

467

THE INDIAN RAILWAYS

WORKSHOP MAGAZINE

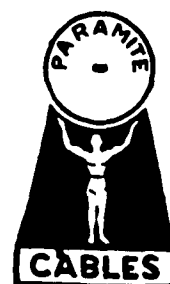


JL
D/LSM2, NSSR
NSS-2-3
177623

Aykan



★ **TRAIN LIGHTING CABLE**
 ★ **LOCO HEADLIGHT CABLE**
 ★ **COUPLING CABLE**
 ★ **RAILWAY SIGNALLING CABLE**



THE INDIAN CABLE CO., LTD.

ESTABLISHED SINCE 1920

Representatives in India for:

BRITISH INSULATED CALLENDER'S CABLES LTD.

Head Office: 9, HARE STREET, CALCUTTA-1 Works: TATANAGAR

Branches: Ahmedabad, Ambala, Bangalore, Bombay, Coimbatore, Jamshedpur, Kanpur, Madras, Nagpur, New Delhi and Secunderabad.

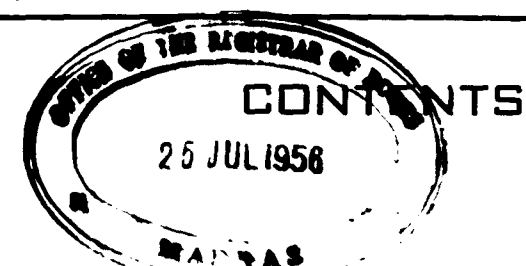
THE INDIAN RAILWAYS WORKSHOP MAGAZINE

MACHINE TOOLS SUPPLEMENT

467
3-56

Vol. II No. 3

May 1956



	PAGE
1. "INDIA'S MACHINE TOOL INDUSTRY"	2
2. APPRENTICESHIP TRAINING IN INDIA	5
3. MODERN MACHINE TOOLS AND EQUIPMENTS IN RAILWAY WORKSHOPS	11
4. "WEBSTER & BENNETT BORING MILLS"	20
5. MACHINE TOOLS DESIGN AND PRODUCTION PROGRESS IN INDIA	24
6. THE NEWALL MODEL 2436 (MK. II) PRODUCTION JIG BORER	29
7. BRITISH RAILWAYS USE LOW VOLTAGE PORTABLE ELECTRIC TOOLS	33
8. "ADCOCK AND SHIPLEY'S" NEW HEAVY DUTY No. 4 HORIZONTAL MILLER	35
9. A WIDE RANGE OF SCOTTISH MACHINE TOOLS	40
10. EDWARDS CONTRIBUTION TO RAILWAY WORKSHOPS	46
11. EUSTACCHIO MACHINES FOR RAILWAY WORKSHOPS	48
12. SWIVELLING ERECTION DRILLING MACHINE (TYPE VRM-50)	53
13. PRECISION BALL BEARING MANUFACTURE IN INDIA	56



"INDIA'S MACHINE TOOL INDUSTRY"

INDIAN Industrial growth is undergoing a terrific upsurge after her attainment of independence. A number of new plants are being constructed in a wide range of Industries which will afford to everyone the means of deliverance from want and drudgery.

Machine tools are the key to modern industry. There is hardly a single product that does not owe its size and shape—its very existence—to machine tools that cut or form metal.

The amazing advances made in railroad transportation, which calls for the provision of immense quantities of mechanism and devices of the most elaborate and accurate nature, have in no less way been dependent on the ever growing part played by the machine tool in production.

Unfortunately for India, before 1936, she was dependent almost entirely on imports and between that time and the global spread of World War II, only a very few firms undertook the manufacture of machine tools on a Commercial basis (producing about 100 machines annually) and then only of the simplest basic types.

Early in 1941, the Government of India passed the Machine Tool Control Order and set up an organisation under a Machine Tool Controller to assess the production capacity of the industry and foster it in every possible way. Thus was born the Indian Machine Tool Industry in the travails of the War conditions.

Under the fostering care of the Government, the Industry made rapid strides as will be evident from the fact that whereas in 1942, the total number of graded machine tool manufactured in India was 273, in 1946 this number increased to 4121.

The present capacity in the country in terms of manufacturing units is that there are at present 17 manufacturers of graded machine tools. Out of

these 17, three are making ancillary equipment and the remaining 14 are manufacturing machine tools—big and small—of grade I accuracy. In addition to these, there are about a dozen engineering Workshops manufacturing machine tools which do not come up to the standards of accuracy. There are still a greater number of firms whose activities are not being regularly reported. In addition there are two State-owned factories at Ambarnath and Jalahalli, which are also manufacturing machine tools. The present range of products of the industry comprises mostly copies of old models of lathes, drilling machines, shaping machines, milling machines, planing machines, some types of grinders and sheet metal working machinery. These machines are mainly suitable for use in small scale industries where the limits of accuracy are not as high as are called for in Class I Railway Workshops, Ordnance Factories and certain other key industries. Attempts are now hand to develop such items as Radial Drilling Machine, tool and cutter grinders, hydraulic shaper, pedestal grinder, turrets and capstan lathes, etc. For most of these items prototypes have been made and successfully tested.

In this state of the industry, it is of vital importance that the way should be cleared for its development. The problems facing the Indian machine tool industry are fairly obvious. High on the list comes the need for rationalisation and a clear demarcation between the private and public sectors of the industry. Although recently the Commerce and Industry Minister has brought out a certain demarcation indicating that special machinery will be on the list of items to be manufactured by the Public Sector and light types of machine tools will be the concern of the private sector, it is in relation to the general types of machine tools that the field is yet to be demarcated in clear cut terms.

Of primary importance is a design staff of higher capability and greater proportionate numbers, than is required for the more stereotyped engineering industries. In this country the designs of machine tools are executed according to the crude requirements of the industries and most of the designers are more keen to keep provisions for the patents than to develop the design as a whole. The principles of interchangeability and production facility are often left out. It is high time therefore that proper training facilities of

technical personnel required for this industry should immediately be created. Arrangements should also be made for research work in this connection. Another factor which is equally important is that the selfish idea of monopolising this industry should be given a go by and in its place, it should be organised under a corporate body to conduct the entire industry. Different parts of the machines should be manufactured by different factories. Important parts which require special skill during the process of manufacture, e. g., lead screws, splines, machine beds, head stocks, gears, clutches, etc., should be manufactured by special factories separately.

The next important consideration will be the availability of raw materials and their correct use. It is however heartening to note that the Government have already taken steps to increase the present capacities of producing raw materials like pig iron, steel, etc. that will be required for the industry.

After the selection of materials, the next important factor to be considered is processing which embraces all the operations right from the making of patterns to the finishing. This portion of the work during the manufacture of machine tools is seldom well looked into in our country by the industrialists on the plea of economy. It is in this sphere that considerable amount of work can be and needs being done.

The aim should be to produce the best machine that can be made for the particular purpose in view and maintain the highest possible standard. Manufacturers of machine tools in India would be well advised to refuse to subordinate the quality and efficiency of their products to a low price levels, as this retrograde step can only end in both their trade and reputation suffering. And for that purpose they should seek their own solutions for the problems now facing this infant industry in India. The recent declaration of the Government of India about the appointment of a Committee to inquire into this industry has also raised a new hope that every opportunity will be afforded to the industrialists to develop a well-balanced and homogeneous machine tool industry, which is so vitally needed in our Country at present.

APPRENTICESHIP TRAINING IN INDIA

By U. A. Kamath

This article starts with the definition of the word "Apprenticeship" as applied in different countries and how Apprenticeship Training in India is of recent origin and how the number of apprentices do not meet the full requirements of all the new industries that are now developing in this country. The article then proceeds to explain briefly the apprenticeship scheme as adopted at the Integral Coach Factory. The salient features of this training scheme is the institution of basic training exercises. Training of Welders is explained in detail as welding is a very important trade in the construction of all welded all steel coaches. The qualifications of a good Instructor are briefly touched upon and some details of the methods used in the further 12 months factory training are touched. The article closes by indicating the capacity of the Training School provided and certain General observations on the advantages of Apprenticeship training.

TO begin with, it may be worthwhile to explain the meaning of the word "Apprenticeship", and the different interpretations to which this word is put in different countries. The primary object of apprenticeship is to supply industry with a steady flow of skilled labour through a systematic and supervised course of training. As defined by the United States Employment Service, an apprentice is "a worker not less than 16 years of age engaged under direct journeyman supervision, and according to a prescribed or traditional series of work processes graded to coincide with increasing trade maturity in learning a skilled occupation that requires, during the learning process, several years of reasonably continuous employment prior to the time that the worker may be considered a qualified journeyman." In general, apprenticeship is legally recognized only if recorded in a written contract, indenture or agreement, in which, in return for services rendered, the employer promises to teach the worker the processes of his trade. The terms of an apprenticeship agreement usually include specific reference to the duration of the apprenticeship period, a progressive scale of wages, and the nature of the processes to be taught. Frequently the agreement also specifies the amount and nature of related schooling in vocational subjects in which the worker was engaged during his apprenticeship period. In the United Kingdom: "apprenticeship is the contractual relationship between an employer and worker under

which the employer is obliged to teach the worker, or cause him to be taught, any trade or business and in consideration of such teaching the worker is to serve the employer as an apprentice throughout an agreed period on stated terms. It may be under a written or verbal agreement." The Swiss interpretation of an "apprentice" is: "every young person over the age of 14 years, irrespective of sex, who is placed by his or her parents or guardians in the establishment of a master or master craftsman with a view to learning an occupation or trade for which vocational training of more than three months is necessary." In France too, a great amount of care and attention is devoted to the training of apprentices, the idea being to make their youth happy so that when they grow up, they will serve their employers more faithfully. The apprentices have gymnasiums, play houses, common rooms with billiards provided and physical training is a compulsory part of the curriculum.

Apprenticeship training in India is of recent origin and only certain major employers of labour such as Railways introduced schemes of apprenticeship in their establishments with a view to obtain a better type of skilled worker. Taking into account the size of the country and its enormous potential for industrial development, the number of such apprenticeship schemes prevalent could not be considered as more than touching the fringe of the problem. The phase of industrial develop-

ment in the country after the last war dried up whatever reservoir of skilled manpower was available in the country making it almost obligatory for all new industrial establishments to set up their own training schemes.

The system of training skilled craftsmen adopted at the Integral Coach Factory Technical School is of a novel pattern. With a view to meet urgently the factory production targets, the Railway Board agreed, as a special case, to reduction of the period of apprenticeship to 1½ years. This reduction is achieved by the twin method of recruiting apprentices who, before enrolment, have undergone a minimum of 1½ years training in their particular trade and by adopting more improved, intensive and efficient methods of training. The apprentice, on recruitment, is required to be between the age group of 18 to 25, have passed Ninth Standard and should have successfully completed over 18 months technical training in a Government recognised Industrial Training Centre or in a recognised Workshop. All applications for recruitment are scrutinised and only those with the stipulated qualifications are required to undergo a series of tests designed to weed out those that are unsuitable. Those include written tests in Arithmetic, General Knowledge and Sketching, a practical trade test and finally an interview.

The apprenticeship period of 18 months is split up into 2 parts,

- (i) an initial 6 months Basic training
- (ii) subsequent 12 months specialisation in Factory.

The initial period of basic training has three distinct facets,

- (i) Practical
- (ii) Theoretical
- (iii) Citizenship and Physical development.

The main emphasis is of course on the practical training on which the apprentice spends 25 hours a week out of a working week of 48 hours. This is carried out in the Basic Training Centre, which is the hub of of any Training School for craftsmen. (Appendix 1—Layout of Basic Training Centre). The Training Centre has three departments (viz.) Fitter, Machinist and Welder, each being independent as far as possible with a separate Stores to feed all three. The departments are fully equipped with the best and up-to-date tools and equipment to impart alround basic training. The cost of equipping the machinery, small tools and accessories in each department of the Centre is given below (in lakhs of Rupees):—

1. Cost of Workshop Sheds and electrical fittings	3.70
2. Machinery—Fitter Dept.	0.85
Machinist Dept.	3.76
Welder Dept.	1.85
Total Machinery	6.46
3. Small tools and accessories	
Fitter Dept.	0.79
Machinist Dept.	0.60
Welder Dept.	0.28
Total	1.67
Grand Total for Basic Training Workshop (including handling etc.)	12.20

The Training Centre is housed in sheds which are light and airy with clean and bright decorations, adequate natural lighting and a well kept garden, all around, conditions which are conducive to good standards of work. If a high standard is set by the surroundings, there is a better chance of higher standards of workmanship being attained.

The traditional method of imparting skill was the long drawn out process of training by exposure (i.e.) observing the experienced worker and then trying to imitate. The demonstrator had neither the time nor the ability to describe his actions and usually not trained to express the process in easily intelligible language. During the last three decades, however, better and more efficient methods have come into use. Separate training centres have become a "must" and Instructors themselves are given courses of training to make them better teachers of the skills involved. "Practice" they said "makes perfect". But it is a practice, the results of which are known, which makes perfect.

Practical training in the basic training centre is under the expert guidance of competent Instructors. Intensive control ensures that all apprentices attain a minimum basic level of skill by concentrated attention and provision of adequate raw materials, tools and other facilities. This satisfactory result is obtained by well-planned systematic graded exercises to cover the various skills involved called Basic training exercises. These have now been standardized for all the three departments. Every exercise is covered by a blue print, copies of which are handed over before work is started. These blue prints contain complete quality specifications—dimensions, tolerances and standards of finish. Every 6 weeks, periodical tests are interspersed. The basic exercises, as well as the test pieces are evaluated by qualified Inspectors in the presence of the apprentices. His errors are pointed out and he is encouraged to improve his performance. Since both quality and time are important, both these factors are considered in evaluating the periodical test pieces, the time allotted being consistant with the stage of training. These periodic grading test serve 3 purposes,

- (a) determines progress made,

- (b) act as a review of the work covered during the period,
- (c) shows the Instructor where his instruction has been weak in subject matter or method or both.

The Integral Coach is an all welded design. This fact throws a heavy responsibility on the School for training the high grade welders whose work will always be dependable and who can be relied upon to turn out modern all welded steel coaches under conditions of mass production. In fact, the success of the production of this new type of coach will depend, to a very large extent, on the standard of welding attained by the apprentices passing through the School. The lack of welders, with previous experience, offering for recruitment places an additional burden on the School. This is met by relaxing admission standards, by stricter control during training and by increased supervision. Since even the welder supervisory staff will have to be drawn from the ranks of welders on the shop floor, the importance of the Basic Training for Welders will be apparent. Each welder apprentice is allocated a Welding both complete with welding set and tools. The actual welding instruction is limited to 4 hours of sustained practice per day during the basic training course since manual practice for more than this period does not increase the speed of learning. The sequence of the course of instruction is such that the student masters the basic skills, such as striking, holding and manipulating an arc, before he can practice depositing welds in the various positions of welding. The deposition of welds in the flat position precedes the vertical and overhead positions, because of the relatively more complicated and difficult manual responses required in the latter positions. A variety of electrodes varying from 8 to 16 gauge are used to meet the exercise requirements. Low hydrogen welding rods are also used in training since these are used in the Factory for joints requiring great

strength and reliability. The main stress is on electric D. C. arc welding of mild steels of good weldable qualities, of thickness varying from 3/32" to 5/8". The distribution of time during the course is as below :

Electric arc welding of Mild steels	405 hours
Gas cutting of Mild steels	18 hours
Spot Welding of Mild steels	10 hours
Oxy-acetylene Welding	18 hours
Fitting and plate edge preparation	18 hours

Training in plate edge preparation for welding is also given for which equipment such as gas cutting machine, guillotine shear, floor grinder and straightening table are provided. The standard qualification procedure for welders recognises that quality of arc-welded joints is determined both by the specific welding procedure adopted and the ability of the welder to apply that procedure. Welding is primarily manual work and the chief functions of the Welding School is to impart the necessary degree of manipulative skill which involves more or less complete control over the pool of molten and metals into which deposited metal flows under his guidance. When the apprentice can exercise this control without undue tension and can continue it with an uniform measure of skill throughout a normal working day, he is ready for the work in the factory.

While the main emphasis is on the practical training, theoretical training is a valuable adjunct, keeps in step with it and assists the apprentices to grasp his practical work more clearly. For theoretical classes, the batches are split up into groups of between 20 to 30, each group being named after renowned Indian personalities (e. g.) Asoka, Harsha etc. By keeping the size of theoretical classes within this range, the best results are obtained by the Instructors who are able to give individual attention and correct sketches in the class room as and when they are done.

Great emphasis is placed on the development of ability to sketch mechanical details and to read blue prints so that, on the shop floor, he will be able to read and work to blue prints without constant guidance from his Supervisor. Sketching is done on squared paper. A drawing syllabus suited to the requirements and starting from basic principles has, therefore, been drawn up. Subjects are also included which aid in enlarging the trainees outlook and general knowledge and make him conscious of his responsibilities both at work and as a citizen. The course of study in each subject is specific and the Instructor makes certain that every one in the class covers the detail and understands the material. The advancement of the group as a whole is his primary responsibility rather than the spectacular development of a few. Better results are sought to be achieved through constant use of instructional aids such as charts, pictures, films and filmstrips.

Certain directives for occupational training have been established by the occupational educationalist Prof. Dr. Ing. Riedel. He has stated that learning in occupation usually involves an unaccustomed and in most cases relatively great physical burden—greater muscular effort, longer strain, rapid tempo and reduced leisure. The young man must accustom himself to all this, to the limit of his capacity. The occupation also demands protected mental application and self-discipline, to which also they are unaccustomed. Since the beginning of the occupation nearly always falls close to the period of puberty, care must therefore be taken that, despite the occupational strain, the youthful organism has sufficient rest for development and inner readjustment. This demands that the trainer should possess a high degree of educational and psychological skill, for he has to consider, on the one hand, that an adequate strain is necessary from the biological point of view for a developing human being, and on the other, overstrain may cause physical and mental injury.

Qualifications of a good Instructor are :—

- (a) Good Technical education,
- (b) Practical experience as a craftsman,
- (c) Experience in the field of supervision,
- (d) Preferably experience in teaching of vocational subjects.

The basic ideal actuating the Instructor should be one that those "with whom we earn our bread in the factory are deserving of as much respect as those with whom we eat the bread." This attitude can have a most decisive influence in developing good citizenship traits amongst the trainees. The Instructors should have a sound respect for the skills and training regarded as "something for what it can evoke from the people and not for driving them, to liberate the physical energy of the apprentices and to guide it efficiently into useful and productive channels." Continual examination of Instructional methods is effected by frequent staff meetings and by close liaison between staff members.

On the completion of the basic training, apprentices are sent to the factory for in-plant training for a period of 12 months. This phase of their training is an integral and important part of the apprenticeship scheme. During this period, the apprentice, who is already accustomed to systematic work in the Training Centre and possesses a versatile training, is given tasks which otherwise fall to a qualified worker. He is gradually made to get acquainted with the realities of factory life and working. Though he is put on production jobs, the Supervisory staff understand the apprenticeship programme and emphasise the instructional aspect also. In view of the fact that the factory depends on the apprentices to form the bulk of the skilled cadre and the necessity for shops to go into maximum production at the earliest possible opportunity, apprentices are usually specialised on the machines or jobs for which they are most suited. They attend School for 4 hours a week to attend classes in Drawing

and Sketching, Workshop Mathematics and Trade Theory. His abilities and attention to duties are recorded and a final trade test is given before his entry into the skilled grade.

Side by side with the practical and theoretical training, the development of the personality and essential qualities of citizenship amongst the apprentices to the maximum extent possible is also attempted. With this end in view it is made compulsory for all apprentices to join the Auxiliary Cadet Corps. Training in this Corps has many facets such as Parades, Physical Training, Citizenship Training, Community Work and Sports. During the period of apprenticeship, a planned approach is also made to the problem of identifying the individual apprentice with the factory. He is given some idea of the importance of his own contribution to the factory and the part played by it in the economy of the nation. Details of the Factory, its production targets and staff policy are explained so that he realises he is one of the team with a common aim and purpose. Vocational fitness by itself cannot achieve maximum output or induce maximum happiness amongst the labour force unless the workers are trained to fit in as a team inside the factory. The fact that most of the skilled workers have been given an excellent training at the Factory's expense may result in the workers developing an attitude of tolerance and sympathy towards the aims and objectives of the Factory and lead to establishment of goodwill between workers and management.

To assist the apprentices in gaining valuable experience in a community living, a Hostel to house 264 apprentices with a floor area of 60,329 sq. ft. at a cost of Rs. 8.45 lakhs has been built. The Hostel will be under the control of a Superintendent in the scale of Rs. 200-300. The Hostel Mess will be run by a Committee duly elected by the apprentices. Common rooms

have been provided for recreational and other activities. Sports and other playgrounds are available around. It is expected that the Hostel will become a centre of the social life of the apprentices after the working hours.

The Training School has been designed to provide training facilities to recruit and train apprentices at the rate of 520 a year, recruitment being half-yearly. By 1959, it is planned that the School will turn out 1300 Fitters, 520 Welders and 725 Machinists, thereby meeting a major portion of the demand for skilled workers in the Factory.

Even in the West, where considerable mechanisation of industry has taken place, higher productivity has been found to depend on individual operator skill obtained as a result of organized training. In addition, other indirect advantages such as lower labour turnover, lower absenteeism and accident rates and improved quality of production result. By fitting the worker to the job and vice versa, training prevents mal-adjustment of the individual to his environment and thereby reduces accident proneness.

Craftsmen are made, not born. While natural aptitude is important to craftsmanship, in the final analysis, it is the type of training received during apprenticeship that determines the skill and quality of to-morrow's craftsmen. As in any other walk

of life, discipline, punctuality, team spirit and skill are expected of a good workman. The success of industrial concerns in the west is in no small measure due to the team spirit displayed at all levels, confidence in each other, faith in his superiors and pride in workmanship. All these qualities can be successfully implanted during the period of apprenticeship.

The advantages of apprenticeship training for industries are so great that there is no doubt that there will be a vast development in this field during the present phase of intensive industrial expansion. In the message which Sri C. Rajagopalachari sent wishing the School success on the occasion of its opening in March, 1954 made the following observation :—

“May this School flourish. The most important part of a factory is its training side. It keeps the thread of efficient work unbroken. A factory without a School attached to it is useful but barren. With a School attached, the factory becomes a living and procreative organism like nature's every fruit that carries a seed within it for multiplication.”

The money spent on apprenticeship schemes will be more than amply repaid many times over and industrial development will thereby be put on a firm and lasting foundation.

NEW DIESEL-ELECTRIC LOCO GIVES DRIVER ALL-ROUND VIEW

Developed to meet the needs of heavy industry, a new British Diesel-electric shunting locomotive is said to provide for the driver an all-round view probably unique in vehicles of this type. The locomotive is being produced in two versions—one of 200 hp and the other of 400 hp. Both have Rolls-Royce Diesel engines, and British Thomson-Houston transmission.

By adoption of the comparatively new 200-hp. Rolls-Royce oil engine, the builders say, the new loco. has been provided with an engine generator set considerably smaller than is typical in installations of its horsepower. This, besides reducing costs, makes possible a smaller bonnet, thus improving visibility from the locomotive cab. The driving cab is centrally placed, with doors opening on to diagonally opposite platforms accessible from the front and rear buffer platforms. The control desk in the centre of the cab is positioned to allow the driver considerable freedom of movement without loss of visibility. All the controls are duplicated at either end of the desk.

Modern Machine Tools and Equipments in Railway Workshops

By Asoke Chandra Bhattacharya, A. M. I. Prod. E.

YESTERDAY'S alchemists sought a “Philosopher's stone” to turn base metals into gold. More useful than their greatest dream, is to-days Machine Tool which turns any metal into a million forms for the services of all mankind.

Since the first caveman hitched his wagon to a dinosaur, people have been looking for ways to live well with less efforts. In this never ending quest, they have developed the Machine Tool and achieved a technical perfection with considerable improvements in its design which is the keynote of success in their physical life.

To-day therefore we find that behind the amazing advances in transportation by land and sea, the conquest of the air, the annihilation of space for communications, the ubiquitous Machine Tool at work. From the Machine Tool flows every object of our industrialized world. More than anybody thinks, Machine Tools are influencing our time, our culture and our civilization. Without them our mechanized society would slowly grind to a halt.

EVOLUTION OF MACHINE TOOLS

In simple terms, a Machine Tool is a mechanical device designed to cut or shape metal. Alone amongst all the modern mechanical marvels the machine tool can produce machinery and can even reproduce itself.

Probably the most primitive form of machine tool, which has been used for centuries past—and which is, indeed still used by the brass and wood workers of India—was a sort of lathe composed of two short posts containing centre points driven into the ground at the required distance to take the

work, and a bar of wood lashed to them to support the tool. The work was rotated by means of a cord attached to the ends of stick about a yard long and the turner sat on the ground, often using one hand and his foot to hold the tool.

What may be considered the pioneer of machine tools was a boring machine made by Wilkinson in 1775 i. e., 10 years after James Watt produced the Steam Engine, for it made possible the development of the steam engine, which in turn made possible the production of other tools and the Machine Shop. From it, have been derived the drilling, milling, screwing and grinding machines.



Fig. 1. Detail of saddle and turret of WARD No. 7 Stay-bolt Combination Turret Lathe.

In the matter of lathe design and construction, the honour of invention belongs to Maudslay, who about 1794 evolved the first slide rest to receive general practical application, in 1800 Maudslay provided his lathe with a lead-screw and change gears.

The need for producing flat surfaces which had to be done by the laborious process of chipping and filing, gave birth to the family of reciprocating machine tools, the planer,

shaper and slotter. In effect, the planing machine is a development and an inversion of the slide rest. One of the earliest planing machines was made about 1814 by Mathew Murray and installed in Leeds to plane the surfaces of Watt's "D" slide valves. A direct descendant of the planing machine is the shaper, invented by Nasmyth in the early 1830's. The milling process is of considerable age, and is credited to Dr. Hooke, about 1664. Bodmer patented a machine in 1839 which was the predecessor of Knee type. In 1865, J. R. Brown of the Brown & Sharpe Co., patented the first universal machine.

PROCESS OF DEVELOPMENT

The process of development of the machine tool from its crude beginnings has been governed by a multiplicity of factors and its trend of design has largely been influenced by the introduction of new cutting materials like carbon steel tools, high speed steel in 1901 and cemented carbides in the

late twenties. Evolution of electric motor driving, and the introduction of alloy steels have brought about further revolutionary changes in machine design.

The perfection of ball and roller bearings, now almost universally used in machine tools for all but the slowest running spindles, has effected further economies in power consumption with increase in speeds.

Variable-speed motors, with Ward-Leonard or other control systems to give a wide motor speed range, are used in many instances to give improved stepless ranges. Greater use has been made of electrical methods of feed control and of relay circuits with push-button switches for machine operation and adjustment. Improved lubrication systems provide pressure supply of filtered oil to the principal rotating and sliding parts so as to maintain them in a proper state of lubrication. These lubrication systems are frequently interlocked with main

driving motors and provided with visual or audible warning of supply failure.

There has been progressive tightening up of limits of inaccuracy. A marked advance has also taken place after the introduction of negative rake machining, increased use of hydraulic systems of machine motions, numerous applications of electronic methods of control and measurement and many automatic copying and profiling devices fitted to a variety of machine tools. Rapid power adjustment as incorporated in the modern machine tools, has greatly reduced setting-up times by providing finger-tip control of their members.

In addition to the mechanical efficiency of the machine itself, safety and comfort of operation have received careful attention, as it has long been accepted that such working conditions for operators are not merely humane, but also help in obtaining increased production.

FUTURE TRENDS IN DESIGN

In forecasting some future trends in the design of machine tools, it may be said that a stage has now been reached whence further development may proceed in two divergent directions. On the one hand people are becoming more and more "automatic minded" and as such a trend towards automatic operation, maximum utilization of horsepower, the ultimate in speeds and feeds, and all other features which contribute to the highest possible productivity in mass production operations, is generally expected. At the same time the possibility of calling for simplification so as to produce simple but effective range of machine tools, cannot also be ruled out altogether.

Although the production of the latter type of machine tools is important, considerable attention is being paid to the design of high production equipment. In features worthy

of further investigation are included the provision of automatic operating facilities, the simplification of maintenance problems, and the adoption of a construction which will permit the use of carbide tools to their maximum capacity.

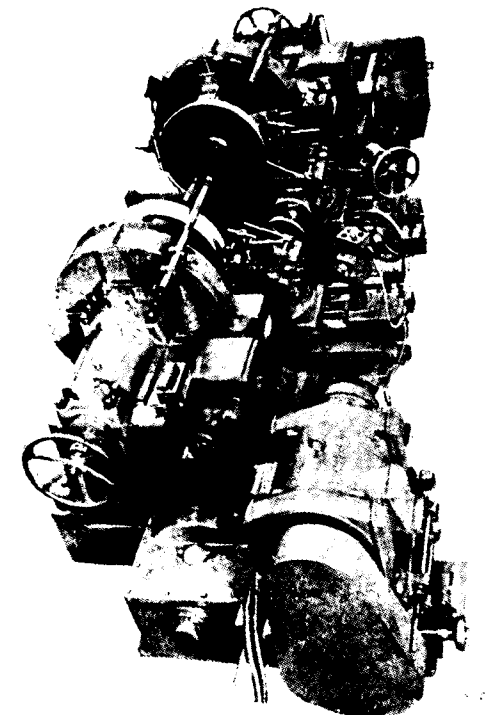


Fig. 3. Railway Wheel Lathe.

There will be a growing emphasis on reducing the time involved in such operations as set-up, loading and unloading, gauging and checking etc. Automatic loading and gauging features will therefore come in for their share of attention, as well as ease of chip removal. Another interesting development which is now being attempted in the West and holds future promise is that off turning by milling, where the work is revolved and the lathe tool is replaced by a rotary multi-toothed cutter.

The Germans seem intrigued with full automatic operation and have given a great deal of attention to what they call "programming" machines and establishment of a

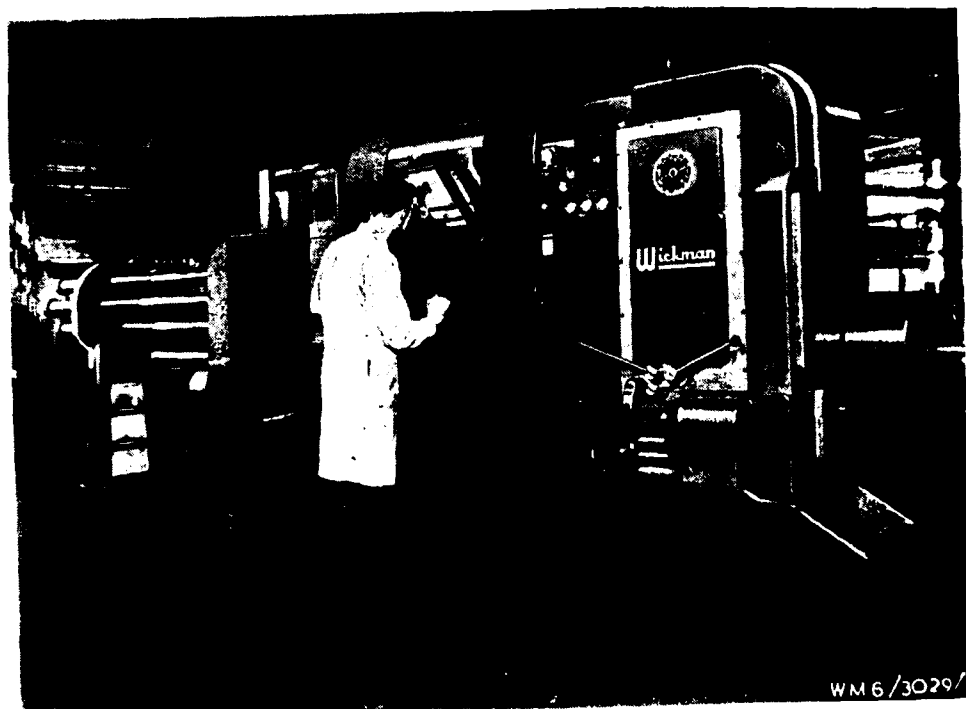


Fig. 2. WICKMAN Chucking automatic Machine.

push-button factory since, based on electronics, these machines are activated by a series of push-buttons to perform a multiplicity of pre-selected operations automatically.

IN RAILWAY WORKSHOPS

Technological advances in railroading which have made possible to-day's high train speeds, greater payloads and increased safety, have also brought a demand for locomotive and carriage components finished to a greater degree of precision and accuracy. For this purpose, the question of equipping the Railway workshops with modern machinery has always been engaging the attention of railway engineers.

Among the machine tools in use in railway workshops, some have been specially designed for the peculiar machining problems encountered in these shops. To attempt even to describe briefly these individualistic single purpose machine tools would require

hundreds of pages, but a touch upon the salient features of some of these machines as calculated to appeal to the railway engineers, will undoubtedly be of interest to the readers. It should be noted however that the particular machines illustrated in this article are not put forward as being the only suitable examples of their kind but that they have only been selected to explain only the types used.

The lathe being the parent of all machine tools, it will be fitting to commence with a consideration of the modern lathe in a few of its many forms.

For development and general shop maintenance work the importance of sliding, surfacing and screw cutting lathes having different sizes of swings cannot be over emphasized. Items like machined pins, piston valve port bushes, cylinder liners, crown stays, stay-bolts etc., are turned, bored

or screwed as necessary at a high production rate, utilising tungsten-carbide tipped tools on combination turret lathes, Fig. 1 illustrates the production details of a typical stay-bolt in Ward No. 7 Combination Turret Lathe. Every advantage is here taken of compound cutting — not only are both ends turned simultaneously, but the tandem self-opening dieheads allow the screwing of both ends at the same time.

Mud plugs and fusible plugs are best dealt with in automatic machines. The typical operations carried out in 5-spindle Wickman Chucking automatic machine for the production of mud plug are as under. The mud plug is initially hot-stamped from a suitable quality of brass bar, the plug having a squared end which is prepared to the correct spanner size required. The squared end is inserted into the idle chuck at the fifth index position of the automatic machine and the cycle of operations begins with (a) rough

turn to taper 1 in 8 in the first position, (b) finish turn to 1 in 8 taper and chamfer end and centre drill in the second position, (c) face for length in the third position, (d) chase thread on taper 1 in 8 at 12 t. p. i. in the fourth position, (e) unload the finished mud plug in the fifth position. In case of fusible plugs, which are turned from 1½ in. square brass bar, lengths of 1.9/16 in. having been cut off previously for each plug, the operation cycle is: (a) load in the first position, (b) finish turn end, part drill centre and countersink end of hole in the second position, (c) finish turn body and complete drilling through in the third position, (d) face to length in the fourth position, (e) chase thread on body and tap centre hole in the fifth position. Other locomotive details handled in automatics are short steel firebox stays, small collard studs screwed at both ends, bright steel hexagonal nuts, steel unions for pipe work and components having tapers on them etc., Fig. 2 depicts one of the



Fig. 4. Journal Turning and Roller Burnishing Lathe.

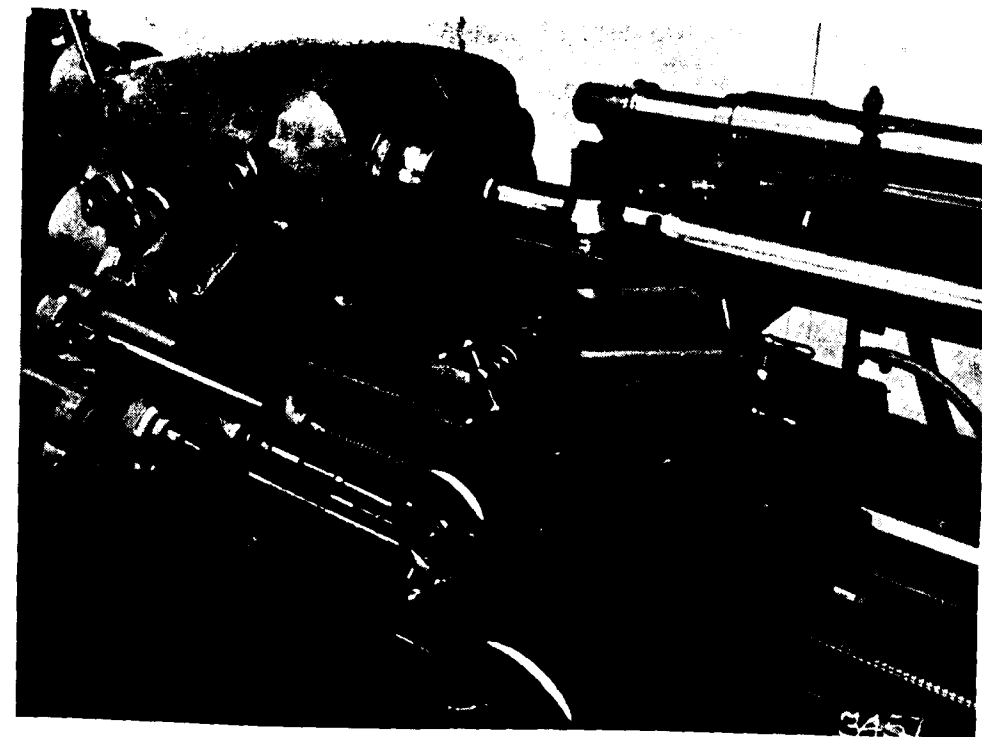


Fig. 5. Axle turning Lathe incorporating hydraulic profiling.

Wickman 2.5/8" - 6 spindle Bar automatic machine.

Fig. 3 illustrates a railway wheel lathe designed by Messrs. CRAVEN BROTHERS (Manchester) Ltd., for turning simultaneously, without torsional strain on the axle, the treads, flanges and inside and outside faces of carriage and wagon wheels up to 3'-9" diameter maximum when mounted on their axles 5'-6" gauge. The maximum length of axle 8'-0" may be admitted. The lathe is of the double ended open centre type having enclosed gear drive throughout, and is provided with spindle speeds for use with both ordinary high speed steel tools and tungsten carbide tools.

For re-conditioning the worn journals of railway wheel sets, the railway axle journal returning and burnishing machine has been designed. One of these machines, manufactured by Messrs. Wilhelm HEGENS-CHEIDT K.-G Erkelenz/Rhld. Germany is shown in Fig. 4. High cutting speeds incorporated in the machine with the help of

carbide turning tool result in excellent turning characteristics of outstanding surface quality. Safety devices incorporated in the control mechanism, ensure without any risk a simultaneous turning operation to both outside journals of a wheel set by only one operator. The roller burnishing device, void of any slides assimilates the contact pressure induced by the burnishing rollers. The special feature of the machine is that the reiterated burnishing process is accomplished not in a to-and-fro pass, but in a single pass, operation to one direction only.

The typical arrangement of axle turning by hydraulic profiling is illustrated in Fig. 5. This profiling arrangement ensures consistent accuracy between each axle and also produces faster production times owing to the elimination of non-cutting time. The machine is arranged with a two-speed gear box in order to provide slow speeds for radius finishing and water scraping. The axle is entirely machined at one pass with the exception of the right hand cheeks of each journal which are

machined at a 30 deg. taper instead of the radius.

PRECISION GRINDING

Precision grinding plays an increasingly important role in the production of locomotive, Carriage & Wagon components requiring great accuracy and ready interchangeability. Because of its ability to remove the minimum of material to regain roundness and finish, the grinding machine excels in the process of reconditioning worn parts.

Locomotive details which are customarily ground include horn cheeks, axle journals, piston rods, piston valve spindles, slide-valve

buckles, expansion links, slide bars, motion pins, piston rings, Crank pins etc.

Fig. 6 shows the CHURCHILL Model 'AJB' grinder which is used for regrinding the inside journals of locomotive driving wheel sets with the wheels in position. There are two grinding wheel-heads for grinding the Journals simultaneously or independently. The grinding wheel-heads can be positioned by hand wheel; the traverse is automatic and the length of the stroke can be accurately set to suit the journals. Traverse speed can be regulated through a four-speed gear box. There is micrometer feed and quick cross movement to either wheel-head. The work-head and tailstock have five spindles the wheel set which is carried on centres is driven from the faceplate an outside crank-

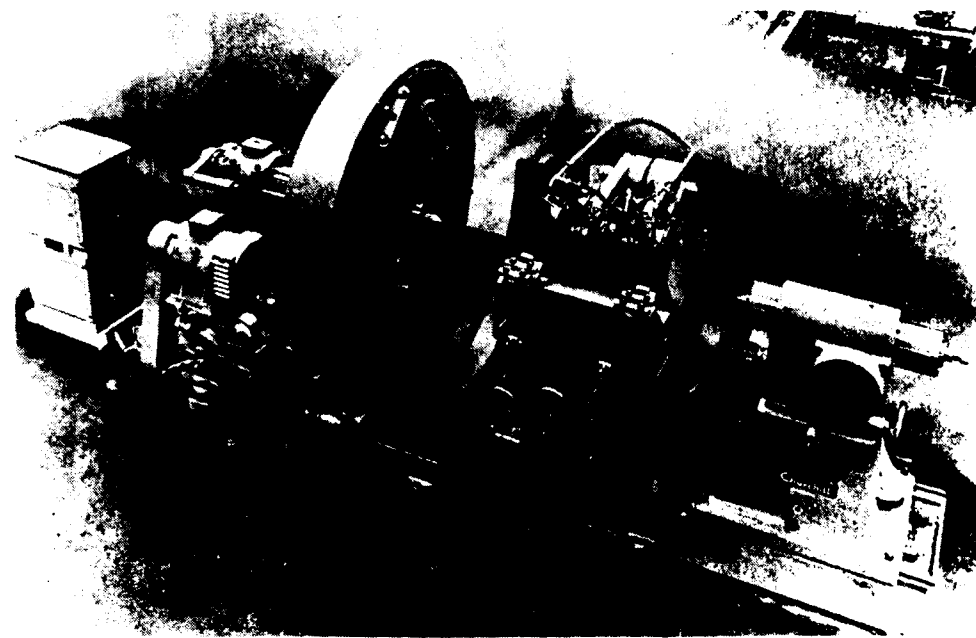


Fig. 6. The CHURCHILL Model 'AJB' Grinder for regrinding the inside journals of locomotive driving wheel sets with the wheels in position.

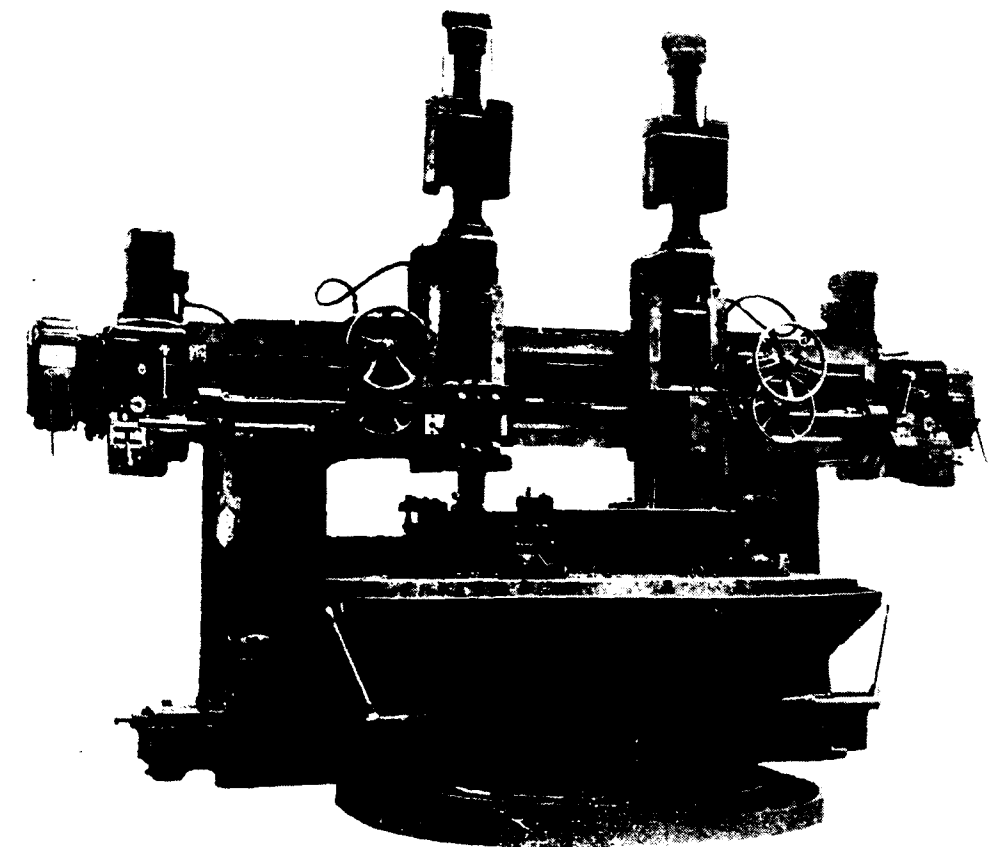


Fig. 7. CRAVEN 5'-6" Diameter table vertical Tyre Boring Mill.

pin or coupling rod pin being used as a driver.

BORING AND FACING MACHINES

The Horizontal Boring and Facing machines are acclaimed indispensable in railway workshops for the machining of cylinder work. Such locomotive details as crank webs, cylinder blocks, cylinder, piston valve chambers, etc., are bored and faced in these machines. The Vertical Boring Machine is generally used for boring, grooving and recessing of wheel tyres.

One of these Vertical Tyre Boring Mill made by CRAVENS for boring carriage and wagon tyres is depicted in fig. 7. It is of the type having a fixed cross slide fitted with two flat non-swivelling tool slides to which are secured the turret type tool-holders. The table is fitted with three hand operated concentric jaws for centering the tyres

together and three auxiliary jaws are also provided. The tool slides and saddles have taper strip adjustment of the slides to take up wear, and the traverse for the horizontal movement is by means of large diameter screws. The vertical traverse is by means of steel racks and pinions with worm reduction gear, to give fine hand control. The feed gear for each saddle is separately controlled at the end of the cross rail, and it is possible to have feed connection to one or both tool slides in use simultaneously, or the quick traverse gear can be used for one of the tool slides, whilst the other is being used for cutting operations.

HORIZONTAL PLANO-MILLING MACHINES

For their versatility and ability to machine facings and projections at the one setting makes these machines ideal for Railway

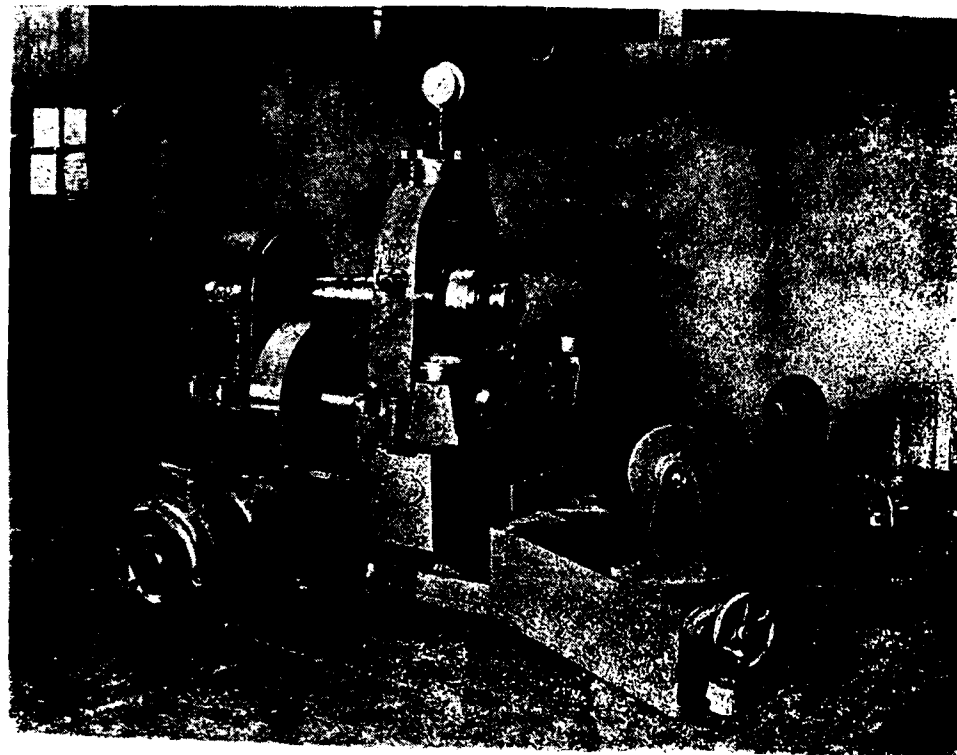


Fig. 8. Fielding's Tyre Lip Rolling Machine.

workshops. These machines are arranged with vertical or horizontal profiling arrangements and are indispensable for machining the flats and profiles of Connecting roads, Coupling Rods, and other motion details. Another important detail tackled in such a machine is the cast steel foundation ring for the boiler firebox.

Besides the machine tools already covered in the preceding paragraphs, others that are extensively used are Planing Machines, Drilling Machines, Shaping Machines, Slotting Machines, Milling Machines and screwing machines.

MISCELLANEOUS MACHINERY & EQUIPMENT

Among the miscellaneous items in railway workshops are included, the Power hammers, Die-sinking machines, Drop hammers, trimming presses, hydraulic presses and the tyre rolling machine.

In the tyre rolling machine as depicted in Fig. 8, a hydraulically loaded roll is pressed down upon the lip on the inside edge of the tyre whilst the wheel is revolved at approximately 10 r. p. m. Three rolling periods are

made with the tyre; the first with a load of 5 tons applied on the roller, the second with a load of 15 tons and the third with a load of 25 tons. This rolling which occupies 4 to 5 minutes, is sufficient for pinching the ring tightly in place.

Modern specifications covering the construction and maintenance of rolling stock call for a high grade of finish on all constructional parts, corresponding to the latest advance in technical knowledge. The man in the workshop is only capable of meeting the ever-increasing demands made by the designer if the machine-tool industry produces suitable machinery which will enable him to machine the parts in question in a practical and economical manner.

Many years ago, Carlyle stated. "Man is a tool using animal, weak in himself and of small stature, feeblest of bipeds, nevertheless he can use tools, device tools; with these the granite mountain melts into dust before him: he kneads glowing iron as if it were soft paste: seas are his smooth highway, wind and fire his unwearing steeds. Nowhere do you find him without tools, without tools he is nothing. With tools he is all".

ALUMINIUM PLANT AT HIRAKUD

INDO-CANADIAN VENTURE

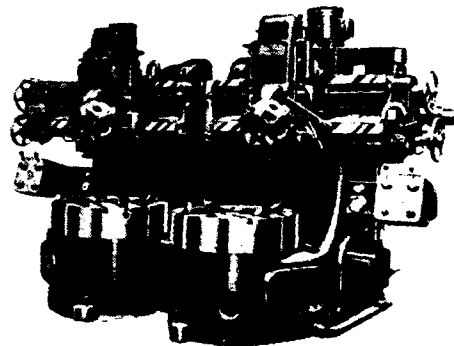
The terms of agreement for setting up an aluminium factory at Hirakud with an annual production capacity of 10,000 tons have now been finalised and work is expected to commence shortly for its erection at Hirakud. The Indian Aluminium Company is a joint Indian and Canadian enterprise. Its representatives, Mr. A. E. S. Greenwood and Mr. Maheshchandra, met the Orissa Government at a conference presided over by the Chief Minister, Mr. Nabakrushna Chaudhuri and attended by the Orissa Industries Minister, Mr. K. G. Deobhanj and Government officials.

Under the proposed agreement which is expected to be signed shortly, Orissa is to supply 20,000 kilowatts from Hirakud to the 10,000-ton smelter. The ultimate production capacity of the factory will be 20,000 tons. It is understood that the company asked for 5,000 kilowatts more for having aluminium sheet rolling machine also. It asked for lands required for the factory (about 200 acres) to be made over to them immediately, so that construction of works might start by the middle of this month. It will have a capital investment of about seven and half crores rupees.

"WEBSTER & BENNETT BORING MILLS"

THE firm of Webster & Bennett was founded in Coventry, England, in 1887 for the purpose of manufacturing Machine Tools. Even in those far off days many of the machines made were exported. In a few years exports to India alone included Screw Cutting Lathes, Two Spindle Drilling Machines, 24" Surface Boring Lathes, Horizontal Profile Milling Machines and 30" Chucking Machines.

Much valuable experience in machine tool manufacture was gained during these early formative years, and as time went on the firm followed a steady course of expansion closely linked with an equally steady policy of specialisation on one type of machine—the Vertical Boring and Turning Mill.

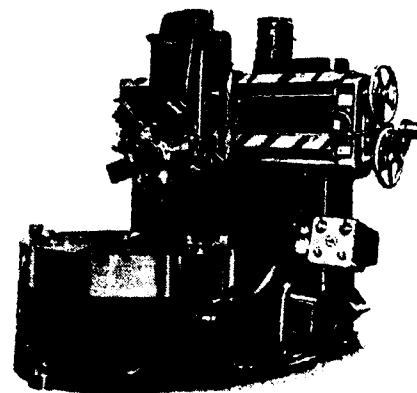


36" Duplex Series 'DH' Vertical Boring and Turning Mill.

This policy, pursued with much forethought and determination, has proved its worth and now, with many years of specialised knowledge backed by nearly 70 years of machine tool manufacturing experience, Webster & Bennett can look with justifiable pride on its place amongst the world's leaders of machine tool design and construction.

India has always been one of the firm's most highly esteemed customers. Conversely the Webster & Bennett Boring and Turning

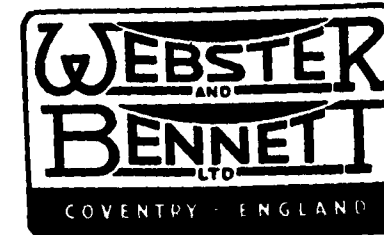
Mill has made a definite contribution to Indian industry, particularly to the smooth and efficient running of the Indian Railways. The machine has come to be regarded as a standard tool both in the Production and Maintenance shops of many Railway organisations because it is ideally suited to the machining of Railway Wheels and Tyres, Axle Boxes, and Piston Heads and Rings, all apart from the fact that it is a general purpose machine of a very high order.



60" Single Series 'DH' Vertical Boring and Turning Mill.

The machine is built in 3 standard sizes, with a chuck diameter of 36", 48" and 60", and Duplex Mills are available in the 2 smaller sizes. It is of solid build, and consequently the best use of carbide tipped tools may be made resulting in heavy cuts being possible. It should not be forgotten however, that it is equally efficient and economical when employed in machining non-ferrous metals. All the main controls are hydraulically operated on the latest type of machine (the Series 'DH') giving the operator complete control of his machine whilst calling for the minimum amount of physical effort on his part.

Various types of attachments can be supplied with the Boring Mill and include

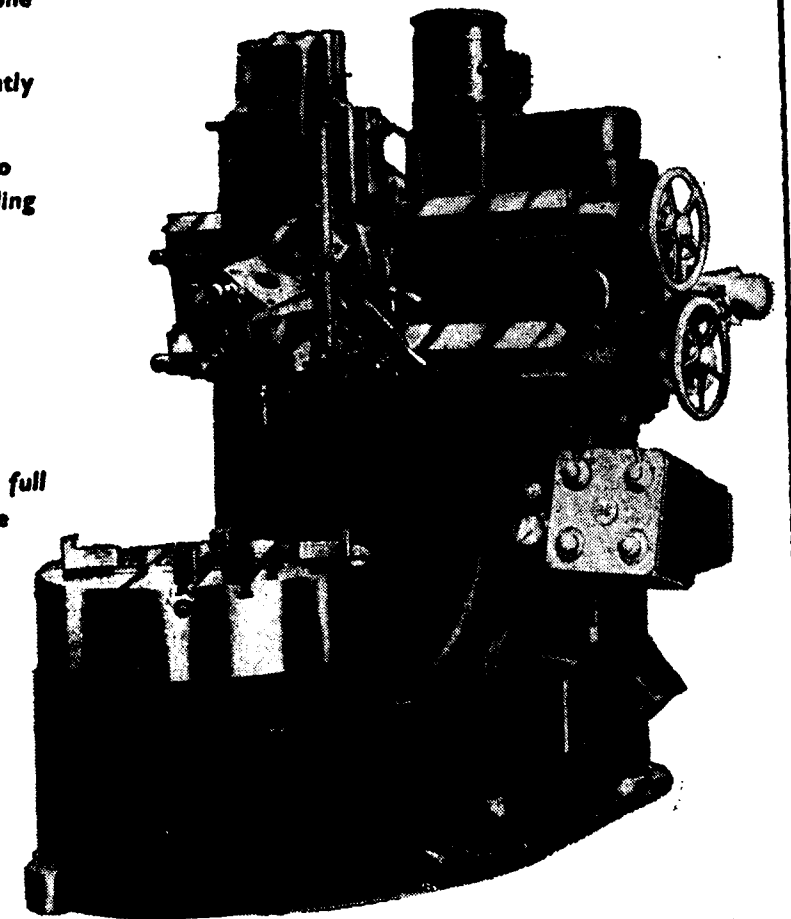


VERTICAL BORING AND TURNING MILLS

EMBODYING FEATURES OF OUTSTANDING PRACTICAL VALUE

- ★ Column and base in one rigid casting.
- ★ 12 Spindle Speeds instantly and easily dial selected
- ★ 12 Positive Feeds also selected by direct reading dials
- ★ Rapid Power Traverse readily engaged in all directions
- ★ Grouped Controls for effortless operation
- ★ Ample power for the full exploitation of carbide tools

Standard machines have 36" (illustrated), 48" and 60" chucks, and are capable of swinging 42", 53" and 64" respectively. And Duplex machines are available



Write for Details to the Sole Agents:

MACHINE TOOLS (INDIA) PRIVATE LTD.

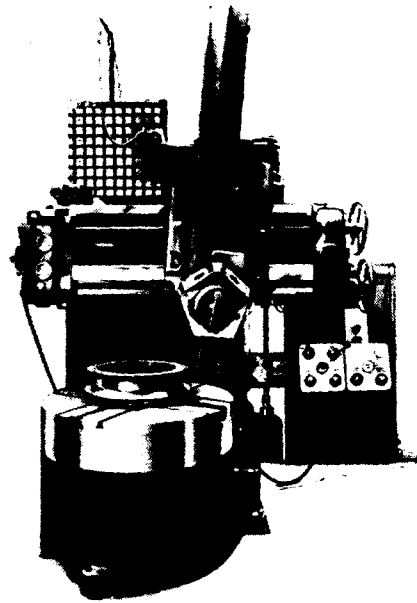
CALCUTTA
BOX 385

BOMBAY
BOX 522

BANGALORE
BOX 407

Screw Cutting, Taper Turning and Taper Generating Attachments, and two types of Profile Copy Beams.

These attachments have been in use for many years, but let it not be thought that the machine design is not constantly under review. A major step forward was taken 2 years ago in this sphere when, after several years of intensive research, Webster & Bennett put into production Boring Mills with built-in Electronic Profile Turning



48" Single Series 'DH' Vertical Boring and Turning Mill with built-in Electronic Profile Turning Equipment.

Equipment. Orders have since been received from many parts of the world for machines thus equipped which are particularly applicable to the production of tyre moulds and dies of intricate profile. This equipment has many features of considerable interest, and by no means the least of these is the simplicity of template manufacture. Templates can be made so quickly, easily and cheaply that a Webster & Bennett Boring Mill built-in Electronic Profiling Equipment

can be used for one-off jobs just as readily and economically as for production quantities.

Furthermore the Electronic Profile Turning Equipment has been built not as an attachment, but as part of the machine thus allowing the machine to perform the dual role of a standard or tracing machine as required.

The design of this Equipment incorporates a patented automatic Bias Control and, as a result of this, any shape of template can be followed without any recourse to hand control. The only limitations of the shape which can be turned are those imposed by the cutting tool design.

The accuracy both of form and of repetition of size are of a very high order. Under ideal test conditions repetition of size within .00075" on diameter has been obtained, though this limit is not guaranteed since the nature of the work material, the depth of cut and the likelihood of tool wear have to be taken into account.

It will be thus seen that Webster & Bennett are keeping well abreast of modern trends of design, and this is no less true regarding production methods as well. Full advantage is taken of the fact that, because the range of manufacture is restricted to variations of a single basic type of machine, production can be rationalised and this in its turn results in relatively low manufacturing costs which are naturally reflected in sales prices.

All sales in India are conducted through the agency of Machine Tools (India) Ltd., with offices in Calcutta, Bombay and Bangalore.



Trusted around the world

Around the globe, General Electric people are working to make life better with the finest of electrical products and services. In India, the G. E. equipment, research and engineering experience have been employed in many power, industrial and educational projects... planned for the progress and prosperity of the country. Look for the G. E. monogram... a sign backed by 76 years of electrical skill and experience... a sign you can trust.

Progress Is Our Most Important Product

GENERAL  ELECTRIC
U. S. A.

INTERNATIONAL GENERAL ELECTRIC COMPANY (INDIA) PRIVATE LIMITED
BOMBAY - CALCUTTA - NEW DELHI - LUCKNOW - MADRAS - AHMEDABAD

Machine Tools Design and Production Progress in India

By R. Koban, Chief Designer (Machine Tools)—Machine Tool Prototype Factory, Ambarnath

ECONOMICAL manufacture of turned parts requires Machine Tools which permit the use and utilisation of efficient cutting tools and are simple and easy to operate and whose clamping devices are quick and sure in positioning the material, bar, components etc.

Machine Tools, especially Capstan Lathes fulfilling the above mentioned requirements have been continuously under development and manufacture. The purposeful engagement of modern Capstan in the workshops, through the exploitation of all the utilisation possibilities and by obtaining full effect of its efficiency is of equal importance to the customer and the manufacturer. The Production Engineer desires in the case of the Capstans as compared to the Centre Lathes, that several manufacturing operations can be

carried out simultaneously or one after another through the engagement of multiple or a series of tools. Realising this, the careful Production Engineer will be constantly scrutinising his manufacturing programme for components, for their suitability of manufacture on Capstans.

This makes it clear that the work which is given nowadays to be manufactured on Capstan Lathes is of such a variety that the Capstan Lathes must have in the first instance a wide range of spindle speeds. For all types of parts, materials and their manufacture, for roughing and finishing, for facing, form turning, cutting off, boring or thread cutting thus a sufficient number of spindle speeds must be available in order to be in a position to work with the most economical cutting speed and in the shortest machining time, thereby accom-

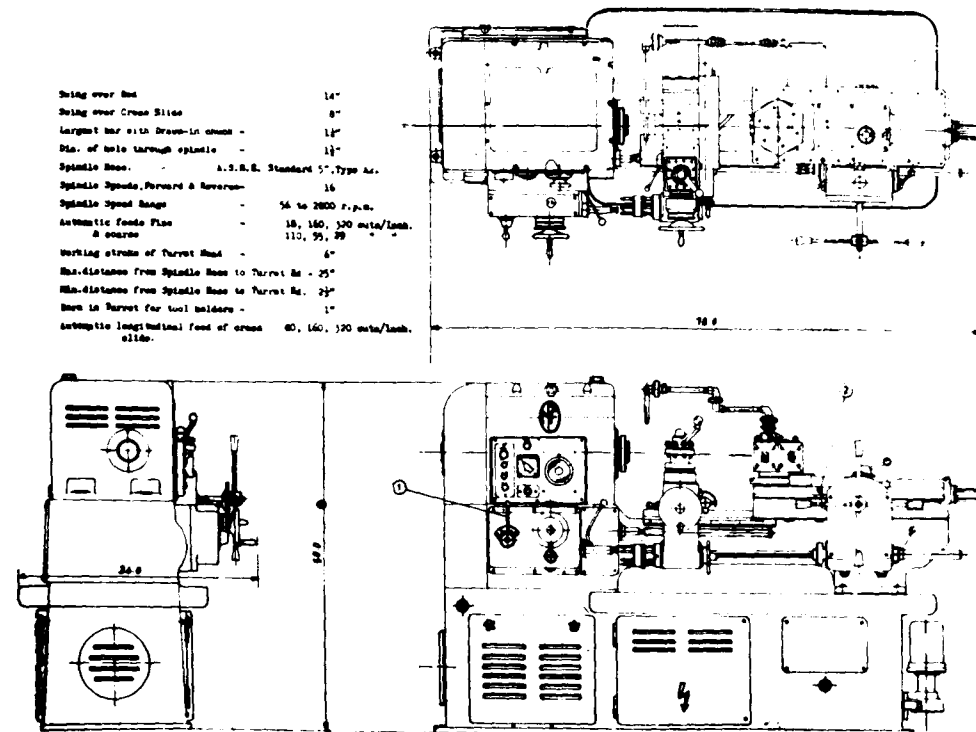


Fig. 1. 147 Capstan Lathe Type CL 14.

BRITISH FIRM GETS RAILWAY CONTRACT

A contract for 5,000 wheel sets worth £ 487,500 for Indian Railways has been secured for a British firm through the Indian branch of the United Steel Companies.

Competition for the contract was keen, and bids were also put in by Italian and Japanese manufacturers of railway gear.

It has been arranged that Mr. C. F. Ryan, chief of the railway materials department of the successful tenderer—Steel, Peech & Tozer, of Sheffield—should visit India to discuss technical and other matters with officials of Indian Railways.

Steel, Peech & Tozer were recently awarded a contract to supply the United States Air Force with 14,000 rings for use in landing wheels. They are specialist engineers in wheel equipment.

coaches mentioned above, 16 are for replacement purposes and 9 (including one spare motor coach) on additional account. None of these Electric Multiple Unit Stock have been received and it has not been possible, therefore, to increase the number of suburban trains. Every possible attempt will be made to increase the trains by a few from 1st October provided at least one rake of 8 coaches is received by then.

CONSTRUCTION AND EXPANSION OF RAILWAY WORKSHOPS, LOCO SHEDS AND CARRIAGE AND WAGON DEPOTS

WITH the increase in rail transport as a result of the developments during the Second Five Year Plan, the holdings of locomotives and rolling stock would increase and the Administration had plans for expansion of the Workshops to meet this load.

The plans for expanding existing Workshops or for putting down new Workshops envisage a total expenditure of the order of Rs. 9 crores.

Similarly, an expenditure of the order of 2.50 crores was envisaged on Running Sheds and Sick Lines.

At Kotah new Workshops would be built. These Workshops would repair 40 wagons every day. At Ajmer the workshops were being remodelled and the new work at the shops would increase by 100 per cent and carriage repair by 60 per cent.

ELECTRIC MULTIPLE UNIT COACHES FOR BOMBAY SUBURBAN SECTION

THE Railway Board have placed orders for 174 electric coaches on foreign firms—100 from Italy and 74 from Japan. Out of these 74 coaches from Japan, 25 are allotted to Western Railway (3 rakes of 8 coaches each and one spare motor coach). Out of 100 coaches from Italy, 8 (1 rake) will be given to Western Railway on loan for stepping up the rehabilitation of old electric multiple unit stock. Out of the 25

plishing savings in time and wages. It is therefore necessary that the change of speeds can be carried out by the operator without any time loss, for which care has to be taken that the operating elements are simple and convenient. Through the use of as many as possible simultaneously working, cutting tools—a basic requirement of Capstan Lathes—the cutting load increases considerably and therefore the Capstan Lathe must be sufficiently powered.

In short the requirements of a modern Capstan Lathe are:—

- (1) Wide range of spindle speeds.
- (2) Easy and quick change of spindle speeds.
- (3) Large number of tooling stations.
- (4) Conveniently and easily operated operating elements.
- (5) Speedy clamping fixtures.
- (6) Sufficient power to meet cutting requirements.

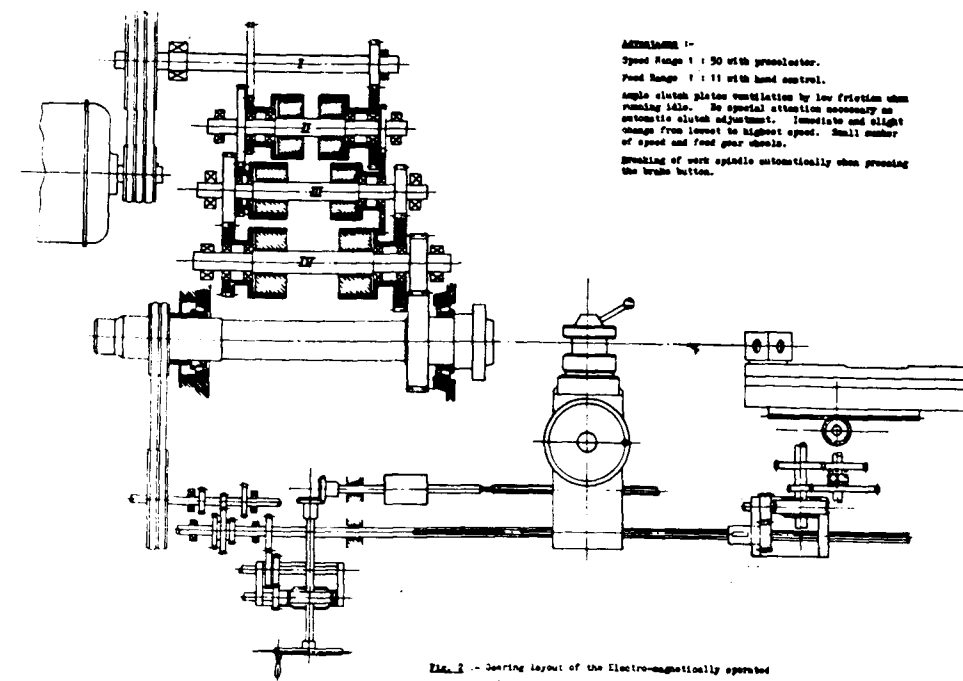
In the design of the M.P.F. Capstan Lathe C.L. 1— $\frac{1}{4}$ " the above mentioned demands have been taken care of and particular importance has been paid by our design staff to fulfil the two conditions of:—

1. **Rigidity**:—Guarantees accuracy and quality of the parts obviates vibrations and prolongs the tool life.
2. **Higher Production**:—By incorporating time saving devices and convenient positioning of all the operating elements.

An operator will give a higher output if the machine he is working on, is easy to handle. By arranging the controls centrally, the handling of the machine is simplified to a great extent and the operator can give his undivided attention to the work going on. By

means of a pre-selective system, speed may be selected for the following operation while the first operation is still in progress. The speed selector control knob is conveniently placed on the head stock to facilitate easy reading and setting of the speed and indicates the 16 spindle speeds from 56 to 2800 r. p. m. (i. e. 1 : 50). The selected speeds come into action by merely pressing the control button in the centre of the control knob. The control button when pressed, actuates the respective series of relays, which operate the electro-magnetic clutches. The two speed main motor of $3\frac{1}{2}$ H.P. and 2800/1400 r.p.m. is mounted on an adjustable swivel plate and situated in the pedestal. The 'V' Belt drive from the motor, drives the pulley of the input shaft of the head-stock. The six electro-magnetic clutches are mounted on 3 shafts which are arranged in one horizontal plane. By parting the head-stock in this horizontal plane the 3 shafts can be mounted in an assembled condition into the head-stock. The main spindle of Ni. Cr. Steel heat-treated and ground and dynamically balanced, carries only one gear of relatively small dia. closely situated to the front bearing and is subsequently driven from shaft No. IV (Fig. 2). By this arrangement additional stresses acting on the main spindle have been avoided. The main spindle is running in high precision taper roller bearings with a special compensating device¹ incorporated, as experience has shown that when a bearing operates at high speeds radial and axial expansion occurs. Therefore if two bearings are mounted on a spindle, at a distance apart, the bearings tend to expand radially quicker than the spindle expands axially. Thereby the radial expansion tightens the bearings the axial expansion tends to compensate. In order to eliminate the time lag between radial and axial expansion it is necessary to allow the bearing to expand radially which has been accomplished by mounting one of the bearings in a semi-flexible sleeve.

¹ British Timken Ltd., Machine Tool Manual No. 4029.



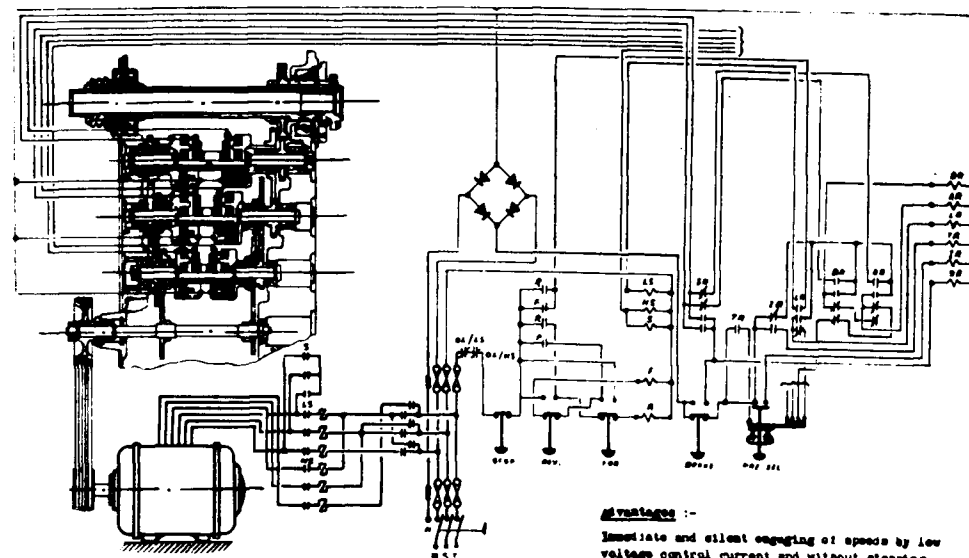


Fig 3. Electrical scheme of electro-magnetically controlled remote control of C.L. 1-1/2.

The box type construction of the pedestal and the sturdy design of the bed guarantee the necessary rigidity for maintaining the accuracy of the machine. The coolant tank is an integral part of the pedestal and has an approximate capacity of six gallons and a bracket type vane pump is directly mounted to the pedestal and through easily set joints, on to the tool. The coolant flows through an accessible sediment tank before being returned to the tool.

Equipment :—The machine is supplied with bar feed equipment, Ward automatic bar chuck, chuck guards and the following standard tool holders: Adjustable stop, Knee type tool holder, Roller box tool holder, Knurling tool holder, Floating reamer holder, Releasing tap holder, Recessing tool holder and Knee tool holder for chucking work.

The above described machine can also be equipped for thread cutting with single point

tool covering a range of 4 to 80 T. P. I. on special demand.

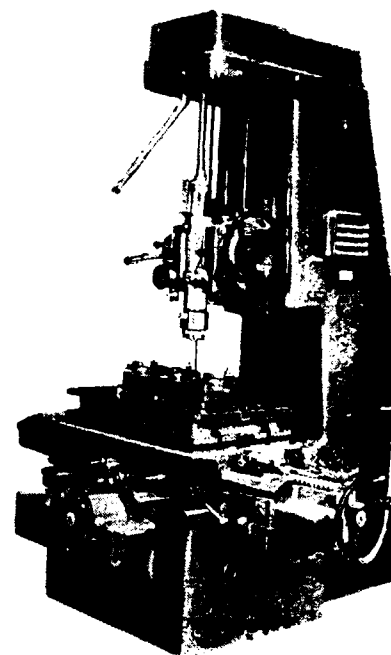
As our factory came into being in 1953 only our contribution of Machine Tools supplied to Railway workshops has been negligible so far. The factory has established the manufacture of various Tool Grinder, Polishing Machines, Monodrives, Coolant Pumps, and Precision Tool Room Lathes etc. The Production of 2 sizes of Hydraulic Surface Grinders and Capstan Lathes C. L. 1/2 is in full swing. The designs for Tool and Cutter Grinder, Precision Universal Grinder, Production Milling Machine etc. are completed. The design of Capstan Lathe C. L. 2 is nearing completion and the designs for Thread Milling Machine, Special Purpose Machine of Unit construction and Hydro copying attachment are in hand. With the establishment of the above mentioned original designs we are convinced that we shall be in a position to supply the Railway workshops with accurate and modern machine tools to their fullest satisfaction.

The Newall Model 2436 (MK. II) Production Jig Borer

UNTIL recently, the great majority of production engineers would have been more than a little taken aback at the suggestion that components for items other than tooling should be handled on a jig borer. With the passage of time, however, circumstances have ensured that this idea is now accepted and is fast coming into universal practise.

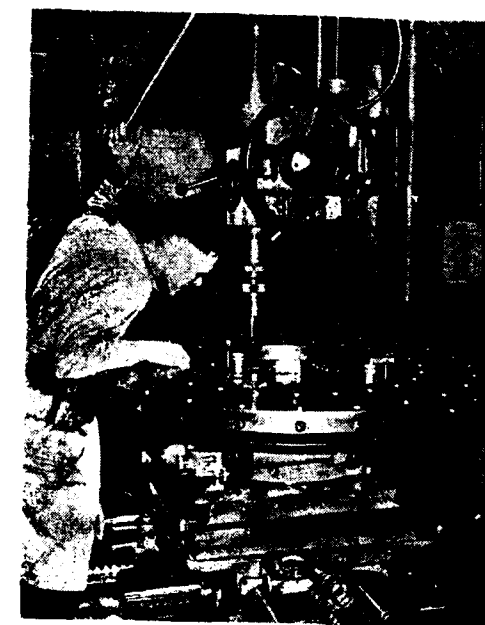
Broadly speaking, the use of jig borers for the making of production components offers two main advantages. Firstly, small batches can be produced to close limits without the

on a jig borer straight from the production drawing. Quite apart from the expense involved in routing tooling through the usually overworked jig and tool drawing office and tool room, a very marked saving in time can be effected. Broadly speaking a batch of components for prototype equipment can be completed on a jig borer in a matter of hours rather than the weeks which would have required for conventional methods. Moreover, should a modification be required, this can be made at low cost on a jig borer. With a jig this would often require the scrapping of the drill plate, or, at least, its complete rebuilding.



The Newall Model 2436 Mark II Production Jig Borer.

need for special tooling. In spite of the fact that a jig boring machine involves a considerably higher hourly cost than, say, a drilling machine, the savings due to the elimination of tooling completely swamp the somewhat higher costs on the floor of the shop. In particular, components can be machined



A 42" diameter drill jig weighing 9 cwt. and containing 168 'A' fit holes of 1-1/8" diameter in course of production on a Newall Model 2436 (Mk II) Jig Borer.

The second case for the jig boring of production components embraces those required to precision limits. Many items required for film cameras, inspection equip-

ment, special machine tools, lamp-making machines and similar products are required to tolerances closer than those which a drill is really capable of producing.

Whereas an average tolerance from a jig is perhaps 0.002 in., the jig borer can maintain a figure of 0.0005 in. with ease and considerably better when appropriate steps are taken.

In view of this trend, The Newall Engineering Co. Ltd. of Peterborough, England, one of the world's largest manufacturers of jig borers, have incorporated new features in their range of machines to suit production conditions. Typical of these have been changes in the quill and spindle assembly to give greater spindle rigidity coupled with improved running accuracy, higher spindle speeds and an increased range of feed.

One of the 6 models built by The Newall Engineering Co. Ltd., the 2436 Mark II Jig Borer has a table surface 24" x 36". The maximum distance from spindle nose to table is 32" and the capacity from spindle centre to column throat 24". Principal features of the machine are :

Open-sided construction to accommodate workpieces in excess of table size.

Exceptionally rigid spindle running in S.K.F. double row cylindrical roller bearings lubricated by an oil mist system. Spindle speeds are infinitely variable from 40-2500 r. p. m. and 4 feed rates, 2, 4, 6 and 8 thousandths of an inch (0.05, 0.10, 0.15 and 0.20 mm.) per spindle revolution are obtained up and down through a gear box. Table setting guaranteed to 0.0002" by the patented Newall system of table location.

Power travers of the table and cross slide.

Centralised controls accessible from one operation position. Limit switches incorporated in electrical circuits to the spindle feed, quill head feed and table traverses to prevent overrun.

* * *

KU HEAVY DUTY UNIVERSAL GRINDING MACHINE

Manufactured by Keighley Grinders (Machine Tools) Ltd., a subsidiary of The Newall Engineering Company Limited, Peterborough, England, this machine is of exceptionally robust construction, and has



The Keighley KU Heavy Duty Universal Grinding Machine.

a wide variety of application in modern engineering practice for cylindrical, face internal and taper grinding. As its name implies, the machine is fully universal, with the wheelhead mounted on large diameter turn-tables and compound slides in addition to the usual facilities for swivelling the work-head and table.

A feature of design is that the grinding wheel can be mounted at either end of the wheelhead spindle; the pulley, guards, etc., being reversible. In all models, the wheel-head and wheelhead under-slide turn tables are of large diameter to provide maximum rigidity with a swivelling movement of 90° right and left of zero position. Table speeds are hydraulically controlled, and infinitely



KEIGHLEY KU GRINDER Set up for internal Grinding.

variable from 3" to 180" per minute with shockless reversal at all speeds. The 12 speed workhead is mounted on a large swivel base and is movable 90° right and 45° left, and change-over from live to dead centre work is easily accomplished.

Among the comprehensive range of equipment available with the machine, which is built in sizes from 18" x 24" to 24" x 96", is a choice of internal grinding spindles with speeds of 10,000 to 30,000 r. p. m.

* * *

THE NEWALL MODEL LA CYLINDRICAL GRINDER

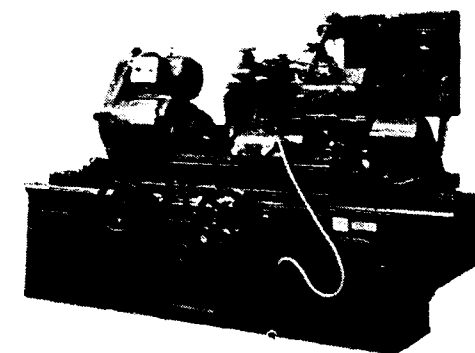
Manufactured by The Newall Engineering Co. Ltd. of Peterborough, England, this



Keighley KU (Heavy Duty) Grinder set up for grinding a steep taper at the tailstock end.

machine has been developed specifically as a heavy duty production grinder. In accordance with modern practice, it is, therefore, of extremely sturdy proportions, capable of exceptionally fast and accurate grinding production, and will maintain both speed and accuracy after prolonged service with the minimum of attention.

The workhead carries a No. 5 morse taper centre and is driven by a 2 h. p. motor, through a 6 speed gear box, giving a speed range of 18 to 265 r. p. m. Automatic lubrication is provided and the workhead is operated by a switch working in conjunction with the lever for rapid advance and withdrawal of the wheelhead. A supplementary switch for 'inching' is also fitted.



The NEWALL 10 x 36 LA Heavy Duty Production Grinder with Wheelhead mounted hydraulic dresser.

The fixed wheelhead is of massive proportions to ensure vibrationless operation, and is fitted with a superfinished nitraloy spindle. Alternative wheelheads with oscillating spindle or spark splitter type are available as extra equipment.

The wheel-head slides on long, accurately spaced vee and flat surfaces, automatically lubricated, and is provided with a hydraulically operated rapid approach and withdrawal movement of 3" with a .080" regulated in-feed. This in-feed can be increased to 2"

by an extended plunge feed cylinder, wheels up to 10" wide can be accommodated, and these are particularly desirable when using the wheel formed by a hydraulic diamond dresser for grinding by the plunge cut method, components having several different diameters.

As will be seen from the illustration, all controls are centrally located to obviate operator fatigue, and provide many time saving features. They include control for varying table dwell at each end of the stroke, hydraulic intermittent or continuous in-feed to the wheel-head, feed accelerator for use where stop removal varies considerably, wheel wear compensation knob, and regulator for the interlocking of control levers. The table can be swivelled for taper grinding and table

traverse hydraulically operated at an infinitely variable speed of 3" to 160" a minute. A table dwell valve, which, if engaged, operates at every reversal, is incorporated in the hydraulic system, and the amount of dwell at the end of the traverse of the table is adjustable.

The LA Grinder is also adaptable for automatic grinding of batch components and special machines for this purpose incorporate a time sizing device and hopper feed mechanism.

Supplied to grind either 10" or 16" diameters, the Newall LA Cylindrical grinding machine is available with capacity between centres from 24" to 84" in increments of 12".

Schlieren Coaches

for Indian Railways

SWISS CAR AND ELEVATOR MANUFACTURING CORP. LTD. SCHLIEREN-ZURICH SWITZERLAND

British Railways use Low Voltage Portable Electric Tools

ELECTRICAL appliances of all kinds, including portable electric tools which generally operate within the standard voltage ranges of 200/250 volts, are perfectly safe in the operators' hands under all conditions—providing that they are correctly earthed.

Within recent years various industrial and engineering concerns engaged upon construction or maintenance work of a "high risk" category have initiated a scheme providing a greater measure of safety to operators or users of electric power tools. Basically, it



Over 400 $\frac{1}{2}$ in. fixing holes are drilled with Wolf type NW3 Drills in Kynal M139 alloy floor of each diesel railcar.

maintenance of steam locomotives, carriages, wagons, diesel cars, signal equipment, etc.

Wolf Tools play an important role also in the Crewe Locomotive Works where the majority of heavy steam locos are constructed for freight and passenger haulage.

It is fitting that this vast industrial undertaking with such a proud reputation for the precautions which they take to ensure maximum passenger safety should apply the same principles of consideration to the safety of their own operators using electric tools.



Drilling 12-17/64 in. holes through 10 gauge steel into teak door frame (Type NW2c)

involves the use of tools specially wound for low voltage use and electrically supplied from a stepdown transformer which has a centre tapped secondary winding connected to earth. Should, by mischance, an accident or a fault occur only half of the transformer output voltage could possibly short to earth which would not be injurious to the operator.

This is the method favoured by British Railways who, for instance, have standardised on 50v machines throughout their vast workshops at the headquarters of the Midland Region at Derby where they are in regular use in the construction, repair,



Heavy duty $\frac{1}{2}$ in. drill, type NW2c drilling holes in a loco chimney pattern.



Wolf VSM Sander connected to 50 volt portable transformer cleaning faces of tender wheel axles for ultra-sonic flaw detection testing.

In shops where Wolf electric tools are used on fixed sites, the transformers which step the standard voltage down to the required 50 volts* are fixed permanently to walls or piers. Some shops, however, require a mobile source of current, so special portable transformers have been designed and built in the Railway's own electrical maintenance departments.

The operator is drilling holes during the construction of a heavy duty hand truck. Thanks to the courtesy of British Railways, Midland Region, we are able to demonstrate some of the many operations performed by Wolf portable electric tools. These are in use throughout their extensive construction, repair and maintenance works at Derby and Crewe. We understand that Wolf electric tools are highly appreciated for their power, performance and dependability in every department—carriage and wagon, diesel railcar, pattern making, tinsmiths, coppersmiths, machine, toolroom, signal equipment, electrical, tender, rod cleaning shops, etc. The machines are inspected at regular intervals by the British Railways maintenance department.

* Wolf are the only portable electric tool manufacturers able to supply their complete range of machines in 50 volts or convert existing standard machines at reasonable cost.

SELECTING A TRANSFORMER

As British Railways have standardised on 50 volt machines a few notes on the selection of transformers may not be out of place.

Transformers can be mounted as permanent fixtures in workshops or used as portable units if required for outside work. The latter are obtainable in weatherproof casings with sockets in place of the normal terminals.

The capacity of a transformer is usually expressed in kilo-volt-amperes, or simply KVA; and the size required can be found



Over 600 $\frac{3}{8}$ in. holes are drilled with Wolf NW3c electric drills in light alloy underframe and body of each diesel railcar.

by adding together the full load KVA ratings of all the portable tools which it is desired to operate at one time. Average KVA ratings of Wolf tools are given below.

Thus, three EG2c drills or three NW3c drills or one GQ4 grinder can be operated from a 1KVA transformer; with a little margin in hand. Transformer sizes usually rise in multiples of 0.5 KVA.

Full details of the transformer required for a particular installation can be obtained from

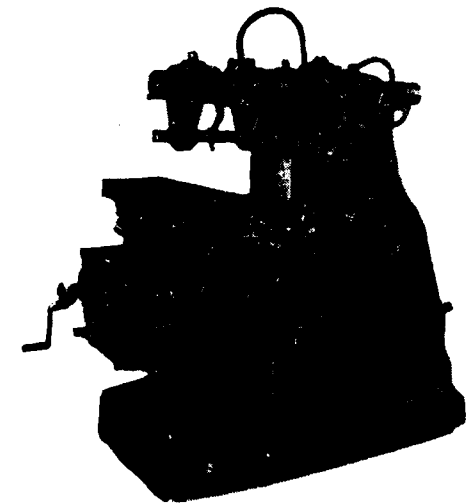
"Adcock and Shipley's" New Heavy Duty No. 4 Horizontal Miller

THE number of Post War designed Milling Machines suitable for Tungsten Carbide milling that are available to Machine Tool users in Europe is still very limited. One of the first to be introduced was the 'Adcock and Shipley' 4AG machine which was first shown at Olympia in 1948.

At that time the machine was the most powerful and heaviest Horizontal Milling Machine of the knee and column type made in this country and it is indicative of the developments that have taken place and the knowledge that has been gained since that date in cutting techniques that the manufacturers have this year decided to introduce at Olympia an even heavier edition of this machine, to be known as the Model '4HG'.

This new machine is designed on the same basic principle as the old 4AG but it incorporates many new features.

The original column was scientifically designed to withstand the most severe stresses



without deflection, was solidly ribbed and had a minimum section of 1" in thickness. The new column has very much larger vees and in actual fact the depth of the 4HG vees is 70% greater than those of the 4AG.

The Spindle, bored No. 50 British Standard Non-Stick Taper is equipped with 5 spindle bearings, two being precision angular

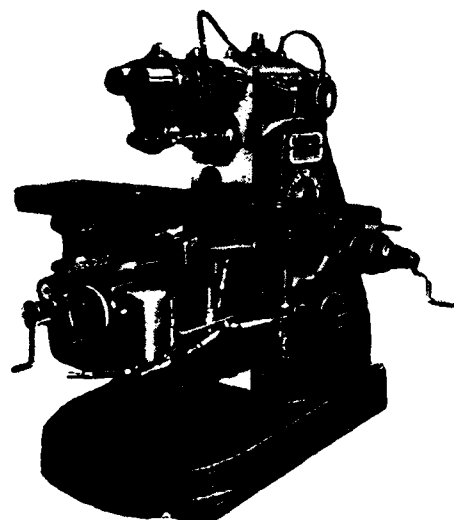
(Continued from page 34)

any transformer manufacturer. It will be necessary to specify the input voltage, the frequency of supply, the output KVA, and whether the secondary is to have an earthed centre tapping or not.

KVA RATING "WOLF" TOOLS

Type	KVA rating average	Type	KVA rating average
Eg2c, HD 1	.. 0.275	NWB	.. 0.450
NW2c, NW23c, NW3c, NW34c,	.. 0.300	GQ4, HS7, BS3	.. 0.850
NWS1, NWT1	.. 0.300	WD4c, WD4, WD5c, WD5,	.. 0.700
SD4c, ASG3	.. 0.500	WD6c, WD6	.. 1.100
VSM	.. 0.500	NW8, NW10, GK6	.. 0.650
FF2	.. 0.400	VR 5	.. 0.500
		GL3	.. 1.300
		GQ6	.. 1.400
		RS10A	.. 1.600
		RS10B	.. 1.130
		RS7	.. 0.630
		SR54	.. 0.630

(Continued on page 35)



Model No. 4AGU Universal Miller.

pumps, whilst oil sight glasses are provided to indicate oil levels in all sumps.

Duplication of controls at the front and rear of the machine is extended to include the cross-slide and knee locks, a feature which is not normally provided on such machines.

The Ammeter is more conveniently positioned than on the early 4AG machines, being mounted on the left hand side of the machine in the door enclosing the electrical contactors and switchgear.

Speed Changing is by levers on the right hand side of the column the speed selected being very clearly indicated on a large diameter dial.

Feed Changes are made from the knee. Three ranges are changed by a knurled knob which, used in conjunction with a handwheel, give an infinitely variable range of feeds from $\frac{1}{2}$ " to 64" per minute for longitudinal and cross movements and $\frac{1}{4}$ " to 16" per minute for the vertical feed.

Rapid Traverse which can be engaged from the front or the rear of the knee is

available at 150" per minute on the longitudinal and cross movements and at 37 $\frac{1}{2}$ " per minute to the vertical movement.

A Built-in Speed and Feed calculator assists the operator in selecting the most desirable Speeds and Feeds but in actual practise it is more usual to base the feed on the maximum that the job or cutter can stand, since it is almost impossible to overload this machine.

The twin 5" diameter Steel Overarms are independently adjustable by a hand wheel on the right hand side of the machine and carry aluminium alloy overarm brackets, two being provided with the standard equipment.

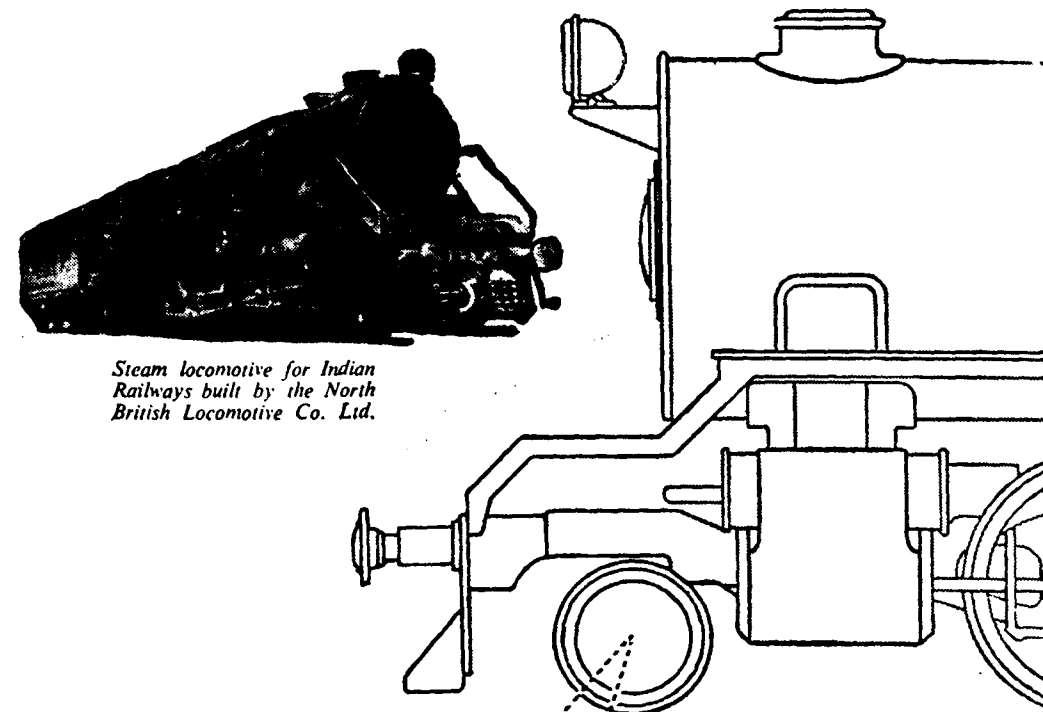
Large diameter micrometer dials of the 'Easy-set' type are fitted to the Model 4HG machine, these dials being 4" in diameter and very easily read. To set them it is merely necessary to pull them out and turn them to the desired reading. Releasing them, automatically locks them in the desired position by a positive friction device.

The 25 h.p. main drive motor is housed inside the main column and the column of the new machine has been increased in size to take totally enclosed motors to British on N. E. N. A. Standards. The electrical equipment is as simple as possible since the only motor used in addition to the main drive motor is for the coolant pump. The switchgear therefore consists only of one Automatic Star-Delta Starter and one Direct-on Contractor enclosed in one case.

Standard equipment includes, electrics, two overarm support brackets, arm brace, draw bar, coolant pump and fittings, positive backlash eliminator with hardened table screw, automatic lubrication, maintenance manual and all necessary handles and spanners.

1 000 000 SKF AXLEBOXES

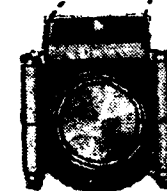
With **SKF** axleboxes nothing is left to chance—and it is not by chance that **SKF** is the first to have supplied 1,000,000 roller bearing axleboxes to the railways of the world. Designers and railway engineers have long known that there is always an **SKF** axlebox that is exactly right for their particular requirement. Standard axleboxes, special axleboxes, single and double bearing axleboxes for mounting inside or outside the wheels—all are included in **SKF**'s first million. All these types—and more special types too if the need arises—will make their contribution towards **SKF**'s second million.



Steam locomotive for Indian Railways built by the North British Locomotive Co. Ltd.

SKF MEANS THE RIGHT BEARING IN THE RIGHT PLACE

**THE SKF
BALL BEARING
CO., LTD.**



**BOMBAY, P. O. BOX 71,
CALCUTTA, P. O. BOX 588,
MADRAS, P. O. BOX 66.**

A WIDE RANGE OF SCOTTISH MACHINE TOOLS

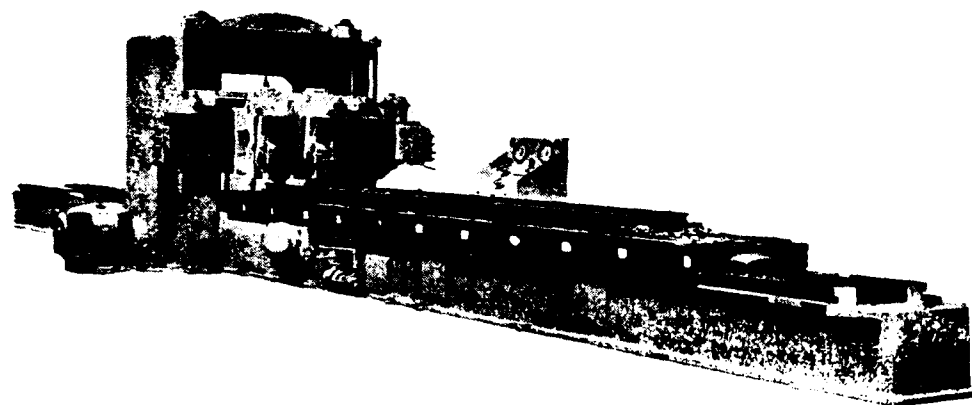
THE Scottish Machine Tool Corp. Ltd., Glasgow, is a combination of four well known Scottish machine tool makers, all of which have been established for many years. It includes Craig and Donald Ltd., James Bennie and Sons Ltd., G. & A. Harvey Ltd., and Loudon Bros. Ltd., and the machines produced by the Corporation still bear these names as they are so well-known throughout the world. Craig and Donald Ltd., in fact, are amongst the oldest established firms who have been consistently making machine tools, as the firm was founded in 1815.

All the firms in the corporation have specialised in machines which are commonly used in Railway workshops. Their range is extremely wide and their machines are to be found not only in the machine shops where components are being turned and bored, but in the Plate shops, Forging Shops and Press Shops as well.

The early Wheel Lathes produced by Loudon Bros. all ran at exceedingly slow speeds and were driven by belts from overhead shafting. The belts pulleys drove the remaining gear in each headstock and all the gears were open. The feed motion was obtained by a ratchet system and was transmitted by chains to the saddle and slide rests. The loose headstock was traversed by hand and few facilities seem to have been

provided for handling the wheel set in and out of the machine.

Fig. 1 shows one of the latest "Loudon" Wheel Lathes of the through type. This machine is intended for high production, combined with particularly easy handling of the wheel sets on a flow system, the wheel coming in at the back of the machine and rolling out the front after machining has been completed. This arrangement avoids congestion in the wheel shop and is a great advantage where modern machines are being used owing to the short time spent actually cutting the wheels. The lathe illustrated is provided with power traverse to each head so that they may be withdrawn and brought forward as each wheel set is introduced. A hydraulic jack, in the middle of the bed, lifts the wheel set from the rails which have been built into the machine and elevates it to the right height for matching the centres of the Lathe. The lathe itself is provided with a very wide range of speeds and feeds which enable the machine to be used with either carbide tools or high speed steel tools. All the controls for the auxiliary motions and the main driving motor are grouped in an electrical control panel which is mounted beside the operator as he stands watching the machine turning the wheels. The lathe, of course, is equally suitable for turning both the treads and flanges of the wheels, and by using



RALLIS INDIA LIMITED

Post Box No. 153
Grams: "RALLI"

"RALLI HOUSE"

320, Linghi Chetty St.,
MADRAS-1.

Phone: { 3981
5 (Lines)

SOLE DISTRIBUTORS FOR:

MASSEY - HARRIS' TRACTORS

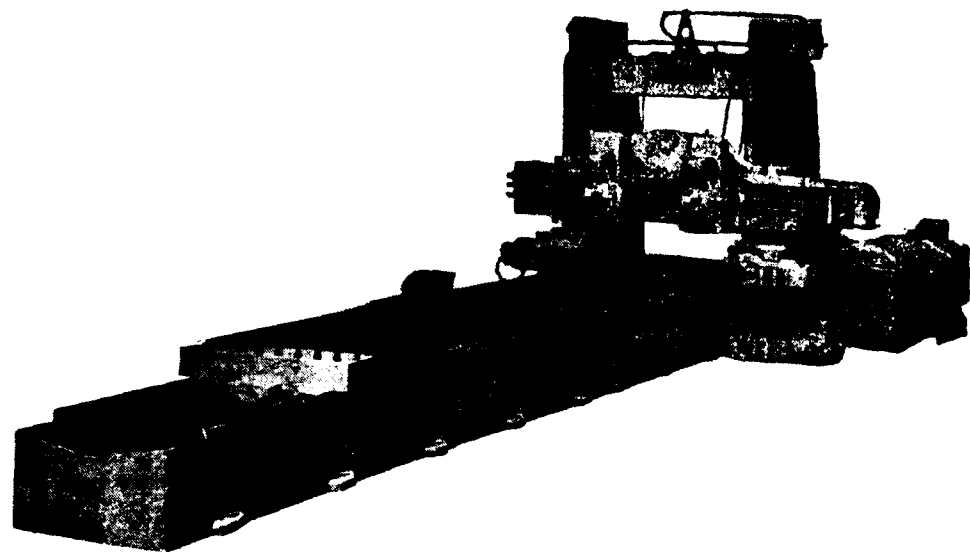
AND

THE WORLD'S FINEST FARM & AGRICULTURAL IMPLEMENTS

SCOTTISH MACHINE TOOLS CORPORATION LTD.,

GLASGOW, SCOTLAND,
Heavy Machine Tools

- **ROCKWELD LTD., ENGLAND**
Superior Arc Welding Electrodes: Suitable for use either AC. or DC. Mild Steel, Cast Iron, Hard Surfacing, Stainless Steel and also Rockweld Motor Driven Welding Generators & Welding Transformers and Bare Shaft Generators.
- **BRUSHWARE LTD., KANPUR**
High class Industrial, Panit, Domestic and general Brushes.
- **B. ELLIOTT & CO., LTD., LONDON.** 'UNIVERSAL' Milling Machines, Grinders, Shapers, Drilling Machines, Hacksaws, Polishers, Bandsaws etc., and Engineering Equipments such as Hand lever Punching and Shearing Machines, Rod cutting Machines etc., etc.
- **M. W. M. BENZ DIESEL ENGINES**
(German make), 5/6, 6/12 & 54/72 H. P.
- **IMANI DIESEL ENGINES** (Manufactured by: **KULKO ENGINEERING WORKS LTD., ICHALKARANJI**) Slow Speed, Horizontal Type 5, 7, 8, 9, & 13 H. P.
- **WOLF ELECTRIC TOOLS LTD., LONDON.** The world famous 'WOLF' range of Electric Tools. Drills, Grinders, Sanders, Polishers, Screw Drivers, Nut setters, Chisel Mortisers, Blowers, Hammers, Valve Shops, 'CUB' Lathe Kit, Saw Kit, Grinding & Polishing Kits, etc.
- **ROTARY HOES LTD., ENGLAND,** The Howard 'GEM' Rotavator. Wet Paddy Model capable of working in both Wet & Dry lands and for easier cultivation between rows.
- **SCANDINAVIAN ENGINEERING SYNDICATE, COPENHAGEN, DENMARK.** Road Rollers, Diesel Locomotives and oil Burning Equipments.
- **CINTRIDE LIMITED.**
THE CRUCIBLE STEEL CO., LTD., SHEFFIELD. Carbide Tipped Tools, Tool Bits etc.



tungsten carbide tools it is generally possible to effect considerable savings in tyre steel as it is not necessary to undercut the break hardened spots which are to be found on the wheel's surface. The use of such tools, however, has meant a great increase in the speeds of these machines and in their weight, as can be seen from the illustration.

The early Planing Machines, which were supplied to Railway Companies a century ago, were all of the belt driven kind with ratchet feed motions, but these were slow and inefficient machines, especially by comparison with modern Planers today. The latest design of Planing Machine, whether for rails or for general purpose work incorporates a Ward Leonard drive to given

infinite speed variation over a wide range of speeds and electronic feed control with solenoid operated tool lifts on each tool box. Loudon Bros. were the first company in Britain to introduce the spiral drive combined with rack and worm, an arrangement which produces a particularly efficient drive as all the rotating members are kept to a very small diameter so that the kinetic energy losses at reversal are reduced to a minimum. In addition to this, Loudon Planers, which are so well known for the heavy roughing cuts they can take, all incorporate a two speed gearbox in the main drive so that the flexibility of the Ward Leonard set can be extended to the lower speed range where the heaviest cutting is possible, consistent with long tool life.

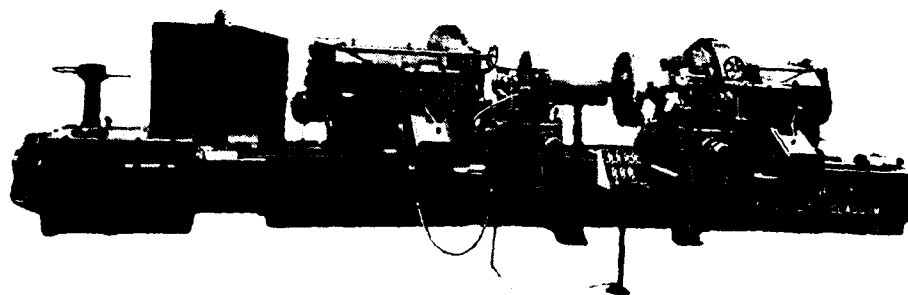


Fig. 1.



Fig. 2.

In the production of leaf springs of the laminated type it is necessary to cut bars to lengths and nib and punch various holes and slots in them. This was often done hot in early Railway Shop practice, but modern machines of the kind in Fig. 2 are capable of doing all these operations cold. This represents a great saving in production costs as the furnace is eliminated completely and allows the operator to achieve higher rates of production owing to the greater facility with which we can handle cold bars. The machine is of all steel construction and various gauges at the back and front facilitate rapid setting up.

Fig. 3 shows an up to date Plate Bending Rolls such as is often used in the making of oil tanks for railway wagons. In addition to the main driving motor this machine features power clamping for the end of the roller

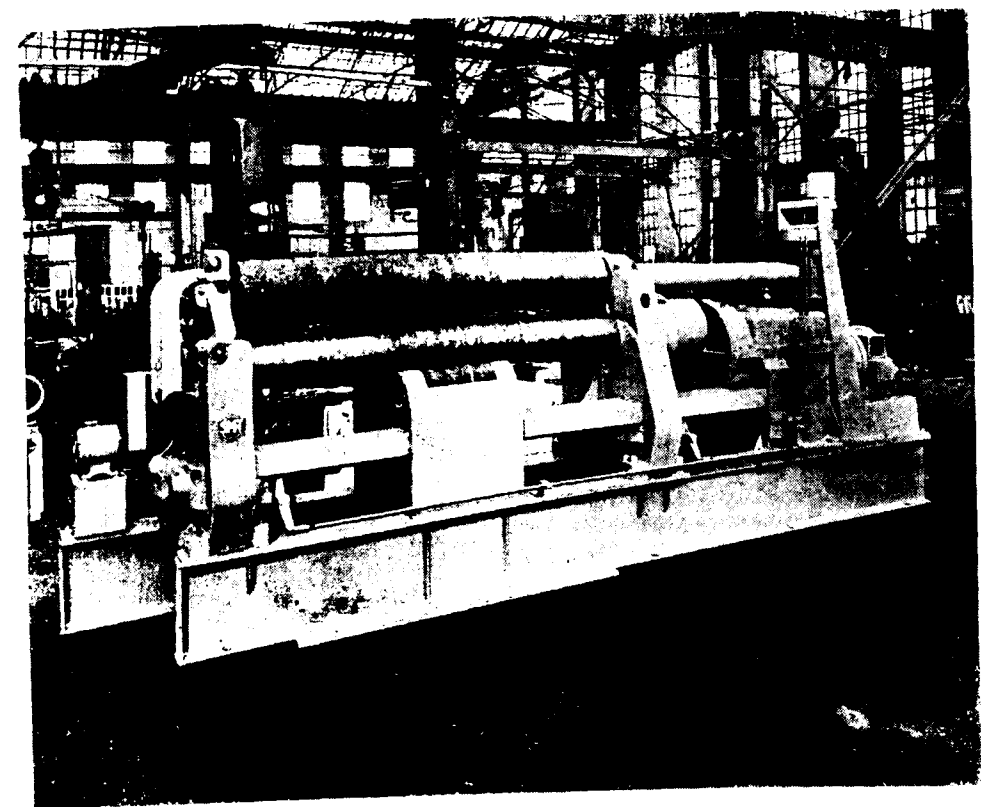


Fig. 3.

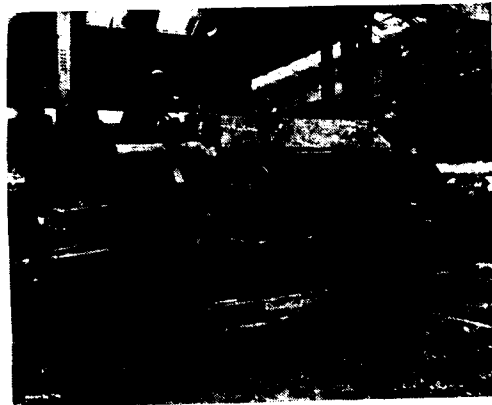


Fig. 4.

when the bearing at the other end is turned down for the removal of the tube and also another motor to turn down the bearing when required. All the remaining controls for the rolls are grouped outside the gearbox which includes a double clutch arrangement for reversing both the main drive to the rolls and the power adjustment to the setting of the top roller. This clutch arrangement makes much greater flexibility in the control of the machine as it allows the operator to inch the machine delicately until it has rolled as a close to the edge of the plate as possible and to achieve very quick reversals without momentary delays while the motor picks up speed and without the attendant current surge. These machines which are built by the Bennie Works of the Corporation have been supplied to many Railway Companies through the world.

Allied with the problem of producing circles in plates is the problem of producing various bends in these plates for making boxes or similar shapes. One machine which has become very popular in Railway Workshops during the last 20 years, for work of this kind is a power operated Folding Machine similar to the kind shown in Fig. 4. This machine, in some ways, resembles the hand operated Folder which is so well known for work on light gauge material, but it has a number of special features which make it a much more versatile machine. The top beam clamps

the plate under power prior to folding and the operation of the front folding beam is controlled by a lever outside the gearbox which contains two friction clutches. This type of drive makes for very delicate control of the folding beam which is a most important feature if accurate bends are constantly to be produced, as it is necessary for the operator always to bend the plate to a greater angle than is necessary to allow for a certain amount of spring back after the pressure has been released. It is assessing the amount of the spring back which calls for care on the part of the operator and his performance is much improved by a sensitive control. The machine also incorporates a special cam knock-off arrangement which insures that the beam consistently rises to the same angle when producing repeat folds. The top clamping beam can be adjusted vertically so that it rises to a height at least equal to its own depth. This is necessary for the production of small boxes or other more complicated shapes which the machine easily manufactures, but where large boxes are being



Fig. 5.

produced these are usually formed around the clamping beam itself. The beam is so arranged that it can be detached at one end and swung out, pivoting about the other end so that the box can be drawn off. This is one of the most versatile machines a fabricating shop can have and it is particularly suitable for short run work as there are no complicated tooling problems involved. The same set of tools combined with a suitable range of packing pieces allow this machine to make almost every shape that is required for fabricating work.

Where a great many parts have to be bent in exactly the same way it is very common practice to use Presses for this work, and many Railway Shops are installing very large machines such as the kind shown in Fig. 5 for the pressing of entire side frames for wagons. Machines of this size usually have a fixed stroke, but have a long slide adjustment available which allows them to suit a wide range of tools which require different shut heights. In the machine illustrated

the drive is through two large gear wheels which have eccentrics cast onto the side of them. The wheel and eccentric units rotate about individual studs so that the various forces set up during the pressing operation are distributed partly on the stud and partly over the eccentric thereby making the arrangement more rigid and better suited to withstanding wear. The press is controlled by an electrically operated air friction clutch which allows rapid engagement to be achieved when the pushbuttons, beside the operating station, are pressed. The clutch is combined with a brake so that whenever the air pressure is withdrawn from the clutch the brake is automatically applied. An interesting feature of the press shown is that the gibs which guide the slide are recessed into the housing so that the slide face is the same size as the bolster. This is particularly advantageous when the machine is working with die-cushions, but is also an advantage when several tools are being ganged up along the length of the bolster for quick production of small parts.

WORLD STEEL OUTPUT WILL BE DOUBLED

Mr. Alfred Krupp, proprietor of the well-known German steel firm of Krupps, in an informal talk with the Pressmen in New Delhi said he estimated that in the next 30 to 40 years, steel production in the world would have to be doubled to meet demands. India would require large quantities of steel for her second Five Year Plan.

Referring to the steel plant at Rourkela in Orissa for which Krupps along with another West German firm, Messrs. Demag, are technical consultations, Mr. Krupp said that by October 1, 1958, the first blast furnace of the plant would be ready.

The Rourkela plant, he said, would be one of the most modern steel plants in the world.

Asked whether the German firm would provide credit for the steel project, Mr. Krupp said that his firm was not in a position to do it and it was for the West German Government to consider the matter.

Apart from the State-sponsored steel project, he said, his firm was building there cement factories for private in India.

Mr. Krupp disclosed that his firm had also offered to provide machinery for the lignite project in South India. The firm had also supplied locomotive boilers and other locomotive parts to the Indian Railways, he said.

MAY 1956

EDWARDS CONTRIBUTION TO RAILWAY WORKSHOPS

THE working of metal sheet and section must always form a major part of railway maintenance and repair work; and our engineers are constantly seeking ways to economise on job costs while actually increasing the production output of the metal working shops. Mechanisation is not always the answer. For instance, the craft of panel-beating will never entirely be superseded by the power press. But, in general, machinery offers the greatest possible help, and represents the most modernising and progressive influence in railway workshop practice. New machines and new technique are continually streamlining the work, and improving the efficiency of the whole railway system.

Many types of metal working machines can be seen at work in the carriage workshops, bridge engineering departments and general maintenance and repair sheds of Indian Railways. Broadly, they can be divided into two main classes: Machines which handle sheet metal and plate (of all thicknesses from 20 s. w. g. to $\frac{1}{2}$ "), and those which handle round, flat, square or polygonally-shaped bars, angle, tee, channel and joist sections, and tubes. A third class of machines, which perform a multitude of operations on solid metal and referred to generally as machine tools, include lathes, grinders, millers, shapers, borers, drillers and many other types. They are designed to produce components from the solid within very fine dimensional limits.

Sheet metal working machines are perhaps the simplest, yet the most interesting to watch in operation. To see a sheet of $\frac{1}{2}$ " plate passed through a motorised Plate Bending Roller and curved smoothly into a cylinder while the operator controls the operation by push-button, emphasises

(Continued on page 48)

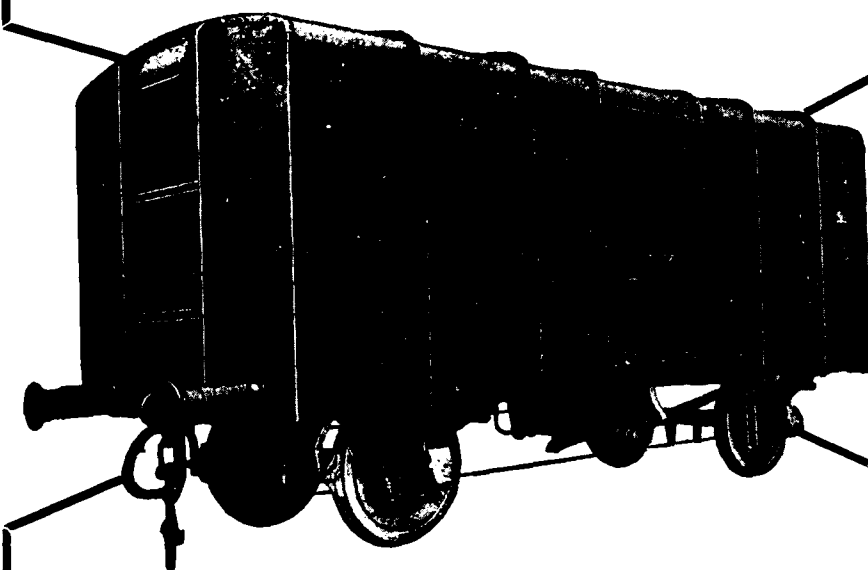
beyond technical description the exact science upon which the design of these machines is based. Folding machines and angle benders (small cousins of the press brake) offer another opportunity to watch metal sheets being formed effortlessly to a desired shape in a fraction of the time taken by an expert craftsman to do the same job by hand, using mallet, anvil block and stakes. The cutting of sheet metal, too, is reduced to a very simple process by the many types of guillotines and shearing machines, which can be set to cut hundreds of sheets to the same size at the rate of up to 30 a minute. Motorised nibbling machines cut the most intricate shapes out of sheet metal, and in the hands of skilled operators are as versatile and easily managed as the school-boy's fretsaw. Hand and motorised swaging and jennying machines put beads, flanges and mouldings into flat sheets and discs, or wire the edges for additional strength.

Only the smallest types of presses are usually to be found in the workshop — arbor and mandrel presses, fly presses and the like. The big forming, punching and blanking types of press are normally used only by the manufacture of components or panels, who produces thousands of units daily. Press tools are expensive; the average workshop will either have replacements supplied by the original manufacturer, or make them singly by hand beating. For this purpose, and for the repair of buckled or dented panels, a wheeling and raising machine may also be used, to 'smooth' the metal sheet into the desired shape by a rolling action under pressure between the two wheels.

In the construction of frames, storage racks, brackets, stairways and in many kinds of repair work, angle iron and other sections

HURST, NELSON

DESIGNERS & BUILDERS OF RAILWAY ROLLING STOCK



Steel 4-Wheel Covered Goods Wagon for
India. I.R.S. type "C.R." Gauge 5' 6".

HURST, NELSON & CO., LTD.,
MOTHERWELL : : SCOTLAND.

INDIAN
AGENTS

MESSRS. BIRD & CO., (PRIVATE) LTD.
CALCUTTA • DELHI • KANPUR

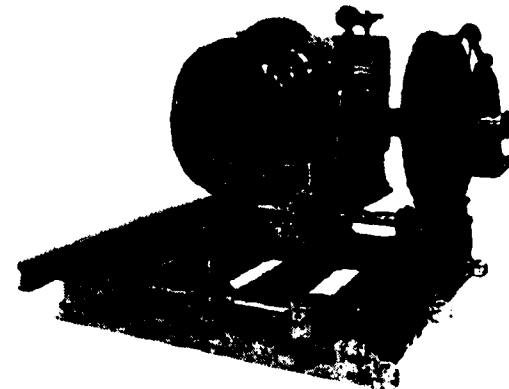
EUSTACCHIO MACHINES FOR RAILWAY WORKSHOPS

THE Stabilimenti S. Eustacchio of Brescia, Italy, which belong to the Finmeccanica group, have been for many years now well known all over the world for their appraised production of heavy machine tools and rolling mill rolls.

The machine tools manufactured by S. Eustacchio interest large mechanical works, shipyards, siderurgical industries and railway shops. Actually they are machines of heavy size and great power, as parallel lathes (min. height of centers 450 mms. = 17.55"), vertical turning and boring mills (min. faceplate diameter 2000 mms. = 78"), facing lathes (min. faceplate diameter 1600 mms. = 62.4"), special lathes for heavy crank shafts, planers (min. planable width 2000 mms. = 78"), rolling mill roll lathes and grinding machines, plate straightening machines, steel and soft metal rolling mills; mechanical and hydraulic presses, etc.

We are going now to describe, among the machines manufactured by S. Eustacchio, those which particularly interest railway shops.

Locomotive, tender and wagon wheel lathe : this is a machine suitable for turning new and worn tyres without taking the



Tyre fixing Rolls.

wheels off from their axles. The machine built by S. Eustacchio is particularly sturdy and powerful and it is equipped with 4 carriages (two roughing and two finishing ones) and with all those attachments which make it a modern and highly efficient machine; therefore it is suitable for railway shops in which tyres are returned without interruption.

S. Eustacchio manufacture three types of this lathe, they are of similar design, but of different size and power, according to the wheel max. diameter to be turned : 2100 mms.—1600 mms.—1125 mms. (81.9"—62.4"—43.87")

(Continued from page 46)

in various metals have to be cut and formed in several ways. They may have to be bent or curved, cut to length, punched or notched. A wide range of machines are used for these operations, from small hand-operated combination machines to handle fairly light gauge sections, to big truck-mounted motorised models suitable for the working of structural metal-work on the site. Angle-iron and section bending rollers, punching-shearing-and notching machines, bar croppers and benders, section cropping and notching

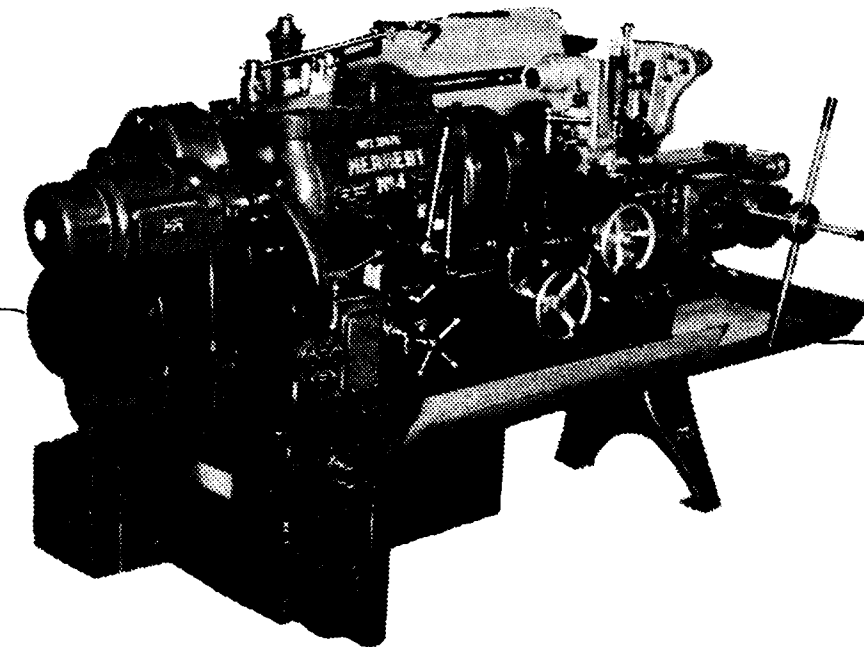
machines .. they are available in a profusion of variations.

Among the many manufacturers of sheet metal and section working machinery whose products are extensively used in our workshops throughout the Indian Railways, is F. J. Edwards Limited of London, England—makers of 'Besco' machines, which are distributed throughout India by Messrs. William Jacks & Co., Ltd., with branches in Bombay and Madras.

THIS

Herbert

No. 4 CAPSTAN LATHE IS ONLY TYPICAL OF THE MANY MACHINE TOOLS, ALFRED HERBERT HAVE SUPPLIED TO THE INTEGRAL COACH FACTORY.



ALFRED HERBERT (INDIA) LTD.

Office: 16, Strand Road, Calcutta 1

Showroom: Hide Road, Kidderpore, Calcutta

Agents for South India

PARRY & COMPANY, LTD.

Dare House, Madras 1

Showroom: 36-B Mount Road, Madras 2

Branches at Bangalore, Secunderabad and throughout South India.

**PARRY & CO.
LIMITED**

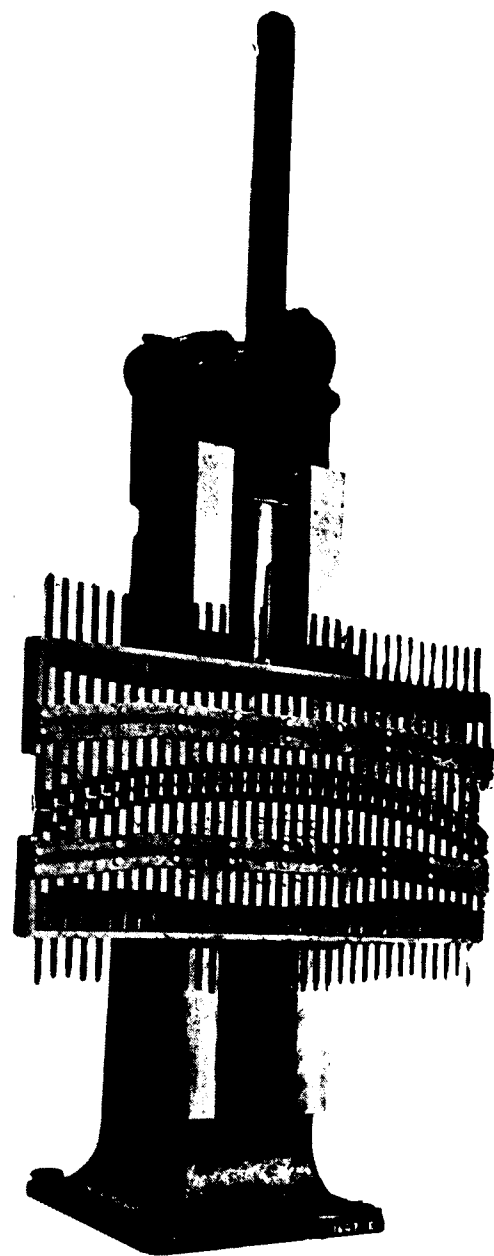
Universal wheel lathe for turning tyres and for turning and grinding journals: this machine is designed as to allow several operations, i. e.: Tyre turning, wheel center turning, spring ring cutting, tyre reaming, hub boring, other workpiece facing and boring, journal returning and grinding. This is a machine particularly suitable for medium shops which do not have a large production and can therefore use only one machine for a whole range of operations. The lathe is equipped with 3 carriages: One finishing carriage, one profiling carriage and one journal turning carriage; the machine is complete with a grinding device which, on request, can be substituted with a burnishing one.

Wagon outside axle journal turning and burnishing lathe: this is a small machine (it weights 6 tons.) which can be used only for working journals. It is equipped with a unit embodying the turning carriage and the burnishing device, of course the burnishing device can be substituted with the grinding one.

It is a machine of medium production, built according to the most up to date technique.

Locomotive axle journal lathe: the lathe S. Eustacchio build for this purpose, is a machine of high production and power. It is equipped with 4 carriages, 2 front ones for turning and 2 rear ones for burnishing. The lathe can take wheels up to a diameter of 2100 mms. (81.9") and is particularly suitable for big railway shops.

Tyre fixing rolls: this is a special press which serves to fix the tyres on the wheels. The machine produces by S. Eustacchio for this purpose is of the universal type as it allows to fix tyres of diameters ranging from 500 to 2500 mms. (19.5" to 97.5"). The pressing power is

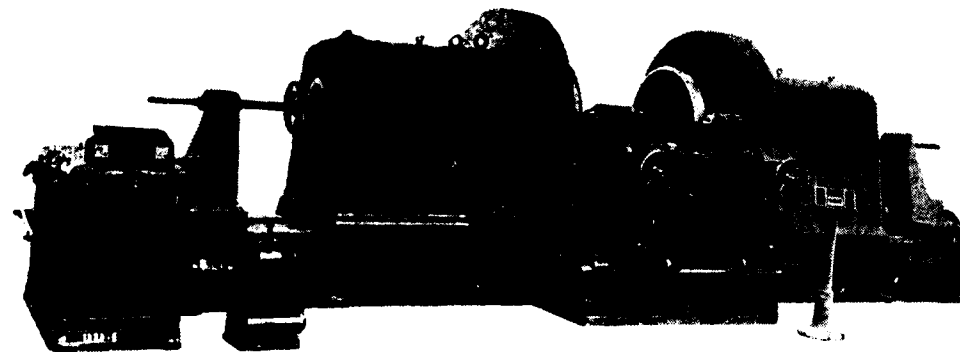


Leaf Spring Bending Machine.

of 30 tons, and it is driven by a 15 HP. motor, weighting 8 tons.

Press for mounting on and taking off wheels on axles: the S. Eustacchio build this machine in all ranges of sizes and power (from 100 to 500 tons) so as to meet any

THE INDIAN RAILWAYS WORKSHOP MAGAZINE



Locomotive Wheel Lathe.

requirements (from tender wheels to wagon, locomotive, electric rail car wheels).

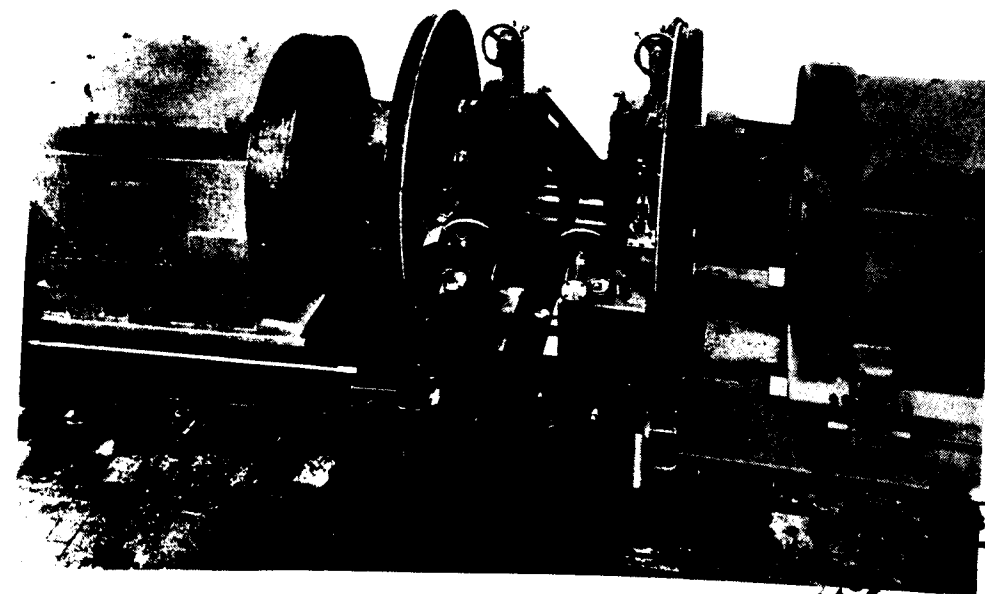
It is a hydraulic horizontal press, sturdily dimensioned so as to ensure a safe and rapid operation.

Leaf spring bending machine: this machine simultaneously bends and hardens (in water or oil) leaf springs. The type manufactured S. Eustacchio is particularly designed for max production and it produces curves of any shape and radius with great accuracy and evenness.

The machine is build in several sizes (the biggest one allows to bend leaves from $2000 \times 120 \times 15$ mms = $78" \times 4, 68" \times 0, 585"$)

Leaf spring eye bending machine: it is a machine which forms the eye of the main leaf spring, by bending the leaf spring ends.

The eyes are bended and gauged rapidly and automatically by three operations. As the machine is capable of 60 strokes per minute, its production is rather high.



Locomotive Journal Lathe.

MAY 1956



The type produced by S. Eustacchio allows to bend leaves with max. sizes of 150×16 mms. (5.8"×0.624") and makes eyes with outside diameters from 40 to 95 mms. (1.56" to 3.7")

Spring buckling presses : they are hydraulic presses provided with a vertical ram and a horizontal one for hot shrinking of the buckle on the spring leaf bundle; they are build of various power and sizes.

Besides the Stabilimenti S. Eustacchio manufacture volute and leaf springs; the railway wagons recently supplied by the Cantieri cell' Adriatico di Trieste and the Officine Meccaniche di Pistoia to the Indian Railways are provided with leaf springs manufactured by S. Eustacchio, the heavy locomotives which the Ansaldo of Genoa are going

to deliver to the Indian railways are also equipped with springs manufactured by S. Eustacchio, the same thing can be said for the railway cranes with which the Navalmeccanica of Naples are supplying the Indian railways.

S. Eustacchio also produce rolled flat spring steels, which, besides being used for internal spring production, are sold to the Italian State Railways and to the main Italian car manufacturing industries.

In the past a lot of steel was sold to the Egyptian and Turkish Railways. We have rapidly outlined the Stabilimenti di S. Eustacchio's production which interests the Railway Shops; as you can realise, we cover a large range of production, therefore our description had to be concise; the S. Eustacchio will be glad to furnish directly all information and clarifications which could be requested.

MASSEYS. RAYAPURAM. MADRAS.

We manufacture :

SUGAR MACHINERY :	3 and 4 Rolls Cane Crushers, Filter Presses & Juice pumps.
OIL MACHINERY :	Standard & Soholar Type Oil Expellers, Filter Presses, Pumps, Tanks etc.
MACHINE TOOLS :	Radial Drilling, Planing & Milling Machines, Lathes and Hacksaws.
CONTRACTORS' PLANTS :	Disintegrators of all sizes from No. 0 to No. 4½
ESTATES MACHINERY :	Coffee Pulpers: Single, Double and Triple Discs and Water pumps.
STEEL STRUCTURALS :	Storage Tanks, Chimneys, Trusses, Gates etc. etc. etc.

AN IMPORTANT ANNOUNCEMENT

We have pleasure to inform all our readers and advertisers that we are issuing a special supplement entitled "LOCOMOTIVE, CARRIAGE AND WAGON" along with our November ANNUAL NUMBER.

This Supplement will contain highly technical articles on various stages of construction of Steam, Diesel, Diesel-Electric Locomotives, Carriages and Wagons by eminent engineers of the Indian Railways.

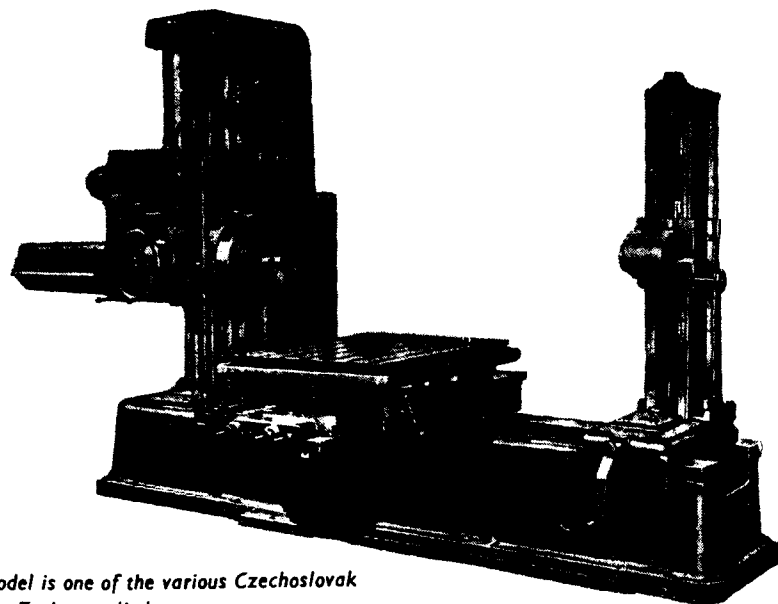
We take this opportunity of requesting all Rolling-stock Manufacturers in India and abroad, who have a large part to play for the success of the Second Five-Year Plan, to extend their full cooperation for the success of this Supplement too which is the first of its kind ever to be published in India.

Editor.

HORIZONTAL BORING MACHINE MODEL H 80

Characteristics :

Preselection and electro-mechanical ranging of speeds and feeds
Automatic working feed;
Automatic travel in all directions;
Enduring accuracy and precision;
Automatic lubrication
High productive ability
Easy operation



This model is one of the various Czechoslovak Machine Tools supplied

by

STROJEXPORT

PRAHA - CZECHOSLOVAKIA

Represented through :

**TRADE REPRESENTATION OF THE
CZECHOSLOVAK REPUBLIC,**

Head Office :—Jamshedji Tata Road,
Kasturi Building,
BOMBAY-1.

Branch Offices :—CALCUTTA
MADRAS
NEW DELHI

Sole Agents :

BATLIBOI & CO. PRIVATE LTD.

MACHINERY MERCHANTS

P. O. Box No. 190 A,
Forbes Street, Fort,
BOMBAY-1.

Branch Offices :—MADRAS, CALCUTTA,
COIMBATORE, DELHI,
AHMEDABAD, KANPUR,
VIJAYAWADA

Swivelling Erection Drilling Machine (Type VRM-50)

By Ing. J. Polak

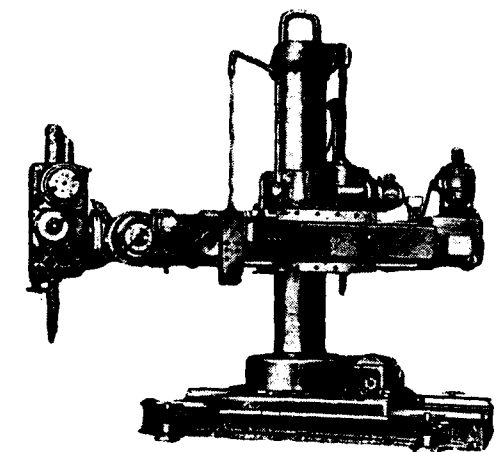
A prominent place among the more than 400 different types of machine tools of Czechoslovak make bearing the SKODA, TOS and MAS trade marks, which are well known for their quality and precision of machining not only in India but in almost all countries of the World, is occupied by the latest novelty of design, the type VRM-50 swivelling erection drilling machine bearing the MAS trade mark. This machine, which is marked by many new features of design and improvements in comparison with similar machines of competitive makes, was the centre of interest of visitors to the Leipzig and Utrecht Fairs. The large number of enquiries received from prospective foreign customers proves that this machine, due to its universal applicability and high capacity—both these qualities being combined with the tradition of many years of Czechoslovak machine tools of MAS make—provides a guarantee that it will be a useful supplement of any engineering establishment in India.

The machine is intended for drilling holes and cutting threads under various angles on parts or structures of large size which cannot be moved to the drilling machine. The machine can be moved by a crane and is used for the erection of heavy machines/horizontal boring and milling machines, planing machines, turbines, locomotives, wagons, in heavy engineering workshops, boiler, locomotive and bridge factories, etc.

The bed, which is fitted with supporting brackets for the increase of the stability of the machine, carries a slide, moved by electric power, to which the column of the machine is attached. On the machine is mounted the gear box for the power travel of the slide and for the power swivel of the drilling machine around the axis of the column. The power

travel of the slide as well as the power swivel are operated by a single electric motor.

On the shell of the machine which turns on the column and is mounted in anti-friction bearings, moves vertically a sleeve with horizontally adjustable arms. The vertical movement of the sleeve is driven by a special



electric motor with a worm gear, a precision nut and an elevating screw firmly in the head of the shell.

The arms of the drilling machine are moved in the guide-ways of the bed either by power by an electric motor controlled by levers which are mounted on both sides of the arms near the tilting head and the movement of which agrees with the direction of movement they control, or by hand from either side by means of hand wheels mounted on the arms near the tilting head carrying the headstock.

The 9 speeds in the gear box are changed from either side by two levers on the front ends of the arms. On the front cover of the headstock there is the lever of the counter-

MAY 1956

shaft gear/double gear/by which the range of 9 spindle speeds is extended to 18 speeds in two ranges overlapping each other.

The head is tilted 90° upward and downward by an electric motor serving jointly for the power feed of the arms and the tilting of the head. In the flange of the tilting head the headstock is mounted with a rotary movement. It can be swivelled 360° by means of a hand crank. The upper part of the headstock carried the head of the power feed with levers for the control of the power and hand feed of the spindle and with the positive stop equipment.

The drilling motor which is fitted on the gear box is controlled by push buttons for two directions of rotation. The push buttons also permit direct reversing of the motor without the use of the stopping push-button.

A few main technical data :

Maximum distance,
shell to spindle ...mm 2100 6' 10½"

Maximum / minimum
distance, centre-
line of spindle to
floor / headstock in
horizontal position/...mm 2734/400
8' 11½" / 1' 3¼"

Vertical movement of
arms ...mm 1220 4'

Horizontal move-
ment of arms ...mm 900 2' 11½"

Swivel of arms .. 360°

Swivel of headstock.. 360°

Movement of slide on
bed ...mm 1200 3' 11¼"

Drilling depth ...mm 350 13¼"

Range of spindle
speeds in either
direction ...r.p.m. 16 to 800

Drilling capacity in
60 kg. per sq. mm
/38 tons per sq.
in. / steel ...mm 50 2"

Total output of elec-
tric motors ...kw 9.5

Weight of machine ...kg 7000 15400 lbs.

Indian customers have already come to know various types of Czechoslovak machine tools imported to India, whether to fairs or to the exhibitions of the Czechoslovak industry in Bombay or New Delhi, or they could satisfy themselves of their qualities directly in operation in various plants. It may be hoped that this machine, too, will excite the interest of Indian industrialists and that it will be among the other machine tools of Czechoslovak machine tools of the SKODA, TOS and MAS trade marks which are already being supplied to India in unprecedented numbers.

The firm of STROJEXPORT, Praha, Czechoslovakia in their capacity of sole exporters of machine tools of Czechoslovak manufacture will be pleased to supply interested parties with further information.

Editorial Notice

The Editor invites contributions from the Engineers and Works Managers of Railway Workshops as well as company-managed Engineering Workshops in the form of original articles, research write-up, production techniques etc. relating to Workshop practices in India and abroad. Besides, suggestions for the technical improvement of various aspects of Railway Workshop practice are also invited with suitable write-ups accompanied by photographs wherever possible.

Contributions are accepted on the distinct understanding that they are sent solely to "THE INDIAN RAILWAYS WORKSHOP MAGAZINE". The Editor accepts no responsibility for the views and statements of the contributors.

All contributions intended for publication in any particular issue should reach the Editor at least 30 days prior to the scheduled date of publication. This Journal is issued quarterly i.e. February, May, August, November.

All published contributions are paid for at our usual rates.

Editor.

PRECISION BALL BEARING MANUFACTURE IN INDIA

THE FIRST UNDERTAKING OF ITS KIND IN ASIA

THE recent world war emphasised the important role which anti-friction bearings play in engineering industries of all countries.

It was because of the growing need for such an industry in India that Messrs. Birla Brothers undertook the important step, of

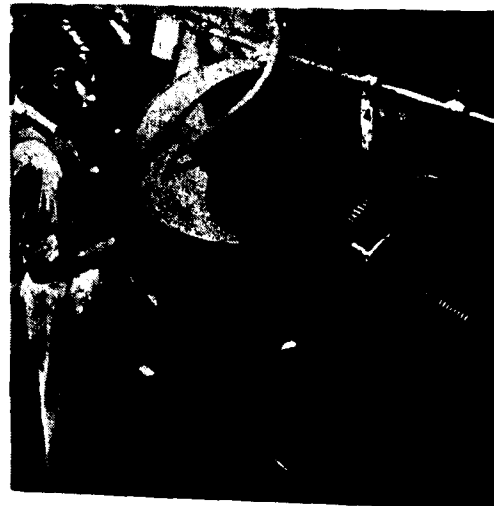


Ball Inspection Department Visual examination of all surfaces for surface imperfections and discolouration.

setting up a plant for the production of ball bearings.

Negotiations were completed in 1947 with Messrs. Hoffmann Manufacturing Company Limited, Chelmsford, England—manufacturers of ball and roller bearings for over 50 years—for the manufacture under licence in India of Hoffmann Bearings, the Indian products being known as "Hoffmann Licence" bearings.

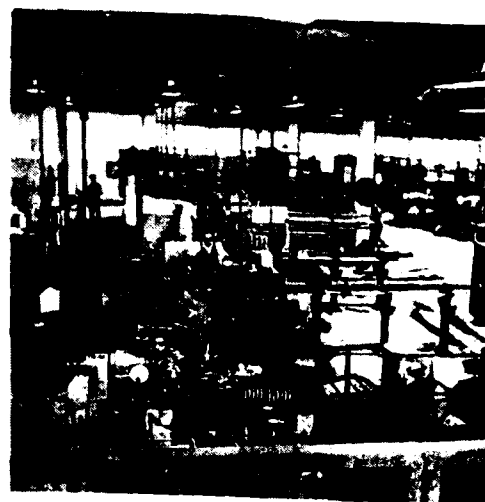
A company was formed known as National Bearing Company Ltd., and a site was



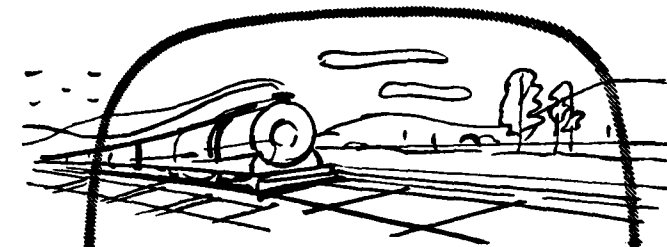
Balls in process of Grinding.

selected at Jaipur, Rajasthan, for the complete factory, which is entirely self-contained and requiring only raw materials for the manufacture of bearings.

The manufacture of precision bearings necessitated a completely dust proof and air-conditioned factory incorporating line flow



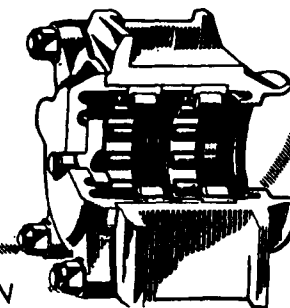
General view of Turret Department with 4—Six spindle Autos in foreground.



MORE LOCOMOTIVES FOR OUR RAIL ROADS

The 910 crores of rupees earmarked for the Railways in the Second Five-Year Plan provides for, among other things, a 51 percent increase in goods traffic, a 15 percent increase in passenger traffic and an increase in the production of locomotives at Chittaranjan from 170 at the end of the First Five-Year Plan to 300 in 1960-61.

Playing a significant part—unseen and unheard—in this project is **NBC**



HOFFMAN DESIGN

NBC

AXLE BOXES

NATIONAL BEARING CO. LTD., JAIPUR

Calcutta Office: India Exchange Bombay Office: 26, Calicut Street,
Phone: 22-2418 Ballard Estate, Fort.
Phone: 261484



General view of Turret Department Form heads on left, Fays in foreground.

mass production methods, with up-to-date scientific control at all stages.

The Factory now completed and in operation, is of R.C.C. construction throughout, occupying a floor area of 66,600 square feet in the main buildings. All windows have been eliminated and N. light is admitted through glass blocks which provide insulation against outside heat. The air-conditioning plant provides fully controlled temperature and humidity, and the air is thoroughly



Operation 54. Press Producing Blanks for pressed type cages from Non-Ferrous Strip.

filtered dust etc., by various filtering arrangements including electrostatic filters.

The main sections of the factory comprise ball heading and lapping, turning, grinding, viewing, assembly, final view and packing department, tool room, measuring department, and laboratory all being equipped with the very latest precision equipment for dealing with the high standard of quality and accuracy of workmanship necessary for the production of high grade bearings.

The hardening department, is in a separate building, dust proof and air-conditioned, containing special types of electric furnaces



Operation 39. Check Inspection Bench for Sleeves and Nuts in Turret Department.

also. Hardening and tempering furnaces gas fired from a gas producer. Control of the furnace temperatures is fully automatic by means of kent controlling and recording equipment.

Lighting throughout the factory is by fluorescent lamps and the layout of the machinery and colour scheming is in accordance with the latest industrial practices to ensure maximum benefits to the operators and quality of their work.

The plant is designed to produce all the bearings and steel balls required by industry



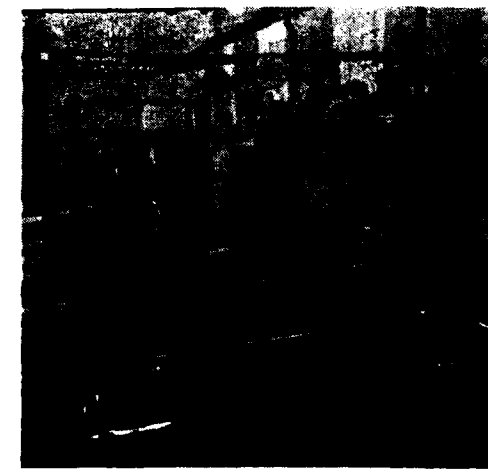
Operation 39. General view of Check Inspection Bench in Grinding Department.



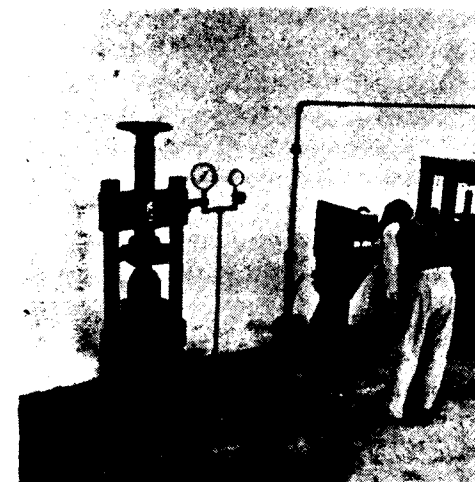
Operation 58. Finished bearings being washed under high pressure Paraffin Jets which rotate the bearings whilst washing.

with a special emphasis on the small sizes required in large quantities by specialised industries in India, particularly for Fan, Electric Motor, Centrifugal Pump and Cycle Manufacturers and bearings required for the Automobiles Manufacturers now producing vehicles in India.

The layout of the plant is arranged for rapid expansion of any section to accom-



Hardening Department showing Special Rotary Gas fired furnaces for Ball annealing and hardening.



Laboratory with Hydraulic Ball Crushing Machine on the left, and Vickers Hardness Tester on the right.

modate increased production, and many of the existing machines and processes have reserve capacity in hand for this purpose.

The high degree of accuracy required in the manufacture of bearings of high quality is ensured by rigid inspection and laboratory testing of all raw materials which are supplied to an exacting physical and chemical specification, laid down by Hoffmann Manufacturing Co. Ltd., based on their unrivalled

experience of the requirements in this respect.

National Bearing Company Ltd., has secured the services of seven European experts from Hoffmann Manufacturing Co. Ltd., to supervise each department and at every stage of production, as well as advising customers on the application and design of equipment to obtain the most satisfactory performance from the bearings. In addition six selected highly qualified Indian Engineer

students were trained at the Hoffmann Bearings Factory in... further Indian E... training in India.

National Bearing safely be described as the... in Asia" and will provide link, in the chain of develop... industrialisation, which aims at... dependance on other countries for... of vital engineering stores and equi...

46 CRORES FOR WORKSHOPS

The Indian Railways are expected to spend approximately Rs. 46,00,00,000 during the second Five Year Plan period on the expansion of their existing workshops and the setting up of new workshops. Compared to the position at the close of the first Five Year plan, the total holdings of railway stock by the end of March, 1961 are expected to be increased by nearly 1,556 locomotives by over 5,800 passenger coaches and by about 99,000 goods wagons. This additional rolling stock is expected to throw a considerable new burden on the repair workshops.

It is proposed to set up two new workshops for manufacturing spare parts of locomotives, one to feed the Eastern, North Eastern, Northern and metre gauge portion of the Western Railways, and the other to feed the South Eastern, Southern, Central and the broad gauge portion of the Western Railways. Major expansion will be undertaken in the case of existing workshops at Gorakhpur and Izatnagar on the North Eastern Railway, at Jagadhri on the Northern Railway, at Perambur and Hubli on the Southern Railway, at Ajmer and Mahalakshmi on the Western Railway, at Jhansi on the Central and Kanchrapara on the Eastern Railway.

Arrangements have been made to take over the Amritsar Workshop from the Punjab Government and to develop it for locomotive repairs. The Western, South Eastern and

also probably the Southern Railways will need a wagon shop each, and the North Eastern will need a new carriage and wagon shop.

RAILWAY EQUIPMENT FOR INDIA

The Indian Railways have for the first time placed orders for railway equipment on manufacturers in USSR, it is learnt.

Orders for rolling stock have also been placed with manufacturers in East Germany, Yugoslavia, Austria and Poland.

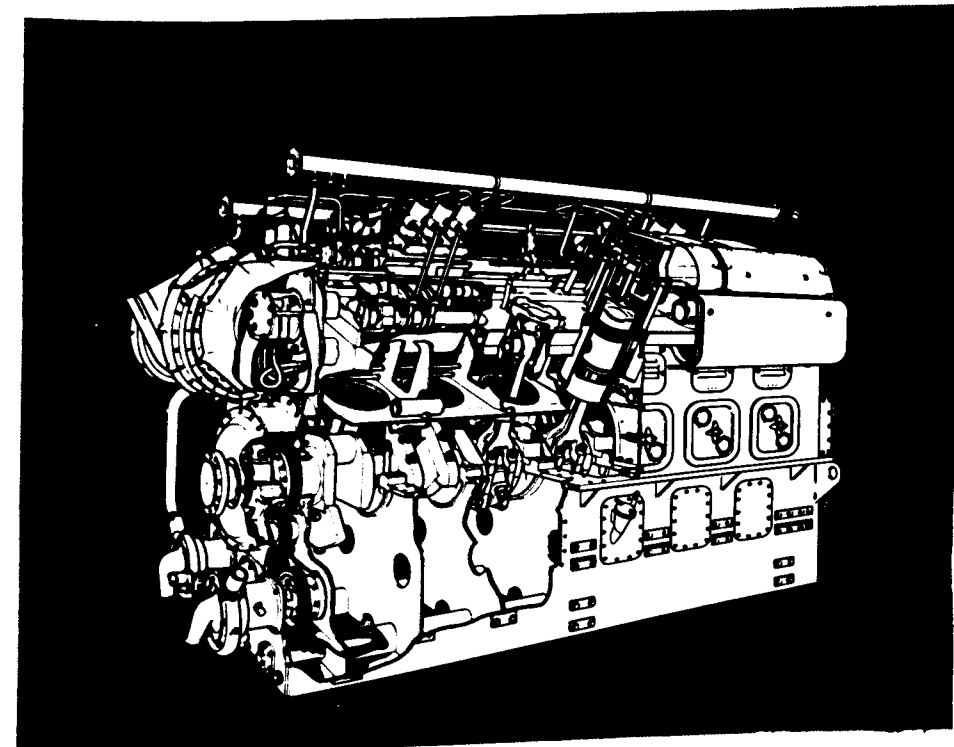
The orders placed in Russia relate to 15 broad gauge steam locomotive boilers, and the total value of the orders is about £ 65,000.

A firm in Yugoslavia has secured an order for 12 steam locomotive engines for the metre gauge system, the total value of the order being £ 131,000.

An order for 17 special type well-wagons for carrying heavy plant and machinery for India's development projects has been placed on a firm in East Germany, at a total cost of £ 71,000.

A Polish firm has been given an order for 30 broad gauge steam locomotive engines at a total cost of £ 908,000. An order has been placed in Austria for an equal number of broad gauge steam locomotive engines at a cost of just over £ 921,000.

THE INDIAN RAILWAYS WORKSHOP MAGAZINE



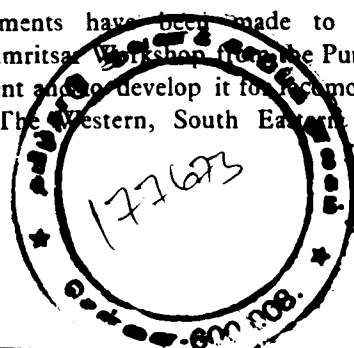
70% Interchangeability

This is the high degree to which a basic set of Paxman spares covers a range of engines powering anything from large shunters to main-line locos. Add to this the advantages of high power, low weight, minimum overall dimensions, maximum service life and complete reliability, to appreciate why Paxman units meet the requirements of electric, mechanical or hydraulic transmission so readily.

PAXMAN
DIESEL ENGINES
for RAILWAY TRACTION
133-2,000 B.H.P.

DAVEY, PAXMAN & CO. LTD. COLCHESTER ENGLAND

Associated with Ruston & Hornsby Ltd. Lincoln.



**YOU CAN DEPEND ON THEM—
EVERY INCH OF THE WAY**



The Indian Railways are a vital part of our economy—expansion of trade and commerce is made possible by the Railways. And in the future the Railways must bear an even heavier burden of transport, to carry up towards prosperity.

The Indian Railways must have the best in specialized equipment. Naturally, when it comes to dry batteries, the Railways choose "Eveready". The "Eveready" No. 6-I Railroad and Industrial Cell, designed and manufactured in India, fully meets the stringent specifications of the Railways.

Wherever dependable, economical performance is required, the "Eveready" No. 6-I Railroad and Industrial Cell is the first choice.

EVEREADY
TRADE-MARK

NO. 6-I RAILROAD & INDUSTRIAL CELL
for heavy duty applications

A NATIONAL CARBON PRODUCT

NCC 785