with stores representatives to find means of obtaining the materials in time.

(d) Cost Control

The Production Office also assists the Cost Accounting department in compiling the costs by issuing completion certificates at the end of each batch order certifying the return of all production documents to the Costing department and making a review of all released materials. A system of cost code numbering viz. No. 3 for detail manufacture, No. 2 for sub-assemblies, No. 1 for major assemblies and No. 0 for installation, is also adopted, which in combination with the group and sub-group numbers of the coach form the Cost Control No., by means of which the cost of any detail or assembly can be extracted.

(e) Overheads

The Production Office also keeps a watchful eye on overheads which are made up of constant and variable factors. The attention of Works Managers is drawn in case a rise is noticed in any of the variable factors.

Improvements in the methods of manufacture, and ways and means of reducing both materials and man-hours are also constantly under review. A Time Study Section attached to the Production Office is fixing operational times on a scientific basis with the object of introducing an Incentive System of payment. Also Suggestions received from staff are closely studied and wherever economies are expected the suggestions are accepted and adopted.

Through the various above mentioned functions the Production Office helps the administration of this factory to produce more coaches with increasing efficiency and decreasing costs.—Courtesy: The Indian Railway Engineer, Bombay.

At the Perambur "Integral Coach Factory"

Contributed by Helmut Jauslin, Neue Zürcher Zeitung Engineering and Industrial Editor

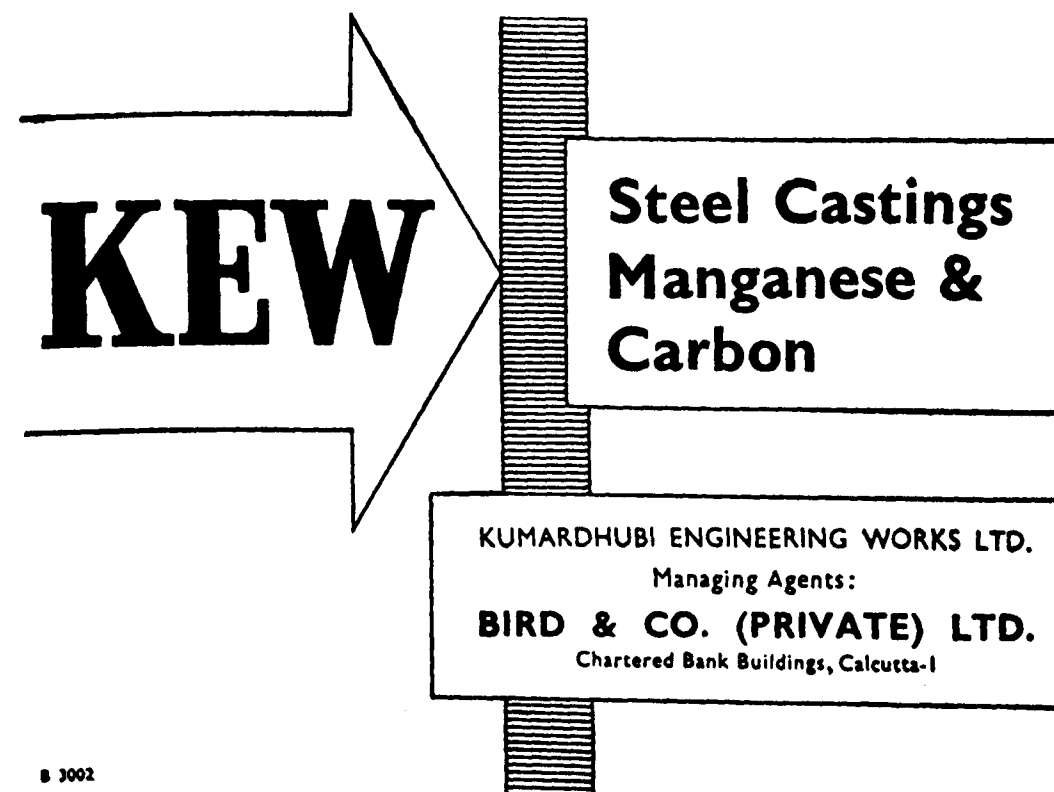
MADRAS—the third largest city in India with a total population of one and a half million inhabitants—is situated far in the south of the Coromandel Coast. The sea and the beach give this city its character while the center of the town reflects the typical Indian life in shining colors. The technological evolution of the past few centuries—from the rikshaw coolie bathed in perspiration to the modern air-conditioned car—mingles idyllically with the daily life of cows, donkeys, goats and dogs. Naturally, Madras also possesses a "Main Street," which is called Mountroad, and the bazaars on this road have the same fascinating effect on the passer-by as the well-lit shop windows have in America and Europe.

The harbor, from which the heavy traffic in the streets results, creates an intense and active life in Madras. The same also applies to Perambur, situated

on the outskirts of Madras. The increase in railway traffic is mainly responsible for the development of Perambur. Locomotive and carriage repair shops have been working there for years, and now the latest project—the Integral Coach Factory (I. C. F.)—is being completed. This new coach factory, which represents an important milestone in the industrialization of India, is based on the decade-old experience of Swiss engineering knowledge and especially on the good co-operation between the Swiss team delegated to Perambur and the Indian staff.

A PROJECT REALIZED WITH SWISS CO-OPERATION

This project materialized as a result of many factors. In the early Thirties already the Swiss Car and Elevator Manufacturing Corp. Ltd., Schlieren-Zurich, in conjunction with the Swiss Federal Rail-



ways, developed a light-weight steel coach. This prototype was put into service as a trial coach as far back as 1933. It was the first time in the construction of railway coaches that the sidewalls and the roof were also used as carrying parts, resulting in a saving of as much as 30 per cent on the coach's weight. The progress in welding techniques brought further advantages in respect to the designing and the manufacturing of light-weight steel coaches. The satisfactory experience made with the new type of coaches aroused the interest of foreign companies and in 1949 resulted in the conclusion of an agreement between the Government of India Ministry of Railways, and the Swiss Car and Elevator Manufacturing Corporation Ltd., Schlieren-Zurich. The main object of this agreement was the construction of a new coach-building factory in Perambur, India, for the manufacture of modern light-weight steel coaches for broad gauge, similar to those of the Swiss Federal Railways. To introduce these coaches as quickly as possible on the Indian Railways, Schlieren, to begin with, received orders to supply complete coach bodies and later on knocked-down coaches together with jigs, fixtures and other equipment for the new factory.

The entire civil engineering work of the project was entrusted to an Indian civil engineer who proved fully capable of solving this great task. The work on the site was started in September, 1952. Thousands of Indian workmen have since then been engaged under the guidance of an engineer-in-chief, and already in May, 1953, it was possible to erect the first steel structures of the workshops. Due to the subtropical climate of Madras, the roofs of the workshops had to be provided with asbestos sheeting combined with glass louvers toward the north. Furthermore, big louvers were used on the top part of the side walls for increased ventilation. In January, 1955, the first workshop was completed and immediately afterwards the installation of the machinery and workshop equipment begun. In close continuation and according to a well calculated time-table insuring co-ordination between the Civil Engineering and the Mechanical and Electrical Department the rest of the workshop was set up and production started.

Simultaneously with the civil engineering work the technical training of the staff had to be started. The manufacture of light-weight steel coaches requires a thorough knowledge of modern welding techniques and up-to-date production methods. In March, 1954—one and a half years ahead of the production

start—the Technical Training School attached to the I. C. F. was inaugurated. In this school qualified boys between the ages of 18 and 26 years are recruited as apprentices and given an intensive six months' basic training under the supervision of four Swiss instructors. According to the experience so far gained, this relatively short training period seems fully sufficient to provide elementary knowledge for the different trades and to prepare the apprentices for their work in the shops.

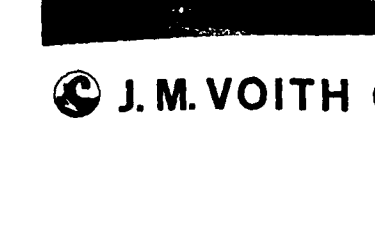
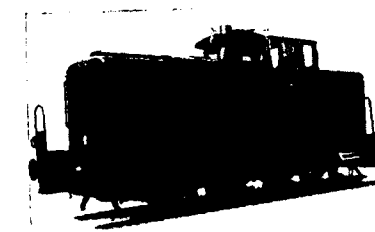
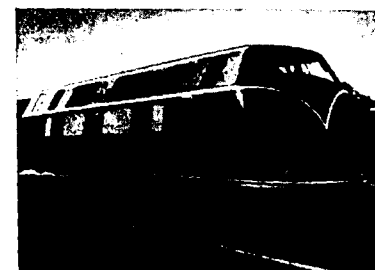
In addition to these six-month training courses, in which an average of 200 apprentices is being trained at a time, 80 Indian engineers and specialists were delegated to the workshops of the Swiss Car and Elevator Manufacturing Corporation Ltd., Schlieren-Zurich in 1954 and 1955. These engineers and



Fig. 1 Aerial view of the I.C.F. looking north.

experts received a special training in the manufacture of light-weight steel coaches. Furthermore, a "Schlieren team" of 40 specialists was sent to Perambur for a contract period of three years. The installation of the machinery in the different workshops of the I. C. F. was carried out in close co-operation between the Indian engineers and workers and the Schlieren team. This team also introduced its indian colleagues to the new production methods, modern machine tools and the new welding technique, as well as the sheet metal treatment. The majority of the team will return to Switzerland in the course of 1958.

October 2, 1955—the birthday anniversary of Mahatma Gandhi—marked the production start of the I. C. F. On this important day, the Prime Minister of India, Mr. Jawaharlal Nehru, inaugurated the first light-weight steel coach assembled in the I. C. F. from sub-assemblies delivered by Schlieren.



VOITH

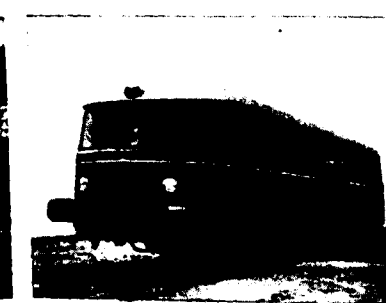
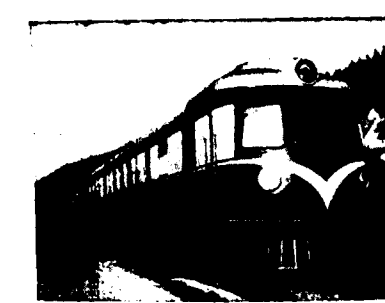
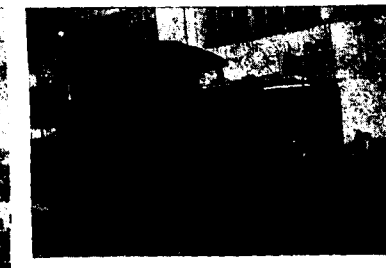
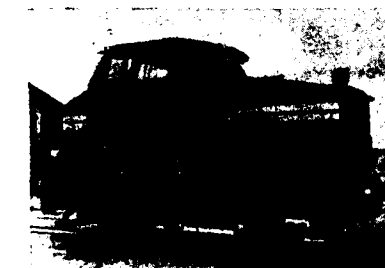
HYDRODYNAMIC POWER TRANSMISSIONS for diesel rail vehicles of every capacity

To this day, we have supplied or on order more than 7,500 fully hydraulic VOITH TURBO TRANSMISSIONS with an aggregate output of about 2.7 million h.p. This is convincing evidence of the popularity of our power transmissions in railcars and diesel locomotives applications. They have been fitted in the diesel locomotives Köf, V60, V100, V200 and in the railcars VT 08, VT 12 of the German Federal Railway and numerous other railroad companies and industrial users, both abroad and in Germany.

The accompanying photos (left and bottom centre) show diesel rail vehicles equipped with VOITH TURBO TRANSMISSIONS of most varied capacity.

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The factory is designed to produce 350 coaches per year and when this target is achieved in 1959, a rail coach will leave the work every 6 hours. An elaborate material handling and transport system has been an important factor in the planning of the I. C. F. In adaptation to this factor as well as to the average daily temperature of 30 to 37° C., the dimensions of the different workshops have been reduced and as a result the layout consists of seven workshops and three warehouses.

The thin and medium steel sheets, which are the main raw material used for building the light-weight steel coaches, are stored on the western side of the factory area. The main production flow, therefore, goes from west to east through the sheet-metal shop, and from there the material moves as a sub-assembly or detail into the big assembly shop. It is then distributed to six parallel body assembly lines where the raw body shells are assembled in eight stages. The raw body shells are then moved on special trollies from the assembly shop via a traverser to the paint and finishing shop located further eastwards. The body shells are cleaned by passing through a grit-blasting plant and in continuation through another number of stations in a one-and-a-half-day rhythm. At these stations they are being painted and sprayed with asbestos and fitted with the doors, windows, draw and buffer gears and the brake equipment. The detail parts used for the assembly in this finishing

shop are manufactured in the machine shop, the wheel shop, the forge and the smithy shop. Doors and windows arrive in large batches from the manufacturing belts located in a separate shop.

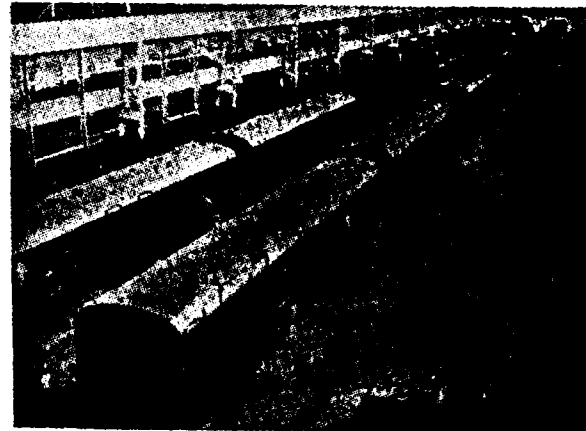


Fig. 2 Large assembly shop, showing 3 out of the 6 assembly lines. In the foreground the finishing touches are being applied to a coach shell.

A separate workshop, containing the millwright section and the tool and die room is attached to the factory, because in industrially underdeveloped countries it is of the utmost importance that repairs can be carried out at the factory itself.

Statement about "The Indian Railways Workshop Magazine" under Rule 8 of the Registration of Newspapers (Central) Rules 1956

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| 6. Names and address of individuals who own the newspaper and partners or shareholders holding more than 1% of the total capital | T. S. Gopal Row
T. S. Krishna Rao
T. S. Sundar Rao (alias Sundaram) |

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.

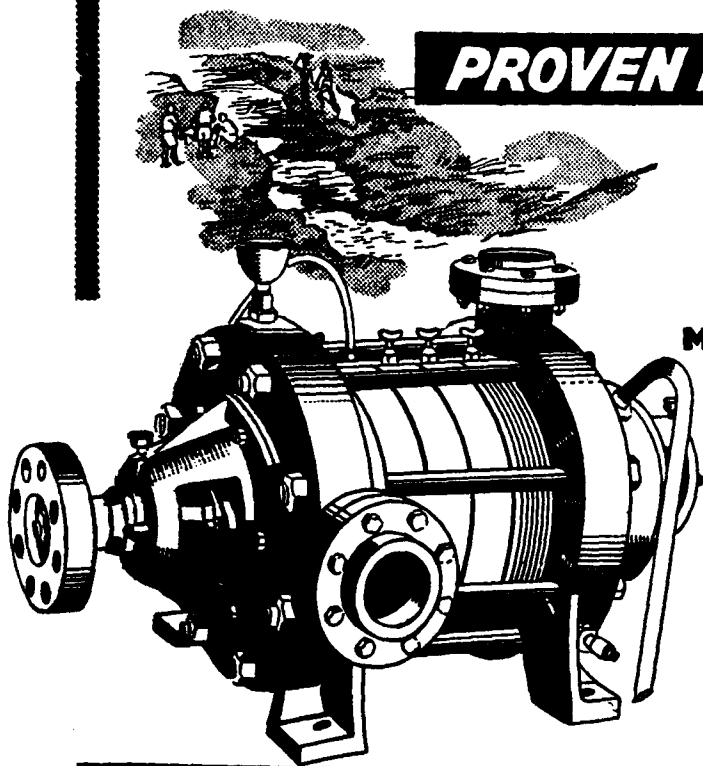
All the raw materials for the buildings, roads, drainage and the steel structure for the workshops have been obtained in India. Part of the raw materials for the manufacture of light-weight steel coaches, however, must still be imported because due to a numerous other projects of the second five-year plan, the steel requirements far exceed the production capacity of the country. It is, however, possible that in the course of time the light-weight steel coaches will be manufactured entirely from indigenous material and an increase of production is even contemplated for the I. C. F. The past two production years have shown great progress, inasmuch as 43 coaches were delivered during the first year instead of the 20 coaches scheduled and a total of 150 coaches were manufactured, instead of 100 during the second year which terminated on October 1, 1957.

Out of these 150 coaches 63 were "made in India" completely.

The success of this project, which was realised at a total cost of 66 million Swiss francs has been greatly appreciated by the Indian Government. The I. C. F. has, therefore, been held up as an example of good international co-operation, in which the planning of all details and the technical support given by the Swiss Car and Elevator Manufacturing Corp. Ltd., as consulting engineers was not forgotten. The I. C. F. is, of course, only one of many projects undertaken by the Government of India to raise the country's standard of living, but we are happy to note the contribution made by a Swiss firm in this particular case.—Courtesy: The Indian Railway Engineer, Bombay.

STEEL PLANTS IN PUBLIC SECTOR

The total estimated expenditure on the steel plants in the public sector, including coal washeries and the fourth steel plant during 1959-60 is expected to be of the order of Rs. 122 crores, it is learnt. The project-wise break-up of the same is expected to be Rourkela Rs. 38.50 crores, Bhilai Rs. 42.71 crores, Durgapur Rs. 37.80 crores, Coal Washeries Rs. 2.93 crores and fourth steel plant Rs. 0.06 crores. All the departments of the Rourkela Steel Plant are expected to be completed by 1961. According to the detailed project report furnished by the Soviet experts the Bhilai Steel Plant will be complete in all respects in 1960. The final date by which the entire plant of Durgapur is expected to be completed in July, 1961.



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High-Speed Production of Non-Ferrous Components

Improvements in design of the Herbert No. 2 Flashcap Lathe to widen its field of application

THE Herbert No. 2 Flashcap Lathe has all the features essential to high production of brass and other non-ferrous components having internal or external threads, or both, necessitating frequent spindle reversals at high speeds. Its performance in the brass industry on work requiring up to six operations, in batches from 100 to continuous production with the same tooling set-up, has been outstanding as is evidenced by the hundreds of machines now in use. Greater accuracy and faster machining cycles are being obtained on work which had, prior to the installation of the Herbert Flashcap Lathe, been done in seconds.

A specially-designed motor control gear provided for instantaneous starting, stopping and reversing by a fluted handwheel and knob on the headstock and, in addition, automatic reverse and change to forward effected by movement of the capstan slide, when required. This automatic change of the direction of spindle rotation is effected by push rods: a rod can be mounted above each face of the turret to actuate the spring-loaded plunger in the headstock to operate the motor switch. Thirty reversals per minute with the spindle running at 1,240 r. p. m. are permissible.

To widen even further the field of application of the Herbert No. 2 Flashcap, the lathe can now be fitted with :—

- Bar feeding arrangement with mechanism for automatic opening and closing of a dead-length bar chuck.
- Air-operated indexing two-jaw chuck that can be indexed without stopping the spindle.
- Automatic stopping of the spindle after completion of the cycle of operations.

Most components produced on the Herbert No. 2 Flashcap Lathe are machined from hot brass pressings. Rough work material of this nature can be produced to very accurate limits, thereby eliminating a large amount of machining and, being much cleaner, is less destructive to the cutting tools, where homogeneity is

essential for reasons of strength and pressure retention, hot pressings are preferable to castings.

There are, however, numerous simple concentric components which can, if machining capacity is available, be machined from the bar and thus reduce raw material costs. It is to meet this requirement that a bar feeding arrangement with fully-automatic chucking, has been designed for use on the Flashcap.

A standard Herbert weight-operated bar feed unit which accommodates bars up to 8'0" long, is used. The bar is inserted at the front of the swing-forward feed tube. The 1½" capacity chuck is of the air-operated dead-length type which has been mounted with the air cylinder at the rear instead of above the chuck, so that it does not interfere with the standard automatic motor, reversing controls and enables the automatic chuck closing and opening control to be fitted.

The dead-length bar chuck imparts no end movement to the work being gripped when the chuck is closed. It enables the full capacity of the machine spindle to be used as the closing mechanism is self-contained and no chuck tube is required. The chuck will accommodate variations in the diameter of the bar of about 0.003" at a given adjustment.

The automatic chuck opening and closing mechanism incorporates a combined operating lever and dead stop mounted on one face of the capstan photo-

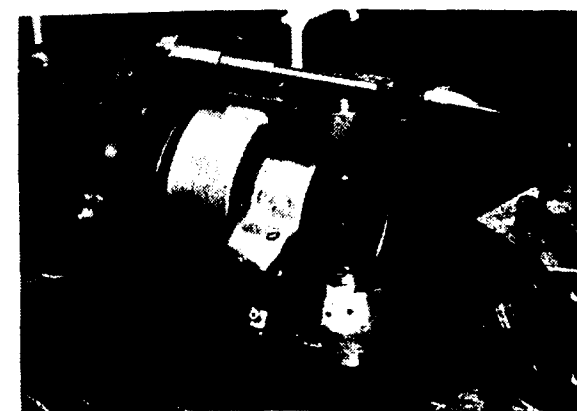


graph F. 20. Forward movement of the capstan slide brings the forward face of the swivelling lever A into contact with the push rod B which, through the air cylinder and yoke, actuates the closing sleeve which opens the chuck. The bar then moves forward under weight control until it contacts the dead stop C. In operation, contact is made during the forward movement of the capstan slide up to the slide stop, at which point the slide is stationary and the forward feed of the bar pushes the dead stop into its supporting bracket, a movement which swivels the lever A to contact the push rod B to operate the chuck closing mechanism. These combined movements can be set to ensure accurate feeding to length. It should also be appreciated that the chuck will remain open unless the feeding of the bar, as pre-set, is to the correct length.

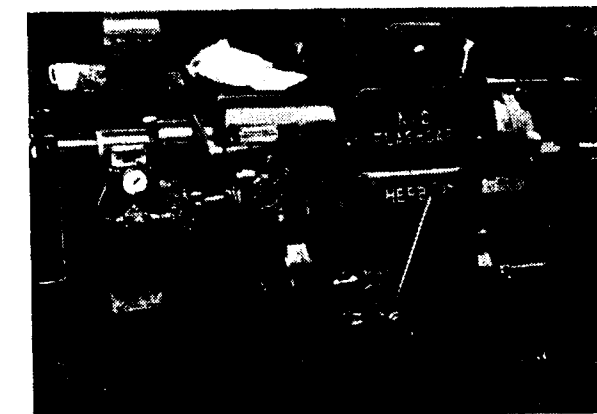
Separate chuck operating controls are also fitted: lever D is for hand-operation when setting-up whilst knob E provides for retaining the chuck in the open position for loading the bar.

Accurate repetition machining to length, essential when tapping blind holes or screwing up to a shoulder, is not affected by the virtually instantaneous reversal of the rotation of the spindle carrying bar stock which varies in weight due to the reduction in the bar length as components are machined.

Flashcap Lathes equipped with bar feeding are supplied with a fixed saddle having either a screw- or lever-operated cross slide, for parting-off or forming.



To reduce chucking times when machining multiple-end components such as elbows, tees and crosses, a new-type air-operated, two-jaw indexing chuck can now be fitted to the Flashcap, see photographs E720/1. Thus, only one chucking is necessary to machine all ends whether of similar or different size or form, and



machining can be continuous without stopping the spindle.

Since the chuck, to be known as the Quadra-chuck, can be indexed through 90° or 180° faster than the hexagon turret, it is advantageous, when all ends of the component require the same operations, to index the chuck and perform all operations with one face of the turret before indexing to the next turret face.

The fact that the capstan slide is withdrawn just sufficiently to clear the work to permit indexing, has a marked effect on the floor-to-floor times.

Closing of the chuck jaws is effected by a lever on the headstock. This lever controls a revolving air cylinder at the rear of the spindle and, through a draw tube and levers, actuates the self-contained hydraulic system in the body of the chuck.

The chuck jaws are mounted on the end of hydraulic cylinder pistons which permit their rotation, in addition to end movement for gripping.

A foot pedal controls the chuck indexing. Pressure on the pedal half indexes the jaws and removal of the foot from the pedal completes the 90° indexing and locking of the jaws. A 180° index is obtained by a double actuation of the foot pedal.

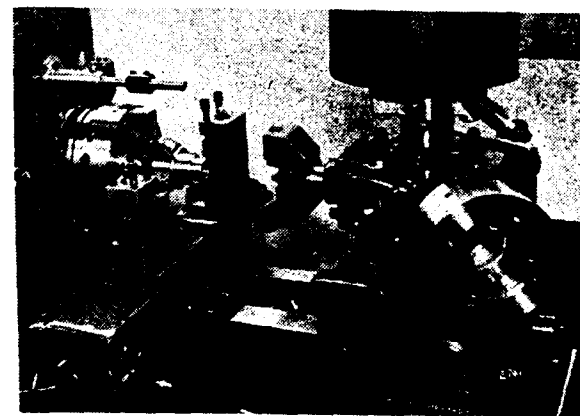
The tenon-located jaw blanks can be machined to suit the workpiece.

The chuck will accommodate work which can be indexed in a radius of 2½": the maximum jaw stroke is 3/8".

High-speed machining can best be maintained on the Herbert No. 2 Flashcap Lathe by the use of end tooling and, although the machine can be supplied,

when required, with a cross slide, cross traverses should be avoided if possible: the same applies to work involving long traverses of the capstan slide, particularly for internal diameters which require machining from the solid.

A great deal of work which is being machined on the Flashcap Lathe today was originally considered unsuitable for the machine, but subsequent machining times amply justified its installation.

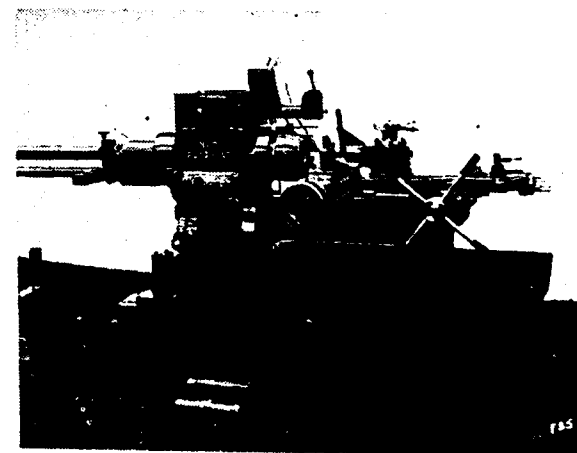


A good example is provided by the machining of the fire hose coupling shown in photographs E 740/1. Machined in two operations, the actual floor-to-floor times of 12 seconds (1st operation) and 25 seconds (2nd operation) are half the estimated times which were considerably less than the times taken with other methods.

This coupling is machined from brass pressings, in the following sequences :—

1st Operation, see E. 740.

- (a) Grip the pressing in a Herbert 6" 3-jaw air-



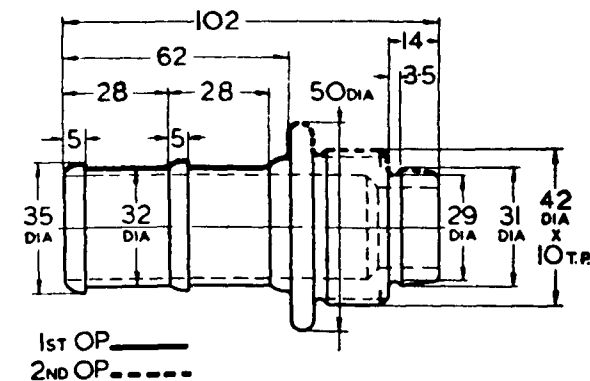
operated chuck, locating the flange against the face of the jaws.

- (b) Support in the bore of the component with a roller mounted on a bar which also carries two cutting tools. All are held in a standard boring bar holder bolted to the 1st face of the turret.
- (c) Form two grooves behind the two 35 mm. diameters with tools held in the toolpost on the front of the cross slide.
- (d) Whilst still supporting the component, a reverse transverse movement of the cross slide locates three cutting tools for profile turning the 32 mm. diameter stem and forming the radii on the stem and flange. Longitudinal movement to the profiling slide is actuated by the cam plate bolted between the boring bar holder and face of the turret. Traverse of the capstan slide pushes the profiling slide to turn the stem and the supporting roller further into the bore of the component until the two tools on the bar radius the end of the stem and chamfer the mouth of the bore.

Machine stops control the transverse movements of the lever-operated cross slide and the longitudinal movement of the capstan slide to ensure accurate repetition machining of diameters and lengths.

2nd Operation, see E. 741.

- (e) Grip the stem of the coupling in a Herbert 6" 3-jaw air-operated chuck. The machined face of the flange is located against the face of the jaws.



DIMENSIONS IN MILLIMETRES

- (f) Simultaneously turn the 42 mm. thread diameter, form the taper, radius the end

and chamfer with the cluster tool holder on one face of the turret.

- (g) Form the radius on the flange and undercut the thread diameter and undercut the thread diameter with the tool held in the rear toolpost on the cross slide.
- (h) Undercut the taper and chamfer the thread diameter from the front toolpost.
- (m) Cut the 42 mm. $\times$ 10 t. p. i. thread with a Herbert $2\frac{1}{2}$ " Solid-adjustable Diehead fitted to the turret. The rotation of the spindle is automatically reversed by the push-rod motor control for withdrawal of the die-head.

CHROME-MOLYBDENUM STEEL BARS AND RODS

An Indian Standard Specification for Chrome-Molybdenum Steel Bars and Rods for Aircraft Purposes (IS : 963-1958) has been issued by the Indian Standards Institution. The chrome molybdenum steel, specified in the standard, finds extensive use in the manufacture of various aircraft parts and components. This steel may be welded but it is not recommended for heavy sections or parts having a wide variation in thickness. The standard prescribes requirements, relating to manufacture, freedom from defects, chemical composition, physical and mechanical properties, rolling tolerances etc.

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HOT-ROLLED CARBON STEEL SHEET AND STRIP

The Indian Standards Institution has published a specification for Light Gauge Structural Quality Hot Rolled Carbon Steel Sheet and Strip (IS : 1079-1958).

The standard prescribes specific requirements, such as chemical composition, mechanical properties and tolerances, for three grades of hot-rolled carbon steel sheet and strip, intended for manufacture of cold formed structural members.

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PHOSPHOR BRONZE INGOTS IN CASTINGS

An Indian Standard Specification for Phosphor

Bronze Ingots and Castings (IS : 28-1958), covering the requirements of a single grade of phosphor bronze ingots and castings, designated as Grade PBz 10, for heavy duty bearings and brushes, has been issued by the Indian Standards Institution.

The standard, which was first issued in 1950 as a tentative standard, has now been revised and issued as a firm standard. The important modifications made in this revision include hardness and fracture test requirements and clauses on sampling. Besides, the chemical composition of the material has also been slightly modified.

This standard is one of a series of Indian Standards on bronze ingots and castings. Other Indian Standard Specifications in the series are :

IS : 305-1952 Aluminium Bronze Ingots and Castings.

IS : 306-1951 Tin Bronze Ingots and Castings. (Tentative)

IS : 318-1952 Leaded Tin Bronze Ingots and Castings (Tentative)

IS : 1028-1956 Silicon Bronze Ingots and Castings.

The first three of these standards are also being revised.

Integral Coach Factory – Furnishing Annexe

By K. M. Aiana

Dy. Chief Mechanical Engineer, (Furnishing) Integral Coach Factory, Perambur, Madras.

HOW THE IDEA OF HAVING A FURNISHING ANNEXE CAME INTO BEING

THE Integral Shells manufactured in the Integral Coach Factory, Perambur, were originally planned to be furnished in the workshops of different Railways. Subsequently, on account of large scale expansions during the Second Five Year Plan period, which steadily increased the holdings of coaching and wagon stock on the Railways, the capacity in the Railway Workshops was required to be utilised for dealing with the increased repair load, and for building certain types of Timber coaches. Consequent to the increased production of shells, the necessity for having a separate unit for furnishing the shells turned out by the Integral Coach Factory, was keenly felt. Moreover, it was considered logically to be most economical to centralise this work and estab-

lish a factory to turn out complete coaches, ready for passenger traffic, in the shortest possible time, by mass production methods, thereby also relieving the zonal Railways of the load of furnishing the coaches themselves.

The Ministry of Railways, therefore, decided to establish a Furnishing Annexe to the existing Integral Coach Factory at Perambur, which would undertake furnishing of all the shells turned out from this Factory, for all the various types and classes of coaches as would be required. Accordingly, the Permanent Furnishing Project was sanctioned in 1956, at a cost of Rs. 3.69 crores. This Unit is being located in close proximity to the Coach Factory connected by rail and situated south of the New Avadi Road, where 260 acres of land have been acquired, for the construction of the factory, sidings, and staff

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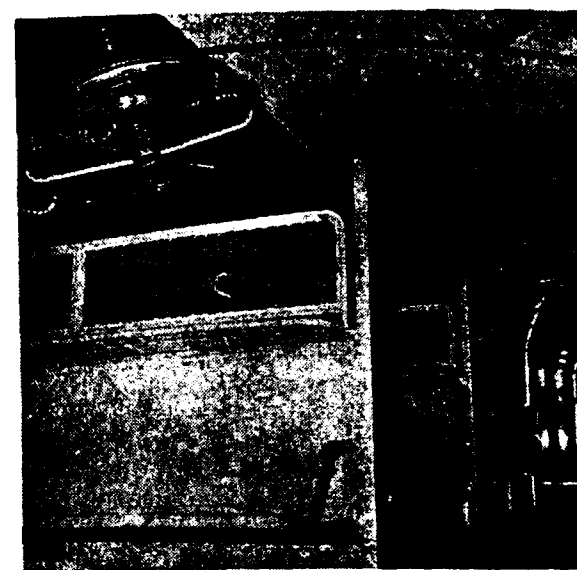
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quarters. The Factory, when completed, will be of a modern design somewhat similar to the existing Coach Factory, and the standards of amenities for good working conditions have been planned on similar lines. It is anticipated that production from this Factory will be in keeping with that of the Integral Coach Factory.

In the first stage, macadam roads, compound walls, storm water drains and temporary construction sheds, in the Factory area, required for the construction organisation, have been completed. A two mile long railway siding from Villivakkam Railway Station and also connecting the Integral Coach Factory, has been laid and is nearing completion. This will enable material and stores for the construction of the workshops being brought to site direct by rail. The construction of 200 Quarters to initially house about 10% of the workers contiguous to the existing colony of the Coach Factory is also in progress.

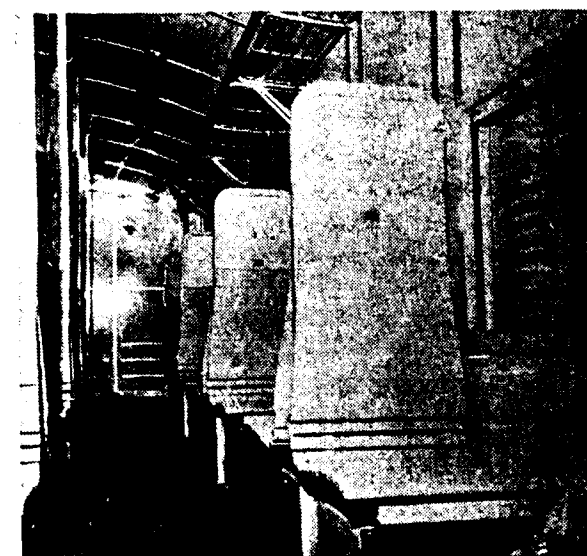


IMMEDIATE FACILITIES FOR FURNISHING COACHES

Pending construction of the permanent Furnishing Factory, it was decided by the Railway Board that the Integral Coach Factory should develop urgently furnishing capacity on a small scale, making use of covered space wherever available, in the existing Shell Factory and by use of temporary facilities. The first third class coach so furnished in the Shell Factory, was turned out and ceremoniously launched by H. E. the Governor of Madras, late Shri A. J. John, on the 21st February 1957.

TEMPORARY FURNISHING ARRANGEMENTS

In order to speed up the production of furnished coaches from the permanent Furnishing Factory, as soon as it is ready, a plan was also devised to com-

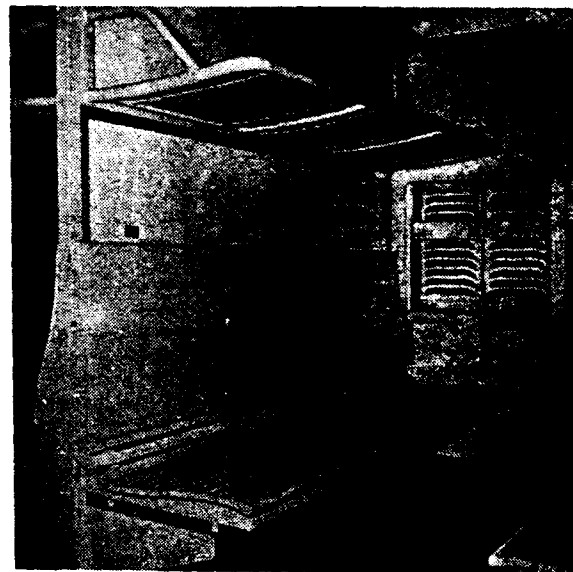


mence furnishing production with some temporary facilities. This was to enable production staff and technique to be built up gradually, while the construction of the permanent Unit is in progress, so that the work will be switched over to the Permanent Unit, so as to attain full production, as soon as it is complete and with the least delay, instead of the production having to be phased over a period of years.

The proposals for the interim Furnishing Arrangements were accepted by the Railway Board and sanctioned and the construction of the Temporary Sheds at the site of the present Temporary furnishing Annexe, situated on the Konnur High Road, was taken in hand early in 1957, utilising some second-hand shedding materials procured from the Avadi Military Base nearby. The construction of these sheds for providing the necessary covered accommodation for the workshops to furnish the shells, storage of furnishing materials and a limited amount of ancillary work, with siding facilities and a Yard, were all completed in a very short time. Steps were also taken to make these facilities offer as comfortable working conditions, as possible, to the workers, as well as production to the maximum. The furnishing work was commenced from May 1957 as and when the sheds were getting ready and the first Third Class Coach was furnished and turned out in July 1957 and the 100th furnished Coach

was launched on 19th June 1958. The strength of workshop staff of various categories is now over 650. Side by side, arrangements have also been made to recruit apprentices and impart training in the various furnishing trades, and such recruitment will continue to be made.

With these facilities it has been possible to so far furnish 193 Third Class Coaches upto the end of December 1958 and to develop capacity to turn out 15 furnished coaches per month with prospects of stepping up this figure further. In this out-turn, one prototype TLR coach (Third Class with luggage and Guard's compartments) was fully furnished and ceremoniously launched by the Hon'ble Deputy Minister



for Railways Shri S. V. Ramaswamy on the 3rd January 1959. At present, there is by far the largest need for third class coaches only. But, the design for upper class coaches is also in hand and a programme for furnishing such coaches in the near future is contemplated. Consequent to the increase out-turn and with the gradual building up of the production staff and technique, it has been possible from the first batch onwards, not only to reduce the direct man-hours per coach, but also to reduce the cost for furnishing per coach and there has been a systematic downward trend. Besides, the furnishing materials used are now fully indigenous.

SALIENT FEATURES OF A THIRD CLASS FURNISHED COACH

- (i) The all-steel light weight Integral coach for third class travel is being furnished bearing in mind

the latest amenity standards to be provided for the maximum comfort of the travelling public.

- (ii) The layout consists of two compartments with 40 seats each and an inter-communicating door for isolation, if necessary. The seats which are of ample widths with sufficient knee room are arranged in one row of single seats along one side, and transverse long seats for 4 passengers on the other side with a passage in between.
- (iii) Flat seats are being provided in order to give maximum advantages to the passengers while sitting or sleeping instead of seats with a curved profile as hitherto provided.
- (iv) The floor is laid with oxychloride flooring composition to provide a hard wearing and washable surface.
- (v) The sides, ends, ceilings and partitions of the coach have been fitted with suitable panelling materials. The ceiling is of white semi gloss finish and the interior has been finished in light biscuit and buff colours relieved by aluminium mouldings giving a pleasing appearance.
- (vi) The steel shell is suitably insulated and a central aluminium cased air duct connecting a number of roof ventilators provides for an efficient draft, and ventilation in the compartments. There are independent roof ventilators for lavatories.
- (vii) 16 fans, 24 compartment lights, 4 lavatory lights and 4 blue night lights have been provided in the Coach. External embarkation lights which automatically switch on at slow speeds and during halts, have been provided.
- (viii) Windows have both glass shutters and aluminium louver shutters.
- (ix) Light luggage racks, and lower luggage racks have been provided to suit the requirements of the passengers. The four seater benches and lower luggage racks above can be used for sleeping.
- (x) On each half of the coach, 2 lavatories have been provided which are fitted with mirrors, shelves, towel rails, coat hooks, and other fittings of stainless steel which can be easily kept clean and hygienic. A 64 gallon capacity overhead water tank in each lavatory provides for an ample supply of water.

TARGETS AND OUT-TURN OF FURNISHED COACHES

The original and revised targets by financial years during the Second Five Year Plan period, as vj

by the setting up of the Permanent Furnishing Unit, according to schedule, and the actual out-turn of furnished coaches are given below :—

Financial year.	Year of the 2nd Five Year Plan.	Original furnishing target.	Revised target including 2nd Shift.	Actual Out-turn
1956—57	I	Nil	Nil	2
1957—58	II	50	(72) actual	72
1958—59	III	140	175	119 upto Dec. 58.
1959—60	IV	220	250	—
1960—61	V	335	350	—

PLANS FOR THE FUTURE

In view of the difficult ways and means position, during the Second Five Year Plan period, it will not be possible to complete the construction during this period, as previously envisaged. The construction of the Factory, as well as the procurement of machinery and plant will be rephased, based on the priority, with which the different shop structures could be taken up for construction, and completed during the Third Five Year Plan Period.

The Furnishing Unit, as an Annexe to the Integral Coach Factory, when completed, will also have an important role to play in the context of the Second and Third Five Year Plans, by contributing to a great extent to the rolling stock assets of the Indian Railways by economical production and extending to the travelling public, modern amenities and comforts. Furthermore, it is estimated that the Furnishing Unit will, initially, provide employment opportunities to 2,400 workers, and also contribute to the growth and establishment of several ancillary industries, with the impetus and encouragement, already given in the Interim stage of activities of the Temporary Furnishing annexe.

In the meanwhile, it is proposed to increase the furnishing capacity in the Temporary Furnishing Annexe and to continue obtaining assistance from some of the Zonal Railway Workshops, where coach shells turned out of the Integral Coach Factory are also being furnished, as a temporary measure, to keep pace with the increased out-turn of coach shells.—Courtesy : The Indian Railway Engineer, Bombay.

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Ideal Atmosphere for Workers in the Integral Coach Factory

By S. G. Iyer

Executive Engineer/Furnishing, Integral Coach Factory, Perambur

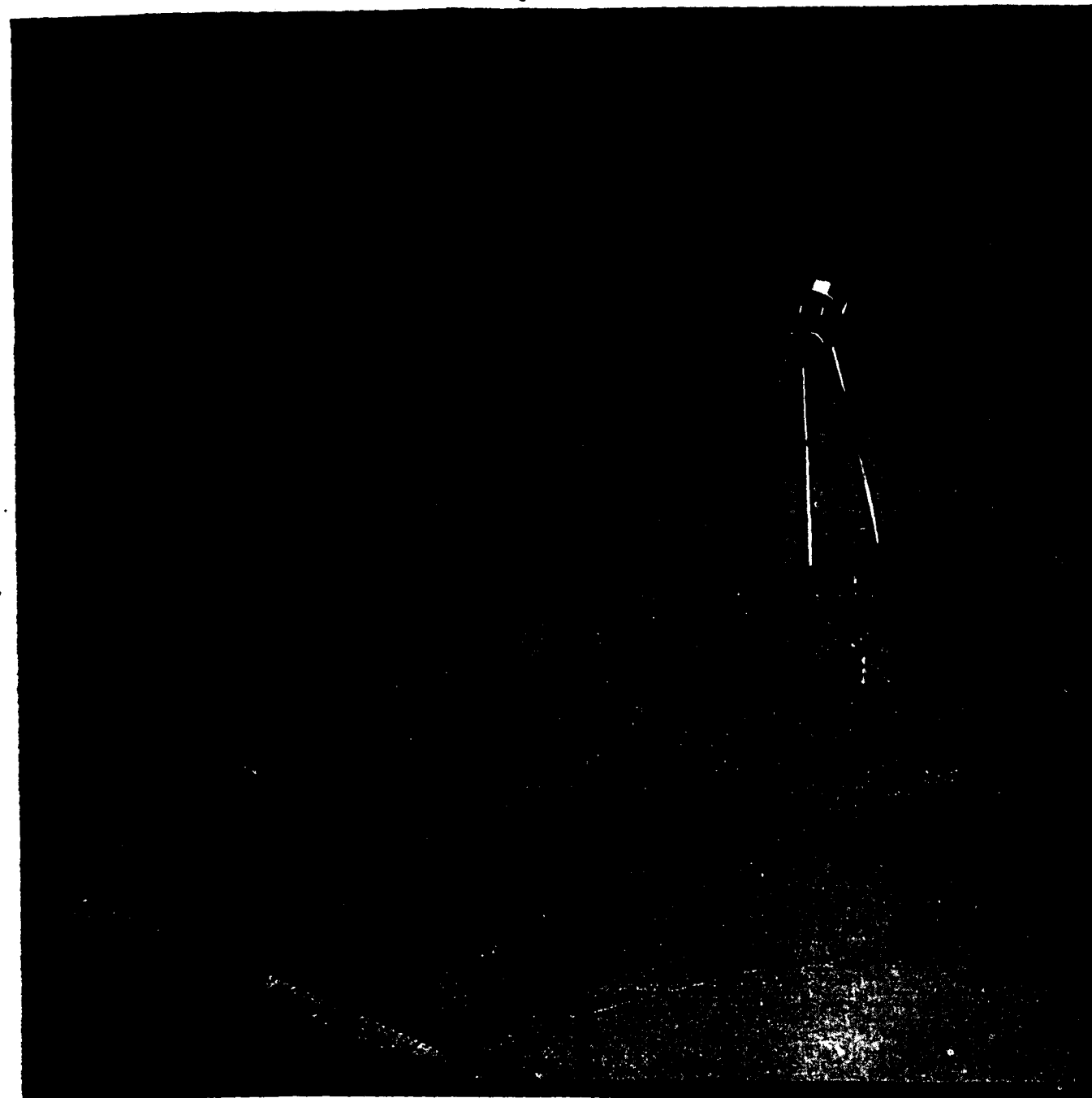
FROM the time of the conception of the Integral Coach Factory, one of the objectives kept in view by the planners was to give an ideal working atmosphere to each and every worker in the Factory, by which alone the worker can be expected to give of his best voluntarily and in a spirit of nation-building. This atmosphere was to be obtained both in the physical working conditions and surroundings and in the aesthetic effect of the environments on the minds of the worker. In a mass production unit like the Integral Coach Factory, it has to be remembered that large bodies of workers will necessarily have to turn out the same type of work over considerably long periods of time and this would obviously result in a certain amount of monotony and boredom. Any break from the routine, therefore, is most welcome to the worker, whether the diversion be in the nature of satisfying the physical needs or affording mental recreation. It will be appreciated fully, how these results have been attained, if we follow a worker from the time he sets foot into the Factory till he leaves it at the close of the day.

The workmen's train brings the worker into the Perambur Loco Works Station 15 to 20 minutes ahead of his scheduled time to start work. Passing through the conventional foot overbridge across the Railway tracks, he comes down the flight of steps to the approaches of the Factory. His first sight is a pyramid of potted plants mounted on circular discs at different levels, some in bloom and some with colourful foliage. To his left, the approach road is flanked by a concrete trellis on which grow profuse creepers of Ipomea and Bignonia alternating with each other. The slopes of the embankment are paved with granite and in this paving are a dozen clumps of bogainvillae of varying hues in almost perpetual bloom. The foot of the slope ends in a long flower trough with tiny little flowering plants filling up the whole trough. Thus his first sight in the I. C. F. area is one of satisfying green and flowers.

He gets down the steps and turns right and in front of him is the popular 'Workers Canteen'. Fresh snacks and coffee or tea are available even at

this early hour and if he has not had a satisfying *chotta hazri* at home, he goes in and has a quick snack. Coming out of the canteen, he cannot fail to notice the different pattern of bogainvillae, this time strutting through the window *chajjas* and sprawling along it with drooping flowers. The whole area is kept clean with a well-kept lawn in front, where water sprays through a plaster statue of a pair of twins. Beyond is an inviting shade garden with benches thrown about, where he knows he is coming back during the mid-day lunch. He gets into the Factory through the Main Entrance and walks up to his shop along a clean concrete road, flanked on both sides with large green patches and flower beds or pots containing various kinds of flowering annuals and perennials. He clocks in on time and gets into his work, be it a machine, or a welding booth or a fitting table or a huge hammer in the smithy, refreshed both in body and mind.

Hardly has he done two hours of daily work and before fatigue actually sets in, he sees the tea and snack trolley coming into the workshop and taking its position at the appointed place. He queues up with his brother workers, takes what he wants and has a bite, perhaps conversing a little on the topics of the day with his fellow workers. But his mind is on the production and the process is made as short as possible, so that he gets back to his machine and perhaps relieves his colleague for a similar fresh up. In between, if he has to answer a call of nature, he has a very clean convenience—not very far away—at the fringe of his shop. The sun outside perhaps starts warming up at this hour, but not so inside the Factory. The side walling has inclined louvres built into the walls and the asbestos roof has also got inclined louvres at the top, thus ensuring a continuous circulation of fresh air in and foul air out, which tends to keep the whole shop pure and reasonably cool also. Even in the hottest of the months, he does not feel the need of a fan while at work in his place, nor is there any adverse glare on his eyes, since the sun light passes through the north-light glazing, which are in a way translucent and produces the effect of diffused light and not alternate patches of



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glare and shade. Even this diffused light is well absorbed by the walls which have been distempered with a mixture of blue and green shade, very cooling to look at.

While at work, he is often visited by his superiors like Chargeman and Foreman, but whose visits are more marked by constructive discussions than mere criticisms of the work. Every worker is encouraged to think for himself and work out for himself methods of improving the quality and quantum of production in the shop and if he is satisfied as to its correctness, he puts it in the form of suggestions in the Suggestion Box provided near his place of work. All suggestions from high or low, big or small are examined by a panel of experts from the view point of feasibility, economy and efficiency and anything which passes the test is immediately adopted and the worker who suggested it, is suitably rewarded by the Administration. This arrangement not only develops original thinking in the workers, but also encourages them to think aloud and discuss with colleagues and superiors. This is one of the main stepping stones to progress which essentially is a continuous state of improvement of one's own performance.

When the mid-day buzzer blows, he goes out towards the Workers Canteen again. If he is having the canteen food, he walks in and finds clean tables and chairs laid out for him and plates and dishes with wholesome food stacked ready on the counter. He has a satisfying meal at a very reasonable cost. Melodious music fills the air of the canteen during the lunch interval through the Radiogram which has been provided as a staff welfare amenity. Amidst the melody of the music and with his colleagues next to him, the meal hour atmosphere is soothing when in addition to a satisfying meal, the body gets relaxed and refreshed. If the worker is one who gets his food from home through a tiffin carrier, he has the alternative of either taking it in the rest shed or under nature's canopy in

the cool shade of large trees in the shade garden, sitting around the lily-pond.

The afternoon session is just as pleasant as the morning with a snack interval during the middle of the session. In his anxiety to fulfil his targets of production, his mind is more on the work, so that he can congratulate himself at the end of the day of having done his share satisfactorily. If there are any important announcements of interest to him to be made by the Administration or any words of wisdom and advice to be listened to from high visiting personages, he does so without detriment to his work and without having to go out for it, by listening in through the public announcing equipment network, that has been provided inside the shops.

Human nature being what it is, the break up hour, in the evening is more interesting to the worker than the entry in the morning, but he leaves his place "not as a ploughman plodding his weary way home", but as a young workman with the satisfaction of having done a good day's work under ideal surroundings and conditions and having fulfilled for the day his quota of contribution to the national well-being.

In the evenings it is really a sight to see the juvenile worker running up to catch their trains or buses, or in a frantic hurry to get into the I. C. F. Sports field, or home for a quick change so that he secures his place in the Institute game table before it gets filled up.

If the proof of the pudding is in the eating, the attention bestowed on the working atmosphere of the factory staff has paid substantial dividends, as reflected by the fulfilment of targets and improvement on the targets set forth for this Factory by the Ministry of Railways, which can only be possible by the unstinted co-operation and efforts on the part of all grades of employees serving this unit.

MK Lathe Attracts Big Crowds at Singapore Exhibition

The Foreign Officer of the Engineering Export Promotion Council stationed at Singapore reported recently that the MK Harihar MB Lathe displayed at the Indian Pavilion in the Exhibition organised by the Singapore Chamber of Commerce created great interest among the visitors and that this machine was constantly surrounded by admiring crowds throughout the period of Exhibition. This Exhibition was organised some weeks back to celebrate the Independence of Singapore.

Eccentric Presses Types LE-100, LE-250 of the Czechoslovak Manufacture

THE frame of the machine is welded, combined of castings and plates. Its rigidity is reinforced by suitable ribs.

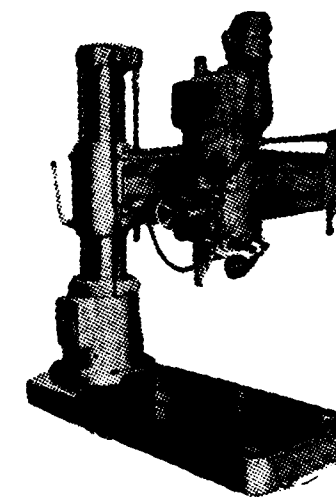
The electric motor is located in the lower part of the frame; the drive is transmitted by V-belts through a multiple disc clutch and band brake on to the flywheel, by a simple reduction gear on to the eccentric shaft and from there to the ram. The machine is started electro-pneumatically by push-buttons. The friction disc clutch and band brake are controlled by compressed air. The electro-pneumatic starting device enables engaging of the individual strokes with one hand, with two hands as well as by means of a foot lever/continuous run and jerking travel of the ram/.

- Safety of operation is ensured by a safety device embodied in the electro-pneumatic starting device. A shear pin located in the ram prevents the press from being overloaded.

The ram is adjustable; the length of the stroke can be changed within a wide range. In the ram there is located the upper ejector adjustable by stop screws. A pneumatic drawing device can be mounted into the passage opening in the clamping plate. The press is provided with an independent stroke indicator and electric lightening.

The design of the press enables performing of the same work by a less powerful electric motor in comparison with presses of former styles. Nevertheless, a motor of the original output has been used, but the number of exploitable strokes has been substantially increased. The mechanical efficiency of machine has been improved and the durability of the clutch substantially prolonged, at least doubly.

The presses enable shearing, punching, bending, cold extruding, stamping as well as shallow drawing. The dimensions of the table provided with clamping slots



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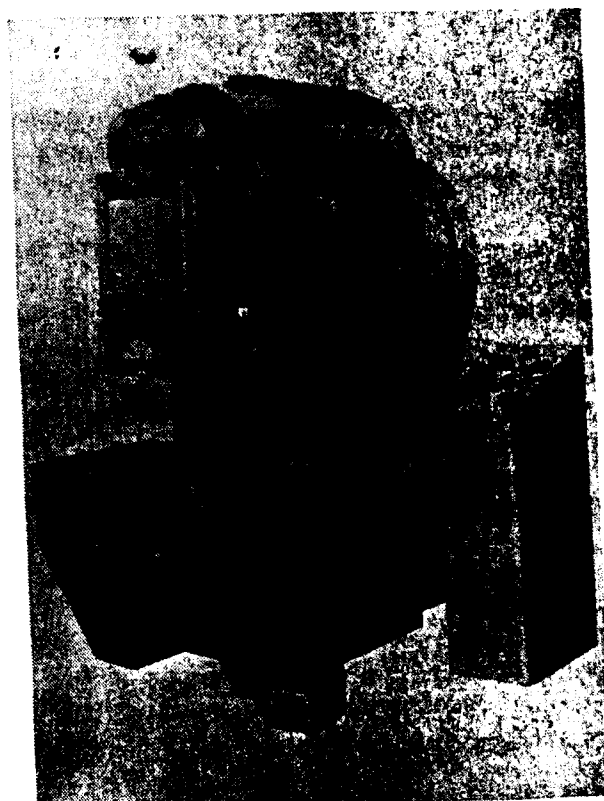
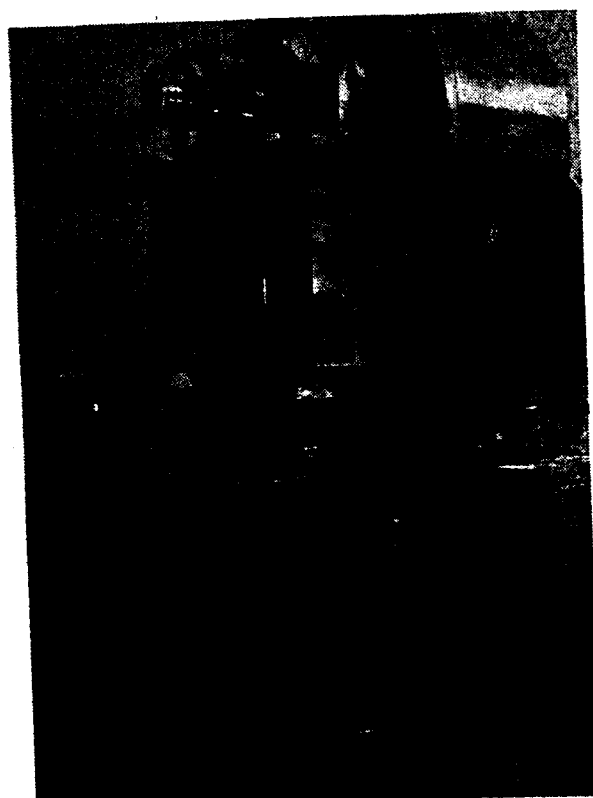
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enable clamping even of large tools. The presses are adapted for using the automatic feed.

These presses are made by the TOS factories in the LE-100, LE-160, LE-250, LE-315 series. The LE-100 and LE-250 presses have a welded frame, the frame of the LE-160, 250 and 315 presses being of cast steel. The series will be supplemented with the type LE-400.

SPECIFICATIONS

	Type.	LE-100	LE-250
Nominal pressure	metric tons	100	250
	long tons	98.42	246
Throat	mm.	320	400
	in.	12-19/32	15-3/4
Max. distance from ram to table	mm.	400	500
	in.	15-3/4	19-43/64

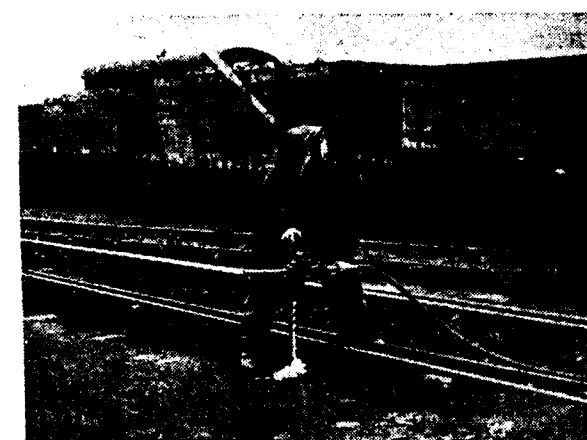
	Type.	LE-100	LE-250
Stroke	mm.	20 - 120	30 - 140
	in.	25/32 to 4-23/32	1-3/16 to 5-33/64
No. of strokes per minute.		55	45
Displacement of ram	mm.	80	110
	in.	3-5/32	4-21/64
Clamping plate	mm.	900×640	1100×800
	ft.	2.95×2.1	3.6×2.62
Output of elec. motor	kW.	7	17
Weight of Machine.	kg.	5,500	12,750
	lbs.	12,125	28,100

Armstrong Whitworth Pneumatic Tools in Railway Workshops

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

Armstrong Whitworth's experience in the design and manufacture of portable power tools ensures that each tool is built to the highest standards of engineering

precision. The arduous conditions found in the Railway industries to which these tools have been supplied, have proved them to be robust in construction and trouble free in operation.



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

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

The Armstrong Whitworth Size 3RDC/35 panel saw is specifically designed and manufactured for repair work on Railway coaches, such as cutting out for patch-repairing panels in sheet metal, when they have become badly rusted. This tool is an ideal tool for fast accurate sawing of light timber, it has a 2 1/2" diameter blade, is extremely powerful, and has a fixed Dead Handle for accurate manoeuvrability, whilst being perfectly safe by the provision of a fixed guard.

Armstrong Whitworth also manufacture a complete range of Rotary Air Impact Wrenches which have capabilities for nutsetting up to 1 1/4" capacity bolt diameter, and can be effectively used with available attachments for screwdriving, tapping, drilling, grinding, wire brushing, and sanding. The Sizes 48HG and 80 Impact Wrenches are particularly



Thor/Armstrong Whitworth size 9300 Rivet Buster.



An Thor/Armstrong Whitworth size 5V Surface Grinder is used on the Horn Cheeks of a locomotive.

suitable for heavy duty work, such as the removal or running down of nuts with bolt diameter up to $1\frac{1}{4}$ ".

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

Armstrong Whitworth manufacture a complete range of Riveting Hammers which are ideal tools for locomotive works, for applications such as stay bolt riveting. The light riveting hammers sizes 76, 79, 712, 46 and 417, have capacities up to $\frac{1}{2}$ " Hot Rivets, and the Size 83S Close Quarter Riveting Hammer had a capacity of $\frac{3}{4}$ " Hot Rivets. The range of long stroke Riveting Hammers covers Sizes 43, 53, 83 and 93 which have capacities up to $1\frac{1}{4}$ ".

Armstrong Whitworth Rivet Buster. This tool is manufactured in two Sizes. 6300 and 9300, and can be



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

Another tool suitable for Locomotive work is the

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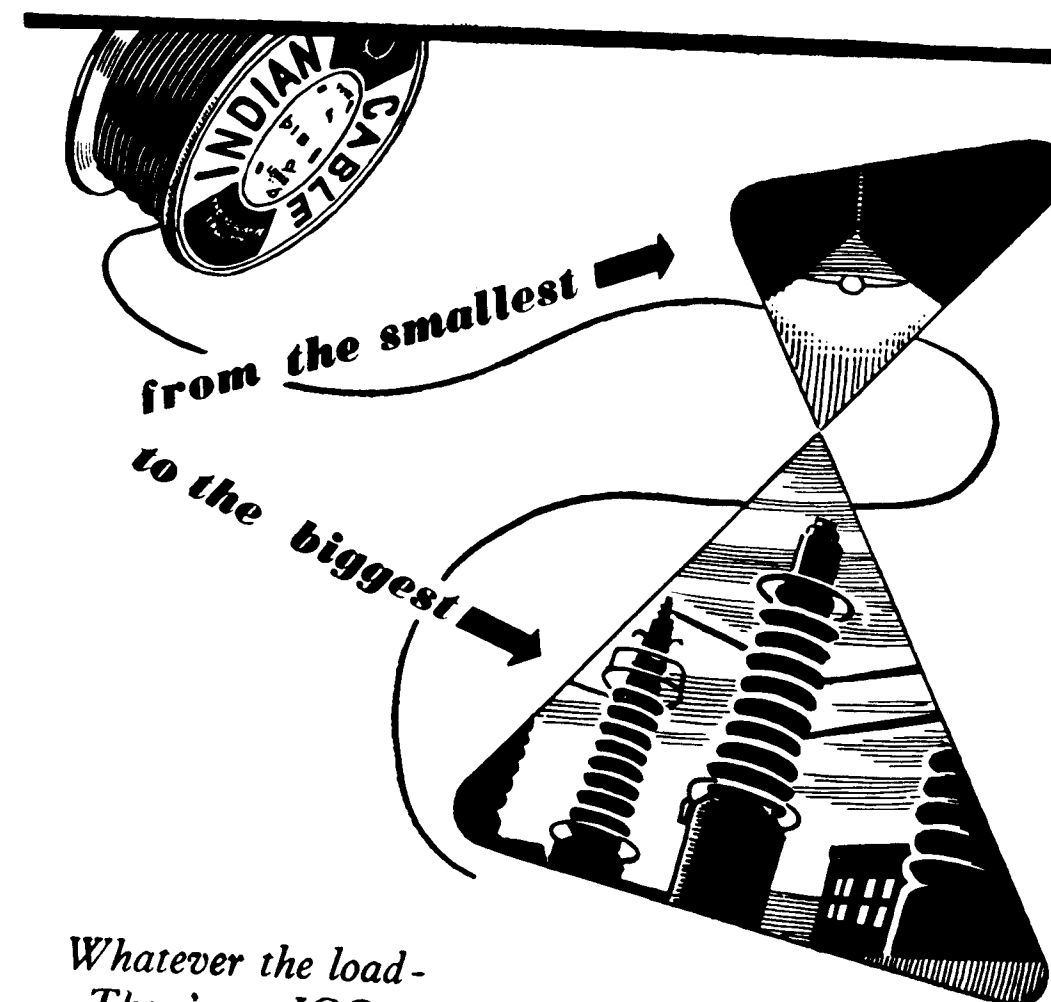
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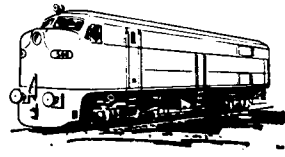


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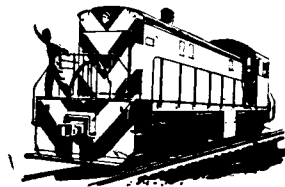


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