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ANNOUNCEMENT

We have pleasure in announcing to all our Advertisers and Readers that we propose to bring out a special **Engineering as well as Signalling & Telecommunications Supplement** *along with our May edition.*

EDITOR

The Development of High-Speed MERCEDES-BENZ Diesel Engines for Diesel train traction

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Stuttgart-Unterturkheim

THE development of high-speed diesel engines, in particular, of those with a high output, for powering diesel trains was greatly encouraged by the Deutsche Reichsbahn (German State Railways) which planned, designed and operated diesel railcars over 25 years ago. The Deutsche Bundesbahn (German Federal Railways), the successor in the Federal Republic of Germany to the Deutsche Reichsbahn, has resumed this tradition after the war and is pursuing it with great vigour, in particular, as far as main line traffic is concerned. New diesel railcars—express railcars and diesel locomotives—which have been developed (1, 2, 3) are playing an increasingly important part in long-distance traffic in the Federal Republic and are frequently installed in trains which run to the capitals of neighbouring countries.

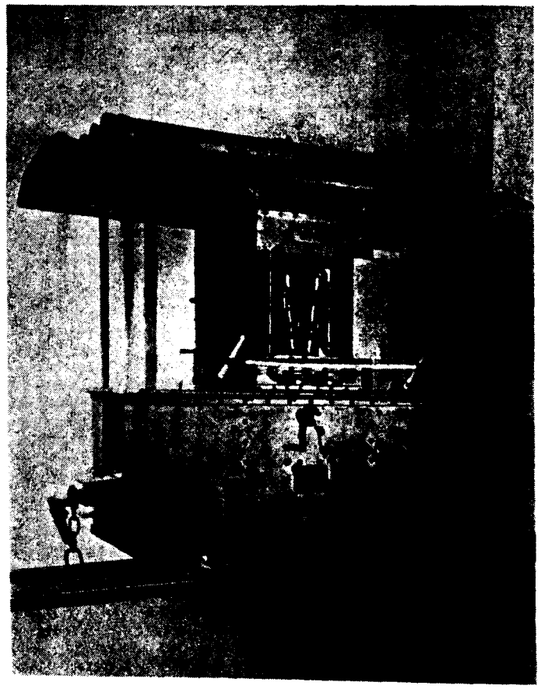

Fig. 1. Engine-powered locomotive of the Daimler-Motoren-Gesellschaft, made in 1887, Ne = 5.5 PS, n = 620 r.p.m.

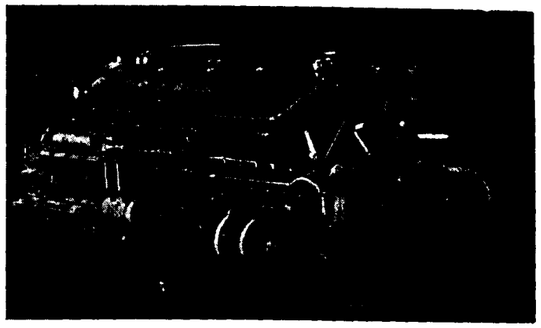

Fig. 2. MERCEDES-BENZ 12 cylinder Diesel engine MB 805, built in 1932, Ne = 300 PS, n = 1,500 r. p. m.

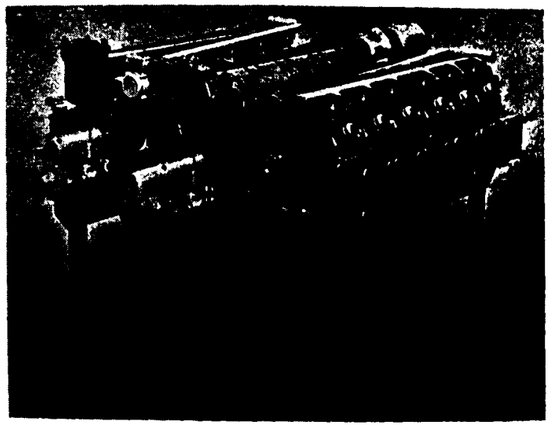

Fig. 3. MERCEDES-BENZ 12 cylinder Diesel engine MB 807, built in 1936, Ne = 275 PS, n = 1,500 r. p. m.

1) Lampe, Curt und Pflug, Erhard:
Die 1000-PS-Diesellokomotive der Deutschen Bundesbahn fur leichten Strecken—und schweren Rangierdienst. – Glas. Ann. (1952) Nr. 4 S. 72/86
2) Lampe, Curt und Goessl, Nikolaus:
Die 2000-PS-Diesellokomotive der Deutschen Bundesbahn.
ETR 2 (1953), Nr. 6/7, S. 275/289
3) Lampe, Curt:
Grundzuge der Diesellokomotive-entwicklung bei der Deutschen Bundesbahn.
MTZ 14 (1953), Nr. 8, S. 223/225

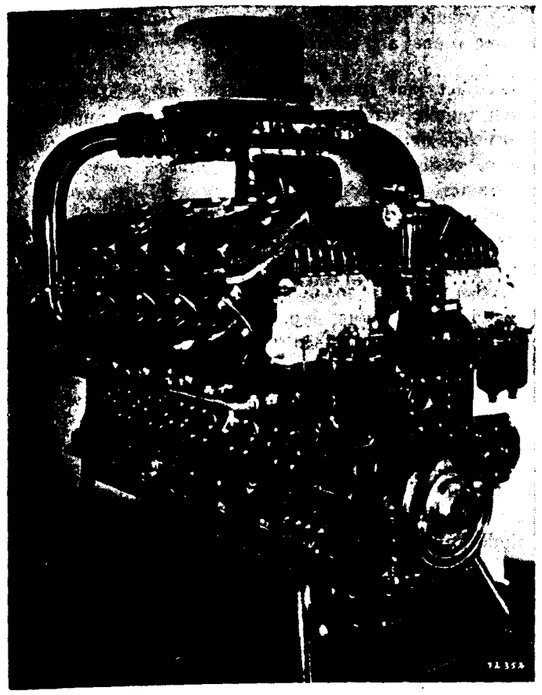

Fig. 4. MERCEDES-BENZ 12 cylinder Diesel engine MB. 816, with BBC exhaust gas turbo-charger, built in 1938, Ne = 650 PS, n = 1,400 r. p. m.

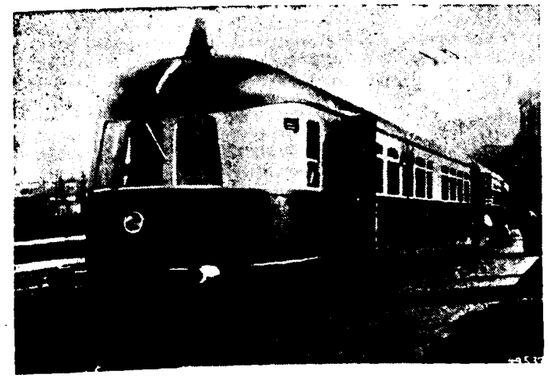

Fig. 5. Express railcar of the Belgian State Railways, equipped with 2 MERCEDES-BENZ Diesel engines MB 806 each of which has an output of 450 PS, maximum speed 93 to 100 m.p.h.

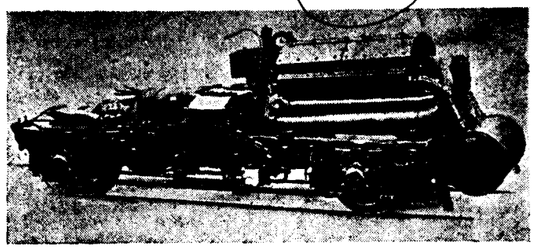

Fig. 6. Bogie of a Diesel railcar with diesel-electric transmission with MERCEDES-BENZ Diesel engine MB 806, built in 1936, Ne = 450 PS, n = 1,400 r.p.m.

Side by side with this development, the use of high-speed diesel engines for shunting operations is constantly gaining ground not only on account of the great economy of operation of the diesel engine which is undisputed in this special field but also because of the advantages of the high-speed engine as such.

Ever more powerful units, larger by far than those which are increasingly being used for diesel rail buses, are being built into railcars which operate on branch lines. These have a higher haulage capacity and can be operated with trailcars, as well as with goods wagons, etc. as the case may be.

The reasons for the use of high-speed engines must be sought in the fact that they are extremely suitable

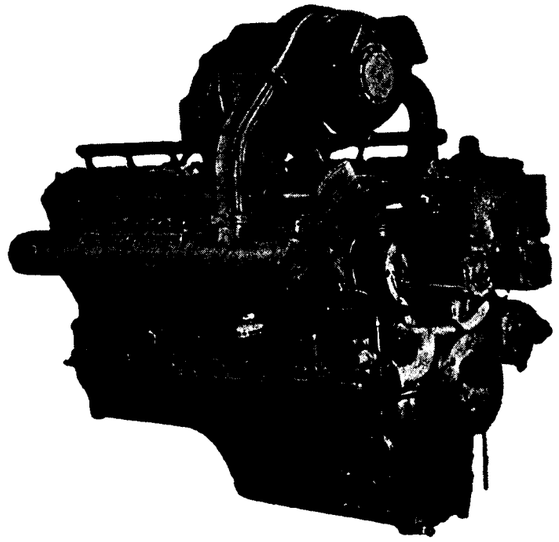

Fig. 7. MERCEDES-BENZ 12 cylinder diesel engine MB 820 Bb with BBC exhaust gas turbo-charger, Ne = 1,100 PS, n = 1,500 r.p.m.

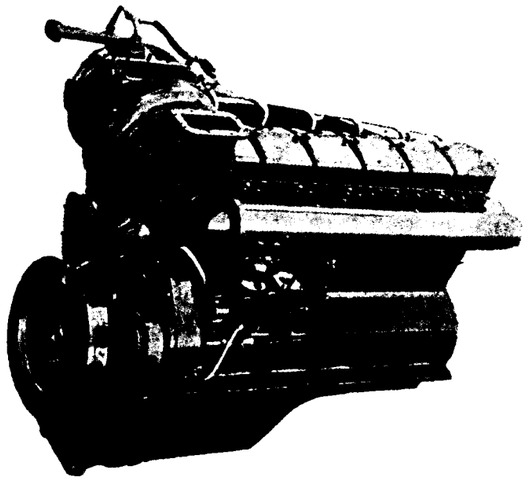

Fig. 8. MERCEDES-BENZ 6 cylinder diesel engine MB 836 Bb with BBC exhaust gas turbo-charger. Ne = 500 PS, n = 1,500 r.p.m.

for installation in rail-bound vehicles. Since they have smaller dimensions and a lower structural weight, possibilities are opened up which are non-existent with the much heavier low-speed engines. Thus the installation of engines in the bogie, e. g. of Diesel railcars, is limited to sizes and weights which preclude the use of engines with low revolution speed. For this reason the development of express railcars for long-distance traffic which was sponsored by the German State Railways and the German Federal Railways could not have been effected if light, high-speed Diesel engines had not been available, and my later remarks will show that it has recently proved possible to install such engine units with an output of 1100 PS and more in the bogie. There are prospects of increasing these output figures still further. Because they save space and weight, the high-speed engines offer a great many advantages for installation in Diesel locomotives. Thus the number of axles is determined by the permissible load per axle and the use of light and small engines makes it possible to limit the number of axles, which in turn results in the use of cheaper locomotives designs, indeed, in many cases it makes it at all possible to operate at certain output ranges although the bearing capacity of the superstructure is limited. Obviously, these remarks are only valid within the limits set by the adhesion weight of the locomotives required for the trailer load.

The advantages of using smaller and lighter, that is to say, high-speed engines not only lie in the field of diesel vehicle design but also to a very large extent in the operational and economical range.

The fact that those parts in the installed engine which require servicing can be quickly dismounted, whilst their weight remains slight, and that the engines can be easily exchanged for the routine overhauls, contributes considerably to economical operation inasmuch as the time during which the vehicles are out of operation so that work can be done at the engine plant can be considerably cut down or eliminated altogether. Minor maintenance jobs only require little time whilst more important jobs are not carried out in the vehicle since the light engine can be dismounted very quickly indeed and replaced by an exchange unit.

Like other German firms, *Daimler-Benz* has played an important part in the development of high-speed engines for rail-bound vehicles. At the birthplace of the first high-speed combustion engine of the Daimler-Motorengesellschaft which has been designed by Gottlieb Daimler in 1883, the first rail-bound vehicles of the world to be equipped with combustion engines, among them the first engine-driven locomotive (Fig. 1) were built as early as 1887.

Before the last war, high-speed engines ranging from 35 to 650 PS, make *Daimler-Benz*, were available for Diesel train traction. Below, we shall only deal with engines with a higher output—from 275 to 650

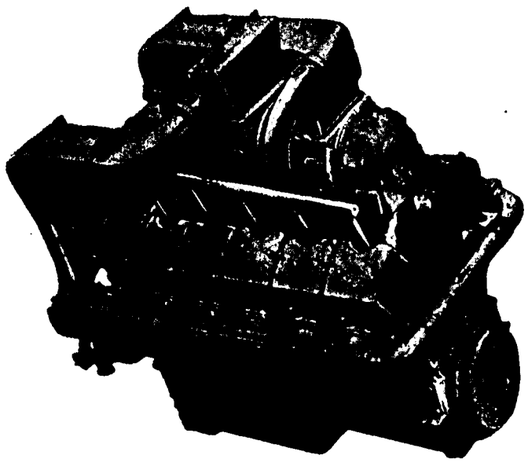

Fig. 9. MERCEDES-BENZ 12 cylinder diesel engine MB 820 Db with high-supercharging by a BBC exhaust gas turbo-charger and intercooling, Ne = 1,350 PS, n = 1,500 r.p.m.

PS at 1,500 r. p. m.—which have undergone further development culminating in the new types which, as already mentioned, have outputs of 1100 PS at the same engine speed.

In the output range between 275 and 650 PS, three engine types were increasingly being used by the Deutsche Reichsbahn before the war :

1. The engine MB 805, 12 cylinders, in V-arrangement, 138 mm. (5 7/16 in.) bore, 170 mm. (6 11/16 in.) stroke, $V_H = 30.5$ l, not supercharged, with an output of $N_e = 300$ PS at $n = 1{,}500$ r. p. m. (Fig. 2).
2. Engine MB 807, 12-cylinder, opposed cylinder arrangement, with the same dimensions as engine MB 805, not supercharged, with an output of $N_e = 275$ PS at $n = 1{,}500$ r. p. m. (Fig. 3).
3. Engine MB 806, 12 cylinders in V-arrangement, 165 mm. (6½ in.) bore, 195 mm. (7 11/16 in.) stroke, $V_H = 50.0$ l, not supercharged with an output of $N_e = 450$ PS at $n = 1{,}400$ r. p. m.

   supercharged by a BBC exhaust gas turbo-charger as MB 816 with an output of $N_e = 650$ PS at $n = 1{,}400$ r. p. m. (Fig. 4).

The engine output was transmitted mechanically, electrically, hydraulically or hydraulic-mechanically as the case may be, whereby equally good results were achieved with the diesel-electric and diesel-hydraulic

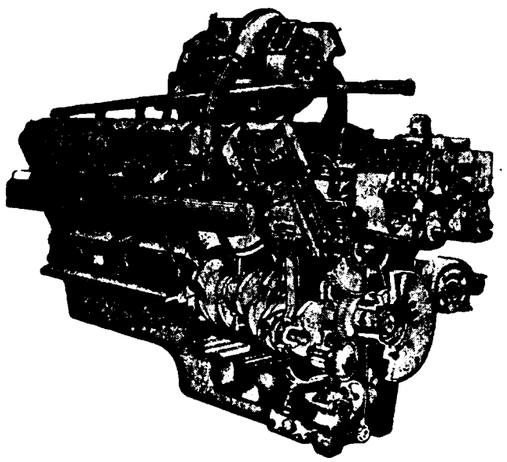

Fig. 10. MERCEDES-BENZ Diesel engine MB 820 Bb – sectional view.

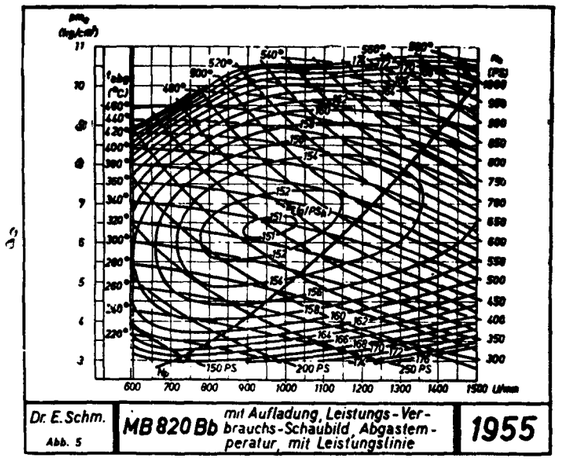

Fig. 11. MB 820 Bb with BBC exhaust gas turbo-charger, Ne = 1,000 PS, n = 1,500 r.p.m., output consumption diagram, exhaust gas temperature, with output curve for diesel-hydraulic drive.

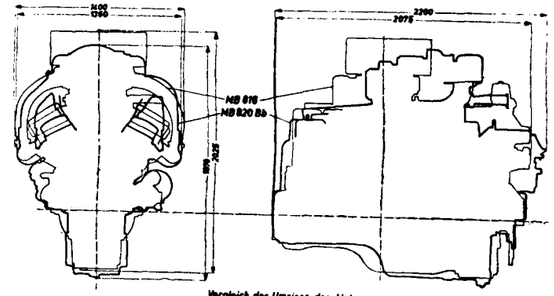

Fig. 12. Comparison of the basic designs of engines MB 816 (pre-war type) and MB 820 Bb (new design).

types of power transmission. The hydraulic or hydraulic-mechanical system of transmission determined the entire post-war development of diesel train traction by the Deutsche Bundesbahn.

The following figures show examples of installation of the engine types aforementioned :

Fig. 5 : Express railcars of the Belgium State Railways equipped with two *Mercedes-Benz* diesel engines of type MB 806, each of which renders an output of 450 PS, maximum speed 93 to 100 m. p. h. Fig. 6 : Engine MB 806, installed in the bogie of an express railcar with diesel-electric power transmission.

The demands which must be kept in mind when designing high-speed diesel engines for rail-bound vehicles are resistance to very hard operating conditions, in particular in view of the many extreme load and engine speed changes involved, on the one hand, and high resistance to wear and long service life of all those engine parts which, if they have to be overhauled, make it necessary to dismount the engine, namely the bearings, and the cylinder bushings and pistons, on the other hand. Such demands are not easily met and they required considerable and very detailed development work. Nevertheless, it was

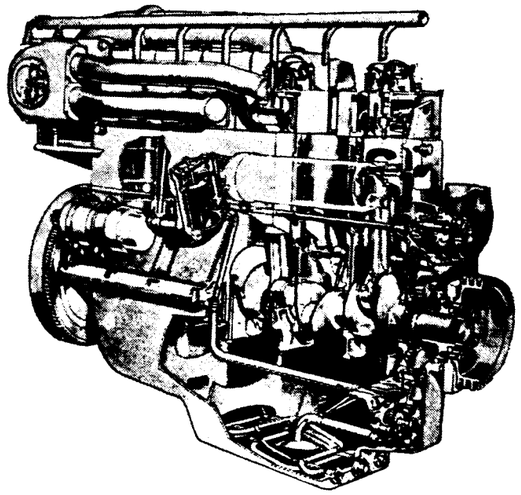

Fig. 13. MERCEDES-BENZ diesel engine MB 846 Ab - sectional view.

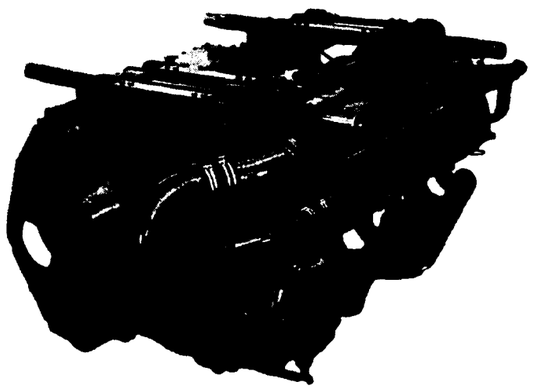

Fig. 14. MERCEDES-BENZ 6 cylinder underfloor Diesel engine MB 846 Bb, Ne = 300 PS, n = 1,500 r. p. m.

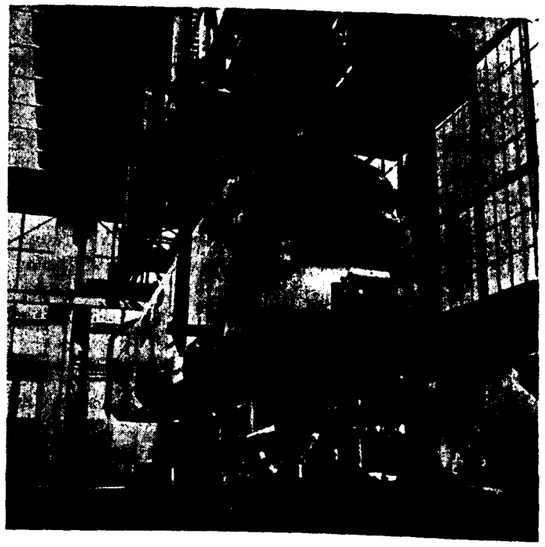

Fig. 15. The carriage body is lowered on the bogies of a Diesel railcar equipped with a MERCEDES-BENZ diesel engine MB 820 Bb, Ne = 1,000 PS, n = 1,500 r. p. m.

possible already before the war to reach service figures of 4,000 operational hours with engine MB 806 under very hard operational conditions, e. g. in express traffic in the Ruhr area, before dismounting the engine for an overhaul.

After the war considerably higher performance standards were set from the very beginning for the express railcars and Diesel locomotives which had been newly developed by the Deutsche Bundesbahn. For the railcars VT 08[3]) and the Diesel locomotives V 80[1]) this was at first 800 PS per engine, a figure which was soon raised to 1,000 PS whilst two engines with 1,000 PS were at first installed in the Diesel locomotive V 200[2]) the output of which has recently been raised to 1,100 PS. These demands for higher performance per unit would have led to new engine developments after the war even if it would have been possible to resume manufacture of the pre-war engines. The work of development which was then carried out naturally utilised the fund of experience accumulated both before and during the war with the construction and operation of light, high-speed Diesel engines. *Daimler-Benz* brought out two new engine types with the designation MB 820 (Fig. 7) and MB 836 (Fig. 8), one of which is a 12-cylinder engine whilst the other has 6 cylinders, both of them, however, have the same stroke and

Fig. 16. Engine compartment of the diesel locomotive V 200 of the Deutsche Bundesbahn equipped with 2 MERCEDES-BENZ diesel engines MB 820 Bb, Ne = 1,100 PS, n = 1,500 r. p. m.

bore and many of their components, such as piston rods, cylinder bushings, pistons, cylinder heads, all control parts, injection pumps and nozzles, to name but a few, are also the same, in other words, nearly all parts which have to be overhauled and, possibly, exchanged. This provides considerable advantages with regard to stocks of spare parts, reconditioning, training of personnel, etc. if both types are operated by the same railway company, as they are by the Deutsche Bundesbahn. Both types have been built in a non-supercharged and in a supercharged design, in which case BBC exhaust gas turbo-chargers were used, to the following specifications :

	MB 820	MB 836
Stroke	205 mm.	205 mm. (8 5/64 in.)
Bore	175 mm.	175 mm. (6 57/64 in.)
No. of cylinders	12	6
Cylinder arrangement	V	in line
Engine speed n	r. p. m. 1,500	1,500
Type designation of the engine, not supercharged	MB 820 B	MB 836 B
Output when n = 1 = 1,500 r. p. m.	PS 700	350
Type designation of supercharged engine	MB 820 Bb	MB 836 Bb
Output when n = 1,500 r. p. m.	PS 1100	500

Both types are also built with intercooling—type designation MB 820 Db and MB 836 Db respectively (Fig. 9) —a design which is mainly used for ship propulsion units, but also for railways operating under tropical conditions and, under certain circumstances, in order to raise the output. The output available in each case depends on the prevailing atmospheric conditions (temperature, humidity) and on the circumstances governing installation (e. g. possible size of cooling unit).

We do not propose to go into the technical design of engines MB 820 and MB 836 and of the pre-war types in detail. We refer the reader to earlier publications (4., 5.). We shall only select a few essential points using the sectional view of engine MB 820 Bb (Fig. 10) to make ourselves clear, and compare them with the earlier types.

The crankcase of the new engine type is made of heat-treated silumin like the earlier one, but that of the newer design is drawn up to the upper edge of the cylinder and thus very rigid, special cylinder blocks of cast iron—in each case jointly for three cylinders—were separately placed on the crankcase of the earlier types. Cylinder liners of special alloys are

4) Buschmann, Heinrich : Triebwagenmotoren. MTZ 1 (1940), Nr. 5, S. 139/152. MTZ 1 (1940), Nr. 6, S. 209/212.

5) Schilling, Otto : Der neue 800-PS-Daimler-Benz-Triebwagen-Dieselmotor mit mechanisch angetriebenem Lader oder Auspuff-aufladung. MTZ 11 (1950), Nr. 4, S. 93/96.

Fig. 17. A MERCEDES-BENZ diesel engine MB 820 B without supercharging, Ne = 700, n = 1,500 r.p.m. being mounted in a shunting locomotive of Messrs. Krauss-Maffei A. G., Munich.

mounted in these cylinder blocks and, in the new types, in the crankcase, these liners are specially adapted to the light-metal pistons and piston rings used in all types. In the new types, the upper piston ring is chrome-plated in order to further reduce wear. The crankshaft has heat-treated journals, case hardened or induction hardened, and runs on steel-backed lead bronze bearings. The design of the bearings is in principle the same as in the earlier types, except that lead bronze has also been further improved and a surface layer of lead with a thickness of 0.02 to 0.03 mm. has been laid on the lead bronze—in the new designs—which advantageously effects the running properties.

The piston rods in the 12-cylinder engines MB 820 and MB 806 have a different design. Whereas the main connecting rod of the pre-war engine MB 806 was of the forked type with an auxiliary rod oscillating on the bearing shell on the outer side, in engine MB 820 the piston rods of two opposite cylinders lie next to each other on the same crankpin, a design which permits the use of the same connecting rods for all 12 cylinders.

Special care has been expended on the new types to ensure that the time required for overhauling and checking those parts of a built-in engine which have to be serviced is kept as low as possible, for this reason single cylinder heads have been provided as against the joint cylinder heads for 3 cylinders which were the rule in the pre-war types. This is the only way to cut down on the time required for the maintenance of a built-in engine, since no lifting appliances of any kind are required to remove the single cylinder heads made of special cast iron. The heads are directly accessible and can be lifted up, after the nuts of the cylinder head bolts have been loosened, without dismounting the intake and exhaust lines. This is further facilitated by the fact that the valves are actuated by push rods as they were in the pre-war engines too. In the cylinder head, there are 2 intake and exhaust valves each around the pre-chamber which lies in the center.

Both engine MB 816, which is a pre-war type, and the new engine types are charged by BBC exhaust gas turbo-chargers.

In engine MB 816, one supercharging unit with vertical axis was over the V, it was not cooled. In

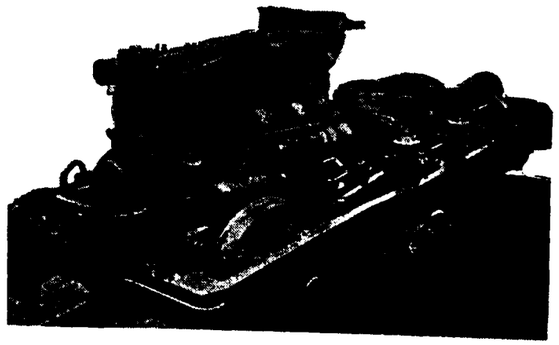

Fig. 18. Bogie of a diesel railcar with MERCEDES-BENZ diesel engine MB 836 Bb, Ne = 500 PS, n = 1,500 r. p. m.

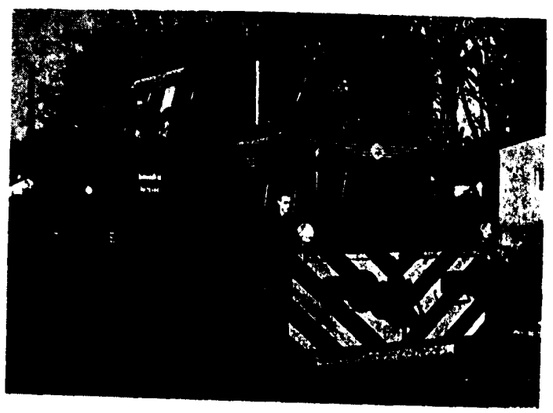

Fig. 19. Shunting locomotive of Messrs. Krauss-Maffei A.G., Munich, equipped with a MERCEDES-BENZ diesel engine MB 836 Bb, Ne = 500 PS, n = 1,500 r. p. m.

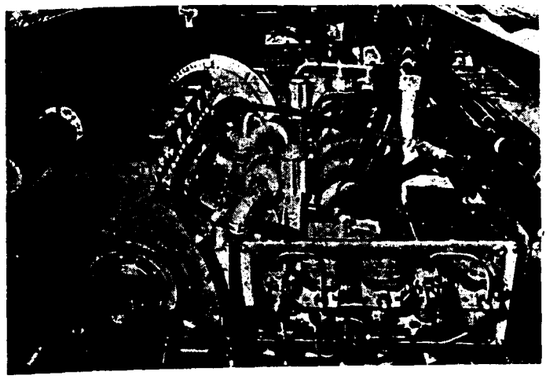

Fig. 20. Installation of MERCEDES-BENZ underfloor diesel engine MB 846 Bb, Ne = 300 PS, n = 1,500 r. p. m. in a railcar "DGT 600".

engines MB 820 and MB 836 water-cooled supercharging units with horizontal axis are used. In engine MB 820 Bb the unit is located over the V, in engine MB 836 Bb at the end of the line of cylinders. The engine MB 820 Db which has intercooling and high supercharging has 2 supercharging units one behind the other in the V, whereas the intercooler is so arranged over the lines of cylinders that it does not impede the dismounting of the cylinder heads.

Special care has been expended on the design of the parts of the cumbustion chamber as well as of the injection system. All engines work according to the four-stroke principle. The combustion chamber greatly differs from the pre-war types, although the pre-chamber system has been retained and has thus undergone considerable further development.

Fig. 11 shows the output consumption diagram of engine MB 820 Bb in its previous design for $N_e = 1{,}000$ PS at $n = 1{,}500$ r. p. m. without intercooling and with normal supercharging. It will be seen that the minimum consumption approximates to 150 g/PSh and lies under 160 g/PSH for a wide range. The output curve according to which the engine is operated with the hydraulic drive of the vehicles of the Deutsche Bundesbahn has also been traced in the diagram.

In the meantime, the output of engine MB 820 Bb without intercooling has been raised to 1,000 PS at 1,500 r. p. m. thanks to improvements in the exhaust gas turbo-chargers and injection system. At the same time, it has proved possible to reduce both the consumption at 1,100 PS and the exhaust gas temperature below the level which was previously reached with the 1,000 PS engines.

It is interesting to compare the two engines MB 806/816 with the engines MB 820 B/MB 820 Bb in respect of specific output, space requirements and weight, since this clearly illustrates the considerable improvements which have resulted from further development work on the high-speed Diesel engine. Fig. 12 compares the basic designs of the two supercharged engines MB 816 and MB 820 Bb.

		MB 806	MB 820 B
Length	mm	2125 (83 $\frac{9}{32}$ in.)	2200 (86$\frac{5}{8}$ in.)
Height	mm	1685 (66 $\frac{5}{16}$ in.)	1540 (60$\frac{5}{8}$ in.)
Width	mm	1410 (55 $\frac{1}{2}$ in.)	1300 (51$\frac{1}{4}$ in.)
V_H	l	50.0	59.2
Weight	kg	2500 (5,500 lbs.)	2450 (5,390 lbs.)
Output	PS	450	700
n	r.p.m.	1400	1500
p_e	kg/cm²	5.8 (82 psi)	7.1 (100 psi)
Power-weight ratio	kg/PS	5–55	3.5

		MB 816	MB 820 Bb
Length	mm	2075 (81$\frac{11}{16}$ in.)	2200 (86$\frac{5}{8}$ in.)
Height	mm	2025 (78$\frac{3}{4}$ in.)	1970 (77$\frac{9}{16}$ in.)
Width	mm	1400 (55$\frac{1}{8}$ in.)	1360 (53$\frac{17}{32}$ in.)
V_H	l	50.0	59.2
Weight	kg.	2820 (6,200 lbs.)	2800 (6,160 lbs.)
Output	PS	650	1100
n	r.p.m.	1400	1500
p_e	kg/cm	8.35 (119 psi)	11.2 (171 psi)
Power-weight ratio	kg/PS	4.35	2.55

From Fig. 12 and the table above it can be seen, that whilst the pre-war type and the newly-developed designs have approximately the same space requirements, the output of the non-supercharged engine has been raised by 55% whilst that of the supercharged one has undergone an increase of 70%, besides increasing the engine speed from 1,400 to 1,500 r. p. m. the mean effective pressure was raised by a third. It has proved possible to reduce the

power-weight ratio quite considerably: from 5.555 to 3.5 kg/PS in the non-supercharged and from 4.35 to 2.55 kg/PS in the supercharged engine.

The two above-mentioned types MB 820 and MB 836 were supplemented by another type, namely engine MB 846, a 6-cylinder in-line engine with a total piston displacement of 201, a bore of 150 mm. and a stroke of 190 mm. This engine is manufactured both as a vertical engine—Fig. 13—and as a horizontal engine—Fig. 14. It renders an output of 225 PS at 1,500 r. p. m. when supercharged, and further efforts are being made to improve both out put and engine speed.

The engine has the same basic design as type MB 836. The crankcase—in this case of cast iron—is also drawn up to the edge of the cylinder. This engine too, has inserted wet cylinder bushings of special cast iron, light metal pistons with top chrome-plated piston ring, and a crankshaft with induction-hardened crankpins running on lead bronze bearings. The single-cylinder heads have only one exhaust and intake valve each, which means that the pre-chamber has been slightly shifted away from the center of the cylinder. The exhaust gas turbo-charger lies at the end of the cylinder line as in the MB 836.

The above-mentioned three new types of engines MB 820, MB 836 and MB 846 have been extensively used in the most various kinds of railway drive units. Engine MB 820 Bb has been mainly installed in the express railcar VT 08 and in the Diesel locomotives V 80 and V 200 of the Deutsche Bundesbahn. Fig. 15 shows a carriage body being lowered onto the bogies of railcar VT 08, Fig. 16 shows the engine compartment of the Diesel locomotive V 200 with the same engine. The non-supercharged engine MB 820 B is used for shunting locomotives. Fig. 17 shows a locomotive which is built by the firm of *Krauss-Maffei A. G.*, Munich, in process of being assembled. The low design of the non-supercharged engine results in excellent visibility in the completed locomotive. Moreover, when certain types of power transmission are used, e. g. with a mechanical type of power transmission, the characteristics of the non-supercharged engine are unusually advantageous.

Engine MB 836 is used for railcars with an output up to 500 PS both by the Bundesbahn and by other railway companies as well as being installed in shunting locomotives to an increasing extent. As

Fig. 21. Shunting locomotive of Messrs. Fried. Krupp, Essen, equipped with a MERCEDES-BENZ diesel engine MB 846 A, Ne = 225 PS, n = 1,500 r. p.m.

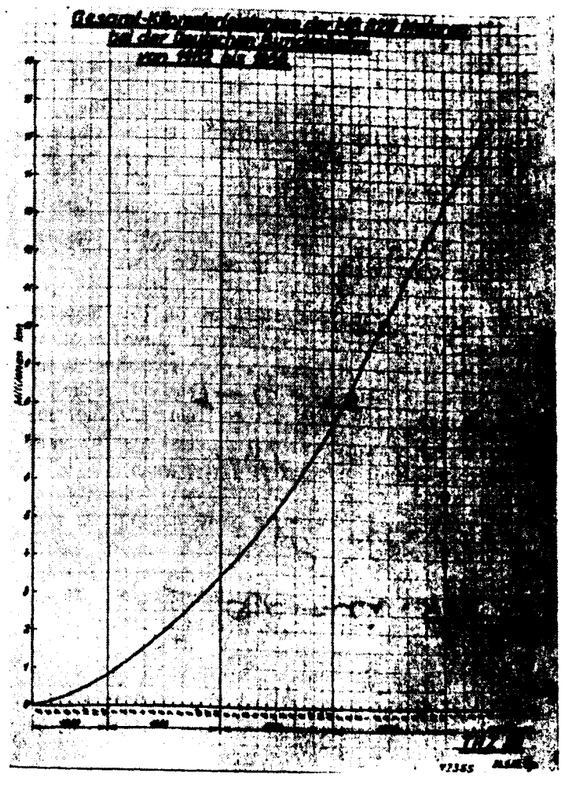

Fig. 22. Total kilometer performances of the MB. 820 engines in the service of the Deutsche Bundesbahn from 1952 to 1956.

examples of the type of installation involved, we should like to call the reader's attention to the bogie

of a branch line railcar—Fig. 18—and to a shunting locomotive built by the *Krauss-Maffei A. G.*, Munich,—Fig. 19. Thanks to the small narrow engine, this locomotive boasts first-rate visibility.

The horizontal design of engine MB 846 is increasingly gaining in importance as an underfloor engine for railcars. Fig. 20 shows the installation of one of two engines MB 846 Bb of 300 PS each in a railcar of the "DGT 600" design. In its vertical design as MB 846 Ab, the engine is frequently used for shunting locomotive operation. Fig. 21 shows a locomotive which has been built by Messrs. *Fried. Krupp*, Essen.

These examples of the fields of application for the above-mentioned engine types of the *Daimler-Benz Aktiengesellschaft* for diesel rail operation could easily be multiplied. It will be noted that the high-speed engine for all types of rail operation—shunting service, branch line operation, main line operation, express trains service—has acquired supreme importance. We have mentioned above that the further improvement of these engines has required protracted and extremely detailed development work. The results of this work can be seen in the fact that the field of application for these engines has been considerably extended.

Earlier fears that the high-speed engine would have a higher rate of wear and tear that the low-speed ones have been proved wrong by the experiences gained with the new engine types, at least. The degree of wear of the susceptible parts is kept within such narrow limits as far as the above-mentioned engine types are concerned that, after 5,000 operational hours, for instance, no part subject to wear and tear had to be overhauled because the operational tolerance limits of play and wear had been reached. In partly very hard shunting operation, engines MB 836, for instance, were in operation for over 10,000 hours without requiring an overhaul, and 6,000 operational hours have been exceeded by engine MB 846 which has not been in operation for such a long period yet.

As far as engines MB 820 are concerned, the Deutsche Bundesbahn has covered an operational distance of over 9 million miles — Fig. 22 — with very low operational failure figures due to engine defects. In this connection, it should be pointed out that some engines have covered distances of over 18,000 miles, the average figures for the past year show that 88% of the engines were in operation every month, a sign of their high efficiency. We shall report on the experiences and results gained in operation in more detail in another article.

SUMMARY

Continuing its tradition of building high-speed engines, the *Daimler-Benz Aktiengesellschaft* had developed high-speed, high-performance diesel engines with outputs up to 650 PS for rail-bound vehicles, with which impressive mileage figures have been achieved, long before the war already. After the war, three new types of high-speed high-performance diesel engines were developed which have found a wide field of application in all kinds of rail operation—shunting service, branch line operation, main line operation, express train service—and which have everywhere demonstrated their reliability whilst the wear and tear figures recorded are very low indeed. The author points out the advantages of using high-speed light engines for rail operation and describes the design of the new types of engines which meet the requirements of rail operation particularly well. A comparison with pre-war engines illustrates the progress which has been made with the construction of high-speed high-performance diesel engines. Selected examples show the varied possibilities of operation in the service of railway companies.

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900 RAILWAY STATIONS TO BE ELECTRIFIED

Over 900 railway stations are to be electrified during the Second Five-Year Plan period, according to a report. The report says that from April 1, 1956, until the end of September this year electricity has been extended to 194 stations and 740 more stations are to be electrified by March 31, 1956.

The Railway-wise break-up of stations to be electrified during the Second Five-Year period is as follows: Western Railway 82, Central Railway 66, Eastern Railway 146, North Eastern Railway 140, Northern Railway 147, Southern Railway 245, and South Eastern Railway 108.

Swing-Over Transfer-Finger Loading

Versatile Method for Automatic Loading of Centreless Plunge-Ground Pieces

AMONGST the numerous methods which have been evolved for the automatic loading of shouldered and similar pieces to the workplate of a centreless grinder, the swing-over transfer-finger method which is now being considerably used by Arthur Scrivener Ltd., of Tyburn Road, Birmingham, has a number of points of interest. The photograph Fig. 1 shows this type of loading mechanism applied to a No. 2 Scrivener controlled-cycle machine, and it will be seen that the action bears a certain resemblance to that of a human hand selecting a piece from a tray or chute and transferring it to the grinding throat of the machine.

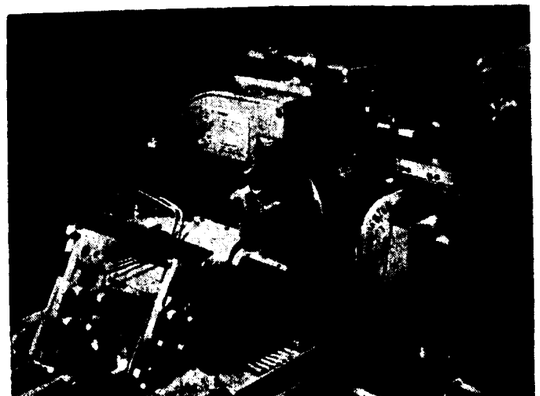

Fig. 1. Automatic transfer-finger loading applied to Scrivener No. 2 controlled-cycle centreless grinder.

The simplified diagram Fig. 2 will serve to explain more clearly the action of the mechanism. The headed pieces are first of all placed in an inclined workchute correctly positioned, that is, with the heads downwards, the end of the chute being fitted with a hook stop. From this chute, the end piece is picked up by the spring-loaded transfer fingers which grip the end of the piece, and under the action of the pinion "C" and the fixed rack "B" swing it over to the workplate between the wheels of the centreless machine. As soon as the piece is in position on the workplate, the forward movement of the piston of cylinder "F" and the push rod "D" open the fingers to free the piece, while

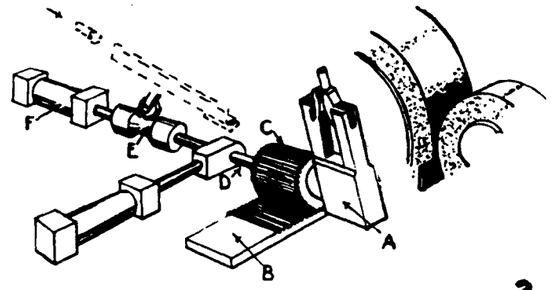

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Fig. 2. Diagram showing principle of mechanism.

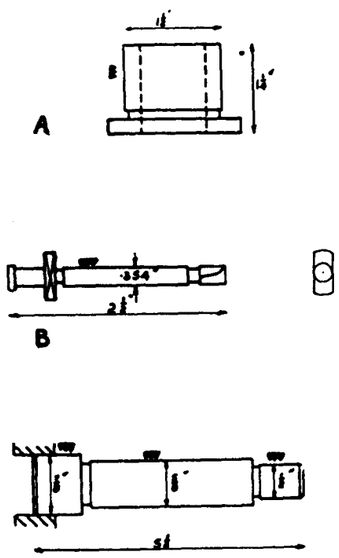


Fig. 3. Some typical pieces and their difficulties.

at the same time the forward movement of cam "E" actuates a limit switch setting in motion the controlled-cycle of the machine which causes the control wheel to close in, thus advancing the piece on to the grinding wheel. While the grinding operation is proceeding, the transfer fingers swing back to the delivery end of the inclined workchute, and when the grinding operation is

finished they grip the next piece, while simultaneously the wheels of the machine open again to allow the ground piece to be ejected, thus completing the cycle.

One of the main advantages of the method is its versatility, as a mere change of the removable jaws enables it to be used for a wide range of pieces differing widely in characteristics, such as the types shown by Fig. 3, all of which present certain difficulties for loading by a normal push feed. The piece "A", for instance, has a square shape (diameter and length approximately equal) which is always troublesome to locate or handle automatically; "B" has a head which would rule out the possibility of rolling it into position into the path of a push feed; "C" which is a multi-diameter piece, when handled by the swing-over method, is laid on the workplate with the large diameter slightly over the edge of the workplate clear of the wheels, and is fed forward into position by the so-called "plunge-and-run" process of centreless grinding, the piece being fed into position by the pulling action of the tilted control wheel.

On pieces of the types shown, assuming a stock removal of some .004" and a tolerance for size and roundness of .0002" the normal setting is a 10-second cycle.

HELWAN BRIDGE OPEN FOR JULY 23—1958

A 2,690 feet long railway bridge which Hungarian engineers are building over the Nile at Helwan is to be handed over on July 23, the National Day of the Egyptian Republic.

The Egyptain Government recently requested Hungary to complete work on the bridge by this date, reports the newspaper *Nepakarat*.

Hungary is also completing work on a 45 megawatt power station and pumping station at nearby El Tabbin which will serve a big steel works also being erected and supply power to the Cairo grid. The contract was awarded to Hungary in 1955 in competition with 15 foreign countries. All the projects are due for completion by the end of the summer.

Indian Railways Third Class Sleeping Coaches

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

THE Indian Railways modernisation plan has been further implemented by the construction of six third class sleeping coaches in Eastern Railway workshops at Kanchrapara. These are prototype stock which will determine future designs.

The coaches are equipped with berths in two tiers. The folding upper berths are upholstered in 2-in. Dunlopillo with rexine covering, a notable improvement over the past practice and a step taken to make third class travel more comfortable and interesting. These berths are to serve as sleeping berths and kept in the closed position locked during day light hours and made available to passengers at night on payment of a small surcharge of Rs. 3/— a night. The berths are of timber.

From the point of view of amenities, these cars are a distinct improvement on the 3—tier Janata Sleeping Cars which were introduced about six years ago. These cars meet some of the passengers' complaints about the Janata Cars and add a few new amenities.

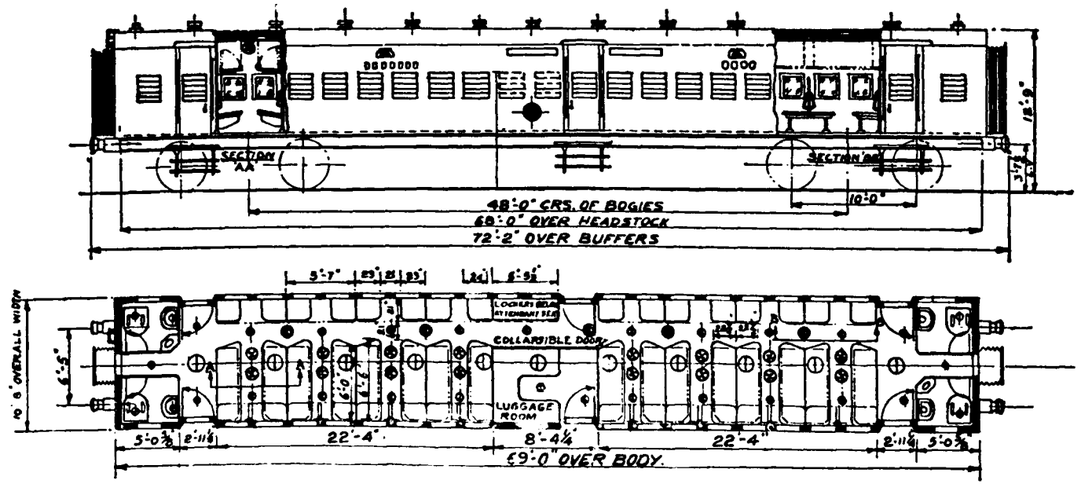
The new service is to operate on the following railways: South Eastern Railway, Northern Railway and Southern Railway, to which these cars have been allotted.

The coaches are of strong timbered construction and 69 ft. over body. Vestibules are included at each end. The bodies with straight sides are 10 ft. 7.3/16 in. over the panels. The body panelling is of 13 G. aluminium alloy sheets. The main roof carlines are of mild steel flat sections of $1\frac{3}{4}$" × $\frac{1}{2}$" size. The principal dimensions are as follows:—

Length over vestibule end panels	69 ft.
Width over body side panels	10 ft. 8 in.
Height over roof sheets	12 „ 9 „
Gauge	5 „ 6 „
Tare weight	45 Tons. 15 Cwts 2 Qrs.

UNDERFRAME AND BOGIES

The underframe is of riveted mild steel construction to the I. R. S. design with a length of 68 ft. over the headstocks. Draw gear is of the I. R. S. type. The underframe is 9 ft. 3 in. wide over solebars and the body overhang is reduced by fixing body brackets on the sides, ends and corners of the underframe so as to extend the width over the body brackets to 10 ft. 6 in.



Elevation and plan of Prototype Third Class Sleeping Car, showing the Layout of Accommodation.

The bogies are to Indian Railways standard design with a 10 ft. wheel base. They are constructed of riveted rolled steel sections and steel plates. The wheels are rolled steel disc type 3 ft. 7 in. dia. on tread. Inside and outside brake blocks act on all wheels.

Plain bearing axle boxes are fitted in all cases. IRS heavy coil bolster springs are used throughout while the laminated side bearing springs with rubber auxiliary springs carry the individual load on each wheel.

The brake gear comprises the automatic vacuum brake and has two standard 24 in. dia. cylinders; the brake on each bogie being operated by one cylinder.

ACCOMMODATION

Accommodation in each car provides seating for 80 persons and sleeping for 24; the sleeping accommodation is obtained by the provision of hinged upper berths, 16 Nos. placed transversely and 8 Nos. longitudinally. The upper berths are trimmed in brown rexine on foam type rubber cushions.

The seats are arranged transversely affording sufficient knee room for the passengers and inclined to 4 deg. Seats are located at a height of 16" above the floor and are arranged to face each other. In place of the conventional cast iron legs, cantilever type built-up seat brackets have been provided to support the seats made up of timber frame with match boards laid on it. This facilitates easy sweeping and washing of floors. A straight through corridor 1 ft. 9 in. wide connects the vestibules located at the two ends of the coach.

Access is by fixed steps through body side doors, two Nos. of which are provided on each side very near to the ends. In addition to these, two emergency doors located near about the centre, one on each side, have also been provided.

LUGGAGE COMPARTMENT

There is a small luggage compartment of 1½ tons capacity in the centre. The intention is to take charge of the passengers' baggages at the time of entraining and return them on completion of the journey.

This compartment is 8 ft. 4½ in. long by 5 ft. 10½ in. wide and is provided with a collapsible gate to form the corridor. A luggage rack is provided in the compartment. Facing the collapsible gate and in line with the single seat, a seat for the attendant with locker below has been provided. The seat is 4 ft. 4.7/8 in. long × 21" wide. The locker is fitted with a sliding door.

The partitions for the luggage compartment and the lavatories, the transverse partitions and the personal luggage shelves are of block board construction and the body interior is finished with plywood. Flooring consists of oxy-chloride flooring composition laid on G. I. P. pattern floor boards.

VENTILATION

To provide a free outlet for air being exhausted through the roof, the coaches are provided with 11

Interior of the Car showing the Seats along gangway and arrangement of transverse and longitudinal Upper Berths.
(By Courtesy of Public Relations& Publicity Officer,Eastern Railway)

Interior of the Car showing the Seating and Sleeping Arrangements.
(By Courtesy of Public Relations& Publicity Officer,Eastern Railway)

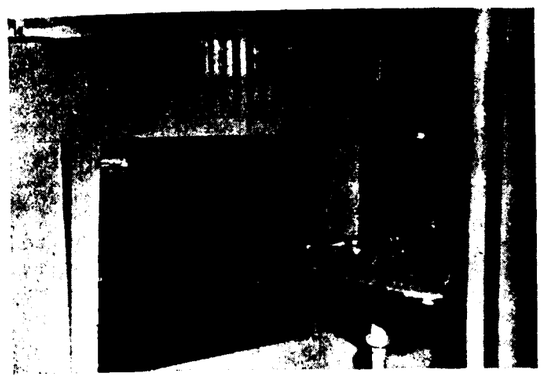
Nos. Oriental type ventilators. The ventilation of lavatories is by Banjo type windows. The upper berth partition is constructed of B. R. C. netting of 3" × 1" rectangular mesh framed in timber for free circulation of air inside the coach.

The transverse upper berths are all of equal size being 6 ft. long and 1 ft. 8½ in. wide. The longitudinal upper berths have been made in two sizes, 5 Nos. being 5 ft. 6 in. × 1 ft. 9½ in. size, three 5 ft. 4 in. × 1 ft. 9½ in. size. Four movable ladders have been placed in each coach for access to these berths.

Amenities for passengers provided in these coaches include 16 Nos. 16" sweep fans of close mesh guard type, 4 Nos. 15 watts blue night lights, a sufficient number of lights including external lights outside the coaches, separate switches for lights, ash trays, safety catches on doors, door windows and body side windows and protection bar fittings on all the window apertures.

LAVATORY ARRANGEMENTS

Four lavatories are arranged at the two ends of each coach. The walls in the lavatories are covered with Eternit granite sheets in light green shade. The metallic fittings located inside the lavatories are either of stainless steel or chromium plated. A water supply of 240 gallons is provided by 2 Nos. overhead tanks each of 120 gallons capacity.



Layout of the Toilet showing Wash Basin, Mirror, etc.
(By Courtesy of Public Relations& Publicity Officer,Eastern Railway)

The lavatories are equipped with stainless steel latrine flushing pan, wash basin, wall protector, mirror, shelf below mirror, Towel rail, soap tray, Lotah shelf, receptackle for lotah, Coat hooks, bottle opener and hand hold. In addition to the above, two octagonal shaped wash basins with mirrors above are fitted in the Lavatory walls of two lavatories, one at each end, on the compartment side.

Power for the electrical equipment is provided by Stone's 100 amp. Tonum axle driven generator. Accumulators are of the standard Indian Railways of double battery parallel block system; the battery is of the lead acid type of 300 amp. hour capacity. Control of lights is by means of magnetic switches and that of fans by iron—clad switches.

The finish of the exterior is carried out in gulf red enamel with the Railway crest at the bottom panel on both sides. The interior is furnished in a pleasing shade contrast in paints light buff enamel and light brown enamel conforming to the Indian Railways standards practice for third class coaches. The ceiling has been given a white mat finish. The door hand holds are made of stainless steel tube to give a bright appearance. The door locks are also nickel plated for the same reason. All the windows are of "lift—to—open" type and fitted with aluminium alloy louvres.

ACKNOWLEDGEMENTS

For permission to publish this article and to reproduce the drawing and photographs, the author wishes to express his grateful thanks to Messrs. A. K. Mullick and D. J. Batliwala, Chief Mechanical Engineer, Eastern Railway and Deputy Chief Mechanical Engineer, Eastern Railway, Kanchrapara Shops respectively.

WAGON REPAIR WORKSHOP—KOTAH SELECTED

A new broad gauge wagon repair workshop is to be set up at Kotah on the Western Railway at an approximate cost of Rs. 2.10 crores. The Railway Board has also decided that the wagon workshop at Mahalaxmi, near Bombay, should be converted into a carriage repair shop.

The Western Railway is likely to have about 26,500 broad gauge wagons in service at the end of the Second Plan Period. It is necessary to provide for capacity for periodical overhaul of 8,800 wagons per year. As against this, the existing capacity is just over 3,000 per year on the railway.

A.E.I. Equipment for first 3000 Volt D.C. Railway Electrification in India

By R. Subramanian, B. Sc. (Hons.), D. I. I. Sc.
Associated Electrical Industries (India) Private Ltd.

THE electrification of the Howrah-Burdwan Main Line of the Eastern Railway has the distinction of being the first 3000 volt D. C. Electrification on the Indian Railways. Associated Electrical Industries (India) Private Ltd. are proud of their contribution to this important suburban electrification, which is calculated to bring much-needed facilities to Calcutta's travelling public after a century of steam locomotion. Their role in this scheme includes the supply and erection of substation and track cabin equipment, electric traction equipment for the multiple unit stock and electric signalling equipment. All the equipments incorporate the accumulated experience, aggregating over a century, of the A. E. I. Group of Companies in the design and manufacture of all classes of electrical plant for use all over the world.

The 66-mile Howrah-Burdwan Main Line is equipped with 6 rectifier substations and 3 track cabins, the entire equipment for which, with the exception of the outdoor 33000 volt A. C. Switchgear, has been supplied by A. E. I. This large installation uses pumpless steel tank aircooled rectifiers which have now become well-established for traction service.

The installed capacities and other basic details of these stations are as follows :—

Station	*Installed Capacity*	*No. of Outgoing Feeders*
Belur Substation	3–2500 KW units	10
Sheoraphuli ,,	3–2500 KW units	7
Bandel ,,	2–3000 KW units	6
Pundooah ,,	1–3000 KW unit	4
Memari ,,	1–3000 KW unit	4
Gangpur ,,	2–2500 KW units	8
Howrah Track Cabin	—	11
Konnagar ,, ,,	—	6
Burdwan ,, ,,	—	4

The Substations receive power from the Damodar Valley Corporation system, over the Eastern Railway's transmission lines, at 33000 volts, 3 phase, 50 cycles A. C. It is then transformed and rectified to 3000 volt D. C. by the transformers and rectifiers in the substations. The outgoing D. C. supply to the overhead equipment on the tracks is controlled by 3000 volt D. C. high speed circuit breakers. At the track cabins, similar high speed circuit breakers are provided to sectionalise and parallel the overhead equipments of the various tracks.

The rectifier transformer is of the outdoor, oil-immersed naturally-cooled type and weighs approximately 34 tons. The 33000 volt primary is connected in star, while the 3000 volt secondary is a 12-phase quadruple zig-zag winding. The transformer tank also houses a tertiary winding to provide a 400-volt 3-phase A. C. supply for the rectifier auxiliaries, a no-load voltage rise suppression unit and special current transformers for protection of the rectifier against back-fire.

Each rectifier unit consists of two pumpless, steel tank, air-cooled, six-anode mercury arc rectifiers. The tanks are mounted on withdrawable trucks on wheels, and are housed in steel cubicles. Underneath each tank, and forming part of the truck, is mounted a motor-driven fan to cool the tank. The rectifier cubicle also houses the ignition and excitation unit, grid control apparatus and other auxiliaries for the rectifier. The complete rectifier unit occupies a floor

space of only 8 ft. × 5 ft. 6 ins., which has been possible due to the use of a most compact design of rectifier tank so far developed for Railway service.

The rectifier tanks are provided with grids, which are used for arc suppression in the event of a back-fire. Voltage control on the rectifiers is by means of off-load tap-changing switches on the rectifier transformers.

Adjacent to the rectifier cubicles, and forming a continuous panel with them, are the two cubicles which house the control and protective gear for the rectifier and its associated oil circuit breaker. In these cubicles are contained various instruments to measure the voltage, current and power being supplied by the rectifier, switches to start and stop the rectifier, indicating lamps and protective relays.

All the 3000 volt D. C. circuit breakers are of the high speed type, working on the "rate of rise of current" principle, which enables discrimination between overloads and short-circuits. The breakers are mounted on trucks on wheels, which are housed in concrete cells. Shutter mechanisms, with padlocking arrangements, are provided which ensure perfect safety for personnel working inside the cells with the breakers racked out. The rectifier breakers are rated at 1600 amps. and are set to trip on a reverse current of 500 amps. The feeder breakers are rated at 1000 amps. and can be set to trip on forward currents in the range of 1500 to 2500 amps.

The operation of the entire equipment is automatic, and can be controlled either from the control board in the substation or from the supervisory remote control board in Howrah. Operation of one switch will in succession, close the 33000 volt A. C. oil circuit breaker, start the rectifier fans, put on the ignition and excitation circuits in the rectifiers and close the 3000 volt D. C. rectifier high speed circuit breaker. Protective devices ensure that the set is shut down and re-started (for a pre-determined number of time) in the event of any type of fault or incomplete sequence.

A noteworthy feature in the equipment is the comprehensive scheme of interlocking provided. Before access to the rectifier equipment could be obtained, a series of operations in a definite sequence have to be done; this is aimed at isolating the A. C. and D. C. sides of the equipment and earthing all live parts; conversely, these operations in the reverse sequence must be performed before the equipment could be energised.

Other items of equipment inside the substation are an L. T. A. C. / D. C. board, which provides power at 400 volt 3-phase A. C., 110 volt single phase A. C. and 110 volt D. C. for the control circuits and auxiliary services, a negative recording cubicle to record the current drawn from the substation and to provide protection against an excessive rise in voltage of the rails above earth, a lead-acid station battery and a charging equipment.

The entire equipment, with the exception of the batteries and charging equipments which have been supplied by two well-known battery makers, has been designed and manufactured by the British Thomson-Houston Co. Ltd. of England, a member of the A. E. I. Group of Companies. A portion of the 3000 volt D.C. switchgear has also been manufactured in India by Associated Electrical Industries Manufacturing Co. Ltd., to BTH designs.

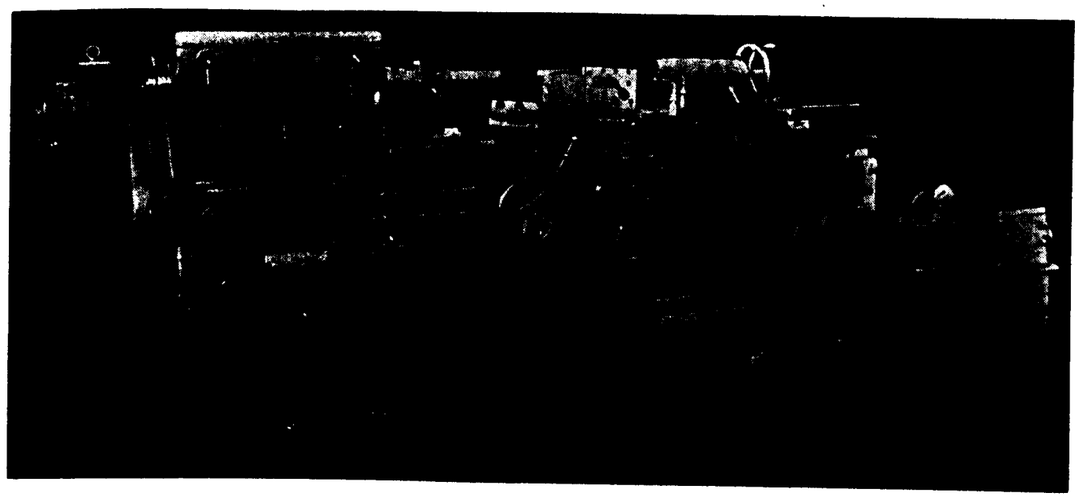
Associated Electrical Industries (India) Private Ltd. have also on order the complete traction equipments for 36 motor coaches and 68 trailer coaches to operate on the Howrah-Burdwan Main Line. These equipments, which will be installed on coaches built by Jessop & Co. Ltd., are being designed and manufactured by Metropolitan-Vickers Electrical Co. Ltd. of England, another member of the A. E. I. Group of Companies. The design of the equipment will be generally similar to the 450 sets of 3000 volt D. C. motor coach equipments successfully manufactured by Metropolitan-Vickers for railways in South Africa, Brazil and Poland.

Each 3-car train will comprise one motor coach and two driving trailer coaches, the motor coach being in the middle. The train will be powered by 4-210 H. P. traction motors, mounted in the motor coach. The motors will be of self-ventilated, axle-hung, nose-suspended type, driving the wheels through solid gear-wheels. Current at 3000 volts D. C. will be collected from the overhead line by either of two light-weight pantographs and fed to the motors through the standard form of resistance control. The motors will be connected permanently in series—pairs, and the control gear will be of the modern electro-pneumatic unit contactor type. A motor-generator set, mounted on the underframe and driven off the 3000 volt D. C. supply, will provide low tension power at 110 volt D. C. for train lighting and ventilation, operation of the control circuits and of the brakes.

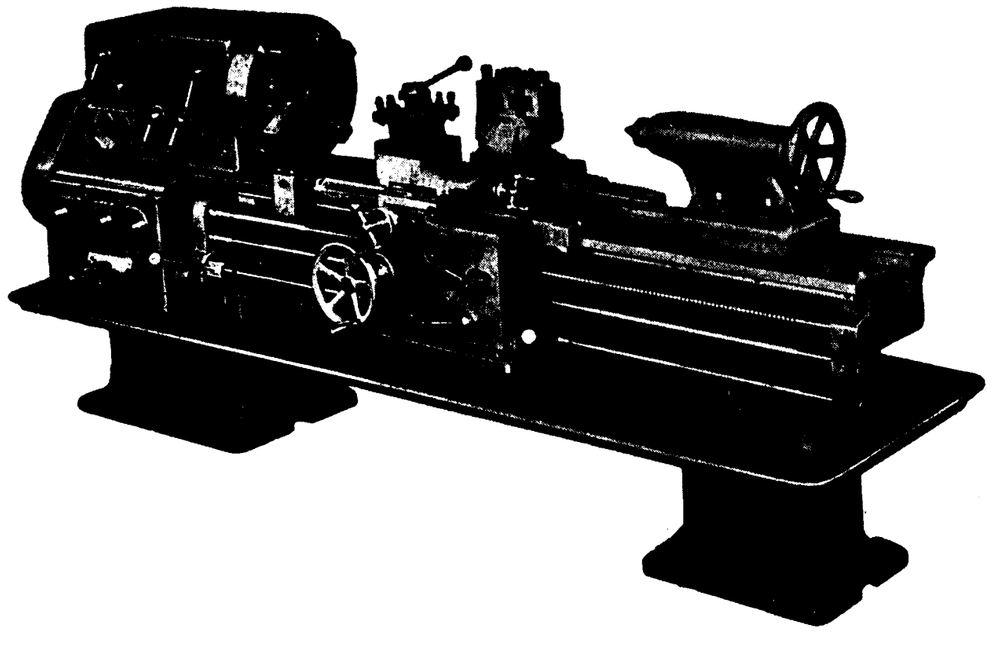
The equipments are designed to permit a maximum speed of 65 m. p. h. on level track with a fully loaded train, and a starting acceleration of 1.2 m. p. h. per second upto 25 m. p. h. Upto three 3-car trains can be coupled together and operated by one driver in the leading cab, which facility will be required during peak hours. Provision is also made to cut out half the motor power and run the train at reduced speed, in the event of a fault in any one motor.

Worthy of particular note is the fact that approximately 15% of the traction equipment is being manufactured in India. The manufacture is being carried out by Associated Electrical Industries Manufacturing Co. Ltd., to the designs of Metropolitan-Vickers. This is the first time when manufacture of traction equipment is being carried out in India, and represents a substantial and welcome saving in foreign exchange.

The electrification of the Howrah-Burdwan Main Line also involves provision of automatic signalling between Howrah and Serampore, and manually controlled colour-light signalling beyond. Well over 350 colour-light signals of the multi-unit type, 50 electric point machines, and considerable numbers of junction direction indicators, A. C. and D. C. relays, and other signalling equipment have been supplied by Associated Electrical Industries (India) Private Ltd. These equipments have been designed and manufactured by Metropolitan-Vickers-GRS. Ltd. of England, also a member of the A. E. I. Group of Companies.



MACHINE TOOLS SUPPLEMENT



Scottish Machine Tools for Railway Workshops

[Scottish Machine Tool Corporation are represented in India by Rallis India Limited.]

SCOTTISH Machine Tool Corporation continue to maintain their close association with Railway Workshops both in India and elsewhere. Among the recent developments which they are now offering for sale are fully automatic profiling attachments for heavy Wheel Lathes using tungsten carbide tooling and high speed rail planing machines of exceptional strength and power designed to utilise tungsten carbide tools.

Among some of the more interesting contracts recently obtained from the British Railways in connection with their modernization programme has been one for supplying approximately half of a large quantity of Axle Journal Re-Turning Lathes fitted with grinding heads. These machines will be employed exclusively in the conversion of axles intended for plain bearings to be suitable for mounting the roller bearings which are being generally adopted now through British Railways. The Corporation are also building a batch of standard Railway Planing Machines for a Central Railway Shop and these Planers are provided with speeds up to 120 f. p. m.

LOUDON Rear View of 6'–3" Locomotive Wheel Lathe

Bennie 8' × ½" Guillotine Shearing Machine

Owing to the diversity of the range of machines built by Scottish Machine Tool Corporation they are also able to provide a variety of other machines in connection with rail working such as rail curving rolls, fishplate punching machines and heavy duty bearing plate punching and cropping machines while for carriage and wagon works they can also supply guillotines, gang punching presses for working on the coach frames, press brakes and plate folders, notching machines and spring plate finishing presses for the cold working of spring laminations. This last machine has been supplied to a number of Indian Railway workshops where it is achieving valuable economies by eliminating the expense of heating the spring steel bars and by making simpler handling possible. Other machines recently delivered to the Indian Railways include an Axle Journal Lathe for working with mounted locomotive wheel sets and a heavy duty wheel lathe having 6'—0" diameter faceplates.

Role of Asquith Machine Tools in Railway Workshops

THE range of machine tools manufactured by member companies of the Asquith Machine Tool Corporation includes many machines applicable to the construction and maintenance of railway locomotives, rolling stock and equipment.

Asquith O. D. Type Radial Drilling Machines are to be found in railway workshops all over the world. These machines are made in a wide variety of sizes up to a maximum radius of 12 ft. and capacity to drill from the solid in mild steel up to 5 in. diameter.

Asquith Radials are well-known for their high productive capacity and a design aspect which contributes to this advantage is the grouping of controls for convenience of operating and for visual as well as manual simplicity.

The O. D. 1 Type Radial has a nominal drilling capacity of up to 3 in. from the solid in mild steel. A range of 12 spindle speeds is provided and 4 spindle feeds are available as standard. If required, a 6-feed box can be supplied.

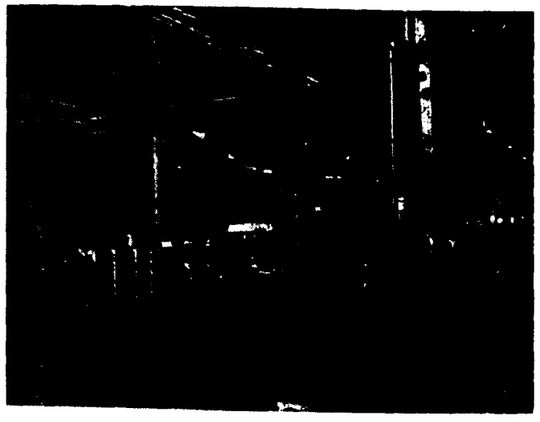
For tapping operations reverse to the spindle is obtained electrically, eliminating mechanical clutches with their incidental conditions of wear and adjustment. The efficiency of this principle is demonstrated in the works of many users where quite often twenty reversals a minute are made continuously on production operations.

Anti-friction bearings are introduced wherever they can be usefully employed on O. D. Radials and a highly efficient system of lubrication is another feature which contributes to the long, accurate, trouble-free operating life of the machine.

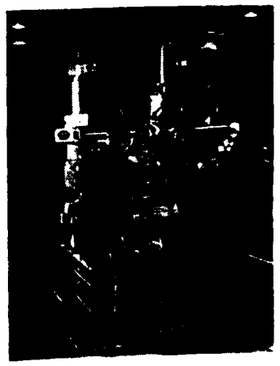
Another Asquith Radial which is widely used for railway applications is the Structural and Plate Drilling Machine, type E. G. C. This may be regarded as a simplified version of the O. D. Radial, specially designed to provide structural engineers with simple, fast, holemaking equipment. This machine is available with a variety of mountings such as traverse bed for drilling loco frames, large structural members, etc.; bogie base for plate drilling; box bed for general purpose work, etc. Drilling capacity of the machine with three speeds, is up to 2 in. from the solid in steel. If required, 12 speeds can be provided and a capacity of 3 in. in steel is then possible.

Machines of particular value for repair work and for holemaking in large workpieces, are the Asquith Portable Universal Radial Drilling Machines. These are designed so that the machine can be brought to the work and positioned as required. This type of Asquith Radial is made in two types. The smaller capacity machine, which drills up to 2 in. from the solid in steel, is provided with bogie bed allowing horizontal traverse to the column on the bed itself, which has wheels and screw jack supports to take the weight when drilling.

A double line of DRUMMOND "Maximatics" employed for crankshaft turning for diesel engines.



ASQUITH H. R. G. 4" Spindle Horizontal Boring Machine, set-up to work with three worktables.



ASQUITH O. D. 1 Radial Drilling Machine, drilling a drum.

ASQUITH E. G. C. Radial Drilling Machines drilling large girder for structural engineering.

The larger type of machine for drilling up to 2¼ in. from the solid in steel, has a radius of 7 ft., and a bed giving 5 ft. 6 in. horizontal traverse is supplied.

Horizontal boring is another field of railway engineering where Asquith machines figure prominently. A very wide range of types and sizes of Asquith Horizontal Boring Machines is manufactured and covers every requirement. In fact, the latest Asquith machine of this type is one of the largest in the world, with a 10 in. spindle and 100 h. p. spindle driving motor.

The H. R. G. machine is a popular general engineering machine with 4 in. spindle. All operating controls are grouped on the front of the spindle slide, and a good selection of speeds and boring and milling feeds is available.

Machine tools manufactured by Drummond Bros. Ltd., Guildford, of interest to railway engineers, include Gear Shaping Machines, Automatic Multi-tool Lathes and Copy Turning Lathes. With the increasing employment of diesel traction, machines for gear cutting and crankshaft turning are of growing interest.

The Drummond "Maxicut" No. 3A Gear Shaper is essentially a heavy duty machine for cutting spur and helical gears up to 18 in. pitch dia. by 3/4 diametral pitch.

A 3 h. p. motor mounted in the base casting at the rear of the machine provides the main drive by vee belt to the gear box. Stepped pulleys enable two speeds to be obtained, and these, together with speed changes from the gearbox, permit a choice of eight speeds.

SWIFT Lathes turning ball joints in a British locomotive works.

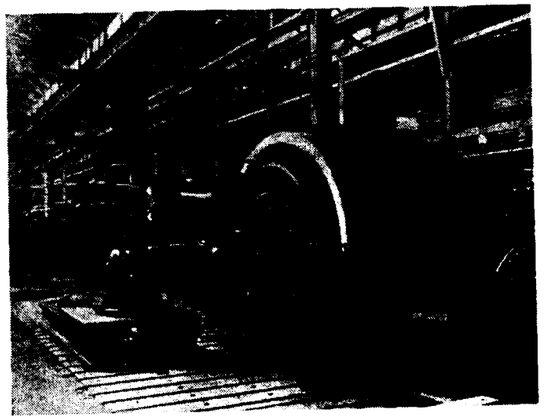
Drives are taken from the gear box to the cutter reciprocating crank and to the feed control box. Two cams on the main drive shaft operate the relieving mechanism.

The feed motions are direct to the cutter spindle and through pick-off gears to the work spindle, enabling them to rotate in unison according to the gear being cut.

When setting the machine, the required speed and feed are quickly obtained with direct-reading hand wheel selectors.

Non-productive time has been reduced to a minimum by the design features of the No. 3A "Maxicut", and it has proved ideal for the production of various types and sizes of gears in batches, as well as for long-run high-output production.

Drummond "Maximatic" Automatic Multi-Tool Lathes are essentially high-production machines and



ASQUITH 7' 0" Portable, Type PD. 5, drilling a large casting.

DRUMMOND No. 3-A "Maxicut" Heavy Duty Gear Shaping Machine, cutting gears for diesel engines.

are widely employed for petrol and diesel engine crankshaft turning.

The " Maximatic " operates on an automatic cycle. After loading the workpiece, the main control lever is pulled forward and the tool slides commence their cycle of quick infeed, turn and quick return. All motors automatically stop ready for the workpiece to be removed.

Drummond " Maximatics " are made in a range of sizes with capacities up to 15 in. by 8 ft. 6 in.

Lathes manufactured by George Swift & Sons Ltd., Halifax, are to be found in many railway shops for manufacture and repair work. These modern lathes are made in a wide range of standard types with maximum swing up to 72 in. and with bed length to meet requirements.

Surfacing and Boring Lathes are a feature of the range, in addition to the normal types of centre lathes, and hydraulic copy turning has been applied to many types and sizes as required.

The illustration shows a typical installation of Swift Lathes in a British locomotive building works.

INDO-JAPANESE TRADE AGREEMENT

India and Japan have signed a Trade Agreement on Feb. 4 under which both Governments agree to accord each other most favoured nation treatment on a wide range of subjects which include customs, tariffs, imports and exports, and foreign exchange transactions etc. The agreement is valid for a period of two years and will continue in force thereafter subject to three months notice.

According to the schedules attached to the agreement, India will export to Japan, inter alia, industrial raw materials (tanning materials, iron and steel scrap etc.), minerals (iron ore, manganese ore, mica, coal and magnesite etc.). India will import from Japan among other things commodities, such as, iron and steel and other metals (galvanized steel plate and sheets other than iron and steel mill products, aluminium rolled products, copper alloy rolled products, insulated electric wire etc.)

Universal Lathe SENIOR

THIS machine is an outstanding new development by WEISSER HEILBRONN, designed for versatile application, easiest operation and extreme rigidity.

The SENIOR lathe has the following features :

(1) All 18 spindle speeds are engaged by two levers only.

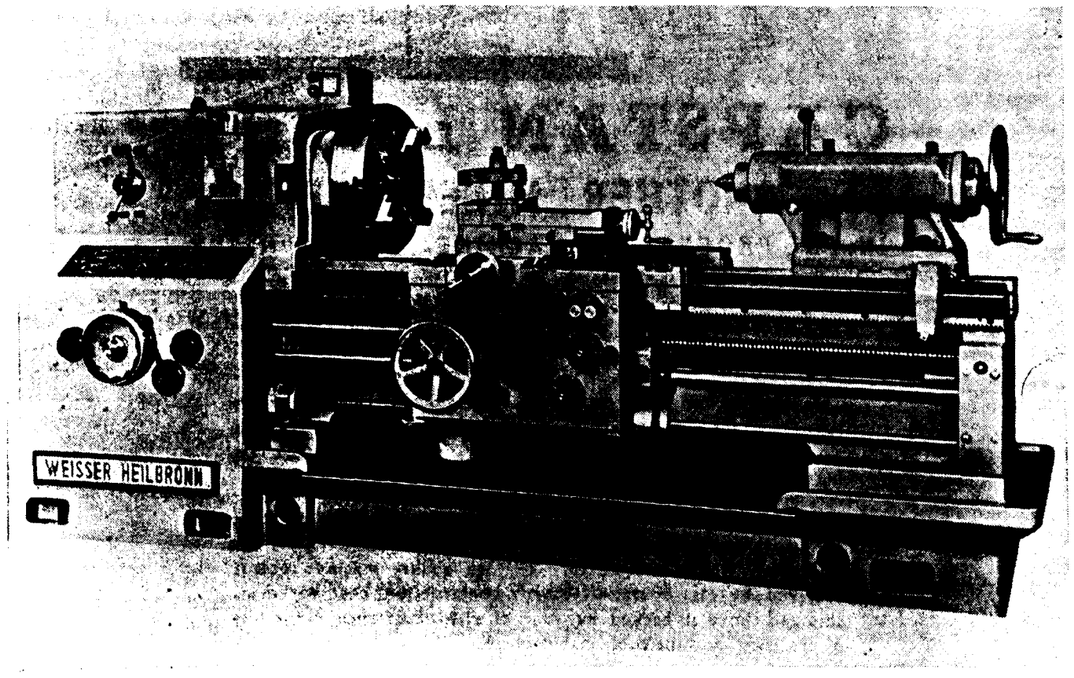
(2) The feed and thread-cutting gear box has no tumbler and is designed as sliding gear drive. A graduated dial for 40 control steps permits quick setting of feeds and threads.

(3) The machine bed is remarkably wide (19.685") and extremely sturdy. The standard design of the machine features hardened and ground steel gibs, to assure utmost unobstructed chip removal.

(4) The main spindle bore has extra large diameter of 3.188".

(5) A patented apron release with an accuracy of .000394 without carriage recoil.

( ) The tailstock is remarkably sturdy and an independent unit. The graduated quill has a large diameter of 4.330".



Universal Lathe Senior

(7) A single-disc electro-magnetic brake permits split-second stops of main spindle.

(8) All sliding gears are mounted on hardened and ground K-profile shafts. There will be no profile deformations even after years of operation.

(9) All bearings and gears in the headstock, feed and thread-cutting gear box, as well as change gear drive unit have central lubrication.

(10) The base mounted main motor, model B 3, is attached at the rear in a well protected

(Continued on page 31)

Railways and "MK" Lathes

By P. M. Somasekhara Rao, B.Sc., B.E.(Mech.), B.E.(Elec.)

RAILWAYS constitute the biggest investment of the Indian Government in the Public Sector. Naturally it plays an important part in the country's economy. During the Second plan period, Railways have quite a big responsibility to cope up with the tremendous industrial activity and Railway workshops have a two-fold responsibility. One is to maintain the existing, fast deteriorating, aged stock of coaches, waggons, and above all locomotives and the other is to replace the obsolete stock which is overaged, as also to increase the stock to meet the increase in goods and passenger traffic by way of manufacture of new stock. It is gratifying to note that Railway Workshops are doing their best and no amount of praise, perhaps, will amply justify the same. It is here, that the Mysore Kirloskar's, as pioneers in the field of Machine Tool manufacture in India, play their part in helping the Railways, in fulfilling their obligation to the nation.

The Mysore Kirloskar Ltd., manufacture the Centre Lathe, which is the most basic Machine Tool, in various sizes to suit the needs of diversified customers. Either it be a small workshop with hardly a machine tool or two, or it be a large highly developed shop like a Railway Workshop or a factory like the Mysore Kirloskar itself, an industry where accuracy is the first and the last word, an MK Lathe has its place in one size or the other.

RANGE OF MYSORE KIRLOSKAR LATHES

CENTRE LATHES. (GEARED HEAD TYPE).	C. H.
Harihar Lathes.	6½"
R. L. Type No. 1. Lathes.	7" – 8"
R. L. Type No. 2. Lathes.	8½" – 9½"
R. L. Type No. 3. Lathes.	10" – 11"
Bombay Lathe.	12½"

CENTRE LATHES. (CONE PULLEY TYPE).	C. H.
Harihar and M. B. Type Lathes.	6½"
Shimoga Lathes.	9½"
Bhadravati Lathes.	10½"

Perhaps there is no Railway Workshop in India without a Machine Tool of MK manufacture. The Mysore Kirloskar Ltd., provides railways with A1 Centre Lathes — known for production and precision. These lathes are of proved design and performance and are manufactured to Dr. Schlesigner Standards under strict vigilance by experienced men at all stages of production. Their modern well equipped foundry, provides all the castings that are necessary for the production of these Lathes. The experienced and well trained staff with the aid of the good sand testing Laboratory, Chemical Laboratory, and Metalographic Laboratory will ensure only the best quality, alloyed heavy duty Cast Iron castings to flow out of the Foundry. The well equipped Machine shop with its modern and precision machine tools as also the special machines designed and built by MK will go to produce the hundreds of parts, that go to make the lathe, in quality and quantity too. Well organised lay-out and proved production methods and co-ordinated planning all go to produce the necessary precision parts which are all subjected to rigorous inspection.

These parts are then fed on to the Sub-Assembly Section, where individual units like Head Stocks,

(Continued from page 29)

position. All controls are united in a control cabinet at the rear of the headstock.

The main specification of the new SENIOR model is as follows :

Height of centres	in.	$10\frac{7}{8}$	$11\frac{3}{8}$	$13\frac{3}{4}$
Turning dia. above bed	in.	$22\frac{1}{8}$	$24\frac{5}{8}$	28
Swing dia. over bed gap (special equipment)	in.	31	$33\frac{1}{2}$	$37\frac{1}{2}$
Turning lengths	in.	40 / 60 / 80 / 100 / 120		

Main spindle speeds :

18 speeds	range I	RPM	18	to	900
or	range II	RPM	22.4	to	1120
or	range III	RPM	28	to	1400
Motor		HP	10 / 15 / 20		

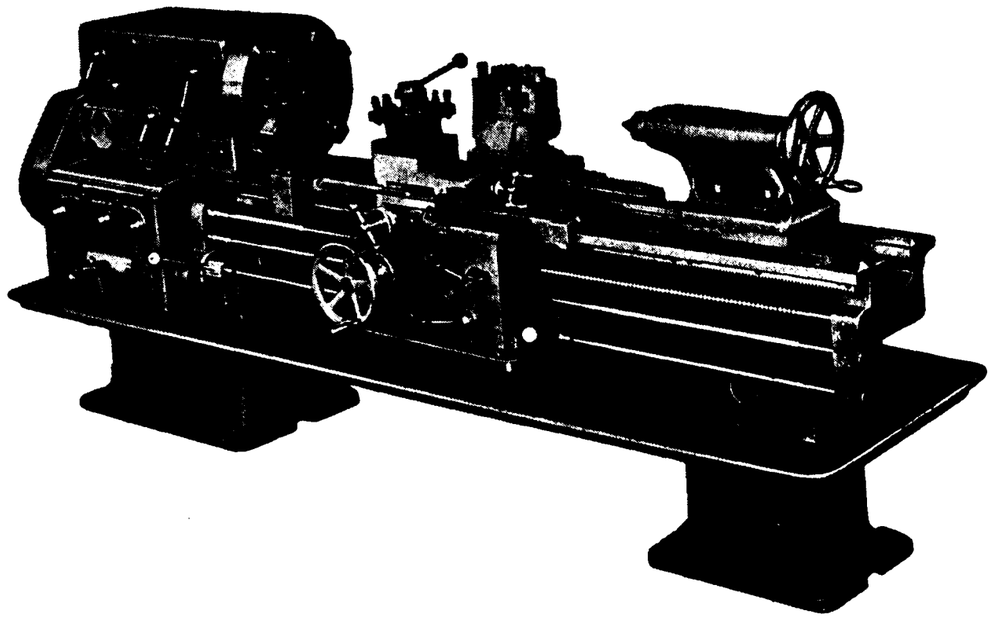
Please note the extremely sturdy construction of the SENIOR model. For example, when supplied with $10\frac{7}{8}$" height of centres and 40" turning length, the machine has a net weight of 7920 lbs.

The Model DLNE High Speed Lathe

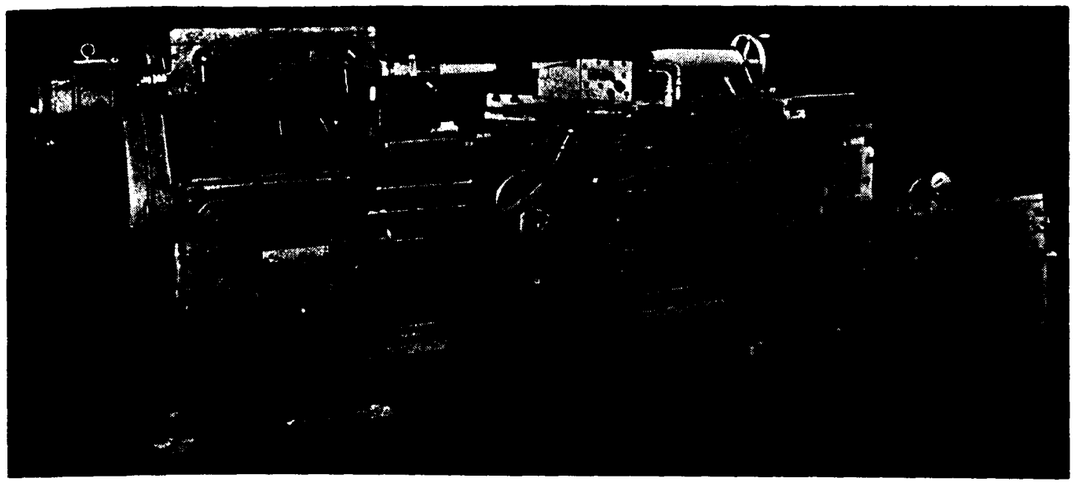
FOR many years this has been the standard machine on the WEISSER HEILBRONN production programme and has become especially popular in foreign countries. It may be designated as the *Prototype of the traditional Engine Lathe.* This machine is not only used in production plants but is also standard equipment in the repair shops of mines, textile and paper factories and chemical plants, as well as in large scale garages and omnibus repair shops and railroad shops both at home and abroad.

This machine, too, is characterized by typical WEISSER HEILBRONN features :

1. All gear wheels and sliding gear shafts are of hardened chrome nickel steel and have precision ground tooth flanks.
2. In place of six spline shafts they are exclusively equipped with triangular K-profile shafts (patented by Krause, Vienna). These shafts have proven their merits on WEISSER HEILBRONN machines for over 12 years.
3. Surface hardened main spindle with lapped bearing surfaces. A pressure lubrication system for main spindle. A pump presses 8 litres of oil through the bearing per minute, so that absolutely correct lubrication is warranted.
4. Patented apron construction with a release accuracy of 0.01 mm by which recoiling of the slide and tool breaking are eliminated.
5. Honed tailstock bore (superfinish).
6. Safety devices on the control shaft give full protection against accidents and make unintentional starting impossible.
7. Transverse feed slide has T-slots in rear for mounting multiple tool holder and recessing tools.



Engine Lathe Model DLNE.



Engine Lathe Model DLNE with copying attachment MULTICOP.

swing over gap	720/780/830 mm	28 3/8"/ 30 3/4"/ 32 5/8"
18 main spindle speeds row I		12—600 rpm
18 main spindle speeds row II		15—750 rpm
18 main spindle speeds row III		19—935 rpm
power requirements		7,5 / 10 HP

DIMENSIONS

height of centres	250/280/305 mm	10"/11"/12"
swing over bedway	495/555/605 mm	19 1/2"/22"/ 23 3/4"

distance between centres

1000—1500—2000—2500 and 3000 mm
40" 60" 80" 100" and 120"

RAILWAY STOCK FROM AUSTRALIA

Twelve diesel rail cars and 460 unassembled rail wagons have arrived from Australia for the Indian Railways.

They have now been unloaded from the chartered freighter "Belkarin" at Madras, where the rail wagons are being assembled and the rail cars prepared for service in the Indian Railways workshops.

Two Australian experts, Mr. S. Dick and Mr. I. Macfarlane, are in Madras to assist with this task.

The shipment is the second major delivery in a Colombo Plan project under which Australia is supplying India with 24 complete rail cars and 2,000 unassembled rail wagons.

The first major shipment—560 rail wagons—reached India in July last year, and delivery has thus reached the half-way stage.

The other 12 rail cars and the rest of the rail wagons are expected to be delivered towards the middle of this year.

Each of the rail cars is valued at approximately £ A 60,000 (Rs. 6 lakhs).

The rail cars are of broad gauge, 72 feet long and 10½ feet wide, with seating for 82 passengers. They have double-end drivers controls, and each car is powered with two 200 B. H. P. Leyland horizontal diesel engines driving through fluid couplings and four-speed epicyclic gearboxes on the inner axle of each bogie. Their top speed is 80 m. p. h.

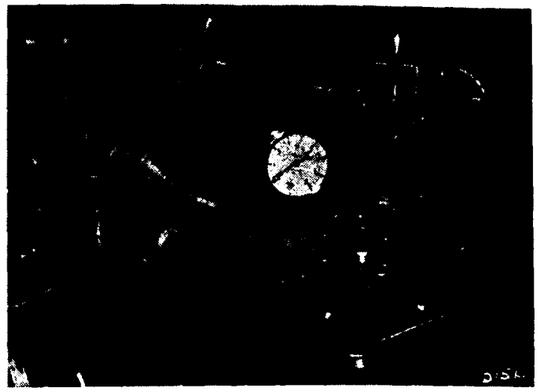
It is understood that the rail cars will be used on feeder services by Southern Railways.

This whole Colombo plan project is designed to assist the development of the Indian railways system as part of the Second Five Year Plan. The total cost is approximately £ A 4 million (about Rs. 4 crores).

HERBERT LATHE DESIGN

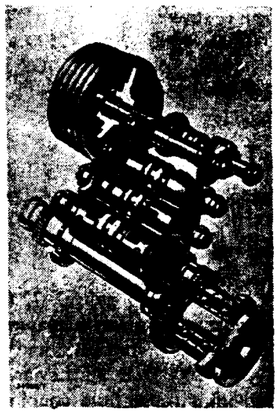
Some features of Herbert Capstan and Turret Lathe design which contribute to high-quality, accuracy, durability and trouble-free operation.

The photograph below shows the headstock bearing of the Herbert No. 9C/30 Combination Turret Lathe, which has a maximum swing of 30".



Wall thickness and bore diameter of the spindle are 1⅛" and 4¼" respectively, proportions which, with the general design, provide for maximum rigidity and eliminate chatter when machining heavy work at high speeds.

Quiet running, dependent on minimum shaft deflection under load, is ensured by large diameter shafts and the minimum distance between bearings. Where this distance is excessive relative to the shaft diameter, intermediate bearings are fitted. Shafts are also kept as stiff as possible, the method, where applicable, of clamping the keyed gears and bearings against a shoulder by means of retaining split rings or circlips being conducive to this design.



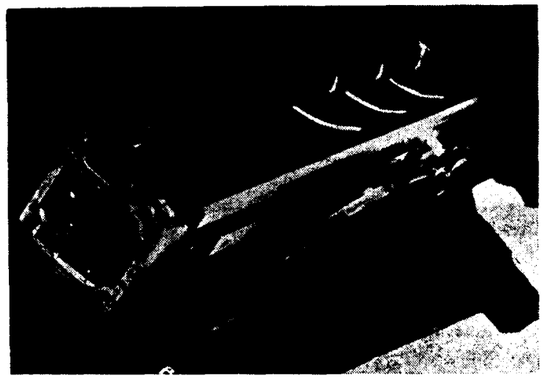
All high-stress gearing on Herbert Lathes is profile ground, an operation which, when producing cluster gears, necessitates the gears being ground separately and then clamped together.

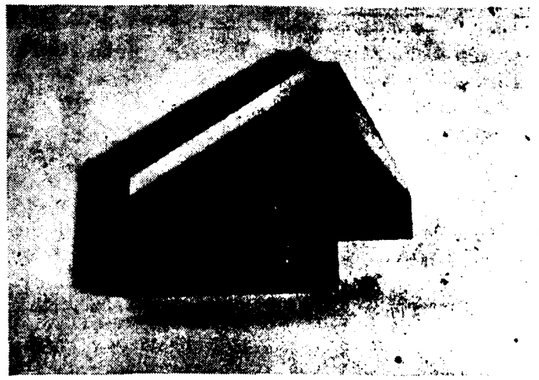
One method of holding the cluster-type sliding gears together is with a hooked key. This positive method is preferred to the radial grub screw which tends to be thrown out of its seating by the centrifugal and vibrational forces developed by high-speed shafts of this kind. The hooked-key method also permits the use of hardened and ground shafts.

Two other features of design in this Headstock are the use of sliding gears on splined shafts, in preference to using sliding keys and all shafts are mounted on ball bearings. The main spindle is mounted on ball and roller bearings; front bearings are of the angular-contact, double-purpose type to take thrust in both directions.

The power-operated Preoptive Headstock is exclusive to Herbert Lathe design and is now fitted to two sizes of each of the ranges of Capstan, Combination Turret and Hexagon Turret Lathes. This headstock with either a two-speed motor or a single-speed motor with double clutch drive, provides sixteen speeds and transmits ample power throughout the range. This headstock eliminates idle time due to speed changing and provides simplicity of operation, long life, quiet running, freedom from vibration and transmission of maximum power to the main spindle flange.

The accompanying illustration of the shaft and





gearing arrangement of the Preoptive Headstock on a Herbert No. 5 Senior Capstan Lathe, shows that the high efficiency originates from a multi-vee rope drive. The efficiency is maintained through shafts and gears made from alloy steel and mounted on ball bearings. The hardened and ground gears are mounted close to the bearings to minimise shaft deflection.

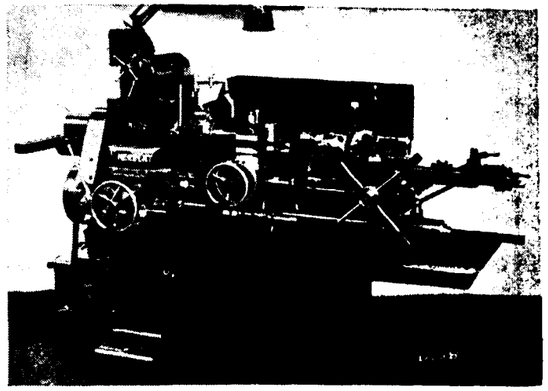
The final drive is to a main spindle which is mounted on a roller bearing at the rear end and two large opposed angular contact ball bearings, which take thrust in both directions, at the front end. These bearings are specially made to precision tolerances and supplied in sets. Each bearing is guaranteed to be within .0001" in the bore and outside diameter relative to each other.

Instantaneous change of speed, under cut if desired, is made possible by the elimination of sliding gears, the actual change being made by the power operation of highly-efficient multi-disc friction clutches which are of Herbert design and manufacture.

These Herbert clutches have been specially developed to deal with high-load conditions in restricted spaces. The clutch diameters have been kept small to permit adjacent shafts to be spaced closely together so reducing gear peripheral speeds and consequently gear noise.

The use of multiple plates running in oil gives smoothness of action combined with the ability to accelerate and sustain heavy torque loads.

Very high speeds are possible with these clutches as they are in perfect balance and not affected by centrifugal force.



HERBERT NO. 2D CAPSTAN LATHE

This is a 1¼" bar or 9" swing capacity lathe, ideal for batch production methods requiring frequent changes of set-up. Sixteen speeds, 50 to 2,550 r.p.m.; eight speeds, forward or reverse, obtained instantly without stopping the spindle.

This lathe is easy to set and simple to operate. It is capable of precision production on materials ranging from non-ferrous metals to stainless steel and its general design permits close limits to be held and maintained throughout a production run.

The machine illustrated has a long bed which increases the distance from the spindle to capstan from 18¾" (standard machine) to 26¾" and is fitted with an automatic traversing saddle. Accurate control of the transverse movement of the cross slide is provided by a large micrometer dial. This control is provided on the standard machine but an alternative fitting is the patent duo-rate cross slide which provides a fast approach and fine machining feeds.

Light pressure is sufficient to operate them, therefore very little end thrust is placed on the clutch shaft during engagement. Driving pressure is self-contained within the clutch and does not put any end load on the shaft.

Maintenance and adjustment is simple.

A constant-torque ball slipping clutch is fitted to the feed drive shafts on all the larger Herbert Lathes. This clutch limits, to a predetermined load, the torque transmitted and so protects the machine in the event of the operator permitting the saddle to run into an obstruction.

A hydraulic gauge is mounted in the turret and the feed is engaged to bring the gauge into contact with the steel block gripped in the chuck. The clutch, in this test on a Herbert No. 4 Senior Preoptive Lathe, slips at 1¼ tons. On a Herbert No. 9B Combination Turret Lathe the load is 3 tons.

The dog clutch shown in the general arrangement drawing is that disengaged by the Chiprupter, a device which breaks into short lengths the long continuous turnings produced by Chipstream Boxtools. The Chiprupter control lever actuates a glut which momentarily breaks the drive.

Although accuracy is an essential feature in the construction of all machine tools, the ability to maintain this accuracy throughout a considerable period of use under workshop conditions, is of equal importance. Thus rigidity, to avoid vibration, and durability, to resist wear, are of major importance.

Rigidity is chiefly a matter of design and, once inherent, does not vary with varying conditions, foundations on the larger machines being considered as an integral part of the machine structure. Durability, however, is never absolute because wear is always present where sliding members are involved and is progressive. Thus the machine-tool maker must combat wear by means of hardened and protected surfaces and efficient lubrication systems.

The quality of wear resistance or durability of sliding surfaces is assisted in Herbert Lathes by the Flamard process which considerably increases the wear-resisting qualities of cast-iron, without detracting from its other excellent properties. This hardening process is applied to bedways and other slides, to the mating surfaces of the turret and top slide and to spindle flanges. Wear has been practically eliminated by this process, for a check-up on a Herbert Lathe with "Flamard" bed after fourteen years continual use, confirmed that the alignments were still within the original limits.

The illustrations show the bed for the Herbert No. 7 Preoptive Combination Turret Lathe, the protection of the asymmetric bedways by a cover attached to, and moving with, the saddle at the headstock end and the depth of hardness on the bearing surfaces of the bedways.

Haphazard methods and sole dependence on the machine operator for proper and adequate lubrication have been replaced by automatic continuous lubrication to important mechanisms. The operator is now responsible only for either topping-up oil reservoirs or operating an oil pump once every four hours.

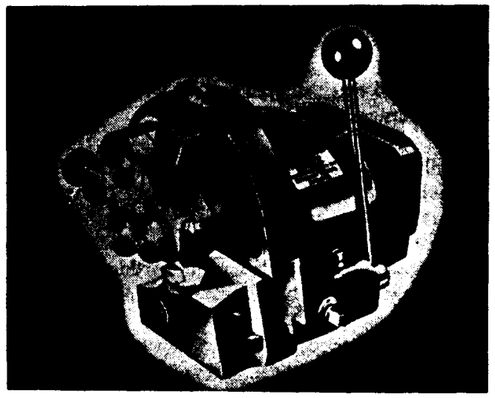
An important unit in the automatic lubrication system to the headstocks of Herbert Capstan, Turret and Auto-Lathes is the indicator, which serves the dual purpose of filtering the oil, through gauze and magnetic filters and providing a visual indication that the pump is working. In this system an oil pump forces the oil to the indicator and so to a distribution tray from which it cascades over the gears, clutches and bearings. Oil is also fed through the shafts and ejected through various orifices by centrifugal force to ensure further distribution of oil to the different moving parts.

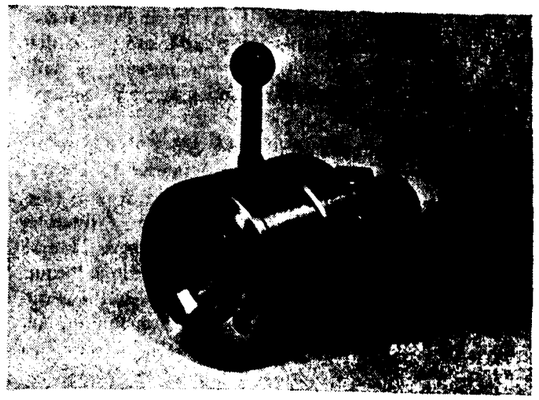
These features include :—

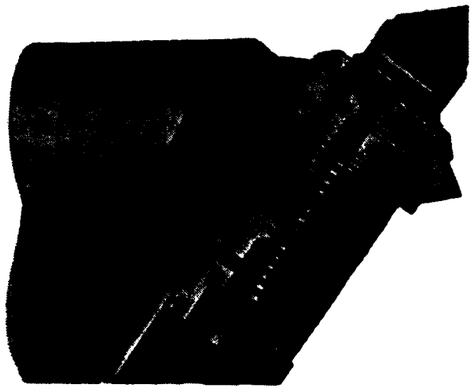
(a) Adequate protection of sliding surfaces such as the cross slide and mating slides of the saddle and turret slide with the bedways, to prevent ingress of fine chips between the mating surfaces.

(b) Wipers are fitted at the right-hand side of the saddle and both sides of the turret slide mating with the bedways. Bed covers are attached to the left-hand side of the saddle. The bottom slide on the saddle has been extended on the No. 12B to ensure full support to the cross slide at its extreme rear position and to avoid the wiper J extending beyond the end of the bottom slide.

(c) Each apron has an oil reservoir for splash lubrication of the apron mechanisms. The overflow pipe for each reservoir also assists







in draining any soluble-oil coolant which may penetrate into the aprons. The coolant, after a period of idle time, will separate from the oil and sink to the bottom of the sumps; the overflow is arranged so that when new oil is poured into the reservoir the coolant is forced out through the overflow pipe.

(d) Longitudinal feeds of saddle and capstan or turret slide are accurately controlled by "barrel-type" trip or dead stops. The fitting of barrel stops on the capstan slide has numerous advantages. They are more precise (being in-line with the thrust of the tools), contact with the trip stops is totally enclosed (chips cannot be trapped between the contact faces, neither can the operator's fingers) and are easy to set.

(e) The turret slide clamp lever locks the slide to the bed. Under extremely severe cutting conditions such as using a revolving centre in the turret, the clamping of the pilot-wheel shaft to its supporting boss, is advisable due to the high ratio of gearing in the turret slide apron.

The average machine-tool is occupied in cutting for a surprisingly short period of a working shift consequently anything which reduces non-cutting times increases the productive capacity of the machine. Herbert designs ensure that controls are readily to hand and are instinctive, operation is easy and precise, without mental or muscular fatigue. It is surprising how the shape of a knob will affect production on a fast-cycle, manually-operated machine.

A standard feature of Herbert Lathes is the quick-acting square turret. One forward and reverse movement unclamps, indexes and clamps the turret. Cross-slides are fitted with a large micrometer dial. The dial has widely spaced, easily-read .001" graduations on a surface of satin finish chrome plating. The graduated ring is adjustable on the periphery of the dial disc so that it can be set to zero at any position of the cross slide.

Accurate indicators are fitted to this dial, also to the capstan slide pilot wheel to assist in repetition machining to close limits. The indicators on the dial avoid dependence on the operator's memory whilst those on the pilot wheel eliminate independent measuring of lengths machined in the work. The dial and indicators also simplify setting the machine trip and dead stops.

The tool clamp screws on the cross-slide tool posts have ground threads. After years of continual use, little damage is caused to screw threads and tapped holes in the toolposts. Their replacement is necessitated only by burred heads (caused by using incorrect spanners) and stepped contact clamping faces (caused by clamping on the edges or steps of tools).

Efficient production is as much dependent on the tooling as on the machine—Herbert tooling is designed to ensure the maximum productivity.

Tools can be set, clamped and used to take full advantage of the power available at the spindle.

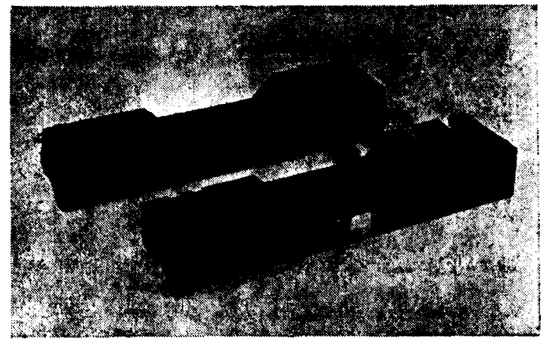
Standard outfits of tools for barwork or chuckwork are available for each size of machine and will deal efficiently with all normal work. Coventry Dieheads and genuine Coventry Dies will cut good threads at high rates of production in any material which can be threaded. Ardoloy, Chipsteam and Microbore tools are highly developed to meet modern production requirements.

Many other features contribute towards general durability of Herbert Lathes; for example:—

(a) Where desirable, knee and combination toolholders are made of light metal, as strong as, but 60% lighter than similar sizes of cast-iron holders. Thus in addition to reducing operational fatigue, wear on the capstan indexing and locating machanism is minimised due to the reduction in weight, inertia and momentum.

(b) Interlocks prevent the simultaneous engagement of two speeds or feeds, or prevent gear changing until the clutch drive is disengaged.

(c) Combination Turret Lathes are fitted with a frictionless rotating turret which can be easily rotated by hand in either direction, irrespective of the weight or unbalanced mounting of the tools. (On unclamping the turret, a thrust race is held firmly against the underface of the turret).

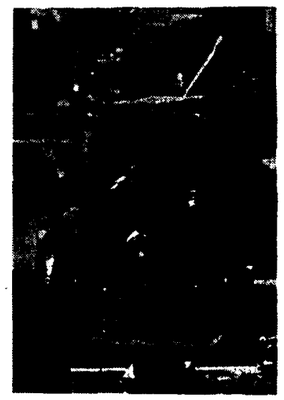


All cross slides on Herbert Lathes (except the Nos.0 and 1 Capstan Lathes, which are of cast-iron) are machined from forgings, approximately 212 Brinell, to ensure maximum strength and rigidity. One forging from each batch is laboratory-tested, a procedure followed with all deliveries of raw materials to our works.

A single oil pump on the saddle and turret slide aprons on a Herbert 12B Combination turret Lathe, lubricates the slides and gib strips mating with the bedways. Oil grooves zig-zagged to the full length and width of the slides and gib strips ensure distribution over the full contact area. Other moving parts such as the front and rear cross slide stop-bar bearings, rotating barrel stops and cross slide handwheel (saddle), turret locking, stop bar indexing and turret slide clamping mechanisms (turret) are also lubricated by these systems.

One stroke of the oil pump every four hours is sufficient.

This efficient single-shot lubrication system is also standard on the Herbert No. 5 Senior Preoptive Capstan Lathe and is a feature of design which has achieved a greater significance by the evolution of new machining techniques which today subject the machines to far more exacting conditions than those previously experienced. This method of pressure lubrication has been developed on most Herbert Lathes to an ultimate which, with the Herbert system of Headstock lubrication, is conducive to prolonged life of the machine and accuracy of its products.



This illustration shows the front cover removed from the Capstan Slide apron on a Herbert No.4 Senior Capstan Lathe.

The power feed to the capstan slide is from the feed shaft through the spur gearing, worm and wormwheel and through gearing to the top pinion shaft which meshes with the rack bolted to the under-side of the capstan slide. After the completion of the forward stroke of the capstan slide, the feed is automatically tripped by an adjustable stop in the rotating barrel at the end of the top slide, which contacts a trip lever which rotates shaft A to press the plunger "a". The downward movement of this plunger rotates the trip plate under the retaining latch B to permit the worm box to drop and thus bring the worm out of mesh with the wormwheel. Rapid disengagement of the drive is ensured by the spring S.

This simple and very effective method of tripping feeds, generally known as the drop-out worm, is extensively used, not only in the Capstan Slide apron, but in saddle and turret slide aprons on Herbert Capstan and Combination Turret Lathes fitted with power feed. In these aprons the worm boxes are mounted on ball bearings and the worm shaft in the worm box is provided with ball thrust bearings.

Ball-bearing mounts considerably reduce loads and, consequently, the rate of wear and power losses, but the extreme importance in fitting them to apron worm boxes is that they minimise friction, a desirable factor to ensure an efficient, rapid automatic reverse feed disengagement. Immediately a forward power feed is tripped, the drive tends to throw out the worm whereas on a reverse feed, the frictional tendency is for the worm to remain in engagement with the wormwheel.

On Herbert Lathes fitted with quick-power traverse an interlock is incorporated into the turret slide drive mechanism to disengage the pilot wheel automatically when either the power feed or quick-power traverse is selected. This is a safety precaution primarily to safeguard against injury due to a rapidly rotating pilot wheel when the quick-power traverse is operative. An oil dashpot is also fitted into the quick-power traverse selection mechanism to ensure that the pilot wheel clutch remains disengaged until the turret slide is stationary.

All essential features are incorporated to safeguard the operator against lack of vigilance or the unforseen. Particular attention is drawn to :—

(a) Complete enclosure of tools and work during operation. The front guard is provided with a window to give full view of the work when in position.
(b) Protection of rotating shafts, slides and covered bedways.
(c) Chip deflectors on Chipstream Boxtools, a safety precaution which, with the Chiprupter, avoids injury from the long coiled turnings produced.

Notice also the compactness of design and that all operating controls are within easy reach of the operator.

DEVELOPMENT OF KOLAR GOLD MINES

Mysore State's Kolar Gold Mines will be developed during the Second Plan period at a cost of Rs. 9,500,000 which has been allotted by the Planning Commission to the Board of Management running the State-owned concerns.

The Board had originally drawn up development schemes costing Rs. 30,300,000 but later reduced them to Rs. 21,800,000. The Planning Commission will allot a further grant of Rs. 7,000,000 upon the successful exploration of ores.

Manufacture of the Herbert-DeVlieg No. 2B/36 Spiramatic Jigmil

Manufacturing facilities in the new specially-equipped plant at the Lutterworth works of Alfred Herbert Ltd.

THE smallest of the range of DeVlieg Jigmils, known as the Herbert-DeVlieg No. 2B/36 Spiramatic Jigmil, is being manufactured under license from the DeVlieg Machine Co. of Detroit, U. S. A. Apart from minor exceptions, it is an exact copy of the American-made machine, to ensure interchangeability between components for both manufactures. We are using the Unified Thread System throughout manufacture and have adopted the DeVlieg standards for such components as splined shafts.

The manufacturing processes are identical to those which have proved satisfactory in the DeVlieg works.

The Jigmil has a general assembly accuracy of .0001" per foot.

All major castings are stress relieved and to ensure that stress is not re-introduced, clamping of the component in subsequent machining operations is kept to a minimum. From the set-ups, it will be noticed that the weight of the component and side and end locating blocks provide the necessary rigidity, whilst machining at low cutting speeds. Stresses set-up by heavy metal removal are also avoided. Invariably the extended machining times are offset by the time saved in subsequent fitting.

After machining, the castings are stored singly to minimise risk of unnatural deflections; special pallets are provided for such components as the saddle.

Precision block levels, auto-collimator and master bedding plates are used in the scraping of the bed and columns.

Boring of all the castings is carried out on DeVlieg 2B/36 and 4B/60 Jigmils. Certain milling operations are also done on these machines. A point of interest is that the feed box is produced in two parts—each is bored separately and then bolted together—the dowel holes being produced at the same time as the bores. This procedure saves time and eliminates the need for long and complex boring bars with their attendant difficulties of tool setting and bar flexing. This method of production however, is dependent on the inherent accuracy of the Jigmil itself. The 4B Jigmil is used for milling such parts as the lead screw nut guide channels on the upper side of the saddle and various tenon slots. It is also used for boring the locating holes in the index tables. These operations exemplify the ability of a Jigmil to perform relatively heavy machining and maintain alignments for extremely accurate boring operations.

The whole of the manufacturing technique of the Jigmil is based on the belief that high accuracy of machining with the minimum of special tooling can produce economically a product which is itself highly accurate, but at the same time readily capable of modification to design changes which are bound to occur with ever increasing development in the application of programme control systems in the modern machine tool.

Engineers interested in this new technique of machine-tool manufacture of a machine, revolutionary in its field, are cordially invited to visit our Lutterworth Works.

MANUFACTURE OF THE MICROBORE

The new production line for producing Microbore tools also serves to show how a new manufacturing technique can ensure a better quality product and effect economies.

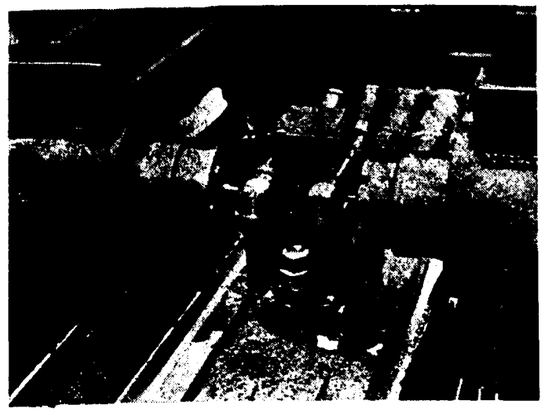
Previously the Microbore cartridge was turned from the bar and threaded in one operation on capstan lathes. Thus for subsequent operations the thread

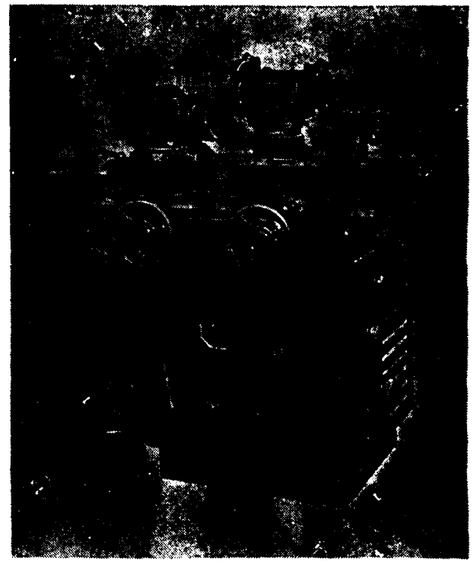
(Continued on page 45)

Jones-Shipman Precision Machine Tools

A number of SLOT-HYDROMIL machines, manufactured by A. A. Jones & Shipman Limited, Leicester, England, have been installed at the British Railway's Crewe and Horwich Locomotive Works and are actively engaged in milling keyways, faces and slots in railway engine and carriage components such as Brake Pins, Tie Bar Bolts, Slide Bar Bolts, Keep Studs, Centre Pivot Bolts, Centre Bearing Studs and numerous other types of shafts and bolts.

These hydraulically operated slot milling machines are specially designed for milling slots by means of two opposed horizontal spindles arranged to feed simultaneously. These slots may be in one shaft or one in each of two shafts, or the two halves of one slot extending entirely through the shaft as a cotterway. Similar operations can also be carried out, such as key-waying, tanging or any delicate mortising or facing operations on metal, ebonite, fibre, etc.





(Continued from page 43)

was liable to be damaged especially as on certain operations the thread was used for locating and clamping.

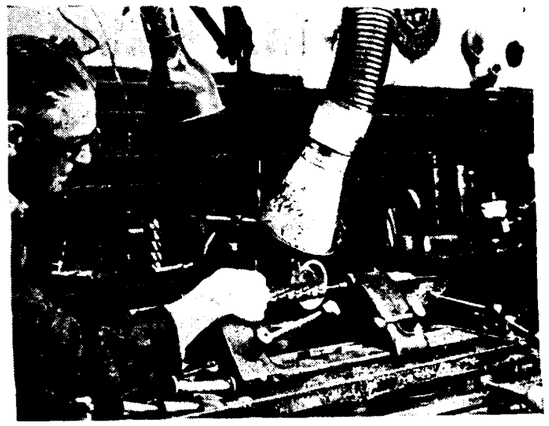
The new sequence of operations for machining the cartridge is as follows :—

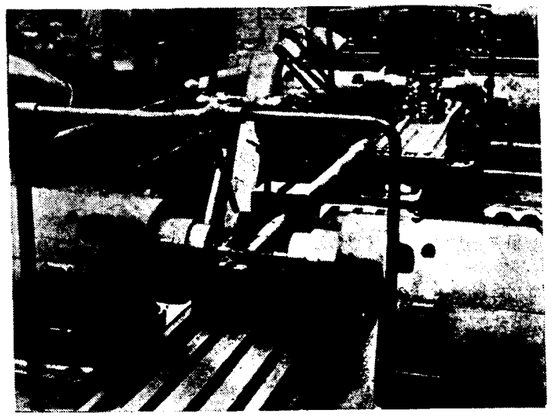
1. Machine cartridge from bar on Herbert Capstan Lathe.
2. Centreless grind thread diameter.
3. Form ears.
4. Mill tip seat.
5. Roll-engrave tip grade identification.
6. Induction braze Ardoloy tip.
7. Vapour blast.
8. Roll Thread.
9. Grind and lap Ardoloy tip.

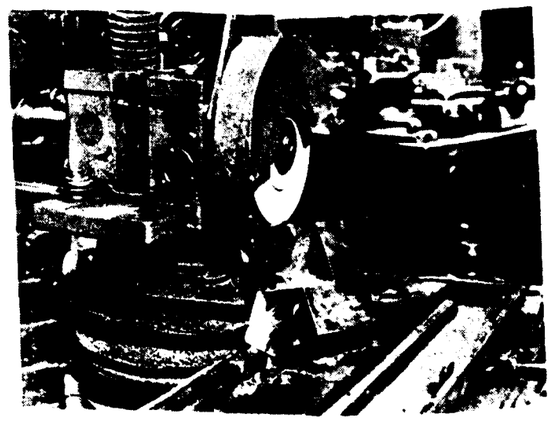
This sequence of operations ensures that the accuracy of the thread is closely controlled.

The dials are also being produced from the bar on Herbert Capstan Lathes.

We are installing a new type of tool grinding machine for semi-automatically grinding an accurate tool profile. This machine, developed by the DeVlieg company, enables a very accurate radius blended with the cutting edges and relative to the clearance angles, to be ground. It is also possible to grind either conical or cylindrical radii by offsetting the axis of the work-holding arrangement.







In operation, an end mill is used to mill out a slot by continuous quick traverses of the table over a predetermined distance, feeding only a few thousandths of an inch at each traverse.

Tool and cutter grinding plays a very important part in the production of the heavy components which go in the making of Railway Locomotives. This industry calls for machines which are easily adaptable for handling a wide variety of tool and cutter grinding operations and this versatility is one of the reasons why Jones-Shipman Tool and Cutter Grinders are principally used at the Locomotive Works of the British Railways. The illustrations show two typical set-ups at the Crewe Loco Works. The Jones-Shipman Cutter and Tool Grinding Machines are designed to cover a wide range of operations in the shortest possible times, so that tools and cutters can be quickly and accurately ground. Convenience of control and ease of operation are features which will readily appeal to the operator.

SUPPLY OF ORE TO DURGAPUR PROJECT

For supplying iron ore to the Durgapur steel plant, a new company, Bolani Ores (Private) Ltd., has been formed in collaboration with the Orissa Minerals Development Co. The Government of India retains 50.5 per cent of the total share capital in the Company. Bird and Co. (Private) Ltd. has been appointed secretary and treasurer of the new Company. At the initial stage, the Company is to supply ore to the Rourkela steel plant also.

Webster & Bennett Vertical Boring Mills in Railway Workshops

VERTICAL Boring Mills are indispensable in any railway workshop where locomotives, carriages and wagons are made or repaired. Webster & Bennett Ltd. of Coventry, England who have been making Boring Mills for 60 years and have specialised in their manufacture for over 40 years have supplied machines to railway workshops all over the world—from Canada to Australia and from India to the Americas.

They ought therefore to know something about the requirements of railway workshops. They claim that the machines they manufacture are well suited to the machining of tyres, wheel centres, solid disc wheels, axle boxes, pistons, piston rings, cross-heads, cylinder covers and liners, vacuum brake cylinders and pistons and a variety of other work always encountered in the workshops that keep railways in operation.

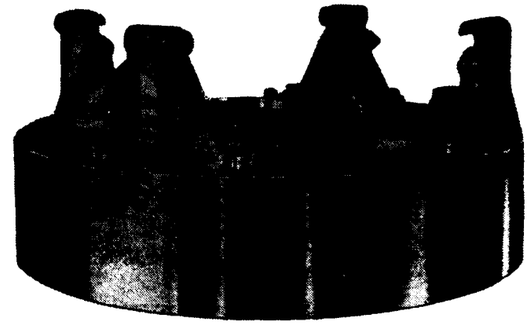
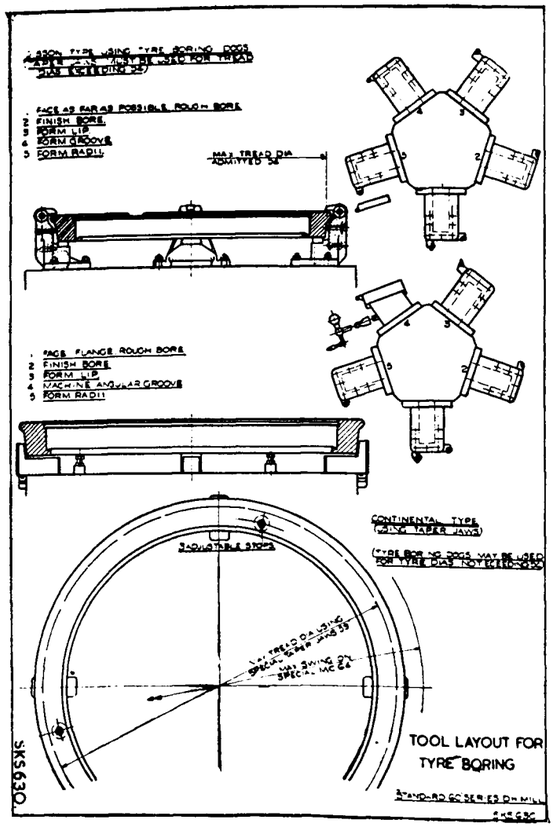


Fig. 1



Webster & Bennett Ltd. recommendations for tooling and machining of the more commonly met components are given below, with the floor to floor times that can reasonably be expected using the methods they suggest.

TYRES. *(Boring, Grooving and Lipping)*

Using the holding equipment of Tyre Boring Dogs and clamps illustrated in Figure 1 which Webster & Bennett Ltd. have designed specially for this purpose, a tyre of 4′ 1½″ dia. bore with Gibson ring type fastening can be produced in a floor to floor time of 36 minutes.

This time is based on 1/8″—3/16″ machining allowance, and due to the rigidity of the machine only one cut is necessary for boring the centre fitting diameter and the step. Cemented carbide tools are used and coolant is necessary. The sequence of operations and the tooling layout recommended is illustrated in SKS 630.

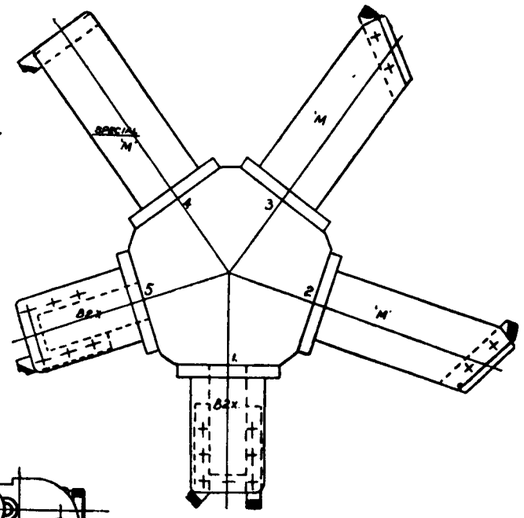
SOLID DISC WHEELS. *(Carriage and Wagon Sizes)*

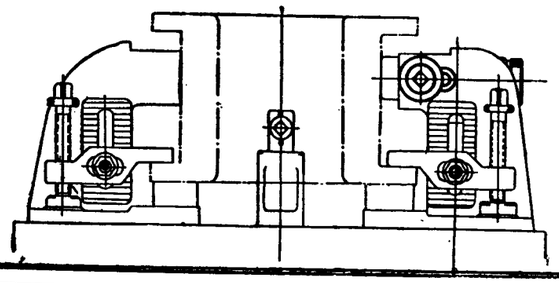
Attractive production rates are obtained by carefully planning the sequence of operations for these using a Webster & Bennett 48″ Duplex machine. It is possible to produce 10 complete wheels per 8 hour shift off each Duplex machine, and finish boring at

LOAD INTO JAWS, LOCATE BACK AGAINST END STOPS.
SET AUXILIARY JAW TO PROVIDE NECESSARY
DISTANCE FROM CENTRE OF BORE TO HORN CHEEKS
GRIP WITH CENTRERING JAWS & CLAMP
ROUGH FACE BOSS :- TURRET POSITION 1.
ROUGH BORE BEARING & KEEP - TURRET POSITION 2.
SET OVER BOX & MACHINE KEEP CLEARANCE - TURRET POS. 2.
SET BOX BACK TO ORIGINAL POSITION & FINISH BORE - TURRET POS. 3.
SET BOX OVER APPROX. .015" & BORE RELIEF CLEARANCE - TURRET POS. 3.
CUT RADIUS AT LOWER END OF BORE - TURRET POSITION 4.
CUT RADIUS AT UPPER END OF BORE - TURRET POSITION 5.
FINISH FACE BOSS - TURRET POSITION 1.

TOOL LAYOUT FOR AXLE BOX M.R.W.B.

WEBSTER & BENNETT 36" SERIES 'DH' MILL
WITH COLUMN 4" TALLER THAN STANDARD

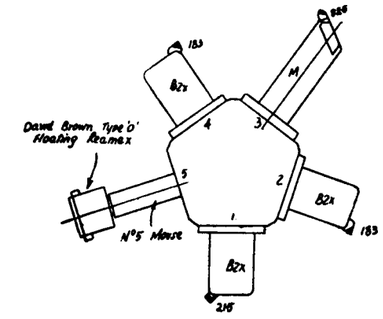


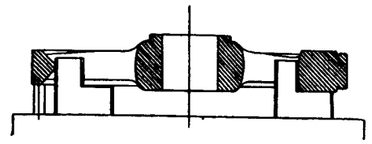


SKS. 310

Second Setting

1. Rough turn 422" dia.
   Face rim
   Face balance weight
   Face boss
2. Turn 11" dia.
   Face shoulder.
3. Semi - finish bore
4. Finish turn 422" dia.
5. Ream bore.



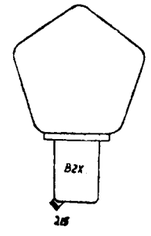


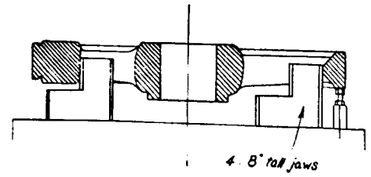
TOOL LAYOUT FOR WHEEL CENTRE
Webster & Bennett 48" Series 'DH' Boring Mill.

SKS 659.B
(See also sheet 'A')

First Setting

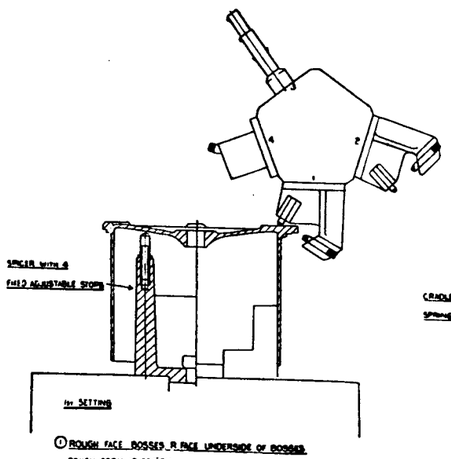
face rim
face balance weights
face boss.





TOOL LAYOUT FOR WHEEL CENTRE
Webster & Bennett 48" Series DH. Boring Mill.

SKS 659 A
(See also sheet 'B')



① ROUGH FACE BOSSES & FACE UNDERSIDE OF BOSSES.
ROUGH FORM 19 7/32 DIA
② FINISH FACE BOSSES & FACE UNDERSIDE OF BOSSES.
FINISH FORM 19 7/32 DIA
③ ROUGH BORE, SEMI-FINISH BORE & REAM 1.625 DIA.

① PART OFF REAR
② ROUGH BORE, ROUGH & FINISH FACE BOSS
③ RADIUS END

3rd SETTING
FINISH BORE USING SPECIAL TOOL INDICATED ABOVE

TOOL LAYOUT FOR 16" VAC. BRAKE CYLINDER C 71838
WEBSTER & BENNETT 36" SERIES 'O' (6" TALLER COLUMN)
WESTINGHOUSE BRAKE & SIGNAL CO. LTD.

SKS. 101.

the rate of 6 per hour can be carried out on a separate machine at one setting.

Machining consists of facing rim and boss, turning tread and flange, cutting radii inside rim and on boss diameter, chamfering and rough boring at two settings. The first setting is carried out on the Right Hand unit of the Duplex boring mill and the second setting on the Left Hand unit, as illustrated on TS 291.

AXLE BOXES

Webster & Bennett Ltd. have designed and now regularly supply to railway workshops special Axle Box equipment which ensures efficient production and is equally applicable to new boxes or reconditioned ones.

Using this equipment, illustrated in Figure 2 the following sequence of operations should be followed, and results in a floor to floor time of 18 minutes for the example shown cn SKS 310 :

Rough face boss.
Rough bore bearing and keep.
Set box over and machine clearance.
Set box back and finish bore.
Set box over approx. .015" and bore relief clearance.
Cut radius at lower end of bore.
Cut radius at upper end of bore.
Finish face boss.

LOCOMOTIVE WHEEL CENTRES

These vary both in type and in the amount of machining required, but the example shown on SKS 659 A and B is typical. The tooling equipment used is simple in design.

At the first setting a straight-forward facing operation only is required which provides of datum face for the second setting when the wheel centre is mounted on fixed stops.

The OD is turned and the rim, balance weight and boss faces are machined. Then the boss diameter and shoulder are turned, followed by 3 boring operations which complete the machining of the wheel centre.

The floor to floor time is 72 minutes at 2 settings.

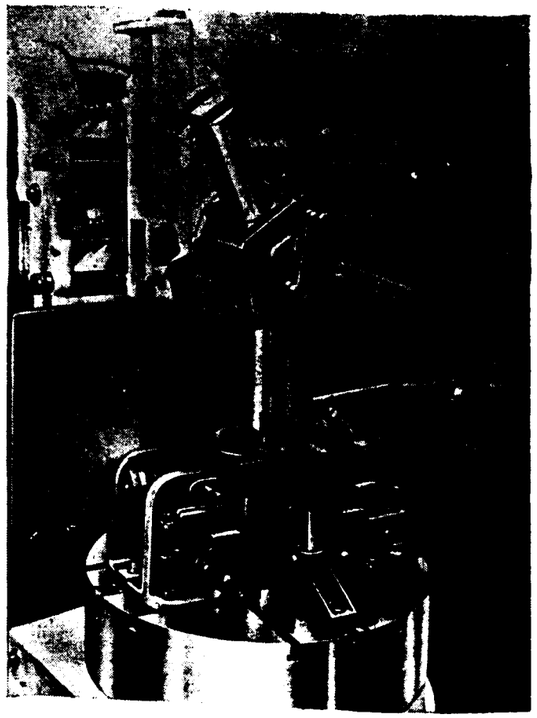
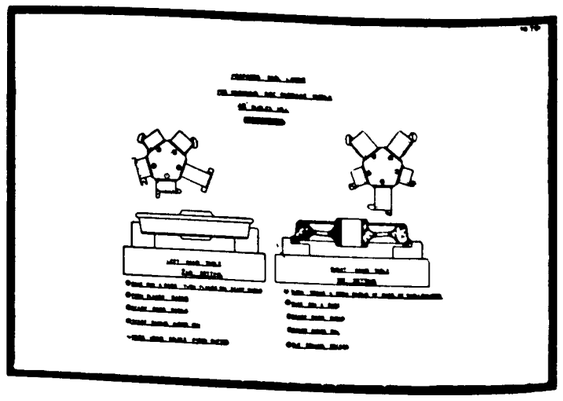


Fig. 2



VACUUM BRAKE CYLINDER

This is another typical application for a Duplex Vertical Boring Mill, the first and second settings being carried out simultaneously on the Right Hand and Left Hand units.

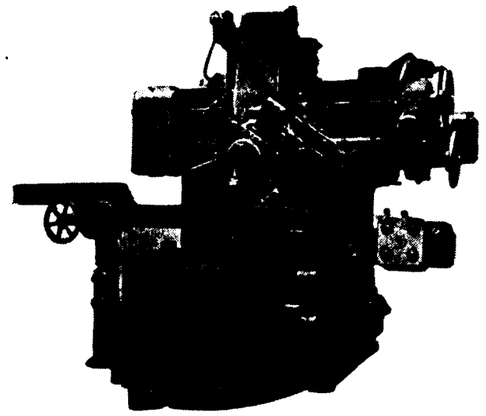


Fig. 3

The example illustrated in SKS 101 is an 18" cylinder and shows the layout adopted by one of the largest manufacturers of vacuum brakes in Great Britain. The cylinders are produced at 3 settings in 37 minutes on a Duplex mill or in 51 minutes on a Single mill.

PISTON HEAD

For this component a Webster & Bennett Boring Mill fitted with a concentric chuck will give a considerably reduced setting time.

A copy-beam attachment as illustrated in Figure 3 will enable the web contours to be machined without recourse to form tools etc.

The tooling layout is shown in SKS 399 A and B and the floor to floor time of the piston head illustrated is 110 minutes at two settings.

Industrial Gas Equipment for Railway Workshops

INDUSTRIAL gases play an essential part in the construction and maintenance of locomotives and rolling stock. The power and adaptability of the oxy-acetylene flame when harnessed by modern machines and equipment will reduce costs and accelerate output in the railway workshop.

Fig. 1. 'Bison' machine cutting locomotive frames from steel plate.

On the constructional side, fabrication of components by flame cutting and welding offers many advantages over forging and casting particularly where mass-production methods are not suitable. The flexibility and accuracy of the modern oxygen cutting machine give it a vital role in this fabrication work.

OXYGEN CUTTING MACHINES

A machine such as the 'Bison' pictured in Fig. 1 will cut from steel plate complete side frames for a locomotive which may be as long as 40 feet. This machine operates on the cross carriage principle. The cutter is mounted on a laterally floating boom which in turn is mounted on a carriage unit running on longitudinal tracks. Thus the cutter can move to any point within the given area of the machine. The movement of the cutter is controlled by a magnetic roller which follows automatically the outline of steel templates placed on the table provided. Alternative heads for tracing direct from a drawing either by mechanical or optical means are also available.

Other machines operating on the magnetic roller or tracing principle are the Universal Cutting Machine which is available in two sizes (to cover the area of a half circle of either 36 in. or 55 in. radius—see Fig. 3) and the Beagle for profiling any shape with a constant bevel.

At the other end of the scale are the portable machines such as the 'Bantam' pictured in Fig. 4 which can be carried to the work in hand. They can be set to run on tracks for straight line cutting or can be guided by hand along a path previously marked out on steel plate.

Fig. 2. Cutting Bogie side frames on the 'Bison'.

Many components for the engine and tender frames are profile cut by oxygen cutting machines. Examples of these are drag boxes, brake shaft arms, bogie frames, cab parts such as the side plates and the various gussets and strengthening flanges. Most of these parts can be flame cut to such a high degree of accuracy that they often require no further machining and can be joined immediately by riveting or arc welding.

HAND CUTTING

The oxygen hand cutting blowpipe is useful in production and almost indispensable in maintenance work. Worn tyres, for example, are easily removed from locomotive wheels with the aid of such a blowpipe and fractures in locomotive frames can be rectified by cutting out the faulty section and welding in a new piece. Fig. 5 shows fire box crown stays being cut out to enable replacement of the fire box. With a little experience these stays can be cut away from outside to free the fire box and leave the internal thread intact ready to receive new stays. These are only a few examples of the many ways in which hand cutting blowpipes play their part in railway workshops.

WELDING

Both oxy-acetylene and arc welding are used extensively in railway workshops and their applications may be divided broadly into two categories. Gas welding and its allied processes such as brazing and bronze-welding are used for the fabrication of

Fig. 3. 55" Universal Cutting Machine, profiling an engine coupling rod forging. This component was originally made by forging and machining.

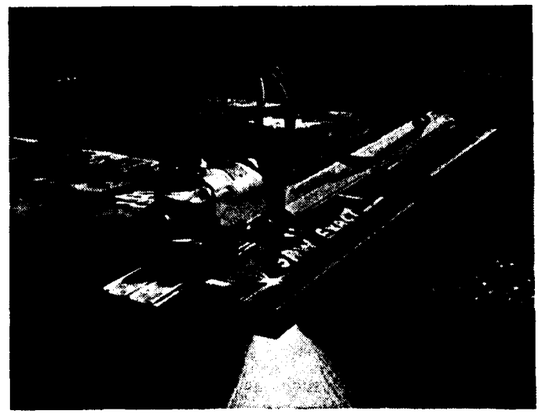


Fig. 4. The 'Bantam' portable cutting machine, trimming 2" thick steel slabs. This machine can be hand steered for profiling curves.

small assemblies and in maintenance work. Arc welding plays an important role in the fabrication of large components and in the erection sheds. Practically all the flame cut parts are arc welded wherever possible, although riveting is sometimes still employed.

In locomotive workshops the most spectacular application of gas welding is undoubtedly to be found in the boiler shop. A copper firebox is liable to fracture because of the wear and extreme temperature to which it is submitted. The firebox walls are usually the most badly affected areas and these must be removed so that a new section can be welded in. Copper is not the easiest of metals to weld because of

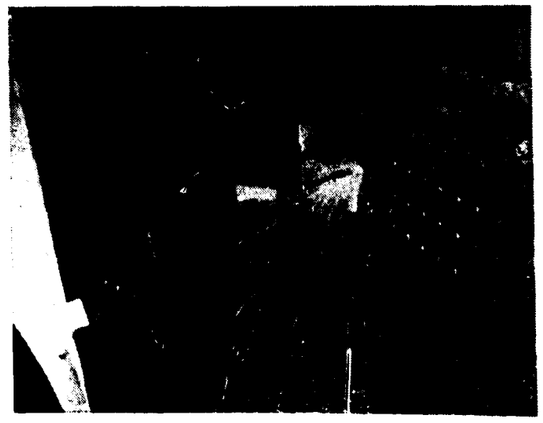


Fig. 5. Burning out fire box crown stays.

the high heat input required. Large size nozzles are used and two operators usually work together on one weld to maintain heat in the work piece. Work can be extremely arduous because of the confined space in which the men must work and great skill is required in the welding itself. Another interesting, although less spectacular, job is the welding of the superheater spear ends. These ends are subjected to the direct heat of the fire and, if welded at the return bend, call for a high degree of skill from the welder. The joint must withstand a high internal steam pressure and also the destructive heat of the fire.

Other processes such as heating, brazing and bending are used extensively in the locomotive workshops, particularly on copper pipe fabrication. In wagon repair workshops the heavy duty heating blowpipe is used in removing dents in steel mineral wagons which sometimes become damaged by mechanical grabs during service.

ARGONARC WELDING

Aluminium alloys are being used increasingly by the railways. They offer the advantage of combining light-weight with resistance to corrosive attack. Many new alloys are being developed which will add to these two advantages the factors of safety and strength. Many coaches today have a great deal of aluminium in their construction.

The suitability of Argonarc welding for a wide range of applications particularly on coachwork has been reflected by many tests which have taken place in recent years. Automatic Argonarc welding offers many advantages to coachbuilders and this mechanization will undoubtedly play an increasing part in coachbuilding of the future. Not only can the special high strength light alloys be satisfactorily welded by the Argonarc process, but this also offers the advantages of welding speed and improved surface finish. Figures 7 and 8 show aluminium coach panels being welded by the Argonarc process.

METAL SPRAYING

This is probably the least known oxy-acetylene process in railway workshop use but the modern metal spraying pistol is an extremely valuable tool with two particular fields of application—building up and protective coatings.

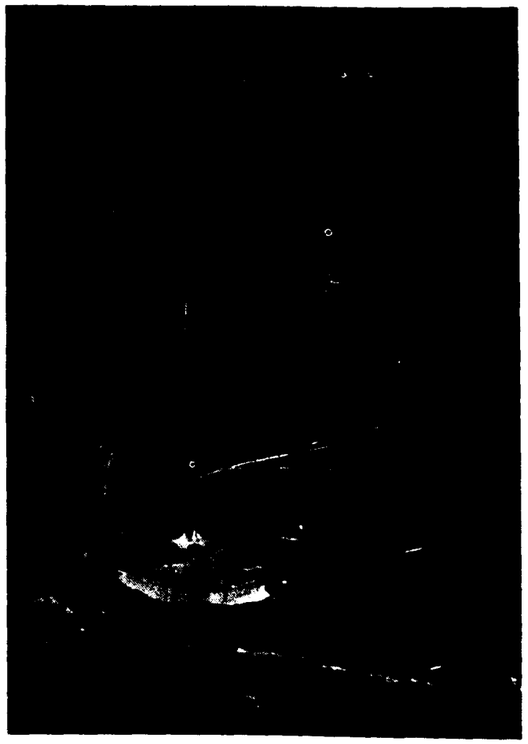


Fig. 6. Repairing a copper fire box in a railway boiler shop. The operator in the background is preheating immediately in front of the weld pool.

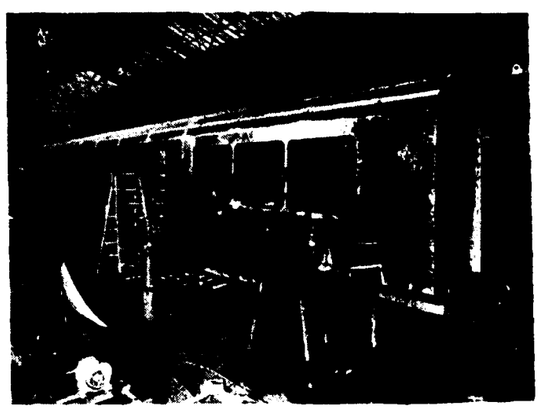


Fig. 7. Argonarc welding aluminium side panels on a diesel twin-set.

Any metal that can be drawn into wire and can be melted in the oxy-acetylene flame can be sprayed into almost any suitably prepared surface, from a sheet of paper to a crankshaft journal.

For building up metal spraying has one great advantage over most other processes (such as welding) in that it is a 'cold' process, the degree of heat imparted to the sprayed surface being negligible which eliminates all risk of distortion. A typical example of railway workshop use of metal spraying for building up is the treatment of both new and worn vacuum brake pistons.

In some carriage and wagon repair shops the metal spraying pistol is used for applying protective metal coatings such as of zinc or aluminium to parts of carriages and wagons subject to severe corrosion. As might be expected, however, more use is made of metal spraying for protective purposes by railways on bridges and similar structures than in actual railway workshops.

The foregoing covers briefly the more important equipment and processes using industrial gases that are fairly widely applied in railway workshops. Other lesser known processes are used on a restricted scale today in railway workshops. Typical examples are gouging and flame-cleaning. Gouging is an adaptation of oxygen hand cutting, in which a special blowpipe and nozzle are used whereby a cut is made in the form of a groove, along the surface of the material being cut; this process is particularly useful in conjunction with arc welding, for preparing the undersides of welds for the sealing runs, for removing defective parts of weld prior to re-welding, and for removing tack welds. Flame-cleaning is a process using the very localised high temperature oxy-acetylene flame to remove rust and mill scale from mild steel; although apparently akin to paint burning, it is in fact entirely different and is carried out with a distinct technique of its own, utilising the different

Fig. 8. Close up of Argonarc welding of aluminium side panels. Note the thin strip of copper used as a backing bar clamped behind the weld.

coefficients of expansion of steel and rust or scale to achieve the object without distortion.

The many industrial gas using processes adopted today in railway workshops have been introduced over a comparatively short period of years and it is safe to say that in the future, new time and material saving processes will be developed from year to year, which make use of the valuable properties of industrial gases.

NEW SOVIET TIN DEPOSIT

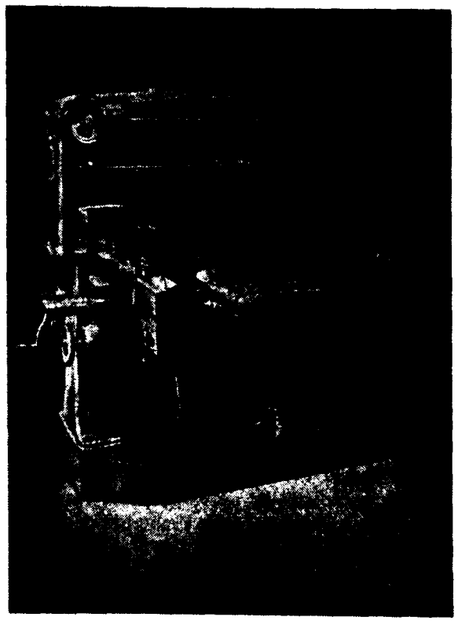
A New Soviet Tin deposit has been discovered in the lake Khanka area, some 100 miles north of Vladivostok, the Industrial and Economic Gazette reports.

A large tin mine has been opened and an ore enrichment plant has been set up in the area. This year, in the January a first lot of 1,000 tons of tin ore was delivered to the enrichment plant.

Hindustan Machine Tools on the March

THE Hindustan Machine Tool Project at Jalahalli commenced construction of the factory in the latter half of 1953 as the interval between 1949 and 1953 was mainly devoted to the selection of the site, planning of the factory, securing of the site and recruitment and training of supervisory and Managerial staff. The Factory commenced production late in 1955 with 225 mm. centre lathe with 1000 mm. distance between centres specifically designed for it by its technical consultants. The first series of these lathes manufactured in the Factory came off the production lines in May 1956.

The original production programme of the Company drawn up in consultation with Messrs. Oerlikons in 1955 and early in 1956, was to reach a production of 400 machines per annum by 1960—61. A number of steps since undertaken during the latter part of 1956, such as the introduction of multiple shifts, emergency recruitment of additional personnel and the provision of increased training facilities, emergency provisioning of stores and raw material to the extent required, and increased supervision and efficiency, have resulted in a substantial increase in production during 1956—57. As against the original target of 57 lathes in 1956, it was possible to achieve an output of 135 machines—an increase of 237% of the target. This substantial increase in production and other reforms have resulted in the reduction in the cost of production by about Rs. 23,000 per machine. Production during the current financial year is also expected to exceed substantially the planned target of 131.



The factory has recently embarked on a programme of diversified production. So far 38 Milling Machines in six varieties — Horizontal, Vertical and Universal in two sizes each — have been produced at the factory.

Picture shows a Horizontal Milling Machine.

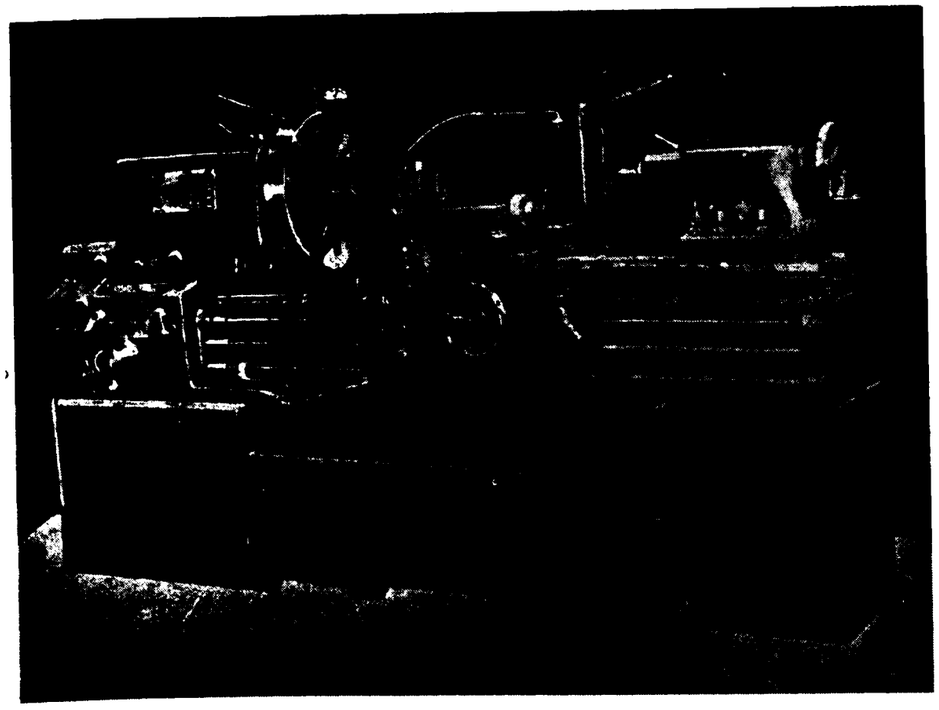
This can be evidenced from the fact that during the calendar year 1957, the factory manufactured 311 machines valued at Rs. 1.24 crores. The production programme for the whole Five-Year Plan period has now been revised upward substantially. The revised target by 1960—61 will be about double the original figure of 400 machines per annum, to be achieved by the working of multiple shifts and increased efficiency.

CHANGES IN CONSULTANCY AGREEMENT

The calendar year 1957 saw a number of changes. The twenty year contract concluded with Messrs. Oerlikons and due to expire in 1974 was revised during this year (i. e., 1957) whereby the capital and management participation of Messrs. Oerlikons in the Hindustan Machine Tools Company was terminated, as it had run into numerous practical working difficulties. The Government of India, therefore took over the complete management of the factory and bought over from Oerlikons their share capital in the Company. During the last one year, rapid progress has also been made with the Indianisation of the Factory, the number of foreign technicians which stood at 85 in 1956 being reduced to 37 to date.

DIVERSIFIED PRODUCTION

The Company also entered into a new technical collaboration agreement with the well-known firm of Messrs. Fritz Werner of West Germany during 1957 for the production of Medium and Heavy Milling Machines in six varieties. The production of these Milling Machines has already been taken and the Factory has produced 38 Milling Machines to date.



H-22 High Precision lathe produced at HMT is first class and compares favourably with machines of this type manufactured in any part of the world.

HIGH PRODUCTION STANDARDS

The standard of production of this factory has been very high and has been acclaimed as the best in the world. The Machine Tool Experts who were members of the British Heavy Engineering Mission led by Sir Eric Coates, who were asked by the Government of India in January 1957 to report on the Project, have commented favourably on the quality of the machine tools produced in the factory. Their report reads as follows :

> "We consider that if Hindustan Machine Tools continue to progress as they appear to be doing at the present time, they should be considered to be an asset for considerable national importance.
>
> The 17" centre lathe which they are producing at present is first class and compares favourably with machines of this type manufactured in any part of the world."

Similar favourable comments have also been made by other visiting foreign Technical Mission in 1957, such as, the American Machine Tool Delegation led by Mr. George Merryweather, and the Russion Heavy Engineering Mission led by the Soviet Deputy Minister for Heavy Industries, Mr. I. Babich.

SOME STATISTICS

Statistics for the year 1957 which were recently released to the press abundantly testify to the remarkable progress achieved by this Factory. The factory which has exceeded Rs. 1 crore mark has also had very heavy booking during the one year period. Orders for over 500 machines valued at Rs. 2 crores had been booked during this period. Against these orders, the Factory despatched 267 machines valued at about Rs. 1 crore during the calendar year 1957. The total production at the

Factory ... consumption ... machine ... lathes ... duty Milling Machines. At the close of ... (i. e. 1957) the Factory had on its books ... orders for 250 machines valued at about ... 2 crores. In the immediate future, a contract is likely to be finalised with a German firm for the manufacture of Radial Drills.

... international ... necessary to ... the high standard of ...

TRAINING FACILITIES

Manufacture of Machine Tools is a high precision industry requiring workers possessing a high degree of manual precision skill. With this in view persons with a technical background are given basic training.

The HMT Training Centre has been expanded considerably to meet the demands created by HMT's accelerated programme. As against 87 trainees in the Training Centre, on April 1, 1956, there are 272 trainees today in two shifts. HMT has a comprehensive training programme under expert guidance. The fact that there has been a remarkable rise in the output efficiency ratio from 22% to 50% as compared

The Factory has been able to ... 500 of its 2700 employees on the premises, that has made available all amenities to its employees including cheap transport facilities, medical aid, etc.

NUCLEUS

It will thus be seen that this factory which has accounted for more than 50% of the country's total production of Machine Tools (of the overall production of Rs. 2 crores, this factory was responsible for producing Machine Tools worth about Rs. 1.25 crores) thus forms the very nucleus around which the anvil of Machine Tool industry of the country will be revolving. Today it can be said ... among themselves, all the units including this ... cater to about 20% of the country's needs of ... Tools. With proper understanding between the units functioning in the Private and Public Sectors having been reached now, it is hoped that India will soon not only achieve but exceed the targets laid for itself in regard to Machine Tools.

STEEL MELTING FURNACES FOR CANADA

In keen competition with American and German firms, G. W. B. Furnaces Ltd., have recently received an order from the Canadian Steel Wheel Co., of Montreal, for two 40-ton (40,640-kg) direct-arc steel melting furnaces. The order is worth about $ 500,000 (Rs. 24 Lakhs). The background of this order is that after January 1st next no cast-iron wheels are to be fitted to Canadian or American rolling stock. Wheels will, therefore, be of steel and either cast or forged. Two American-controlled companies operating in this field are going forward with plans to manufacture cast-steel wheels, while the Canadian Steel Wheel Co., is to manufacture wheels of the forged type.

The 3-phase direct-arc melting furnaces will be to the designs of the British company's Italian associates, Leone Tagliaferri & Co., of Milan, although the complete furnace (except the refractories and some ancillary equipment which will be obtained in Canada) will be supplied from the U. K. As stated, the furnaces will be of 40 ton (40,640 kg) capacity, and they will have a 16-ft. (4,877-mm) dia. shell and will be fitted at 17,500 kVA through an on-load tapped transformer. Three 18-in (457-mm) dia. graphite electrodes are to be fitted in each furnace. Following the latest steel works practice, the furnaces are of the top-charging type in which the roof is lifted and swung aside to receive the charge from drop-bottom charging baskets. The three graphite electrodes are to be controlled hydraulically by the patented Tagliaferri system which is considered to be superior to the motor-operated method since a finer degree of control and faster electrode operation are obtained, largely owing to the absence of inertia which is inherent with the motor system. This electrode control system is part of a common hydraulic system for tilting the furnace, lifting and swinging aside the roof and raising the door.

The customer's engineers made thorough investigations of the designs of melting furnaces available and were, in fact, able to examine two 40-ton (40,640-kg) furnaces working side by side which were exactly the same except that one had electrically operated electrodes while the other was fitted with a hydraulic control system. In addition to this the Canadian engineers were favourably influenced towards hydraulic control by the recommendations of Premier Steel Mills, Ltd., of Edmonton, Alberta who have recently started operating their second G. W. B.-Leone Tagliaferri 12-ton (12,190-kg) melting furnace. The second Premier Steel Mills melting furnace was one of the units which was inspected by engineers from the Canadian Steel Wheel Co.

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