MACHINE TOOLS SOUVENI

(A QUARTERLY TECHNICAL JOURNAL DEVOTED TO MACHINE TOOL INDUSTRY)

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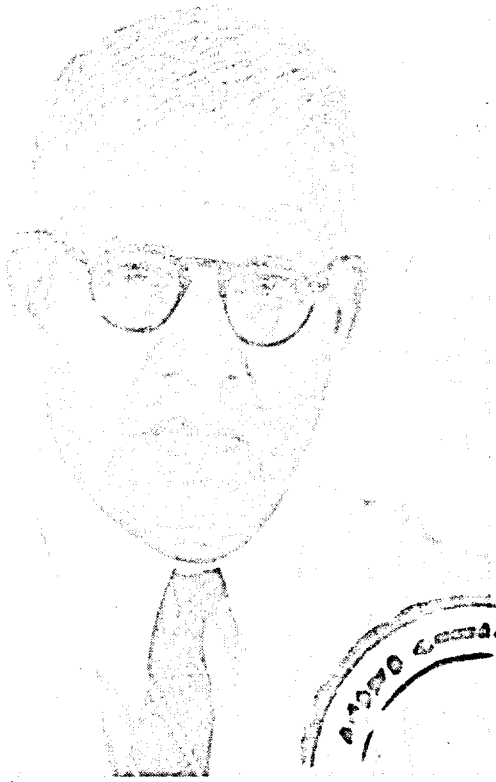

MACHINE TOOLS SOUVENIR

(A QUARTERLY TECHNICAL JOURNAL DEVOTED TO MACHINE TOOL INDUSTRY)

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TANJORE

(SOUTH INDIA)

CONTENTS

PORTABLE ELECTRIC TOOLS

By F. W. Hughes, M.A.S.E.E. ★

THE practice of 'bringing the tool to the job' has rapidly increased the usage of portable electric tools in industry. Moreover as such tools have been developed for industrial applications, they have also been applied by garages as well as in small workshops by the home craftsman. This article, therefore, offers advice in the selection and use of such tools not only to the industrial but also to the domestic user.

There are a number of factors that should be considered in determining the best model of portable electric tool for a specific job. Before purchasing a tool, it should be examined in regard to its weight, spindle speed, suitability of shape, safety features and ease of maintenance. A tool may be favoured because of its light-weight, yet it may not have a motor powerful enough for the job in hand, since tool weight and motor horsepower are generally roughly proportional. At the same time, it is slow and uneconomical to use a heavy tool when a light tool can do the job equally well.

The spindle speed of a portable tool is usually established to suit its application. If the speed is too high in relation to horsepower, the tool may stall in operation. But a tool of the same horsepower with a lower speed has more torque and is less apt to stall. For proper application to the job, it is considered by the present writer that the relationship should be such that the speed under load can drop off to between two-thirds and one-half of the no-load speed.

A large tool with a low speed will, of course, have ample torque to drive a small cutter, but at a rate that is too slow to give a satisfactory output. Thus, there are the two extreme conditions, firstly, a speed too high for a motor that is not strong enough, so that the tool stalls and, secondly, a motor strong enough but too slow, so that time is wasted.

Proper cutting speeds must also be considered in determining spindle speed. If spindle speed is excessive and the motor of the tool strong enough to sustain the speed under lead, the cutter will burn. A tool with a lower spindle speed and possibly a less powerful motor is indicated for this situation.

No-load spindle speeds recommended for various sizes of portable electric drills are indicated in Table I. The speeds given are for drilling mild steel. For soft materials, such as aluminium, these speeds can be practically doubled. For harder or tougher materials, such as stainless steel or Monel metal, these speeds should be about one-half of those given.

TYPE OF HANDLE

The smaller portable electric tools, such as drills and screwdriver generally have a pistol-grip-type handle. This permits the tool to be held securely and comfortably with one hand. For medium-sized tools, where there is more over-hung weight, a closed end handle is better. An auxiliary side handle on low-speed high-torque models lets the operator use both hands to resist any tendency of the tool body to turn. On the larger drills and screwdrivers, side handles or pipe handles (usually located opposite the switch handle) are essential to give the operator good control over the tool.

Closed handles afford the best control for portable saws. For grinders and right angle sanders, straight end handles are preferred. The sanders preferably have an auxiliary side handle at the spindle end.

ELECTRIC CABLE

Every tool should have a suitable motor switch, conveniently located. This switch is generally of the instant-release type. On tools like drills, screwdrivers and tappers, the switch can have a pin for locking it in the 'on' position. But on tools with cutting blades, like saws, there should be no arrangement for locking the switch 'on' so as to product the operator. Still other tools, like grinders and sanders, are equipped with plunger or toggle switches. It is important that all switches be located and protected so as to avoid accidental operation.

Even if the tool is designed for light service, it should have a substantial cable of sufficient size to carry the full load current to the motor. Where an extension cable is

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needed, this should be substantial enough to carry the current without too much loss in line voltage. Lighting flex should *never* be used for electric tools.

In Table II are shown wire sizes for various ampere capacities and wire lengths for 220 volt tools. These figures actually represent the wire section necessary and this cross sectional area may be made up of the requisite number of wires of any smaller diameter. Data are based on a current equivalent to 150 per cent of the full load with a loss in voltage of not over 5 volts. For 115 volt tools, the wire size indicated for twice the cable length required should be used. The words under the size represent the recommended insulation.

The Motors of portable electric tools are normally designed to operate satisfactorily with a variation in their nominal voltage of up to 6 per cent. Any greater variation has a pronounced effect on the motor performance. A 10 per cent drop in voltage reduces the power of the motor about 20 per cent and the speed of the operation at full load falls off considerably.

The necessity for using the proper rating of cable is obvious. On the other hand, with an increase in voltage, motor speed increases as well, with the possibility that the motor will overheat if operated over an extended period.

EARTHING

All British electric tools to-day are supplied with a three-core cable. The third wire, having green-coloured insulation, is for earthing. One end of the earth wire is connected to the tool housing and the other end should be connected to a good earth contact, such as a water pipe, conduit or copper rod driven into the earth. Earthing is particularly important when tools are being used in a damp area or inside of a tank, or on metal structures that are themselves earthed. The earthing connection should always be made *before* the current supply connection is made.

Some wiring systems are supplied with three-pole earthed socket, in which case the cable can be equipped with a three-pole plug. The prong to which the earth wire is connected is longer than the two other prongs, so that an earth is automatically made before the current can flow through the power wires.

CARING FOR THE TOOL

With few exceptions, the gears in portable electric tools are grease lubricated. The lubricant will remain in the gearbox for quite a long time. When it becomes necessary to replace it, all the old grease should be removed and the box thoroughly cleaned. A grade of grease recommended by the manufacturer of the tools should be used. Care should be taken not to fill the gearbox more than one-half to two-thirds of its capacity.

Ball bearings in tools so equipped are usually permanently sealed. They should never be put in cleaning fluid, as this removes the grease, which cannot then be replenished. If the tool has sleeve bearings, they are usually self-lubricating. Other sleeve bearings can be oiled through a ball valve on the tool.

TABLE I

No-load spindle speeds for portable electric drills

Drill Capacity in inches	No-load spindle speed, r. p. m.
1/4	1,700 to 2,500
3/8	600 to 900
1/2	400 to 650
5/8	350 to 550
3/4	300 to 450
7/8	250 to 375
1	225 to 350

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TABLE II

Size of extension cable for portable electric tools

(Based on current equivalent to 150% full load of tool and a voltage drop of approximately 5 volts)

Name Plate Rating of Tool in Amps	0 to 2.0	2.1 to 3.4	3.5 to 5.0	5.1 to 7.0	7.1 to 10.0
Distance in Feet	Wire Sizes (S.W.G.)				
25	20 3 core thin	20 standard	18 standard	18 standard	16 standard
50	20 3 core thin	20 standard	18 standard	18 standard	16 standard
75	20 standard	18 standard	18 standard	18 standard	16 standard
100	20 standard	18 standard	18 standard	16 standard	16 standard
200	18 standard	18 standard	16 standard	16 standard	— standard
300	18 standard	16 standard	16 standard	—	—

Note : If voltage is already low at the source, have voltage increased to standard, or use a much larger cable than listed in order to prevent any further loss in voltage.

Brushes are readily removed for inspection. If worn to less than about ¼ in. length, they should be replaced; otherwise the motor will are badly and damage the commutator. If the commutator shows roughness, it can be smoothed with fine sandpaper. A smooth, dark brush track on the commutator is normal.

The switch should operate freely. There should be no likelihood of it sticking in the 'on' position with the possibility of causing an accident. The cable connections with the switch and plug should be tight. If the cable is worn it should be replaced with another of the same size.

SPECIAL FEATURES OF TOOLS

Portable electric screwdrivers usually contain a clutch that disengages the drive when the screw (or nut) has been tightened sufficiently. There are three general type of these tool. In one type, there is a positive clutch, enabling the operator to control the release of the driving torque by the pressure he applies. This screwdriver is ideal for driving for wood screws, where torque increases constantly and varies widely. It is not recommended for use in metal assemblies, unless by experienced operators, since the sudden increase in torque when the screw is tightened can cause damage and injury.

In the second type, the clutch of the screwdriver is adjustable. Here the release of the driving torque is not controlled by the pressure applied by the operator but by a change in tension of a spring against which a jaw of the clutch operates. Once the value of torque is set, it remains fairly constant until the jaws of the clutch wear appreciably. This type of clutch is preferred to a positive clutch for driving machine screws and fasteners in metal assembly work.

The third type of screwdriver, the impact wrench, employs a driving torque releasing mechanism that is not controlled by the pressure applied to the tool or by spring tension. Its construction is such that there is practically no torque reaction transmitted to the operator. Tool size must be carefully chosen to suit the work, because the impact can create stress beyond the elastic limit of the fastening device.

Portable electric grinders have an elongated gear housing which can be grasped by the operator's hand. The grinding wheel is mounted directly on the end of the spindle. If the tool is inadvertently dropped or hit against an object so as to damage and possibly crack the wheel, there is the danger of having the wheel fly apart. Before using a wheel, it should be examined for cracks by being sounded with a solid piece of wood, such as a hammer handle.

A maximum surface speed of 6,000 ft. per minute should be observed for the general run of vitrified wheels. Special bonded wheels can run at a higher speed and require separate consideration. A quick way to check the

surface speed (in ft./min.) is to multiply one-fourth of the wheel diameter in inches by the speed of the spindle in revolutions per minute. For protection, the operator should always wear goggles and a suitable guard over the grinding wheel is mandatory.

Electric saws are usually equipped with a lower guard that recesses into the upper guard as the tool enters the cut and springs back over the exposed portion of the blade after the tool completes the cut. If the lower guard ever sticks and fails to spring back, the saw should be disconnected from the power source before any attempt is made to rectify the condition.

Unless portable electric tools are fitted with explosion-proof motors, they should never be used where there are inflammable dusts are vapours, because of the arcing between the brush and the commutator. Tools subjected to an excessive amount of moisture should be disassembled, cleaned and baked dry. Otherwise the motor is likely to be earthed, thus endangering the operator.

Table III shows some of the most common causes of portable tool failure together with suggested means of correction.

TABLE III

Possible causes of trouble in portable electric tools

Fault	Check for	Remedy
New tool, motor does not operate	Brush stuck in holder, not making contact with commutator	Remove burr from brush holder
	Poor contact at the socket	Replace plug
	Broken conductor in cable	Cut off broken end or install new cable
Tool has been in service, but motor does not operate. Takes no current	Worn out brushes	Replace brushes, preferably by those recommended by tool manufacture
	Switch not making contact	Replace complete switch mechanism
	Open circuit in field coil	Rewind or replace field coil
	Two or more open coils in armature	Rewind or replace armature
Motor hums and takes heavy current, but does not operate	Short circuit in field coil	Rewind or replace field coil
Motor operates abnormally. Slow, jerkey excessive sparking at commutator, runs hot	Short circuit in armature. Charred insulation may give location of short circuit. Solder may be thrown from connections to commutator bars effected	Rewind or replace armature. *Note :* An accumulation of dirt with carbon and metallic particles between commutator bars can cause a short acircuit
Motor operates at excessive speed, gives poor operating performance	Partial short circuit in field coil	Rewind or replace field coil
Ring of fire visible around the commutator	Open circuit in armature	Rewind or replace armature
Motor overheats, solder thrown from connections to commutator bars	Overload voltage too low	Use heavier extension cable
	Dull cutter, requiring heavy pressure	Sharpen cutter
	Motor ventilation poor	Clean vent holes of motor housing
Operator gets shock	Earthing wire not connected	Connect earth wire
	Carbon and metallic dust on brush holder insulation	Clean brush holder insulation

DEVELOPMENT AND DESIGN OF MACHINE TOOLS IN INDIA

By R. Koban, Chief Designer, Machine Tool Prototype Factory, Ambarnath.

IN this country with its size and large population, it is undoubtedly obvious that Industrial expansion is a necessity and, to accomplish this industrial expansion, Machine Tools of many types are required. As the Industries improve, so must the accuracy, speed and the automation of various machine tools, in a similar proportion. For, the results are controlled by the Machine Tool or apparatus which does the work.

Far-seeing and wise Industrialists in India have already commenced the manufacture of many types of Machine Tools and the Government of the country have likewise seen its necessity and thus in different parts of the country have sprung up reliable and well-organised Factories for the production of immediate requirements and future necessities. The demand, however, at the present time is more than the supply and consequently imports are necessary; thus the economy of the country has, to a certain extent been restricted. Therefore, the Factories have a task before them of rapid but always excellent production, to ensure stabilization of the country's industrial future. The Machine Tool Prototype Factory in Ambarnath has been set up by the Government with a view to design, develop and manufacture a variety of Machine Tools to cover the needs of Ordnance Factories, for the Defence Services and other Government departments in the first instance: and, likewise, as they are to cover the higher precision or automatic types of Machine Tools, the surplus capacity will be directed towards supplying civil trade.

The establishment of a Machine Tool Design Office was a definite necessity and this Factory can be considered as having the first, and original, design team in India and it is proud of the fact that the Indian Designers and staff have reached a stage where they can work independently on the design of any type of Machine Tool.

The establishment of the designs and Production of the Factory was by a graduated process to ensure efficiency and experience and, design and manufacture of various tool-grinders, polishing machines, monodrive (gear-box adaption for old types of lathes), Precision tool room lathes, Hydraulic Surface Grinders and 1/2"

1 Handle for change of Spindle Speed.
2 Push Button starter for main motor.
3 Push button starter for coolant pump motor.
4 Pole changing switch for 2 speed motor.
5 Turret Slide.
6 Cross Slide.
7 Lever for operating the Collet.
8 Automatic bar feed arrangement.

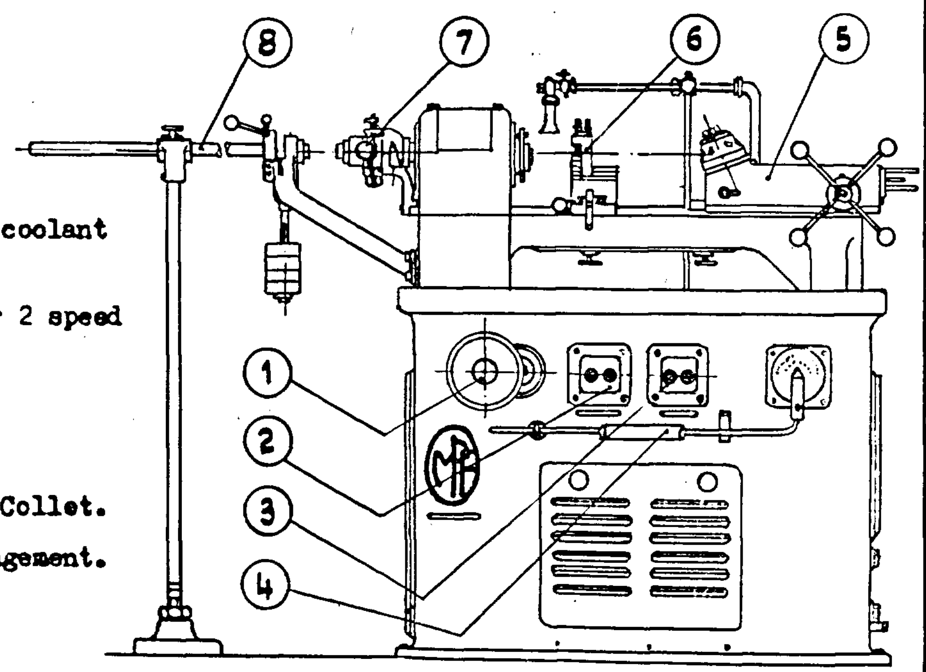


Fig. 1. Capstan Lathe CL 1/2.

Capstan Lathes have been established. The Prototype of $1\frac{1}{4}''$ Capstan lathe and the design of 2" Capstan Lathe is at present in hand, and these machines are designed following the present trends of automation in Machine Tools by incorporating pre-selective spindle speeds, feeds and programme setting. By keeping to the modern trend in the manufacture of Machine Tools the Factory authorities are hoping to contribute to attaining self-sufficiency of the Indian Machine Tool Manufacturer.

With the old type of Capstan Lathe; which invariably has an unwieldly setting and manipulation,— it was rarely considered an economical Machine Tool unless the members required from it were in the region of hundreds; as the setting time required to ensure a semi-skilled worker to do the work could not be compensated unless the numbers were large. But the modern machine with its easy speed changes, its standardized tool boxes and tools and easy application, can be set so quickly that even pieces of 20 and upwards are easily and economically manufactured.

A Capstan Lathe 1/2" is at present undergoing rigid test in the test branch of the Machine Tool Prototype Factory, Ambarnath. The following main characteristics of the Capstan Lathe, type CL 1/2" (Fig. 1) are given.

The most striking feature of the CL. 1/2 is the absence of any gears for the main drive. The range of spindle speeds is from 300 to 3000 r.p.m. infinitely variable. By having the main drive of infinitely variable speed, it is always possible to obtain the optimum cutting speed for the job in hand and also achieve the most economical chip removal. Due to the wide range of spindle speeds, the machine is ideally suited for the machining of ferrous, light metal and plastic materials for Bar and Chucking work. The pedestal and chip tray are cast in one piece and 'house' the main drive, coolant pump tank, and the electrical equipment. The bed was designed in such a way that the maximum resistance against torsion is obtained. The sturdy head stock and the mounting of the heat treated and ground and dynamically balanced main spindle with American Spindle Nose No. 4, Type A2 in high precision taper roller bearings guarantee the sustained and continuous accuracy of working. The turret saddle can be clamped in the desired position by means of two eccentric clamps. The turret slide has a useful stroke of $2\frac{1}{2}''$ and carries the turret head with six tool stations with standard $\frac{3}{4}''$ mounting holes. The turret head is automatically indexed and rigidly locked in position. The indexing of the turret head is automatically accomplished through the return stroke of the turret slide actuated by hand over star wheel, pinion and rack. The tool stops, which are adjustable in the longitudinal direction, are indexed at the same time as the turret and thus ensure perfect similarity of cutting lengths on every component. The cross slide movement is actuated by a conveniently adjusted lever and the slide carries two tool posts one in front and one at the back on which form tools can be set as well as a parting tool for accurate forming as the tool stroke can be set over an adjustable stop.

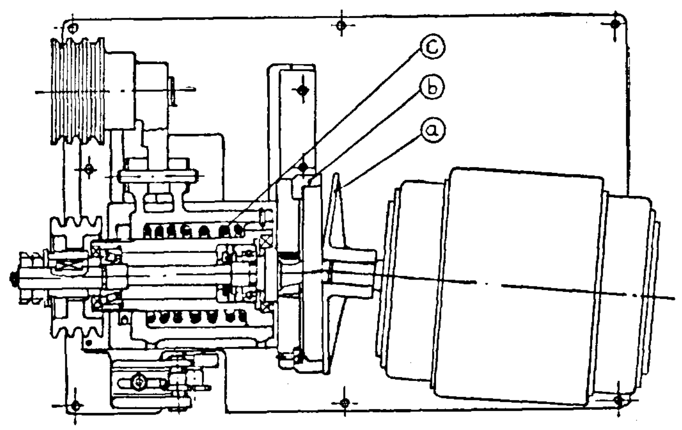


Fig. 2 : Variable Speed Main Drive.

The infinitely variable main drive unit (Fig. 2) consists of a two speed motor of indigenous manufacture with 1400/2800 r.p.m. and 1.1/1.5 H.P. On the motor shaft a cast iron cone disc (a) is mounted, which is in contact with a friction disc (b) of laminated bakelite. The necessary contact pressure is obtained through a compression spring (c). Through the variation of the radius of contact the speed variation in the ratio 1 to 5 is achieved. The necessary movement of the unit, housing and friction disc, is effected over screw and nut which are freely operated by a hand wheel and a chain. The hand wheel is connected over gears with a graduated dial indicating the speed. The main spindle is driven by means of 3 link type 'V' belts from the floating driving pulley of the friction wheel unit. By designing the driving pulley floating, this ensures that the spindle pulley, and the main spindle is not subject to additional thrust due to misalignment, which might have arisen as the friction disc goes forward to take up the wear as indicated in Fig. 3 below:—

The jockey pulley mounted on the friction wheel unit takes up the slackness which may arise due to movement of friction wheel unit for speed adjustment and also

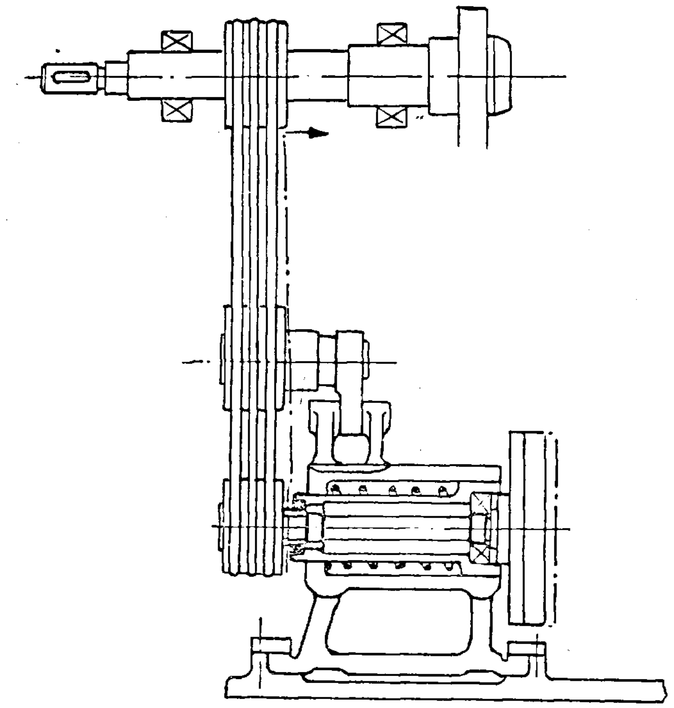


Fig. 3.

guarantees the alignment of the driving pulley with main spindle pulley. This type of variable drive is suitable for transmission of power upto 3 H.P. and covering upto a maximum speed ratio of 1 to 5.

The machine is supplied with the following standard equipment:—

Collet attachment of push type which is operated by a conveniently arranged lever on the end of the head stock (Fig. 4).

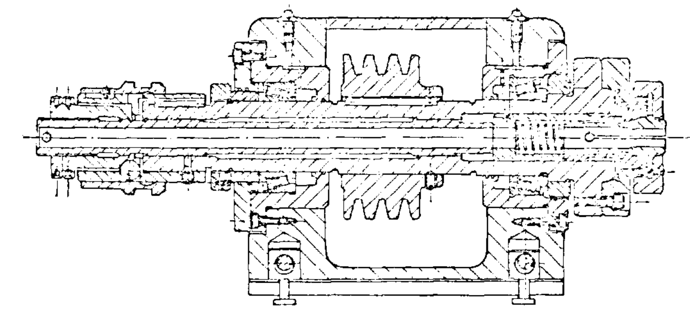


Fig. 4 : Head Stock with Push Type Collet.

Automatically fed bar feed arrangement and the following tool holders:—

Adjustable stop Knee tool holder, Centre tool holder, Releasing die holder, Releasing tap holder, Adjustable tool holder, Box holder.

The following extra equipment can be supplied a extra cost.

Collet of double gripping type suitable for the push type collet attachment (Fig. 5).

Draw in type collet attachment (Fig. 6) with a full range of collets.

Thread chasing attachment (Fig. 7) for the cutting of threads upto a length of 2", likewise adaptable for taper screw cutting. A standard range of leaders and nuts for 5, 6, 8, 10, 12, 14, 15, 16, 18, 20, 24, 28, 30 and 42 T. P. I., R. H. are readily available. The supply of

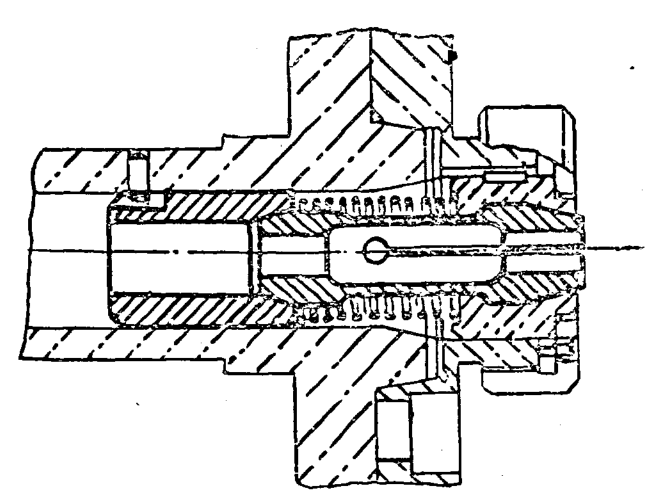


Fig. 5 : Double Gripping Type.

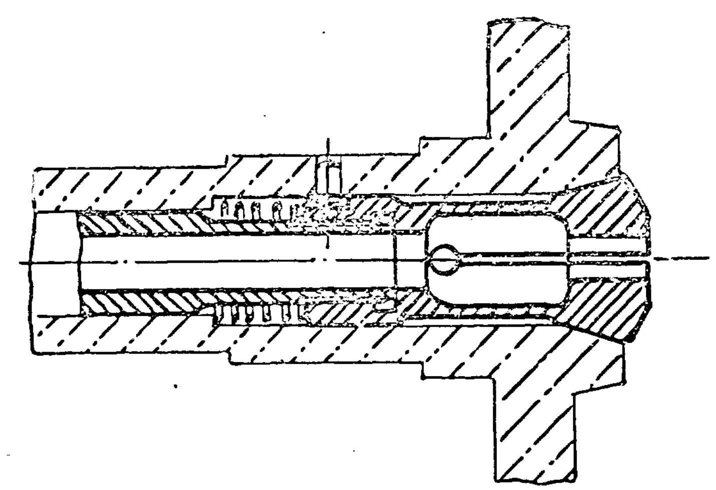


Fig. 6 : Draw in Type.

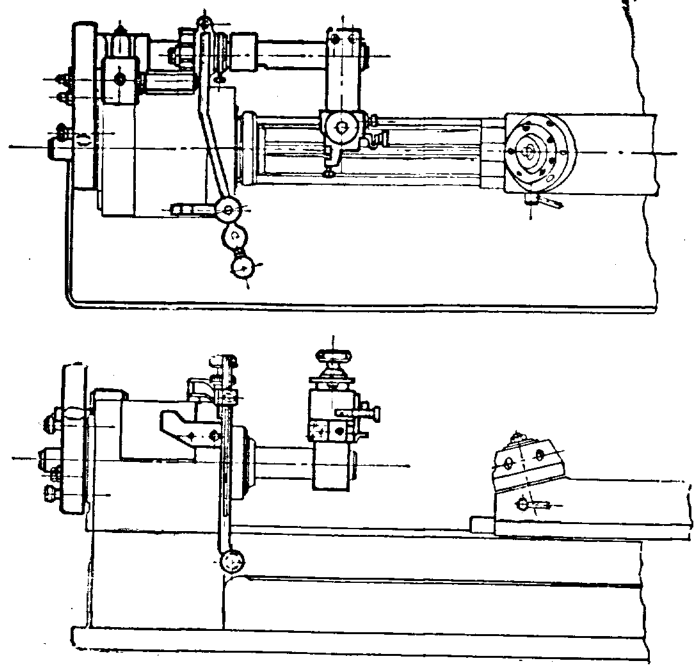


Fig. 7 : Thread Chasing Attachment.

leaders and nuts for L. H. and any special pitch sizes can be arranged if demanded.

The ½″ Capstan Lathe can be easily converted into a centre lathe by replacing the cross slide and turret by a compound slide and a tailstock respectively. This so converted lathe is called a Cabinet Lathe (Fig. 8) of 4½″ height of centres and admits between centres 17″. The cross slide and compound slide movement are 3½″ and the movement of the tail stock sleeve is 4″.

The above is a description of one of the notable machines designed and produced by the Machine Tool Prototype Factory, Ambarnath. Its sturdy, efficient, accurate and modern design recommends it to any production engineer.

1 Handle for change of Spindle Speed.

2 Push Button starter for main motor.

3 Push button starter for coolant pump motor.

4. Pole changing switch for 2 speed motor.

5. Tail Stock.

6 Compound Slide.

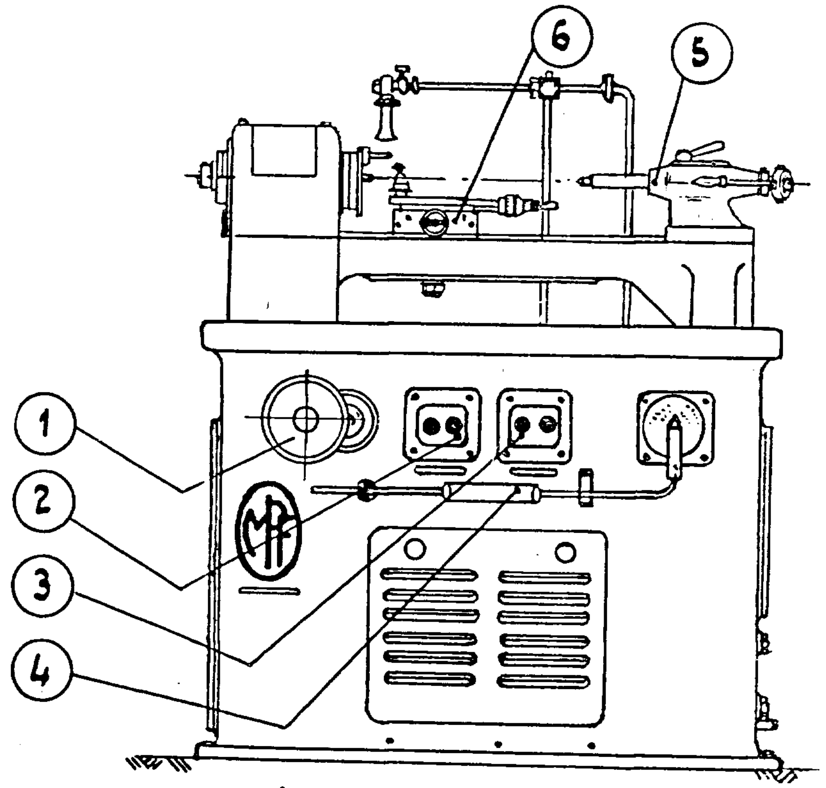


Fig. 8 : Cabinet Lathe - CBL - 4-1/2″.

BIRTH OF MACHINE TOOL INDUSTRY IN U. K.

THE Herbert organisation was established in the year 1889 at Coventry, England, and began with the manufacture of simple hand lathes and drilling machines. Later a considerable number of machines were made for the repetition production of cycle components.

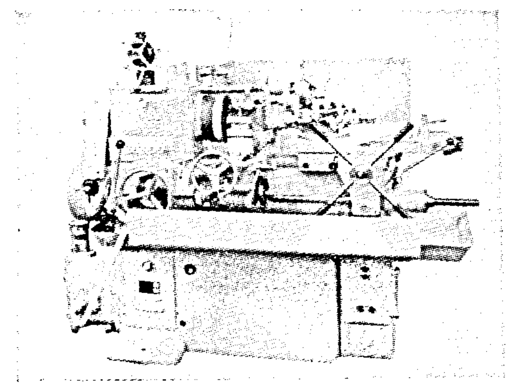


Fig. 1. Herbert No. 2D Capstan Lathe for bar work up to 1½″ diameter and chuck work up to 9″ swing.

Gradually the hand lathes were developed into capstan lathes and the ultimate adoption of travelling saddles and chasing attachments laid the foundation of the now famous Herbert No. 4.

Most companies grow from the creative ideas of one man and the Herbert organisation is no exception. Throughout the past 60 years the company has enjoyed a continuous growth and development due to the creative genius and leadership of its founder Sir Alfred Herbert K. B. E. Today it is the largest machine-tool organisation in the world and includes four factories having a total floor area of 29 acres and employing over 5,700 workers.

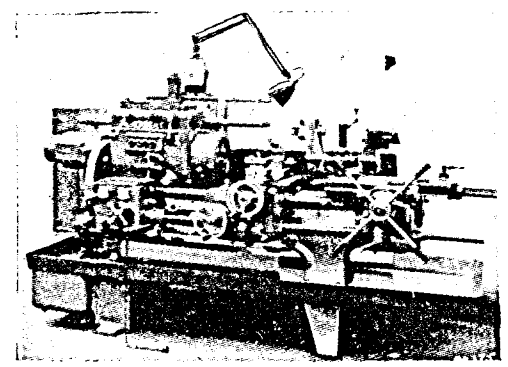


Fig. 2. Herbert No. 4 Senior Preoptive Capstan Lathe for bar work up to 2″ dia. and chuck work up to 15½″ swing. Power-operated speed changes are instantaneous and may be made while the tools are cutting.

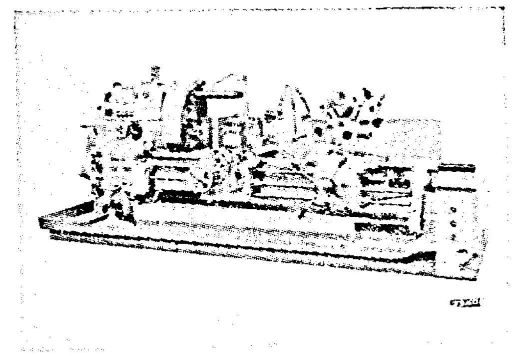


Fig. 3. Herbert No. 8 Preoptive Combination Turret Lathe for chuck work up to 20″ swing. Fitted with independent feed shafts to saddle and turret slide.

The Herbert manufacturing programme covers an extremely wide range of machines which can be grouped as follows :—

Capstan Lathes, seven sizes for bar work up to 2″ diameter, and chuck work up to 15½″ swing.

Combination Turret Lathes, five sizes from 16″ to 36″ swing.

Hexagon Turret Lathes, two sizes, 2″ and 3″ bar capacity.

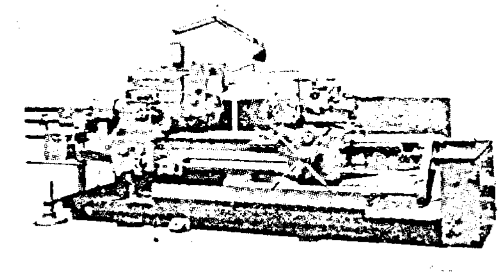


Fig. 4. Herbert No. 3 Hexagon Turret Lathe specially designed for bar work up to 3″ diameter and 36″ long. Preoptive headstock eliminates time lost due to frequent speed changing from high speeds for turning low speeds for threading.

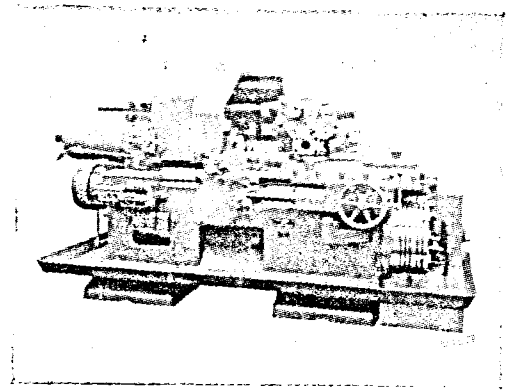


Fig. 5. Herbert No. 4 Auto Lathe, a high-speed automatic chucking machine for continuous high Production. Maximum swing: 16½" diameter.

Carbitracer, for the copy turning of shafts up to 6" diameter and 48" in length.

Auto Lathes, four sizes from 8½" to 25" swing.

Vertical Milling Machines, three sizes, 48"×16"×23"; 62"×29"×28½"; 62"×29"×30½".

All-electric Drilling Machines for holes from the very smallest up to 1¼" diameter.

A comprehensive range of engineers small tools is made including Coventry Dieheads and Dies, Tangic

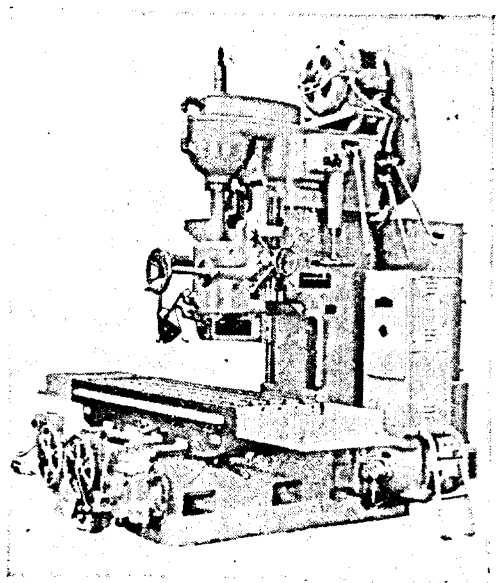


Fig. 6. Herbert No. 28A Vertical Milling Machine, a powerful machine for the heaviest classes of milling including negative rake carbide milling. Capacity: 62"×29"×30½"

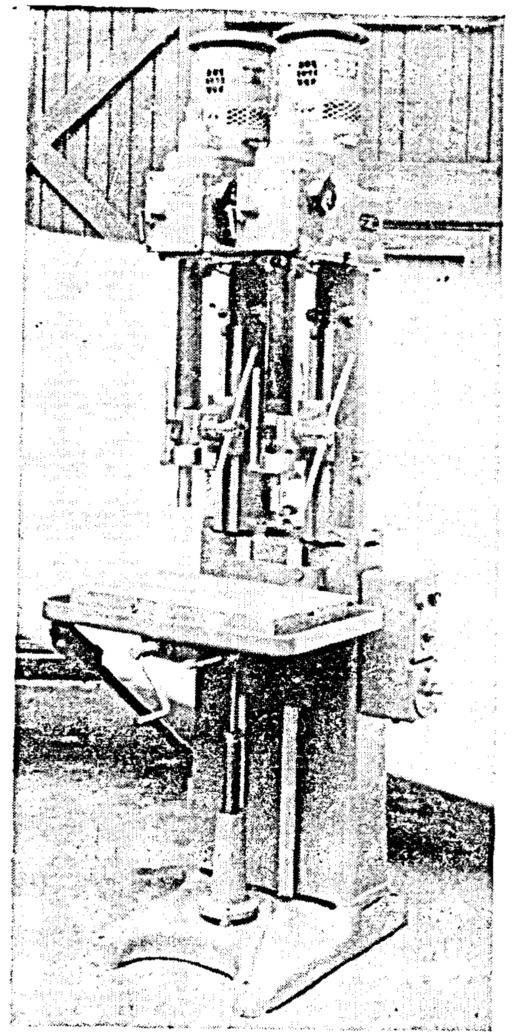


Fig. 7. Herbert type C all-electric two-spindle drilling machine.

Unit construction of these machines enables a wide range of customers needs to be met simply by assembling various combinations of standard units to form a complete machine.

Dieheads, Tangel & Tangar Dieheads, Coventry Chucks, Herbert Air-and Electric Chucks, Coventry Quick-change Drilling Chucks, Ground Thread Taps, Ground Thread Rolling Dies, Coventry Adjustable Reamers, Ardoloy-tipped Tools, Hypercut Lathe & Planer Tools and Coventry Gear Pumps and Fittings.

A further branch of the business is the manufacture of the Atritor-Dryer Pulveriser, a machine for drying and grinding in one operation, coal, clay, chalk, limestone, sewage sludge, gypsum and other sticky materials. The Atritor can be applied to the firing of boilers, metallurgical furnaces and kilns for cement and lime manufacture.

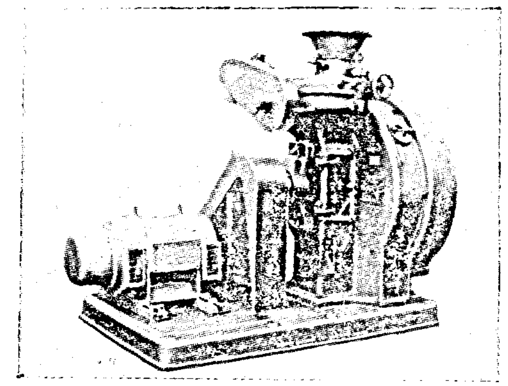


Fig. 8. Atritor Dryer-pulveriser. Grinds and dries in one operation, coal, clay, chalk, limestone, sewage sludge, gypsum and other sticky materials. Ideal for firing boilers and furnaces.

Alfred Herbert Ltd. have eight branch offices in Great Britain, associate companies in India, Australia, France, Italy and Argentina, and agents in forty-four other countries throughout the world.

They are also agents for the leading British, American and Continental machine-tool makers.

The Indian Company, Alfred Herbert (India) Ltd., is the finest organisation of its kind in the East. The head office is in Calcutta where spacious showrooms afford ample opportunity for visitors to see the latest types of Herbert and Factored machine tools. There are also branch offices in Bombay and Madras and a resident representative in Southern India.

In addition to acting as sole agents for the sale of Herbert products they represent many leading British and American machine-tool makers.

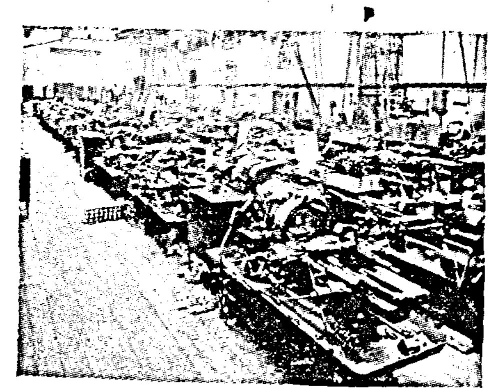


Fig. 9. Large numbers of Herbert Capstan Lathes are used in the brass shop of the British Railways works at Derby.

Workshop-trained production engineers and specialists in various machining operations are employed so that an efficient advisory service on all such problems can be given. Machines are offered complete with necessary tools and fixtures.

The territory covered by Alfred Herbert (India) Ltd. includes India, Ceylon, Burma, Siam, Federation of Malaya, Colony of Singapore, British North Borneo, Sarawak and Brunei.

When Herbert Capstan and Turret Lathes were first introduced over 60 years ago, railway engineers were the amongst the first to recognise their great advantages and have continued to install them as new and improved

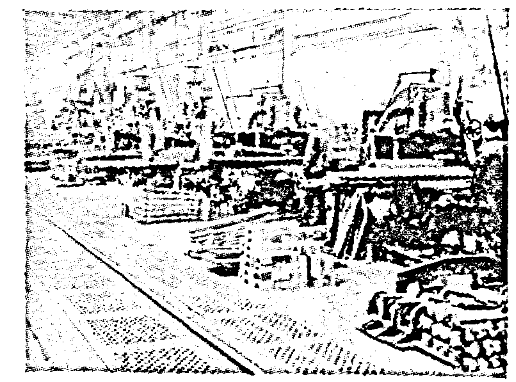


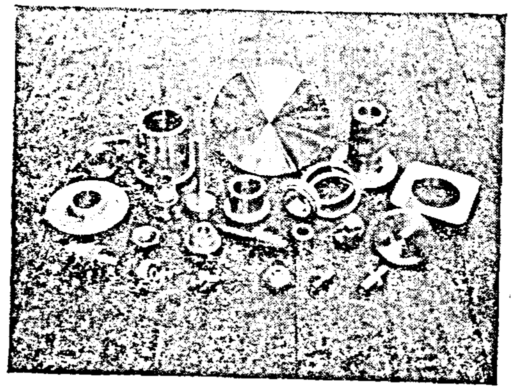
Fig. 10. Three Herbert Vertical Milling Machines installed in the Horwich works of British Railways.

designs have been evolved. The following examples are typical of the work done on Herbert lathes installed in railway workshops throughout the world.

Fig. 12 shows a Herbert No. 2S Capstan Lathe set-up for machining fire-box fusible plugs from brass castings in a total time of 1 minute each.

The casting is gripped on its square end in a Herbert 6" Air Chuck fitted with special hard jaws. The sequence of operations is as follows:—

1. Start drill, form the 60° angle and turn 15/16" diameter with tools held in a combined toolholder.
2. Drill 27/64" diameter hole.
3. Face the end and form the 5/32" wide recess with tools held in the square turret.
4. Turn external taper with tool held in a special taper turning slide.



11. Typical examples of the work dealt with on Herbert Capstan Lathes at the Derby works of British Railways.

5. Thread taper using a Coventry $1\frac{1}{2}$" Taper Threading Diehead (Thread Form is at 90° to the taper).
6. Tap $\frac{1}{2}$" Whitworth Thread.

The tooling arrangement shown in Fig. 13 is for machining Stay and rivet bushes from reeled mild-steel bar. The machine is a Herbert No. 4 Senior Capstan Lathe fitted with a hand-operated dead length bar chuck and automatic bar feed.

1. Feed out the bar to the stop.
2. Start drill with a 13/16" diameter twist drill.
3. Drill, using a patent straight flute drill having an internal coolant supply.
4. Cone the mouth of the bore with a special coning reamer.

The component is then supported by a revolving centre while the following operations are performed from the saddle.

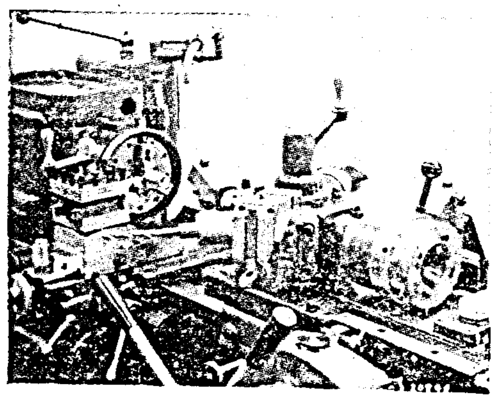


Fig. 12. Herbert No. 2S Capstan Lathe, set-up for machining fire-box fusible plugs from brass castings in a total time of 1 minute each.

5. Form the five 1.3/16" diameter grooves with a grooving tool held in the rear tool post.
6. Form the five taper diameters using a form tool held on the first face of the square turret.
7. Chamfer the back and front of the taper diameters with a tool held on the second face of the square turret.
8. Chase the five taper threads using a chaser held in the square turret in conjunction with the taper turning attachment and the leader control.

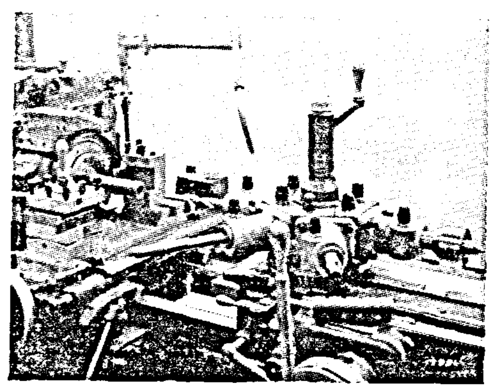


Fig. 13. Tooling arrangement on a Herbert No. 4 Senior Capstan Lathe for producing Stay & Rivet bushes from reeled mild-steel bar.

The total time per length of five bushes is 23 minutes.

The operation is completed by parting off the five bushes with a tool held on the fourth face of the square turret. The total time per length of five bushes is 23 minutes.

Fig. 14 shows a Herbert No. 2 Hexagon Turret Lathe used for machining Sling and Crown Stays from mild-steel hexagon bar, $1\frac{3}{4}$" across flats, in two operations. The machine is equipped with a 2" capacity double-toggle bar chuck but for the second operation a Coventry 9" three-jaw chuck is required. This is fitted with a special adapter and gripped in the bar chuck.

1st OPERATION

1. Feed out bar to an adjustable stop in a triple tool holder on the first turret face.
2. Centre end with a roller-steady centring tool held in the triple tool holder.
3. Start turn to 1.21/64" diameter using a step turning tool fitted with a dead centre.

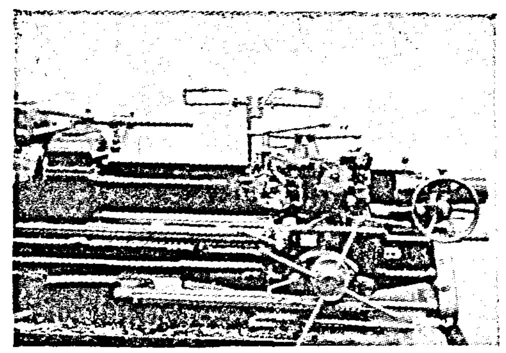


Fig. 14. Sling of Crown stays are machined from mild-steel hexagon bar on a Herbert No. 2 Hexagon Turret Lathe.

4. Turn 1.21/64" diameter up to the head of the stay with a Chip-stream Boxtool.
5. Dig in and turn the taper waist diameter, feeding away from the chuck with a special roller-steady taper turning tool.
6. Turn the parallel waist diameter, feeding away from the chuck with a roller-steady turning tool.
7. Break the corners of the hexagon bar at the back of the head with a parting-off tool, form a chamfer at the back of the head and complete the parting off. Both tools are held in a cut off slide on the second face of the turret.

2nd OPERATION

The component is gripped on the hexagon head in the Coventry chuck, previously mentioned.

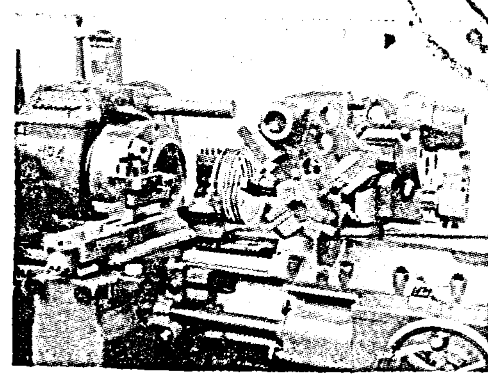


Fig. 15. Herbert No. 4 Auto Lathe, fitted with a Herbert 15" electrically-operated chuck, set up for producing piston valve head rings from an iron casting.

1. Start turn the 1" thread diameter and form the end with a roller-steady ending tool held in the triple toolholder.
2. Turn the 1" thread diameter with a chip-stream boxtool.
3. Turn the taper thread diameter and chamfer the hexagon head with a special roller-steady taper turning tool.
4. Cut the 11 T.P.I. taper thread and the 1"—11 T.P.I. parallel thread simultaneously, using $1\frac{1}{2}$" taper threading diehead mounted in the bore of 2nd turret face and a $1\frac{1}{2}$" CH Diehead held in the long stay attachment.

The total time taken was $9\frac{1}{2}$ minutes for the first operation and $4\frac{1}{4}$ minutes for the second operation.

Fig. 15 shows an interesting method of producing piston valve head rings from an iron casting. The machine is a Herbert No. 4 Auto Lathe fitted with a Herbert 15" electrically-operated chuck, the sequence of operations being as follows:

1. Rough turn the 10" diameter and rough bore the $8\frac{3}{4}$" and 9" diameters.
2. Finish bore the 9" diameter and finish turn the 10" diameter.
3. Chamfer the inside corners of the rings and rough face the end using tools mounted on a slide facing toolholder operated by a pusher on the front cross slide.

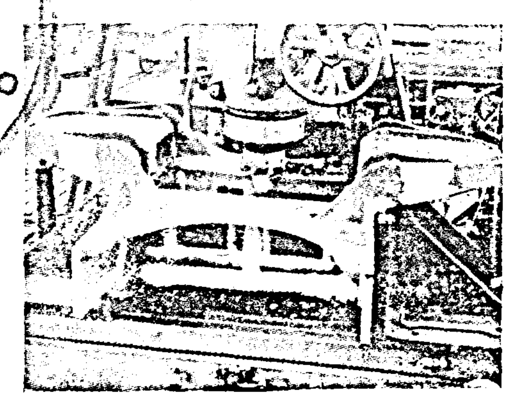


Fig. 16. Machining a cast-steel bogie centre on a Herbert No. 28V Vertical Milling Machine.

The operation testifies to the rigidity of the machine on heavy work and the finish obtained, using Ardoloy-tipped cutters, is of a better standard than that of corresponding work machined with high-speed tools.

3A At the same time as 3 finish the end face.

4. "Catcher" moves forward into the bore.

4A At the same time as (4) part-off the rings with tools held on the rear cross slide.

In this way six rings are produced for one cycle of the turret the total time taken including chucking being 16 minutes.

A good example of the use of Ardoloy Tools in the railway workshop is shown in Fig. 16.

The machine is a Herbert No. 28V Vertical Milling Machine, the component a cast-steel bogie centre.

The overall size of this casting is 5′ 4″×4′ 7″ and it is necessary to reset the casting on the machine table for machining each surface.

Four surfaces are machined having a total area of 696 sq. ins. The stock removal on each surface is approximately 5/16″ and despite its outsize in dimensions and weight the component was handled on this machine in characteristic style.

The operation testified to the rigidity of the machine on heavy work and the finish obtained using Ardoloy-tipped cutters is of a better standard than that of corresponding work machined with high-speed tools.

The success of the Herbert organisation is largely due to the efficient service available both before and after sales.

Workshop-trained production engineers give advice on machines, tooling equipment and methods for the most economical production of any desired work.

The most suitable machines are offered with all necessary tools and fixtures and reliable estimates of production are given.

Demonstrators attend customers works to give assistance and advice to operators and service engineers call periodically to ensure satisfactory results.

An efficient and prompt spare parts service is also available.

(By Courtesy : IRWM)

HARNICK—HYDRAULIC DIAMOND DRILL

Completely automatic pressure regulation is a function of the Hydraulic Brain in the drill feed. This amazingly simple mechanism "knows" when to increase or decrease the feed pressure according to the hardness of the materials being drilled. The main cylinder, which supplies uniform drilling pressure hydraulically, is fed through an orifice in the automatic oil control valve. The valve equalizer diverts oil through a by-pass when harder rock is encountered. The harder the rock, the greater the flow of oil through the by-pass; consequently the decrease of oil pressure in the main cylinder results in decreasing the feed pressure applied to the bit. The inverse is true when meeting softer rock. As the rate-of-descent increases, the flow of oil through the by-pass lessens; the cylinder pressure then builds up to the normal operating range for the feed control setting.

Another function of the Hydraulic Brain is to limit the spindle stroke as it nears the extent of its travel. This important safety feature affects spindle "feed" as well as "return" thereby removing hazards associated with screw-feed machines should the operator neglect to exercise customary care.

The electrifying performance of the Hydraulic Brain combined with the ruggedness and precision of the entire drill mechanism, provides the most revolutionary development in drilling techniques of recent years!

BENRATH MACHINE TOOLS

TYPE "HAK" HIGH PRODUCTION DYNAMIC BALANCING MACHINE

THE Type "HAK" Machine is the only type embodying its design from the simplest mathematical principles. This enables it to head that class of production types used in the workshop and operation by unskilled labour. As its name implies, it is intended for use on quantities of the same part to be balanced yet possesses versatile qualities for odd workpieces.

Being of the cradle type construction, more than two bearings for supporting the work to be balanced can be fitted such as in the case of a Crankshaft. This is of particular importance, since distortion due to its own mass is completely avoided and does not affect the final balancing result.

The same type of construction is also necessary for the balancing of Railway Traction Armatures and the likes, in which the bearings are situated inside the windings and the cooling fan. Special bearing housings with snouts for accommodating the bearings are simply arranged for, thus supporting the Armatures in the most ideal way.

Chief users of this type of machine are manufacturers of Crankshafts for motor-car engines and Diesel engines, Cardanshafts, Electric Motors, Wood-working Machines, Pump Impellors, Cylinders and Rollers of all kinds.

BALANCING PRINCIPLE AND METHOD

The compensating plane passes directly through the fulcrum of the Machine, thus requiring only two simple balancing operations which is the least number possible to obtain dynamic balance.

Two balancing planes I–I and II–II are pre-selected in which it is convenient to add or remove metal.

The part is inserted in the Machine and the top cradle positioned so that the first balancing Plane I–I is directly in line with the fulcrum. The first balancing operation is effected by finding the direction and amount of unbalance to compensate on Plane II–II. For balancing in Plane I–I the cradle is moved to position the second balancing Plane II–II in line with the fulcrum, and compensation made in Plane I–I. While this is the normal method of balancing, it may not be possible in some cases to bring Plane II–II in line with the fulcrum, but this is not necessary and complete instructions are given in the Working Instruction Book.

Each balancing operation is such that the workpiece is driven up to a speed in which the maximum vibrations occur, on a Precision Dial Clock. A variable speed motor is employed either from Direct Current supply or Alternating Current supply. In the case of Direct Current supply the Control Panel should be fitted with a face-plate starter, a regulator having between 40 and 60 contacts and a vernier regulator having about 10 contacts. In the case of Alternating Current it should be of the commutator type motor, operator either through an Induction Regulator or by mechanical movement of the Brush Gear. The balancing speed which may be varied to suit any workpiece usually lies between 600 r.p.m. and 1,200 r.p.m., but lower and higher speeds are possible. Positive synchronously revolving counter-weights, adjustable in amount from nothing to a maximum, and as regards augular position around 360° are adjusted by means of Stationary Handwheel so that the forces created by these weights oppose centrifugal forces in the workpiece to be balanced, causing the vibrations to cease which are indicated on the Precision Dial Clock. These actual weights will never vary over the life of the Machine with use, age, temperature, etc., thus enabling the Machine to give continued and permanent accuracy.

A comprehensive Instruction Book is supplied with every Machine.

BALANCING TIME

The time required to balance any workpiece can be analysed as follows:—

(a) Time required to insert workpiece in Machine and to remove it again.

(b) Time required for starting Machine, driving up to speed and stopping again.

(c) Actual balancing time, this time for finding direction and amount of unbalance.

(d) Time required for making compensation of unbalance found.

Times a, b and d are dependent entirely on the operator, the type of workpiece and the provisions made locally.

Time c is 10—20 seconds on the smaller Machine and may be up to 30 or 40 seconds for each balancing plane in more complicated cases and on the larger sizes of Machines. We would state that the Machines are designed in such a manner that operations take only an absolute minimum of time.

BALANCING ACCURACY

The accuracy obtainable depends to a certain extent on the machining accuracy of the workpiece to be balanced, since balancing means measuring the displacement of the centre of gravity from the true axis of rotation. These radial displacements which can be detected on our Machines vary from 0.001 millimeters (.00004") to 0.003 millimeters (.00012"), according to type and size of Machine. At any rate our Machines are designed to give, and are quite capable of giving a considerably higher accuracy than is usually required in practice.

COMPENSATION OF UNBALANCE

Compensation of unbalance has no direct connection with the design of the Balancing Machine itself, with the exception of a few very specialised cases. Every designer of machine parts which require balancing should consider it an important point to make suitable provision for the quick and easy removal of unbalance, so that the advantages gained by the installation of an up-to-date Balancing Machine are not offset by slow and inefficient method of compensation.

DESIGN

These Machines have been developed for workshop use and are made of the best materials available. They are designed in such a manner that they give not only quick results but that the operation is the most simple and that the results obtained remain permanently accurate.

The Bedplate carries all the integral parts of the Balancing Machine, being of substantial and well ribbed design.

The Bottom Cradle is supported on two highly sensitive fulcrum bearings, the free end supported on interchangeable balancing springs.

The Top Cradle is adjustable along the Bottom Cradle, the former carrying the Balancing Head and the work to be balanced on either Open Type Universal Bearings or Closed Type Bearings. Movement of the Top Cradle along the Bottom Cradle is effected by Crank through Rack and Pinion, and unclamping and clamping of the Top Cradle to the Bottom Cradle is by a short crank movement operated by Crank through Springs. When the Top Cradle is in the unclamp position it rests on Ball Bearings, thus being easy to move and avoiding any wear on the slides.

The Balancing Head incorporates the complete measuring mechanism. It consists of Driving Pulley keyed to the main Driving Spindle this running in Precision Type Ball Bearings. Fastened to this same Spindle is the Driving Holder which carries the Driving Plate which constitutes the drive of the work to be balanced. Keyed on Spindle is the Sun Wheel which drives Sun Wheel through Planetary Gears. Reduction Gears make the final drive to Gear, which is fixed to the Weight Slide. This Weight Slide carries the positive Balance Weight which is fixed to Rack, this Rack being adjustable along Slide operated from Handwheel through Circular Rack and Pinion to Rack. When the Weight is in its innermost position the whole Balancing Head is in perfect balance. Thus to increase the amount of unbalance in the Head, Handwheel is turned which moves Rack forward turning Pinion round in its Bearings which moves Weight out through Rack. This of course is done during rotation of the Balancing Head which is coupled to the work to be balanced.

To obtain the direction of unbalance, Planetary Carrier is operated by hand and the Gears are in such a ratio that one turn of the Planetary Carrier advances the Weight Slide one complete turn ahead of the Driving Pulley which in turn is directly connected to the job to be balanced. Planetary Carrier has the Friction Brake fixed in a convenient position, the pressure of this being such that it can be easily turned by hand and yet does not slip.

For setting the direction of unbalance, Weight Slide has an Index Line marked on it and when the work

has been balanced and the Machine stopped, Pulley is turned by hand until this Index Line shows on the corresponding Index Line marked on Transparent Cover. This is arranged so that the true unbalance position comes on the horizontal centre line. The amount of unbalance is immediately read on the scale fixed to Slide Bracket this scale being calibrated in inch-ounces and frictions thereof.

Operation is such that the Machine is run up to resonance speed which speed gives the maximum vibrations caused by the unbalance in the job and Handwheels turned by hand until the vibrations cease. This is a matter of a few seconds only. Extremly accurate balancing results are obtained, and due to the simplicity of the design, the Balancing Head is entirely trouble free, keeping its accuracy over the life of the Machine.

Clamping and unclamping of the Head on the top frame is quickly effected by means of a short crank movement and another handwheel movement is provided for axial movement of the Head along the frame for coupling purposes.

The Coupling for connecting the Balancing Head to the work to be balanced is normally in the form of a simple sleeve, one end to fit the spindle end and the other slotted to engage with a driving plate in the Balancing Head. Usually it is supplied by the customer and the design depends on the particulars of the workpiece.

The indicator Stand carries the Precision Dial Clock for indicating the existence of vibrations and a recording indicator is also fitted for taking diagrams of vibrations.

The Bearings for carrying the workpiece can be located in any position on the top cradle and are supplied in various executions to suit the different needs. For high precision balancing it is advisable to use the actual bearings of the individual workpiece.

The Closed Type Bearing is used where highest accuracy is required. Adaptor rings are simple construction to take either the sleeve type bearing or ball and roller bearing design.

The Open Type Universal Bearing will take any diameter required from the minimum and maximum diameters laid down by means of a simple screw adjustment. A Guage is supplied for setting to the exact diameter. This type of bearing is very useful for high production, since loading time is only a matter of seconds.

The Balancing Spring serves only for the amplification of unbalance, and is *not* used for measuring. Any change of state in the Spring only means a change of speed, which does not interfere with the balancing accuracy and the spring, therefore, lasts the life of the Machine and does not require renewing. The strength of the Spring and its natural frequency determine the balancing speed of the workpiece, and within reasonable limits the balancing speed for any particular workpiece may be selected by using the appropriate spring. Two or three Springs, covering the full range of the Machine are supplied with Standard Accessories, interchanging being easy and quick.

The Driving Arrangement consists of the motor with Cardanshaft, Main Drive Shaft and Endless Belt. The main drive shaft runs in specially selected highly accurate ball bearings and is of ample dimensions to avoid distortion during balancing. The Cardanshaft is equipped with joints which permit angular and axial alignment without interference with the high sensitiveness of the Machine.

ABRIDGED OPERATING INSTRUCTIONS

(1) Insert workpiece into Machine.

(2) Start Motor and drive to resonance speed.

(3) Turn handwheels for amount and direction of unbalance until vibrations disappear.

(4) Stop Machine and note amount and direction of unbalance.

(5) Move top cradle to second plane.

(6) Start Motor and drive to resonance speed.

(7) Turn handwheels for amount and direction of unbalance, until vibrations disappear.

(8) Stop Machine and note amount and direction of unbalance.

STANDARD ACCESSORIES

One Precision Dial Indicator Clock.

One Set Balancing Springs to cover the whole range of the Machine.

One Set Bearings, either closed type or open Universal type.

One Endless Driving Belt.
One Guage for marking direction of unbalance.
One Instruction Book.

SPECIAL ACCESSORIES (Additional charge)

Complete Electrical Equipment consisting of Motor and Control Gear.
Special Slide Rule.
Special Vector Chart.
Additional Driving Belt.
Driving Couplings.
Additional Bearing Bridge.
Adaptors for Closed Type Bearings.

SEMI-AUTOMATIC RAILWAY WHEEL SET BALANCING MACHINE

The existing machines, apart from ours, are more or less built on a very elementary basis, without a thorough knowledge and study of the problems of dynamic balancing. For this reason we employed our vast experience, gained on production balancing of motor car parts, such as crankshafts and flywheels as well as electric armatures and rotors, etc., for the design of a Wheel Set Balancing Machine, and we built a machine capable of fast and extremely accurate work.

It is not, of course, essential that you should balance to absolutely the last limit which the machine is capable of indicating, but you can lay down limits of accuracy just the same as you do when employing gauges or micrometers during machining in your Works at present. If you want to work to certain limits you must have equipment measuring more accurately than the limits which you have laid down for machining.

Collectively we would express the chief points of our machines of this type as follows :—

(1) Maximum accuracy, as positive counterweights are used in the Balancing Machine for the detection of direction and amount of unbalance, exactly as positive weights are used on any pair of precision scales for weighing purposes.

(2) Lasting accuracy, as the weights are unaffected by age, temperature, wear, etc.

(3) Reliability of results, as upon in accurate setting of the weights by the operator the vibrations on the dial clock would simply not cease, and the man would have to continue adjusting the weights until they opposed the unbalance to 100% in direction and amount, when the dial clock will show a stationary needle, i. e., no more vibrations.

(4) Maximum output, as the most modern balancing principle is employed with one pre-selected compensating plane in the fulcrum of the machine, which makes the balancing two distinct and accurate operations. The semi-automatic balancing apparatus, with fine adjustment handwheel for the setting of the compensating weight at will, requires only a few seconds for the correct setting of this weight to oppose the unbalance entirely.

(5) Unskilled young labour, as the operation of the machine is extremely simple and can very easily be learned.

(6) Suitability for fastest mass production as well as single workpieces every time of varying sizes.

(7) Extreme sensitiveness, so that precision work can be done on the machine on a production basis.

(8) Maximum life of the machine, as all fast moving parts are running on interchangeable precision ball bearings.

Point (4) requires further explanation and in this connection we refer to the old balancing principle which has been employed on almost all Balancing Machines in the past, i. e., the bearings of the job acted as fulcrum, and since for dynamic balancing two operations are, of course, essential, the two bearings act alternatively as fulcrum ; the result is that the unbalance affecting both compensating planes is acting during each reading, so that not two distinct operations but a long sequence of operations is required to obtain final and perfect balance.

The simplified balancing method is a very simple method of balancing on our machines, in which the machine has the fulcrum in one of the two compensating planes and not in the bearing of the job to be balanced.

The result is that after the first balancing operation the unbalance left is reduced to one single force acting distinctly in the balancing plane which happened to be in the fulcrum of the machine during the first operation. It is then possible to either move the fulcrum of the machine as is done in our smaller machines, or to reverse the job in the balancing machine, which is done in our Railway Wheel Set Balancing Machine on account of the fact that railway wheel sets are symmetrical. The balancing principle is, however, not affected by this reversing of the job and simplified balancing method of the calculations quite meets the case.

We would mention shortly a few further points which deserve consideration, and these are :—

(*a*) The balancing spring is not used for measuring the unbalance and neither do we use the amplitude of vibrations for measuring unbalance since such methods are never constant or accurate on account of variations occurring gradually in springs under use on account of varying load on the spring, etc. The balancing springs are solely used for magnification purposes, i. e., to create proper resonance conditions. Since under varying load also the resonance period varies slightly, our machines are equipped with variable speed driving motors, variable in extremely fine steps so as to enable driving of the workpieces properly in resonance.

(*b*) To enable fast work we recommend the fitting of a speedometer so as to enable driving to the same speed quickly during repetition work ; fine variations in speed being possible, of course, and the indicator dial can be used for setting the resonance in the machine accurately.

(*c*) The positive weights for compensating the unbalance in the work to be balanced are used in preference to other methods, such as magnetic resistance, calibrated springs, etc., since contrary to those designs mentioned, the positive weight is unaffected by temperature, age, use, etc., and balancing is made more of a weighing process under revolving conditions, in a similar manner to the normal weighing on precision scales.

(*d*) Our machines reduce the oscillations in one plane, i. e., we are preventing circular oscillations for a number of reasons, which reasons it is quite difficult to give in an abridged form ; we merely content ourselves with stating that balancing under use of a single spring with oscillations in one plane only is enabling higher accuracy, quicker work and, incidentally, also a design at the lowest expense.

DESCRIPTION

The rigid machine bed carries on two uprights the well ribbed and carefully calculated machine cradle which cradle rests in specially selected ball bearings and is supported on the front end by an interchangeable balancing spring. The machine cradle, which is of semi-steel, has cross braces of steel to prevent side vibration. Along the top there are Tee Slots which serve for locking the bearing bridges and balancing apparatus in position.

The bearing bridges which are of cast steel, are fitted with adjustable blocks which in turn carry the actual balancing bearings consisting of floating rollers which can be set for any diameter of journal on the shaft to be balanced. The rear bearing bridge carries an axial stop with floating washer for axial location of the wheel set. The bearing bridges can be adjusted to any position required along the machine bed.

The balancing apparatus which rests on the front end of the bed is axially adjustable according to the length of axle of the wheel set to be balanced, and also for the coupling purposes by means of a large handwheel through racks and pinions. A quick clamping device serves for quick clamping and unclamping of the apparatus on the machine cradle by means of a single lever. The balancing apparatus contains a live weight which moves along a side and thereby produces centrifugal forces of varying amount. If this weight is moved into the central position of the apparatus no unbalance is created, whereas by moving from the centre of the balancing apparatus, the unbalance can be increased as regards amount at will. The phase of the weight, i. e. angular position can be adjusted in relation to the driving pulley with fixed driver pins around 360 degrees by means of a second stationary handwheel on the apparatus, so that it is possible to adjust the unbalance weight incorporated in the balancing apparatus as regards direction and amount of unbalance to oppose the unbalance in the wheel sets to be balanced, until the effect of the unbalance is counteracted entirely, when vibrations in the machine cradle cease entirely.

An indicator dial clock is provided to indicate the existence of vibrations, the amplitude, etc.

The driving motor is fitted to the rear end of the machine cradle and is directly coupled to the main drive shaft, the open end of which runs in a specially selected ball bearing.

The driving pulley on this drive shaft drives the large driving pulley on the balancing apparatus through vee ropes.

A Brake with interchangeable wooden blocks for breaking purposes is fitted to the centre of the machine. Operation of the brake is by means of a lever which, when depressed, lifts the brake block against the circumference of the wheel.

A speedometer is provided to indicate the balancing speed throughout the operation.

The Electrical Equipment is required for infinite speed variation within a given range.

BALANCING PRINCIPLE

The machine is designed in such a manner so as to enable one of the two pre-selected compensating planes (which planes are lying in approximately the centre of each wheel) to pass through the fulcrum point of the machine. By this method the unbalance forces are divided into two distinct forces which can be compensated directly by one weight each, and one single measuring process only for each of the two planes is necessary thus enabling fast and highly accurate balancing. A centre point on the machine indicates the neutral plane, i.e., the plane of the fulcrum of the machine.

METHOD OF OPERATION

Insert one wheel set into the balancing machine after bearing bridges have been set to the correct diameter of journal. The bearing bridges should then be set so that the inner rollers run against the inner shoulders of the journal to prevent excessive movement. One of the wheels should also pass through the centre of the balancing machine, i. e., through the fulcrum point marked on the machine.

Put driver disc on to open end of journal and give slight turn to close. Move balancing apparatus by means of handwheel up against driver disc to couple by means of two pins provided inside the driver disc on the balancing apparatus.

Start driving motor and regulate speed by means of regulator wheels on starting equipment to speed in which the maximum vibrations are shown on the dial clock in the machine. Turn handwheel at the end of the apparatus which adjusts the amount of unbalance until the vibrations on the dial clock reach a minimum. Now turn small handwheel in front of the apparatus slowly which alters the direction of artificially produced unbalance in relation to the actual unbalance in the wheel set until the vibrations in the dial clock cease entirely. This proves that the artificially introduced unbalance is equal as regards amount and phase to the actual unbalance in the wheel set.

Stop the balancing machine by means of the electric regenerative brake acting on the motor, and the independent mechanical brake acting on the tyre of the wheel in the centre of the balancing machine.

Turn wheel set with coupled balancing apparatus until unbalance in the apparatus is in a horizontal line, and mark by means of gauge supplied the unbalance on the wheel set as regards radial direction and amount. Unclamp balancing apparatus by means of single lever movement, and uncouple apparatus from work by a short turn of the large handwheel.

Take off driver plate.

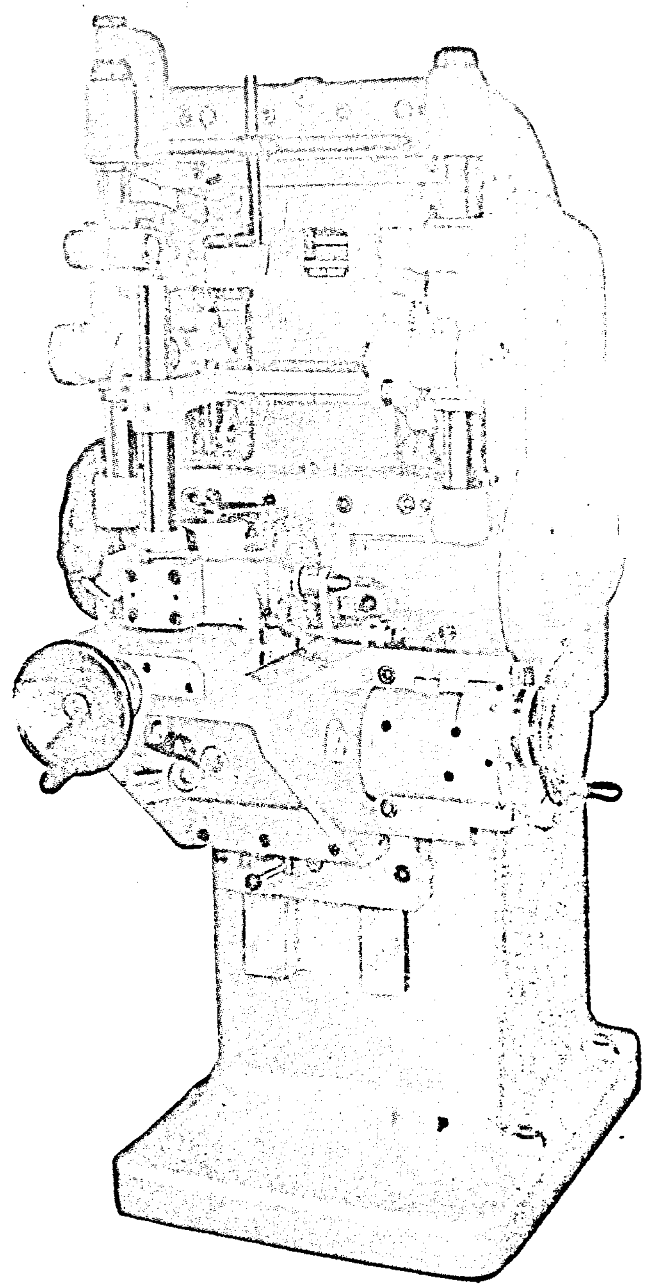
Reverse work in machine and repeat the first-mentioned operation for the second wheel.

After the work has been balanced in both planes and has been taken out of the machine, independent workmen can fit the compensating weights.

SPECIFICATION

	Size I
Maximum weight of wheel sets to be balanced, approximately	2—3 tons.
Maximum overall length of axle	100"
Maximum distance between tyres	64"
Minimum distance between tyres	39"
Maximum diameter over flanges	52"
Maximum diameter of gear wheel or crank that will swing on account of centre base in any position	16"
Horsepower of Motor	10
Speed of Motor	570/1425 r.p.m.
Nett Weight	11,200 lbs.
Gross Weight	14,000 lbs.
Measurements of Case	15 ft.×9 ft.×5 ft.

NASSOVIA-THIEL 32, st



DRIVE

Flanged motor to drive the hydraulic gear unit. Switching on and off through the medium of a motor protection switch.

HYDRAULIC GEAR UNIT

Hydraulic gear unit for lifting and swinging movement of the shaping tool (slotting tool).

LIFT STROKE MOVEMENT

Lever gear produces the straight-line lift movement of the shaping tool; adjustability of stroke: 50 – 150 mm. at the adjustment spindle.

SWING-OVER MOVEMENT

Lever gear produces the swing-over movement of the shaping tool after complection of the straightline lift movement; the swing-over movement can be set as required 0—90° at the adjustment spindle even when the foot does not require a radius.

PUNCH FORMING AND SHAPING MACHINE WITH SLOTTING ATTACHMENT

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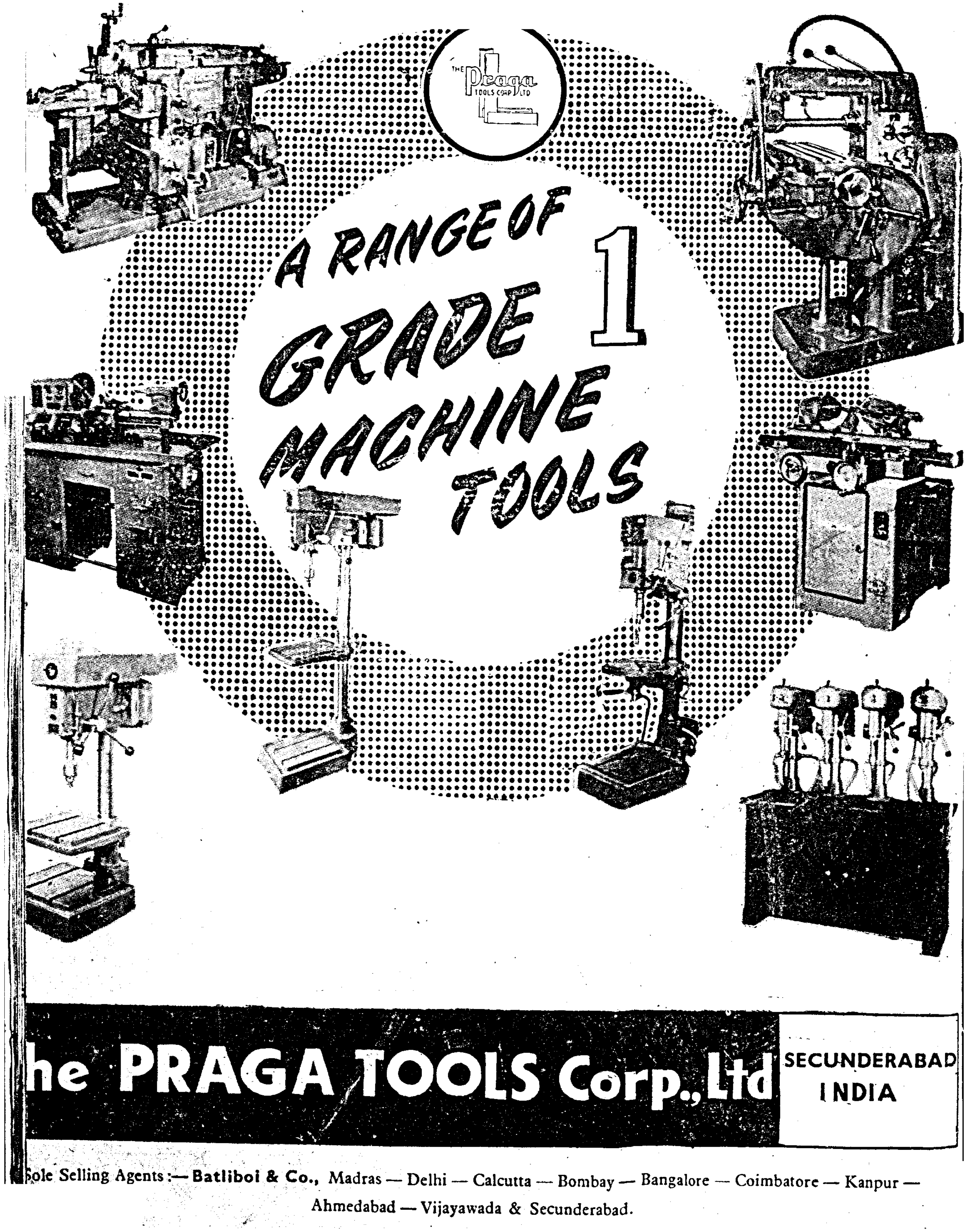
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