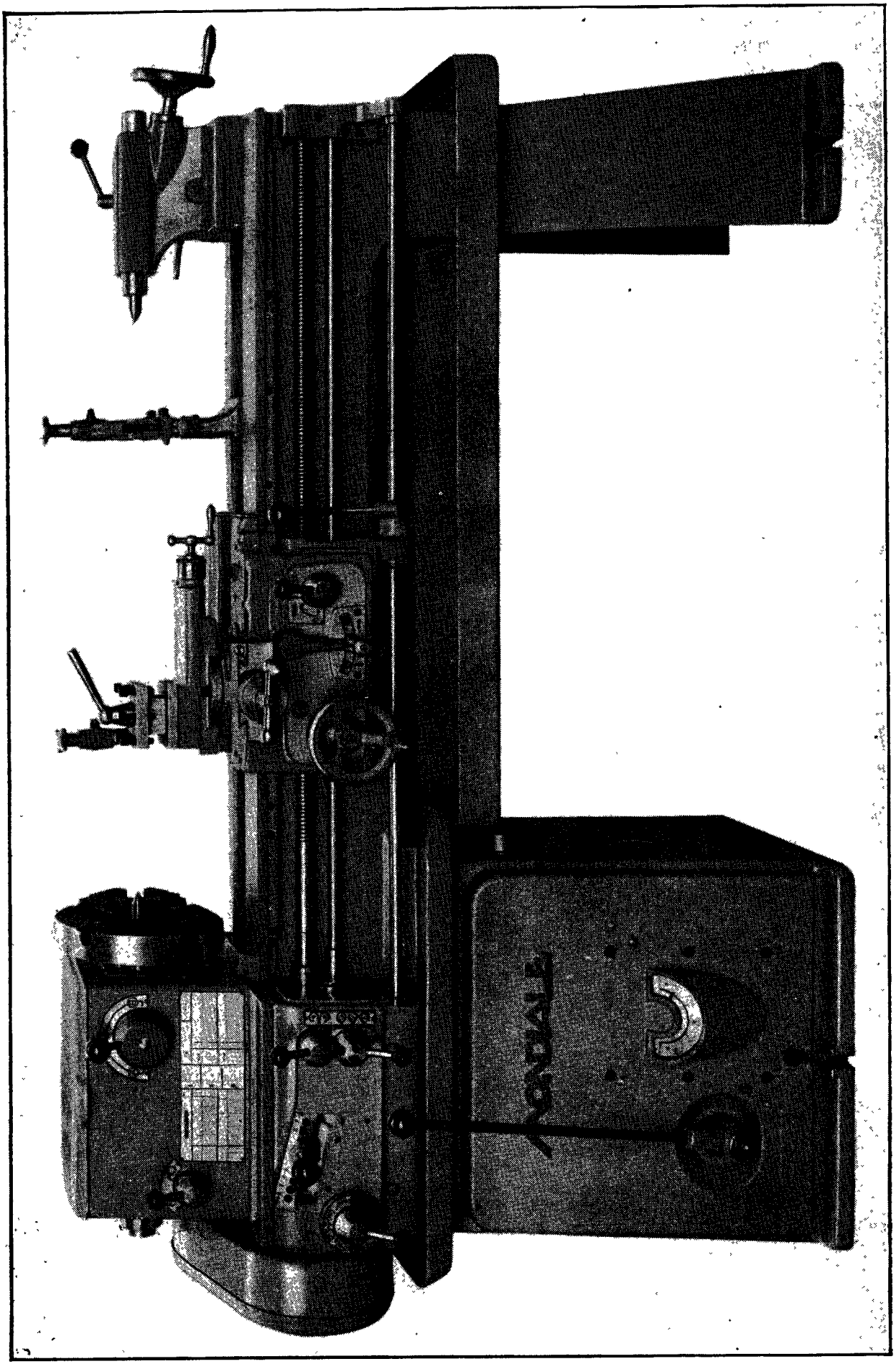


Fig. 8.

SPECIFICATION OF THE « L-1 » LATHE

TYPE OF LATHE		AL-1	BL-1	CL-1	DL-1
Height of centres	Inches	7"	7"	7"	7"
Between centres	Inches	20"	30"	40"	60"
Swing over bed	Inches	14"	14"	14"	14"
Swing over cross slide	Inches	8" 3/8	8" 3/8	8" 3/8	8" 3/8
Swing in gap	Inches	—	20" 3/4	20" 3/4	20" 3/4
Width of gap	Inches	—	7"	7"	7"
Bar capacity through spindle	Inches	1" 3/8	1" 3/8	1" 3/8	1" 3/8
Spindle speeds :					
without back gears	r.p.m.	all speeds from 150 to 900			
with back gears	r.p.m.	all speeds from 37,5 to 225			
Morse taper in spindle nose	N°	5			
Spindle nose thread		60 metric threads 5,5 mm. pitch.			
Tailstock Morse taper	N°	3			
Maximum traverse of tailstock spindle	Inches	4" 3/4			
Traverse of tailstock spindle for one revolution of handwheel	Inches	3/16"			
Setting over of tailstock on each side of centre line	Inches	3/8"			
Pitch of leadscrew		4 T.p.I.			
Screw cutting range :					
Metric	mm.	0,25 to 7 mm. pitch.			
Whitworth		56 to 2 T.p.I.			
Range of feeds :					
Sliding	Inches	.00197 to .1260			
Surfacing	Inches	.00095 to .0630			
Maximum traverse of saddle	Inches	16" 3/8	26" 3/8	36" 3/8	56" 3/8
Maximum traverse of cross slide	Inches	9" 1/2	9" 1/2	9" 1/2	9" 1/2
Pitch of cross slide screw	mm.	5			
Maximum traverse of tool slide	Inches	4" 3/4			
Angle of rotation of tool slide		90°			
Pitch of tool slide screw	mm.	3,5			
Weight of lathe in working order	Lbs	1389	1499	1543	1654
Power of motor	kw.	1			
Electric current		3 phases 220/380 V. 50 c.			
Speed of motor	r.p.m.	1450			
Spindle V belts		2 of 1/2" × 5/16" × 33" pitch length.			
Variable speed unit V belts		5 of 1/2" × 5/16" × 33" pitch length.			

I. — INSTALLATION OF THE LATHE

TRANSPORT.

According to the mode of shipment, your lathe will reach you packed either in a case (sea packing) or in a crate.

In any case, the machine is fixed on two wooden beams which brace the legs.

In order to avoid any difficulty when the machine is received, we recommend the following :

1° If the case or crate must be handled by lifting tackle such as pulley block, crane, etc., do not use hooks, but a wire rope passing under the case, and consequently under the beams;

2° Unpack the lathe immediately in order to find out its condition and eventually to make in due time the necessary reservations to the transporter;

3° Leave the lathe on the beams in order to be able to move it on rollers to its final place;

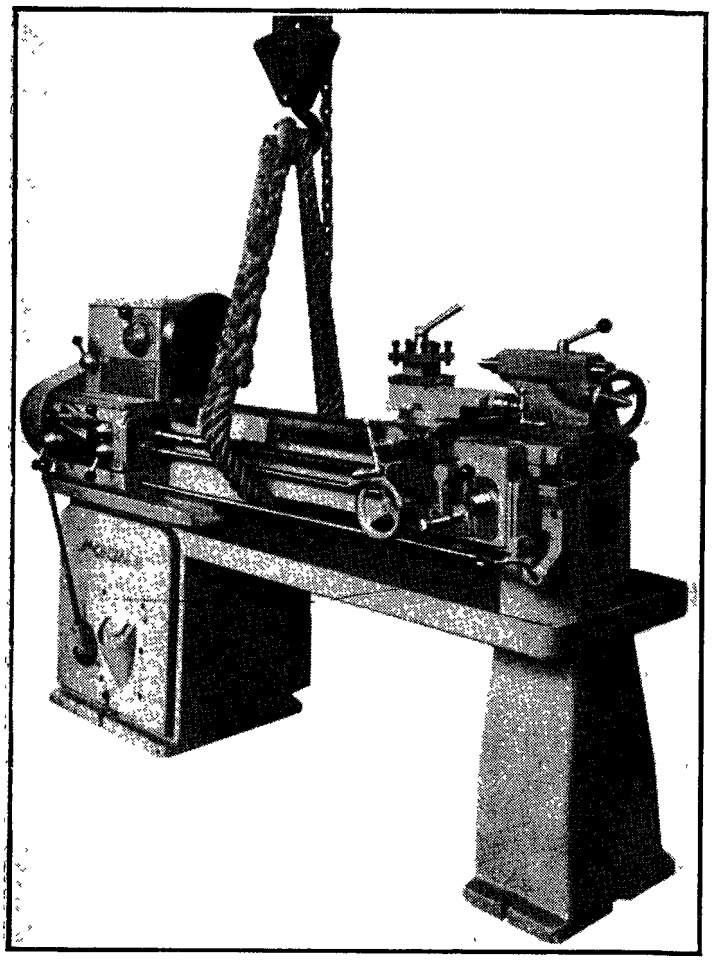


Fig. 9.

4° If the lathe must be handled again after it has been unpacked, we advise :

a) To use a hemp rope rather than a wire rope;

b) Take care that the rope does not foul any fragile part of the machine such as the leadscrew;

c) To prevent this, use wooden blocks against the bed (fig. 9);

d) Lift the lathe under the bed, just against the front leg; the machine can be balanced by moving the carriage and tailstock.

SELECTING THE PLACE.

When selecting the place where your lathe will be installed, it is necessary to bear in mind :

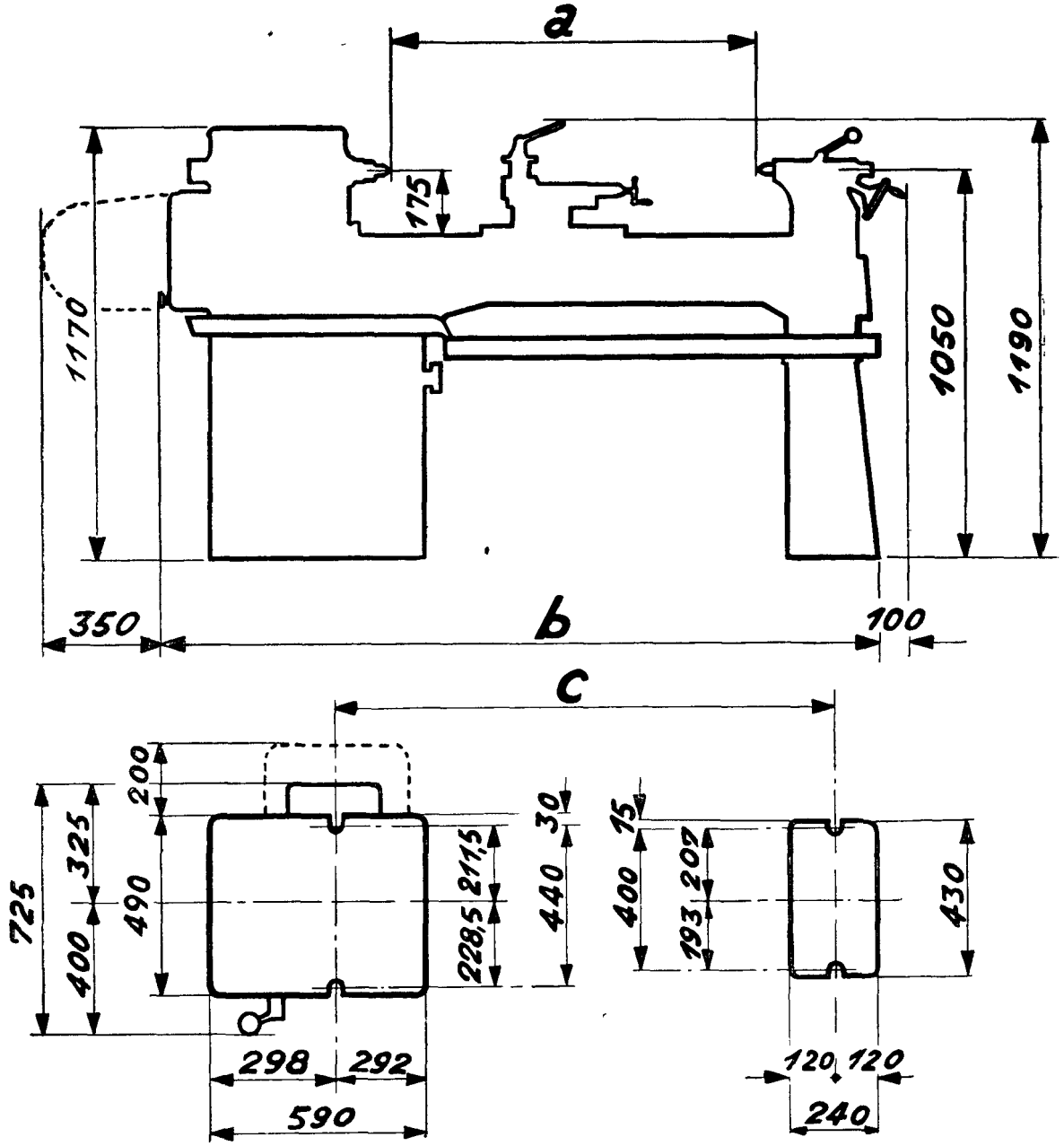


Fig. 10.

Types	AL-1	BL-1	CL-1	DL-1
a	500	750	1000	1500
b	1460	1710	1960	2460
c	888	1138	1388	1888

The measurements are given in millimeters.

See in appendix the table of equivalents.

1° The work for which the machine will be used such as the passage of bars through the spindle;

2° The necessities of maintenance and dismounting. For instance, easy access to the swing frame end, to the rear cover of the front leg for the motor inspection.

Figure 10 gives the overall dimensions and the location of the holes for fixing the « L-1 » lathe.

FOUNDATIONS AND LEVELLING.

The foundations of your lathe should be prepared as follows :

1° The ground should be stable, not liable to sink and not subject to trepidations;

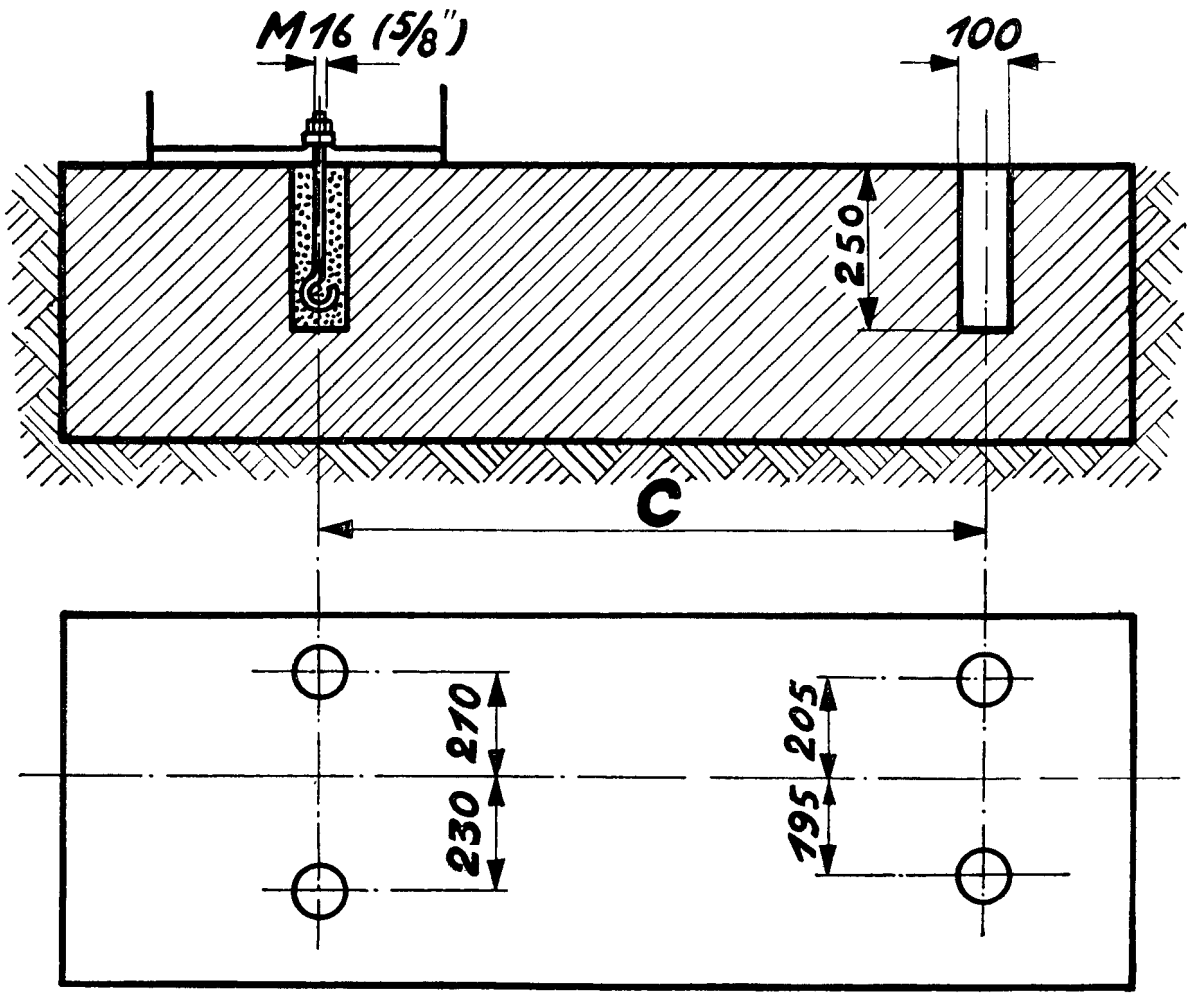


Fig. 11.

2° Should this not be the case, a cement foundation of sufficient depth should be established as shown on figure 11;

3° Bring the lathe only when the cement is perfectly dry.

As a perfect levelling of the machine is necessary in order to maintain the precision of the lathe, the following instructions should be adhered to :

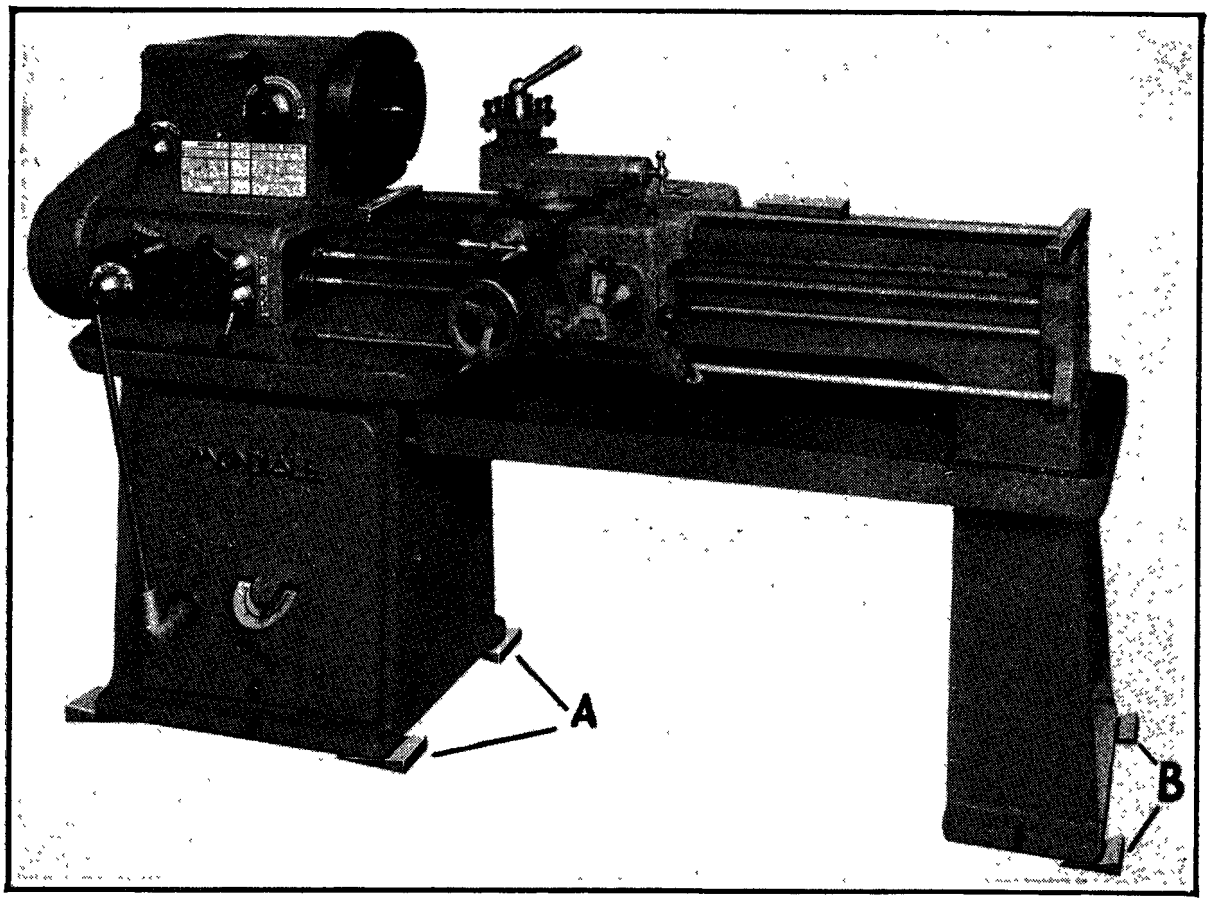


Fig. 12.

1° Let the lathe rest on six steel wedges placed under the four corners of the front leg and under the two back corners of the back leg (fig. 12);

2° Place the foundation bolts with the nuts screwed on, in the holes provided for.

The levelling of the machine will then take place as follows :

1° Level approximately by moving the two wedges A and the two wedges B;

2° Finish levelling by moving the six wedges.

The lathe should then rest on the six wedges.

We also call your attention to the fact that :

1° The spirit level must have a sensitiveness of 0,02 mm. per meter at least;

2° The differences on the bed must not exceed 0,02 mm. per meter both longitudinally and transversally;

3° For levelling the bed longitudinally, place the level on the flats of the bed; for the transversal levelling, place the level across the flats of the Vs (fig. 12).

EMBEDDING.

We recommend the following method, which is very simple and gives excellent results for our lathes :

1° Build a frame round the lathes'legs, in which a layer of good cement 1" thick will be grouted; the cement will penetrate under the legs and support them all round;

2° Make sure that the holes for the foundation bolts are filled;

3° After the cement has completely set, tighten the foundation bolts nuts progressively and check the level again at the same time.

CLEANING.

For the cleaning of your lathe we advise the following procedure :

1° Remove the antirust varnish or the grease protecting the machined parts, using petrol or paraffin;

2° Do not touch the painted parts which will become bright by rubbing with a greasy soft rag;

3° Remove the excess of grease on the leadscrew, using a very clean rag;

4° Immediately after cleaning, pass a greasy rag on all bright parts to prevent rust.

ELECTRICAL CONNECTIONS.

Unless specified otherwise, the lathe is equipped with a 220/380 volts, three phase, 50 cycle, 1 kw motor and reversing switch. Connection to the main supply should be made in accordance with the indications of figure 13.

We supply the metal protected cable inlet through the lathe leg, to the reversing switch, and the connection between motor and reversing switch.

Our diagram indicates :

1° The electrical supply;

2° The three pole switch with fuses;

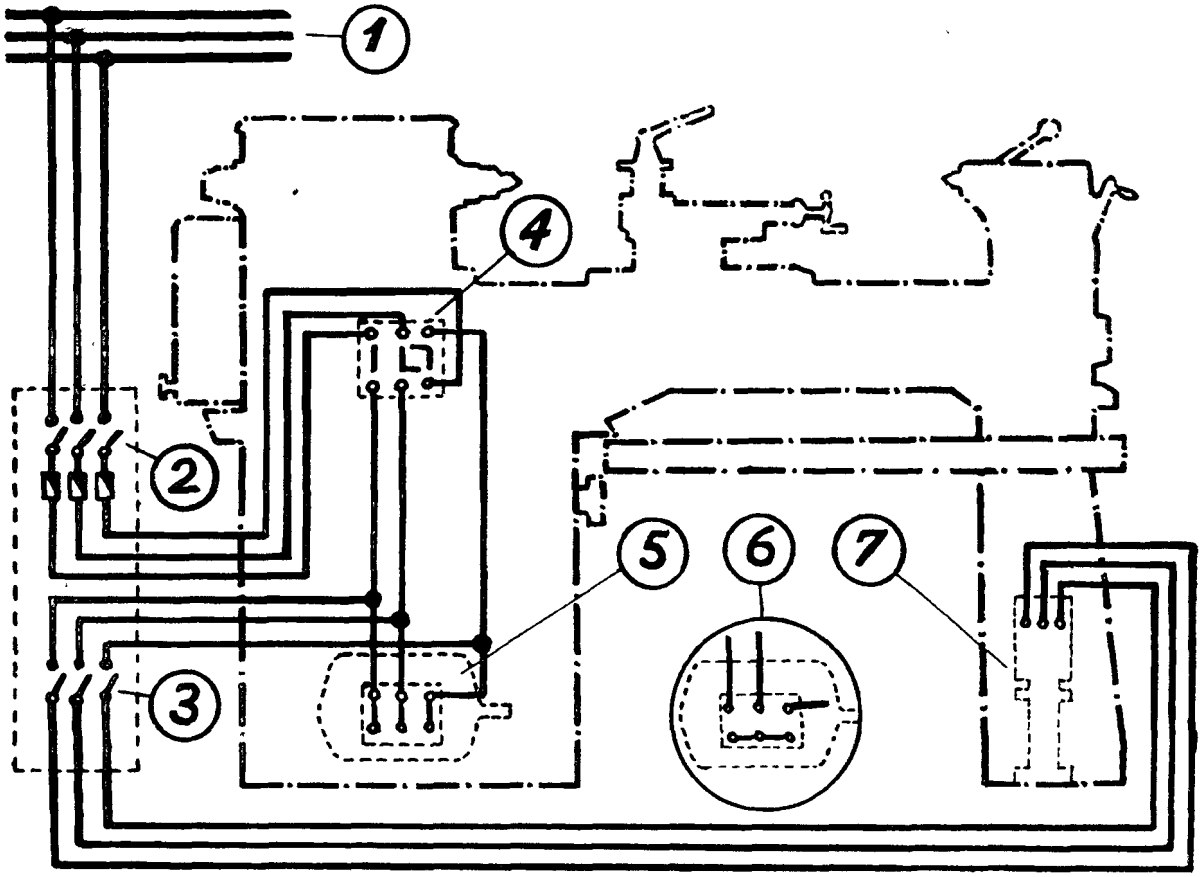


Fig. 13.

3° The three pole switch for the motor pump when this extra is furnished;

4° The protected reversing switch, under the « Norton » gear box, operated by a reversing rod (in A, fig. 21);

5° The motor connected for 220 volts (standard);

6° The motor connected for 380 volts;

7° The coolant motor pump (when furnished).

The motor pump is connected to the main motor. Therefore the pump will stop when the motor stops and as the pump delivers in both directions of rotation, reversing the motor does not affect the pump delivery.

The phases must be connected in such a way that the spindle rotates in the normal direction (anticlockwise) when lowering the reversing lever 8 (fig. 23).

The regulations concerning the connections and protections of the electrical equipment which are in force in the country where the machine is used should be strictly observed, especially those concerning the fuses on the wires taking the current to the machine.

FIRST RUNNING OF THE MACHINE.

Before starting the lathe, make sure that it is complete and that all parts are perfectly greased.

In this respect refer to the chapters of the booklet dealing with the lubrication and the manner to operate the machine.

After these preliminary operations, proceed as follows :

1° For the first run select the lowest spindle speed;

2° Increase the speed progressively; however keep the machine running during 10 to 15 minutes at each rate of speed and reverse now and again;

3° At the same time engage the leadscrew and feedshaft, selecting the finer threads or feeds and increasing them gradually;

4° Engage alternatively the automatic longitudinal and transversal feeds and leadscrew nut;

5° Now and again reverse the motion of the leadscrew and feedshaft by means of the reversing lever on the « Norton » gear box.

II. — DESCRIPTION OF THE LATHE

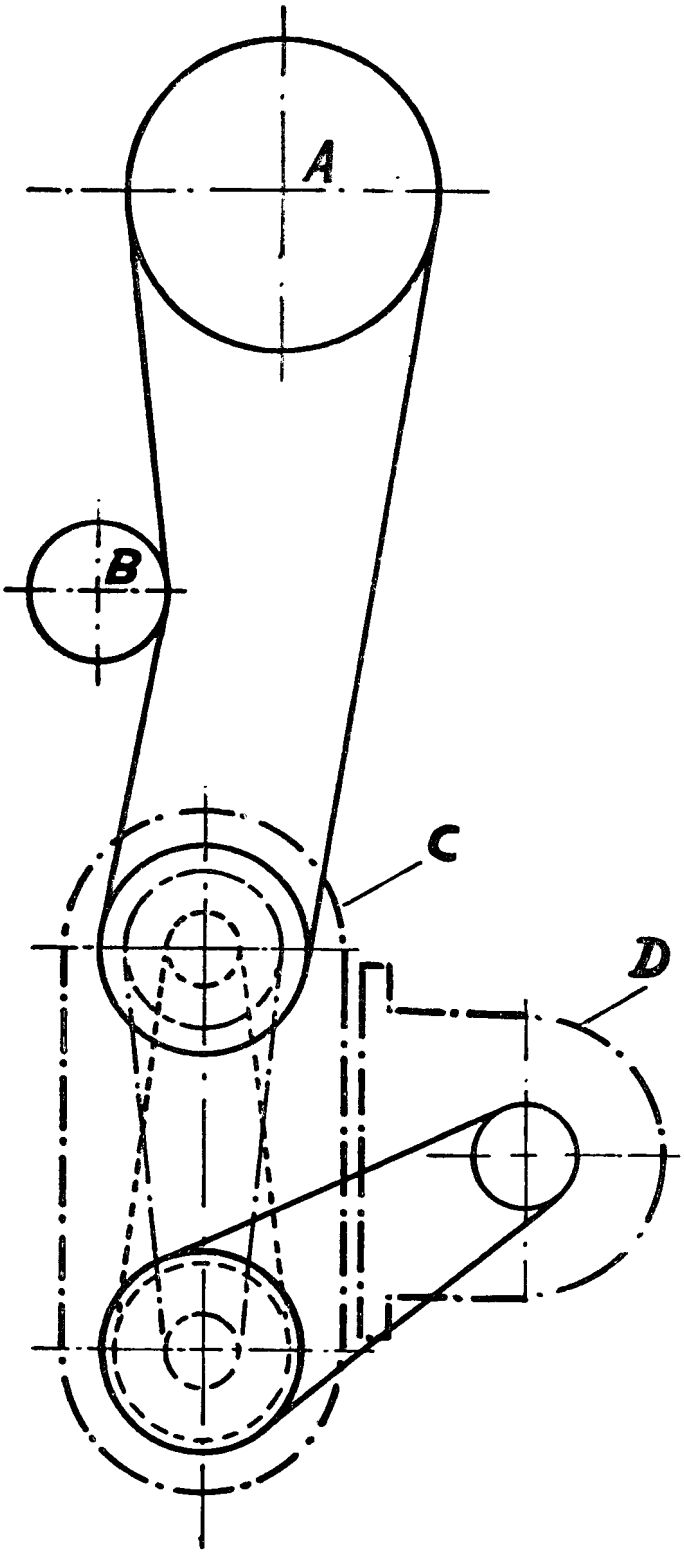


Fig. 14.

DRIVE.

The 1 kw. motor, in D. (fig. 14), is mounted on the Multibelt variable speed unit C by means of a saddle.

The motor drives the variator pulley by two 1/2" × 5/16" × 33" endless V belts. The saddle carries the belt tensionning device.

The variator is mounted on the front door of the leg and the drive to the spindle A is by means of a flat leather belt passing over a tension pulley B.

VARIABLE SPEED UNIT.

The « Multibelt » variator (fig. 15) consists of two semi housings containing two parallel shafts, each carrying an expanding pulley. The drive between these two shafts is by standard V belts.

The diameter of the cylinder formed by the segments is decreased by drawing apart or approaching the two cones.

The expanding pulleys consist of two taper discs with radial grooves; suitably shaped bars which connect the tapers slide in these grooves and form the expanding hub. The bars are shaped to accomodate V belts.

In figure 16, the top pulley is illustrated with its smallest diameter whereas the bottom pulley has its maximum diameter.

In order to obtain a certain speed ratio between the driving and the driven pulley of the « Multibelt » it is sufficient to choose the suitable diameter of the two expanding pulleys.

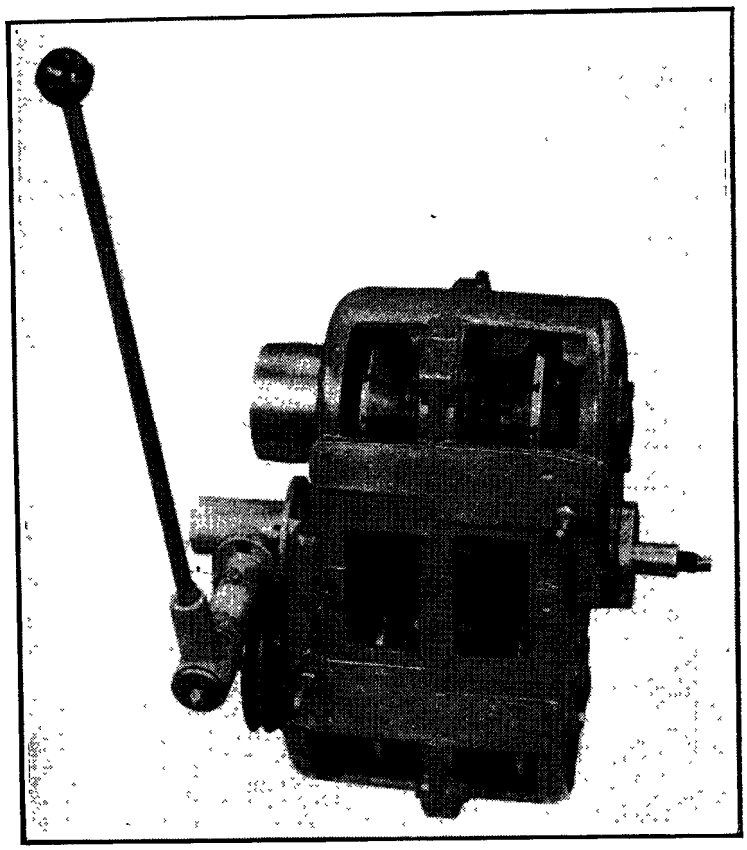


Fig. 15.

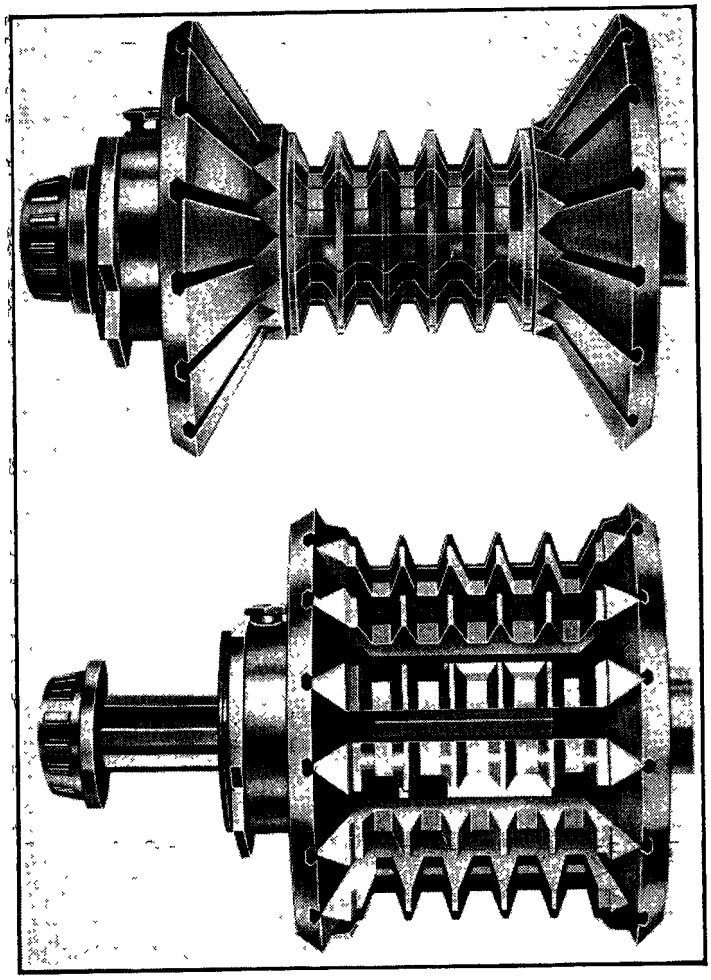


Fig. 16.

Therefore, the model M6L variator mounted on the lathe gives an infinite number of speeds, the ratio between bottom and top speed being 1 to 6.

The two parallel splined shafts carrying the expanding pulleys are supported in taper roller bearings.

The combined movement of the expanding pulleys is controlled by an outside lever connected

to an arm which operates the two pulleys simultaneously; this insures the constant belt tension at all speed ratios.

The belt tension can be regulated from the outside (see the chapter dealing with this point).

The speed variations are obtained by a ratchet device which gives a slow progressive motion; the ratchet is reversible and operated by the to and fro movement of the control lever; lifting the lever and turning it 180° will reverse the ratchet so that the speeds are increased with the lever in one position and decreased in the second position; two marks + and — at the base of the lever indicate the direction of the speed variations.

A dial fixed to the door indicates the spindle speed which has been selected; the speed range from 37 to 225 r.p.m. is obtained with the back gears and the range from 15 to 900 r.p.m. without the back gears.

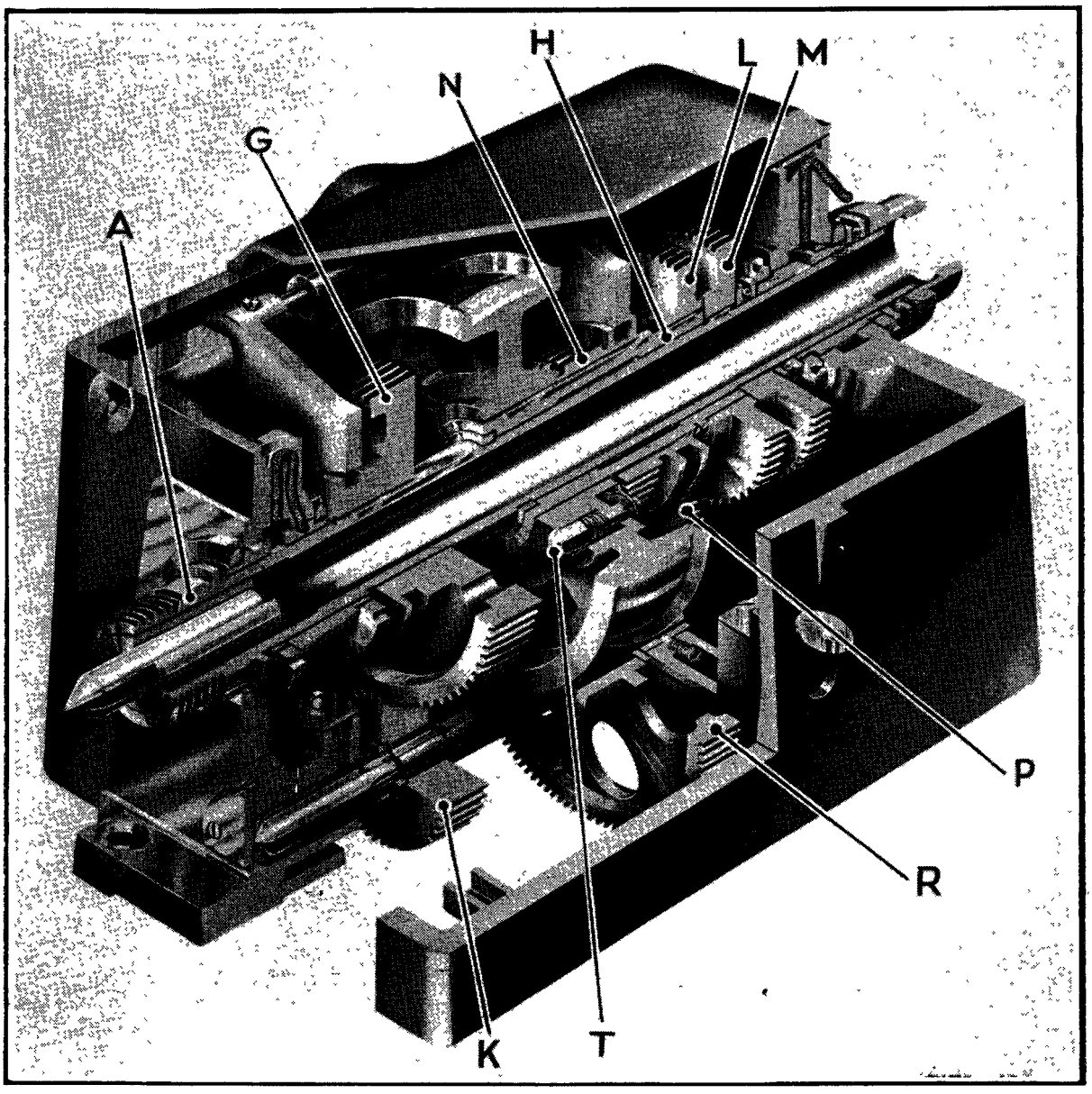


Fig. 17.

HEADSTOCK.

The headstock is secured to the bed by two bolts at the front and one clamp at the rear. The alinement is maintained by the V of the tailstock.

The headstock contains the spindle, the back gears and the driving gears of the feed and screw cutting motion.

The spindle is made of high tensile heat treated steel; the journals are superfinished and revolve in two phosphor bronze bearings which are adjustable for wear.

As shown on figure 17, the spindle carries :

1° Gear « G » which slides on a key;

2° Sleeve « H » which carries the pulley and one of the pinions « L » driving the feed and screw cutting motion;

3° The second pinion « M » driving the feed and screw cutting motion.

The backgear pinion « N » slides on a key on sleeve « H ».

The headstock contains also the backgear shaft which carries the pinions « K » and « R ».

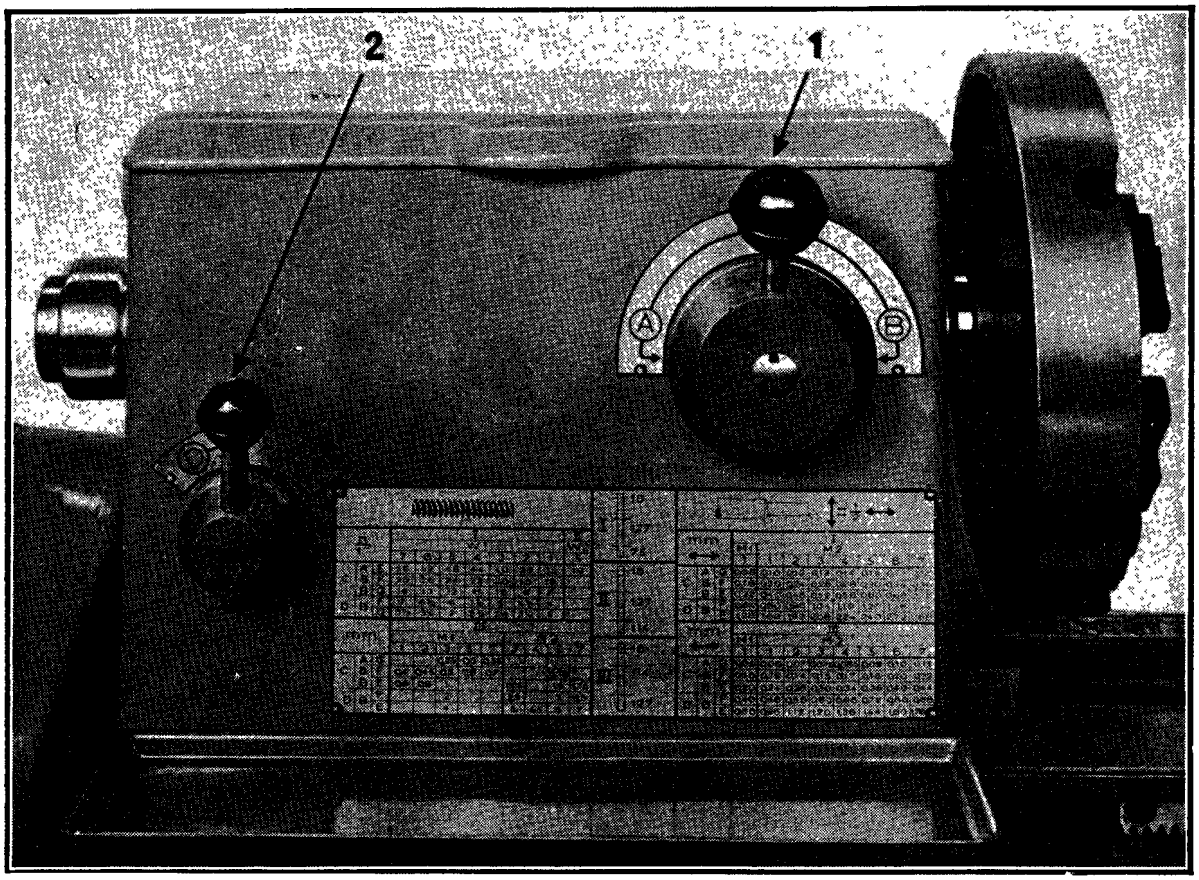


Fig. 18.

Handle 1 (fig. 18) controls the simultaneous movement of the two gears « G » and « N » (fig. 17).

In position « A », pinion « G » has been disengaged from pinion « K » and moved against the pulley to which it is connected by a driving pin « T », whereas pinion « N » is disengaged from pinion « R ». In this position the spindle runs ungeared.

In position « B » (fig. 18) the spindle revolves through the back gears as shown on figure 17. The speed ratio between spindle and pulley being 1 to 4.

Handle 2 (fig. 18) which engages the motion of the leadscrew and feedshaft gives only two different speeds when the back gears are engaged (handle 1 in B).

In this case with handle 2 in position C, pinions « P » and « M » are engaged and the speed to the feed driving mechanism is the same as the spindle speed.

With handle 2 in « D », pinion « D » engages pinion « L » and the speeds at the driving gears of the feed motion are in the ratio of 4 to 1 in regard to the spindle speeds.

This position is used for fast feeds or when coarsepitch threads are cut. This is why this position is usually called « coarse pitch ».

On the other hand, when the spindle revolves ungeared, the speed in « F » is the same as the spindle speed whether lever 2 is in « C » or in « D ».

Handles 1 and 2 must be moved when the motor being switched off, the spindle is slowing down almost to a stop.

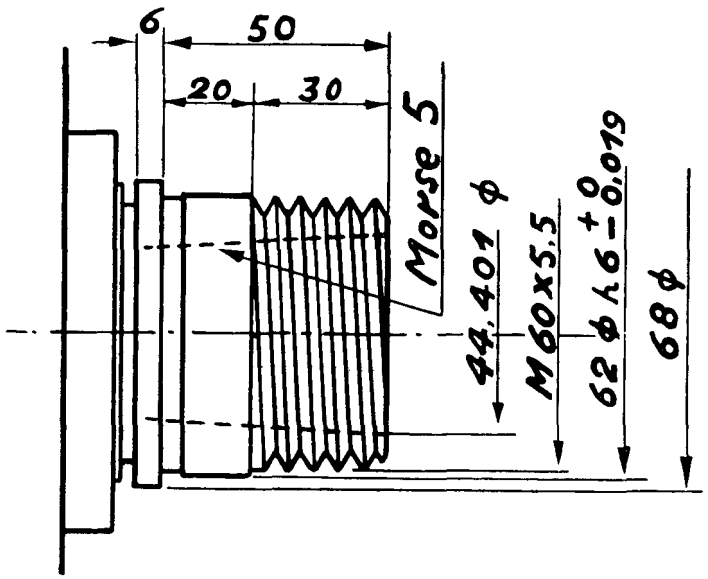


Fig. 19.

Bars up to 1 3/8" diam. can pass through the spindle; the spindle nose is bored Morse taper No. 5.

The taper sleeve and Morse No. 3 live centre are supplied with the lathe.

Figure 19 gives all the dimensions of the spindle nose which may be required for making faceplates or special fittings.

We strongly advise not to use the 4 jaws face plate when the spindle rotates at a higher speed than 600 r.p.m., in order to prevent the face plate unscrewing itself on account of its high momentum, should the lathe stop suddenly, or to prevent the spindle being overloaded when machining parts which are not properly balanced. On the other hand, a selfcentering chuck can be used even at the highest speed.

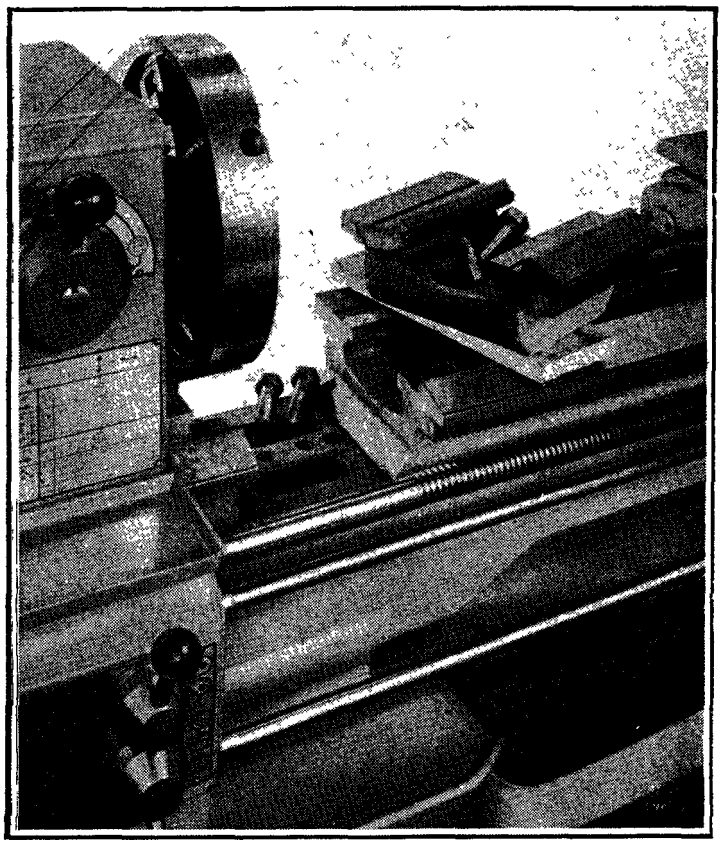


Fig. 20.

BED.

The bed has a gap, the gap piece being scraped at the same time as the bed (fig. 20).

This gap piece is held by two screws and located by extracting pegs with screwed ends M 16.

In order to remove the gap piece, the holding down screws are removed and a nut screwed on the tail of the extracting pegs.

This nut can be taken from one of the face plate jaws.

REVERSING SWITCH.

The reversing switch is mounted on the front face of the bed, under the « Norton » gear box and is protected by a cover fixed by two nuts (fig. 21).

It is operated by a reversing rod to which it is connected by a pin.

« NORTON » GEAR BOX.

Besides the tumbler lever, the « Norton » gear box has 3 handles (fig. 21).

Handles 3 and 5 in combination with the tumbler lever give the feed or the pitch which has been selected in accordance with the indications of the screw cutting index plate.

All information and examples concerning the screw-cutting index plate and the « Norton » gear box are given in the chapter « Operating the lathe ».

Handle 4 (fig. 21) reverses the rotation of the leadscrew and feedshaft.

It is advisable to engage the « Norton » gearbox levers when the spindle is running; moreover this should be done quickly without any hesitation, the handles being brought well in front of the required position.

In each case, this position is located by a slight locking of the handle.

Move handle 3 preferably when leadscrew and feed shaft have been disengaged by reversing handle 4.

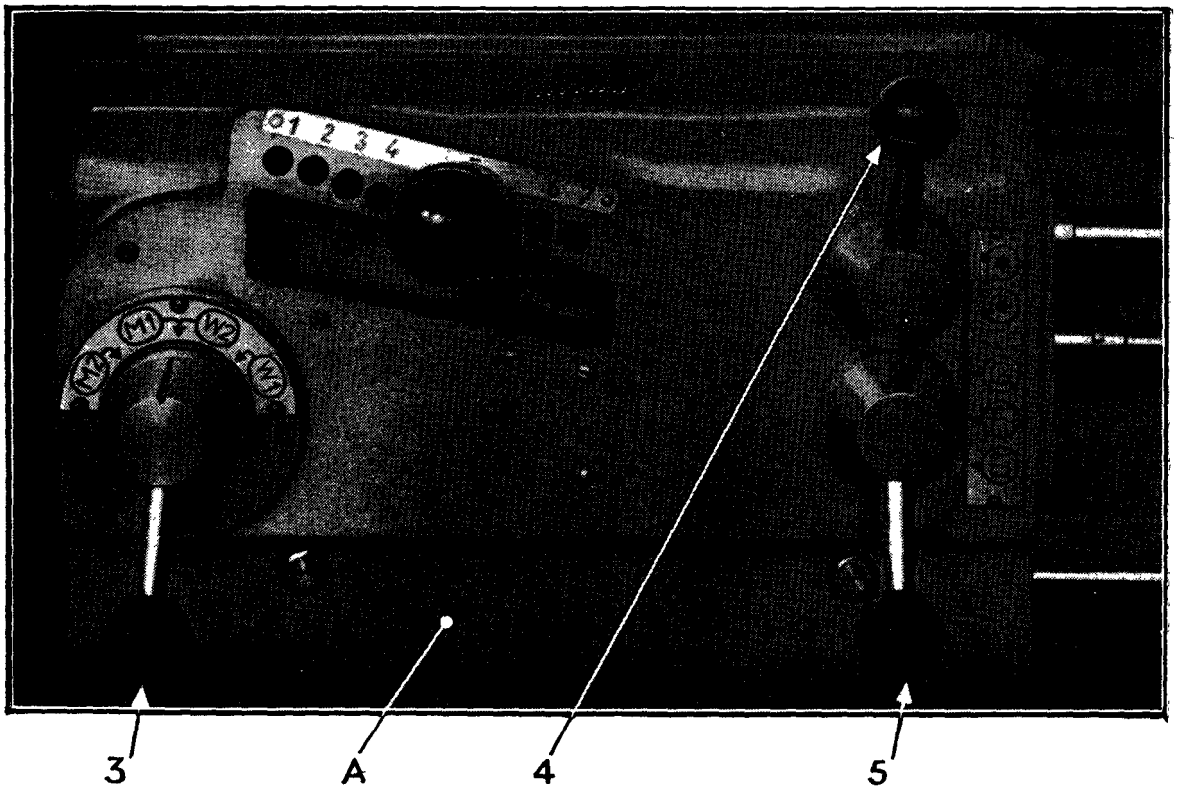


Fig. 21.

SWING FRAME.

The swing frame swivels on the bearing of the coarse pitch stud (fig. 22); it can be secured easily in the various positions by tightening a square head bolt.

Two slots are provided for mounting the gears.

One of the slots (fig. 22) is used for normal combinations whereas the other one serves for mounting the gears required for pitch or module threads or special combinations.

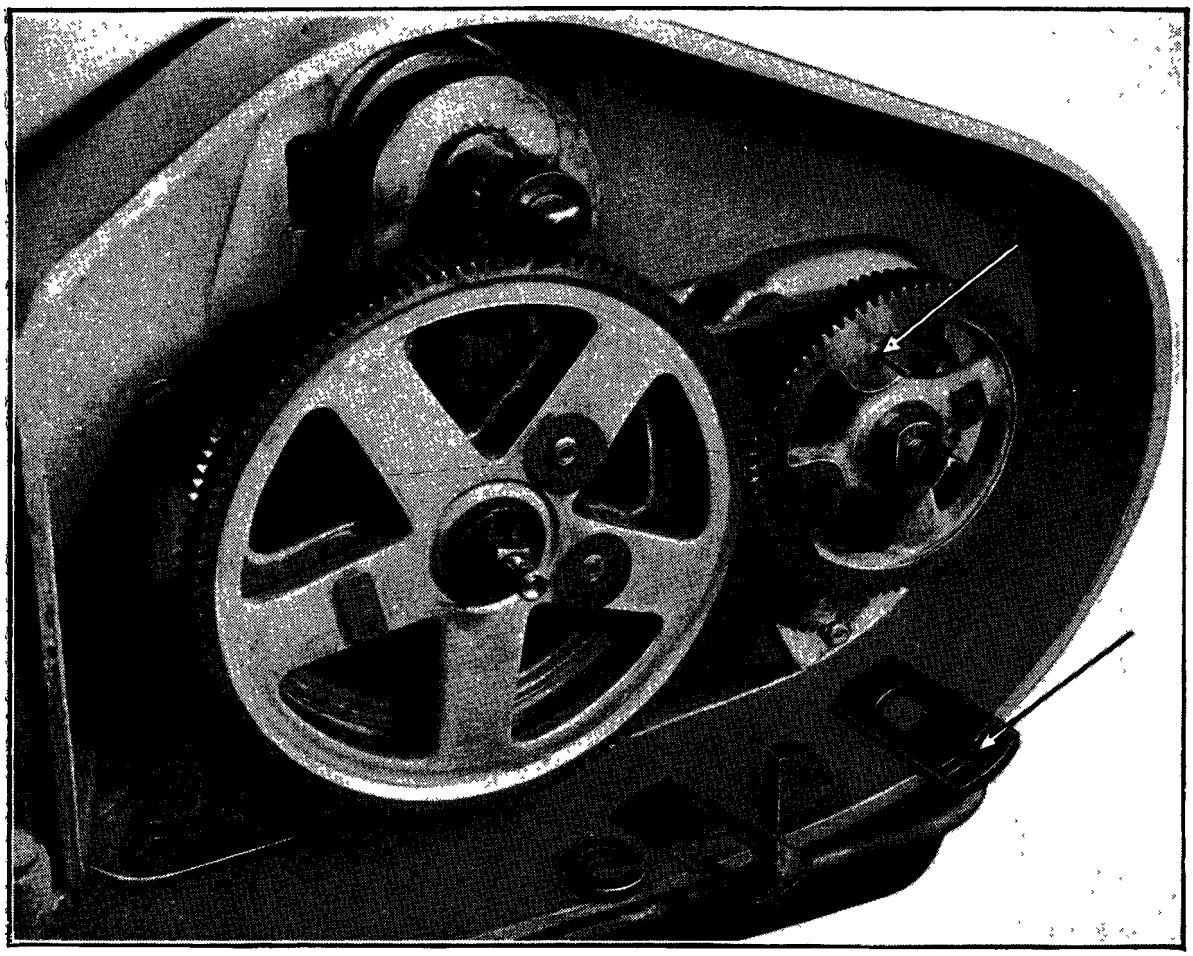


Fig. 22.

The gears are connected on a stud which however operates only in the compound gear combination and not in the plain combination as represented on figure 22.

In the plain combination one gear only works as an intermediate wheel, the other being only an idle gear.

On the contrary, in the compound combination, the movement is transmitted from the coarse pitch shaft to one of the gears on the stud, the second gear on this stud driving the gear on the « Norton » gear box.

The gear on the « Norton » gear box has a safety device which consists of a shear pin 3 mm. diam. and 24 mm. long made of mild steel having a maximum tensile of 19 to 25 Tons per sq. inch. Should abnormal efforts endanger the feed mechanism, the shearing of the pin disconnects the « Norton » gear box.

The shear pin is inserted through a driving key in the gear which is loose on its axle.

Replacement is quite easy as explained in the chapter « Adjustment ».

APRON.

The apron consists of a double walled housing used as an oil reservoir (fig. 23).

All the gears except the rack gear, have helical teeth.

Lever 6 controls the automatic longitudinal and transversal feeds. A safety device prevents the change over from sliding to surfacing; it is necessary to turn the handle 180° from the dead point position in order to change the direction of the feed; this is indicated by arrows on the lever 6 guide plate and on the lever handle.

Lever 7 engages and disengages the leadscrew nut

The feed and screw-cutting motions are interlocked to prevent both levers being engaged at the same time.

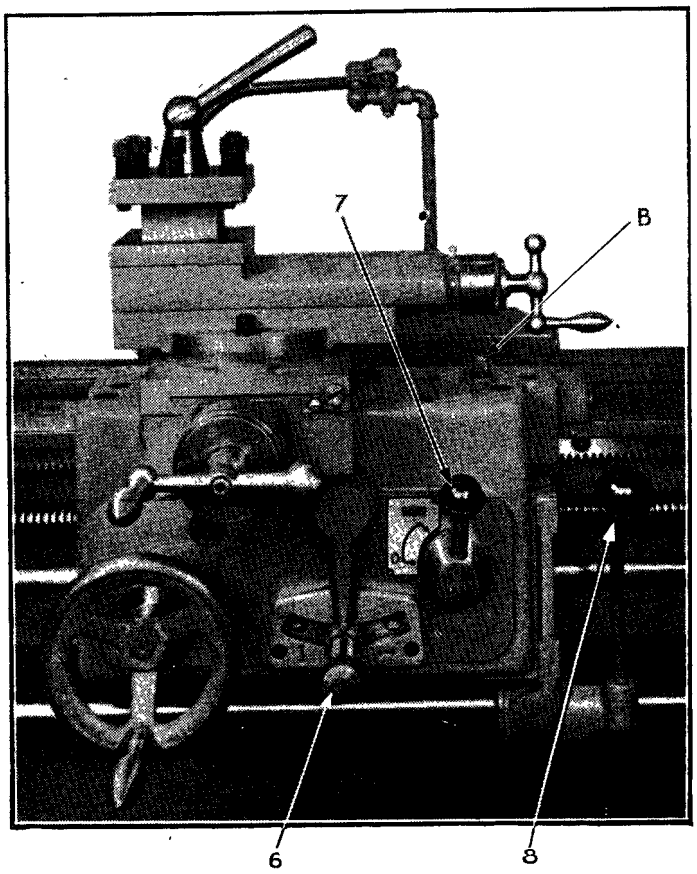


Fig. 23.

Lever 8 moves with the apron and operates the motor reversing switch rod; this lever has three positions : the medium positions corresponds to stop and the two extreme to forward and reverse.

SADDLE AND SLIDES.

The guides of the cross and tool slides have taper gibs which are adjustable by a single screw for taking up the wear.

The saddle can be clamped on the bed by means of bolt B (fig. 23).

One graduation of the verniers corresponds to 001.

The square toolpost can be located in eight 45° positions.

TAILSTOCK.

The tailstock centre is traversed by means of a screw which operates an inclined rack cut in the quill.

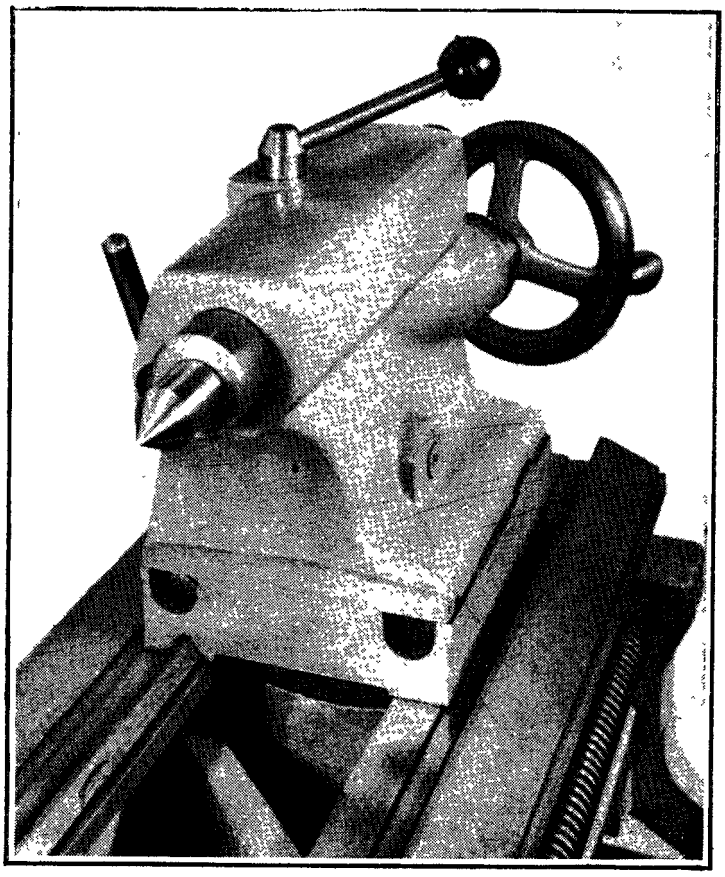


Fig. 24.

A lever (fig. 24) locks the quill by means of two floating jaws

The quill is bored Morse taper No. 3 and the centre or any tool with or without a shank are automatically ejected at the rear end of the quill traverse.

The tailstock body rests on a saddle; the top face of this saddle has a square guide which insures the correct position and guiding of the tailstock body when setting over; the tailstock is set over for certain taper turning operations up to 1/2" on each side if the centre line.

The bottom face of the saddle is guided on the bed by a special V.

A side lever clamps the tailstock at any point of the bed; this is effected by an excentric pin and adjustable taper which lock two swinging jaws against the bed guides.

STEADY REST.

The steady rest can be fixed at any point of the bed and has the same guide as the tailstock.

The smallest diameter admitted is 3/16" and the largest 3 1/8".

FOLLOW REST.

The follow rest is fixed at the front of the saddle by two square head bolts and admits the same diameter as the steady rest

PLATES.

Four jaws faceplate.

Consists of a cast iron plate 11" diameter turned and faced. The hardened jaws are reversible and slide in 4 slots.

Once again, we strongly recommend not to use this face plate when the spindle speed is higher than 600 r p.m.

The outside jaws can be used for holding parts from 1" to 9" diameter and the inside jaws for parts from 3/4" to 10 3/4".

This face plate can also be used with various kinds of set-ups after the jaws have been removed.

Catch plate.

6" in diameter, has two slots, one for the dog and one for the balancing weight.

Chuck adaptor plate.

Has a diameter of 8 1/4", and has been fitted and machined on the spindle nose of the lathe in our works.

The front face should be machined by the user to the size of the chuck; we recommend the following procedure :

1° Screw the adaptor plate home on the spindle;

2° Machine the front face;

3° Turn the centring shoulder, the tolerance being such that the chuck may be fitted by hand but without any play;

4° The rear face of the chuck should fit the adaptor plate perfectly and the width of the centring shoulder should be about one hundredth of an inch smaller than the depth of the chuck recess.

TOOLS.

The tools supplied with each lathe include :

1 spanner for the adjustment of the spindle bearings;
1 spanner for taking up the play of the lead screw;
1 spanner for the slotted nuts of the feed screw;
1 box spanner for the gap piece;
1 spanner for the square head screws;
2 double ended spanners for various nuts;
1 grease gun.

EXTRA ACCESSORIES.

Screw-cutting indicator.

This attachment is very useful when the pitch of the screw is designated by the number of threads per inch. It indicates the exact moment when the lead screw should be engaged, the tool being in the correct position for each cut.

The saddle can be quickly returned by hand after the lead-screw has been disengaged and it is not necessary to reverse the motor and return the tool slowly to the starting point.

However, the screw-cutting indicator cannot be used for metric pitches.

The screw-cutting indicator is fixed to the right side of the apron by a bolt which fits in a hole already drilled and tapped.

The indicator should rotate freely and not be forced against the leadscrew, a normal play being left at the bottom of the teeth.

The chapter dealing with the screw-cutting gives all the particulars of the screw-cutting indicator.

Taper turning attachment.

This attachment consists of (fig. 25) :

a) A special screw for the cross slide;

b) The attachment itself which is bolted to the rear of the saddle which is machined for that purpose;

c) A fixed bracket which fastens on the flat guide of the bed.

The frame 1 moves with the saddle to which it is attached, whereas guide 2 which is held by rod 3 and clamp 4 does not move. A rule 5 attached to guide 2 can be placed at any angle from 0° to 10° in both directions by means of a knurled knob 6.

A slide 7 connected to frame 1 by another slide 8, rests on rule 5. The slide 8 is assembled to the feed screw 9 of the cross slide. Therefore, when the saddle moves along the bed, slide 7 moves crossways according to the angle of slide 5 and this movement is transmitted to the cross slide by slide 8 and screw 9.

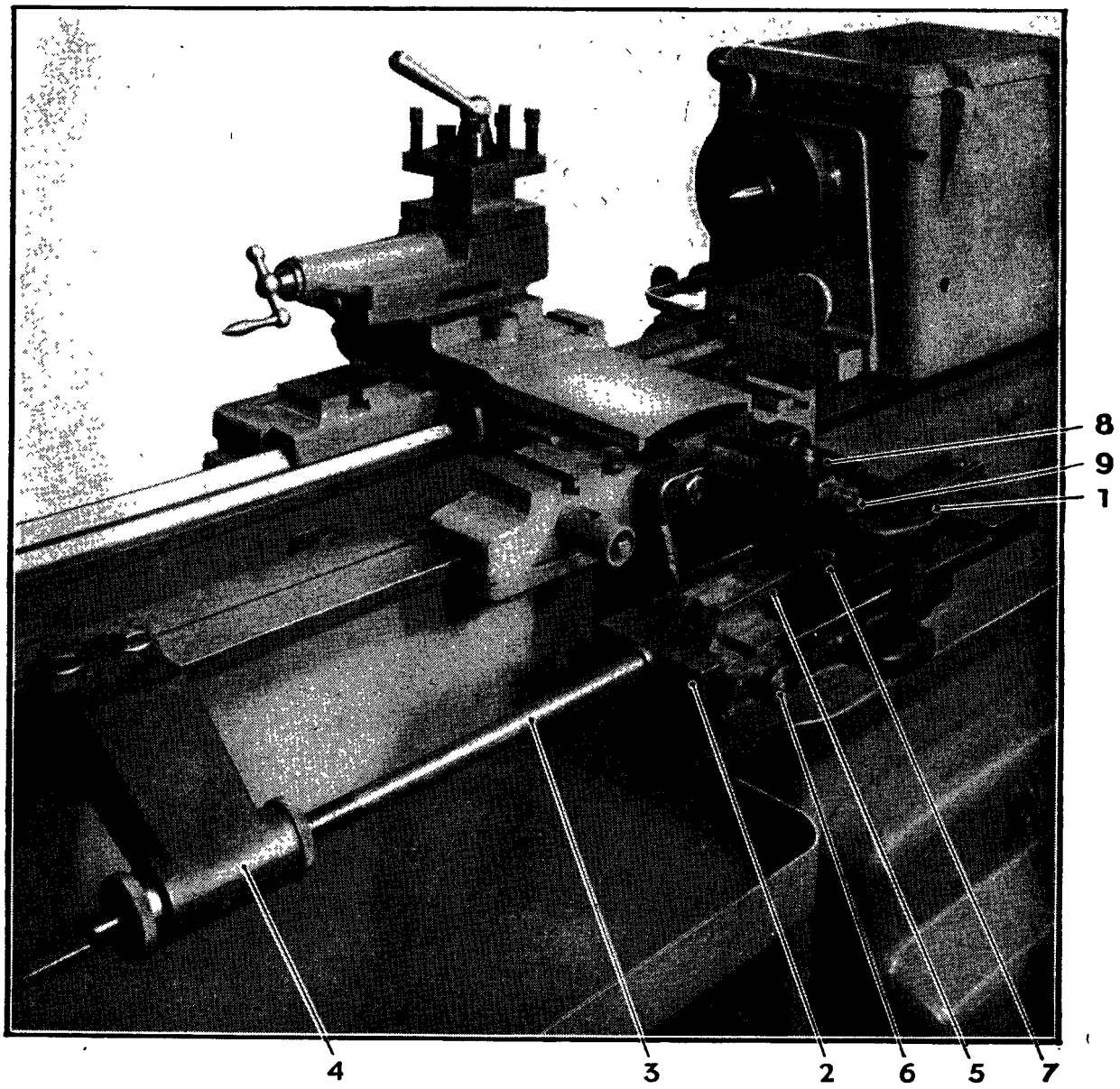


Fig. 25.

MOUNTING.

When mounting the taper turning attachment, it is necessary to scrape the machined surface at the rear of the slide and ascertain the parallelism and perpendicularity of this surface in regard to the flat guide of the bed.

Moreover, the attachment must be level, like the bed, and must be placed in such a way that the slide is on the same vertical line as the cross slide feed screw, which must not be forced.

To replace the standard screw by the special turning attachment screw, proceed as follows :

1° Move the cross slide forward to the end of its travel and remove the protecting plate which is fixed by 3 screws;

2° Remove the cast iron guard fastened to the cross slide by 2 screws;

3° Remove the 2 hexagon-socket cap screws which hold the feed screw nut and also the adjusting screw of this nut, on top of the cross slide;

4° Remove the 3 screws which hold the bearing bush of the screw at the front of the cross slide;

5° Unscrew the feed screw out of the nut which can then be taken out through the rear of the cross slide;

6° Dismount the handle and the two nuts holding the vernier and drive the screw backwards; this will disengage the helical pinion.

For mounting the special turning attachment screw, the above sequence of operations is reversed.

After the taper turning attachment has been mounted, the end of the screw should be fixed with a running fit, but without any play, in slide 8 by means of two slotted nuts.

The frame is attached to the saddle by two bolts and located by two pins after the tests and adjustments have been made.

TESTING.

After the attachment has been mounted, as exactly as possible, it should be adjusted and checked as follows :

a) **With a dial indicator :**

1° Place between centres a perfectly cylindrical piece about 16" long;

2° With the indicator fixed on the tool slide, move the indicator's feeler along the horizontal generant of the piece;

3° Correct the deviations by turning knurled knob 6, bearing in mind that the maximum total variations given by the indicator must not exceed .0012;

b) **Without a dial indicator :**

1° Place between centres a piece at least 16" long;

2° Turn a cylinder and correct by means of knurled knob 6 until a tolerance of .0012 is obtained.

After this adjustment, mark a line on the rule opposite the o of the angles graduation. This locating line will enable the attachment to be set back to o after having been used for taper turning.

LUBRICATION.

It amounts to the maintenance of a film of grease on all rubbing parts, i.e., the guide and the two slides; a ball type grease cup is provided for this purpose.

Cooling equipment.

Includes the following :-

1° Motor pump;

2° Tank and strainer;

3° Piping with cock and fittings;

4° Electric wires with insulating tube;

5° Switch.

The tank carrying the pump and the motor fits into the rear leg.

The piping is attached to the back of the lathe and to the back of the saddle (fig. 26).

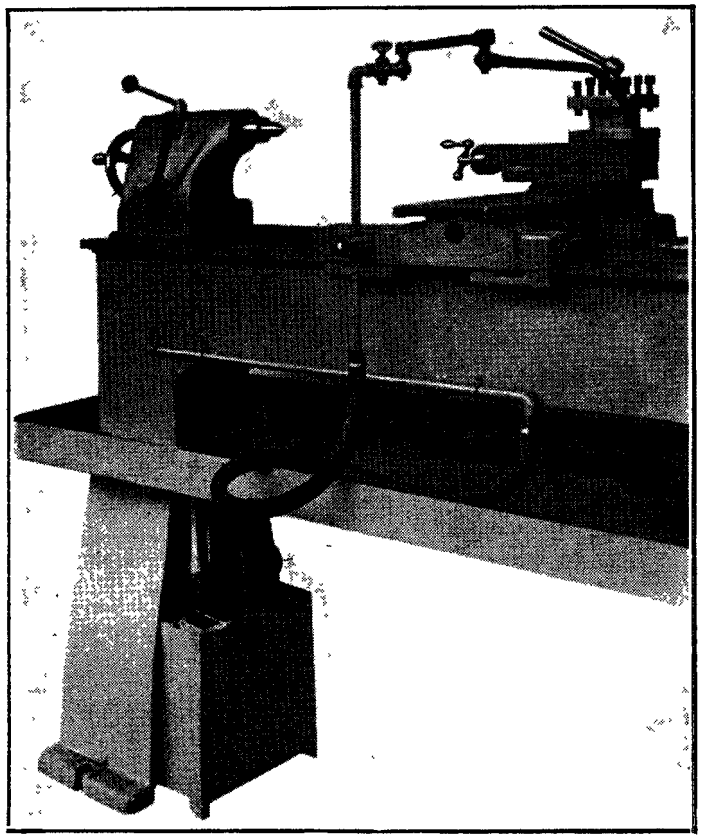


Fig. 26.

The following holes must be drilled :

1° One 5/8" hole at the back of the bed;

2° Two 5 mm. holes drilled and tapped for the clips (metric pitch);

3° One 10 mm. hole drilled and tapped at the rear of the saddle (metric pitch).

ELECTRICAL CONNECTIONS.

They are made in accordance with the general diagram (fig. 13).

The pump delivers as soon as the main motor starts, but it can be disconnected by means of its own switch.

The switch is usually fixed to the outside face of the front leg by means of two flat head screws.

The delivery of the coolant can also be stopped by means of the cock placed on the piping.

However, the cock should be used for short stoppages; when the coolant is not required for long periods, i.e. for dry cutting operations. the pump motor should be stopped by the switch.

LUBRICATE YOUR LATHE

R E G U L A R L Y !

READ THE FOLLOWING

CHAPTER CAREFULLY.

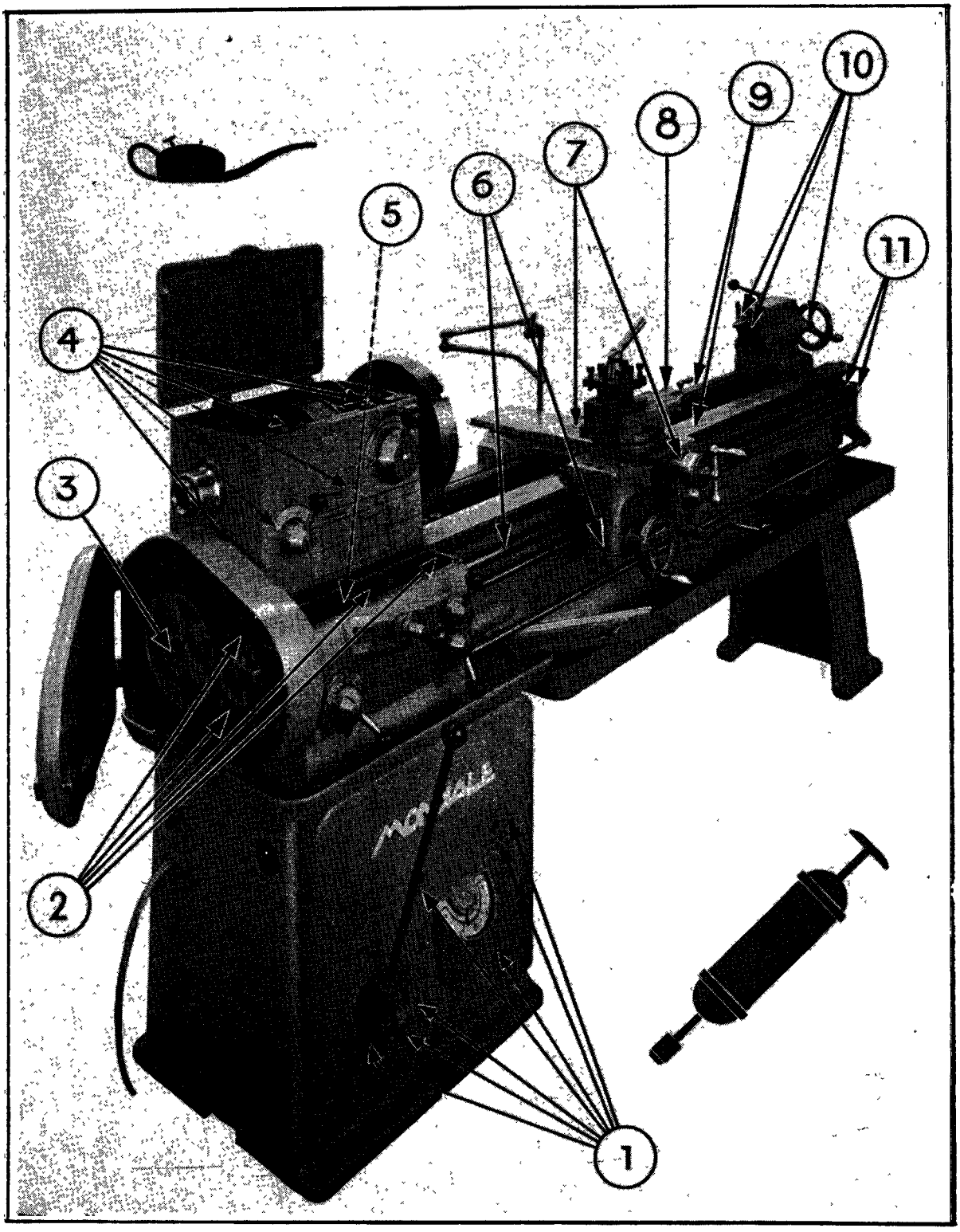


Fig. 27.

LUBRICATING CHART.

1. Variable speed unit.	6 lubricators on front door. 1 lubricator on lever hub. Taper discs slots. Driving shaft.	Grease.	After 100 hours run.
2. Norton gear box.	2 oil wells under cover. 2 oil wells on the slide.	Oil.	After 50 hours run.
3. Swing frame	1 lubricator on shaft end.	Oil.	After 8 hours.
4. Headstock.	2 oil wells under the cover. 1 lubricator on pulley.	Oil.	After 8 hours.
	2 oil wells at the back. 1 oil well above the swing frame.	Oil.	After 50 hours.
5. Tension pulley.	1 lubricator at rear.	Oil.	After 50 hours.
6. Apron.	1 oil hole with gauge.	Oil.	Maintain the level.
7. Saddle and Cross slide.	4 felt pads.	Oil.	After 25 hours.
	1 lubricator on screw bearing. 1 lubricator for the nut.	Grease.	After 50 hours.
8. Tool Slide.	1 lubricator.	Grease.	After 50 hours.
9. Bed.	Guides.	Oil.	Always oiled.
10. Tailstock.	2 lubricators.	Grease.	After 50 hours.
	Quill.	Oil.	After 8 hours.
11. Rear bearing of feed shaft and leadscrew.	2 oil wells.	Oil.	After 25 hours.

N. B. — Before lubricating the guides, remove all the chips.

READ CAREFULLY THE FOLLOWING DETAILED INSTRUCTIONS FOR THE LUBRICATION OF YOUR LATHE.

III. — LUBRICATION

Use a good mineral oil of medium viscosity, neither acid nor alkaline, and a ball bearing grease having the same qualities.

FRONT LEG.

The front leg contains the « Multibelt » variable speed unit and the motor. The latter does not require any lubrication except after reconditioning. In this case, the ball races should be cleaned and refilled with grease.

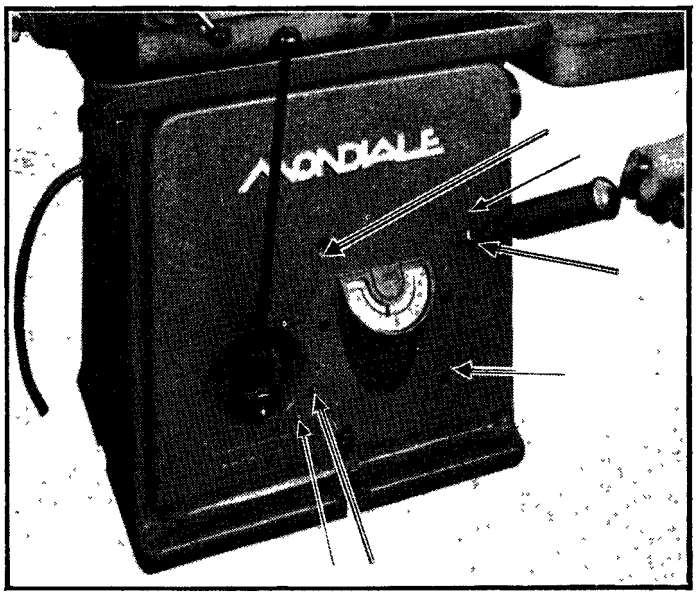


Fig. 28.

The « Multibelt » variable speed unit requires lubrication after every 100 hours run, and this should be done as follows :-

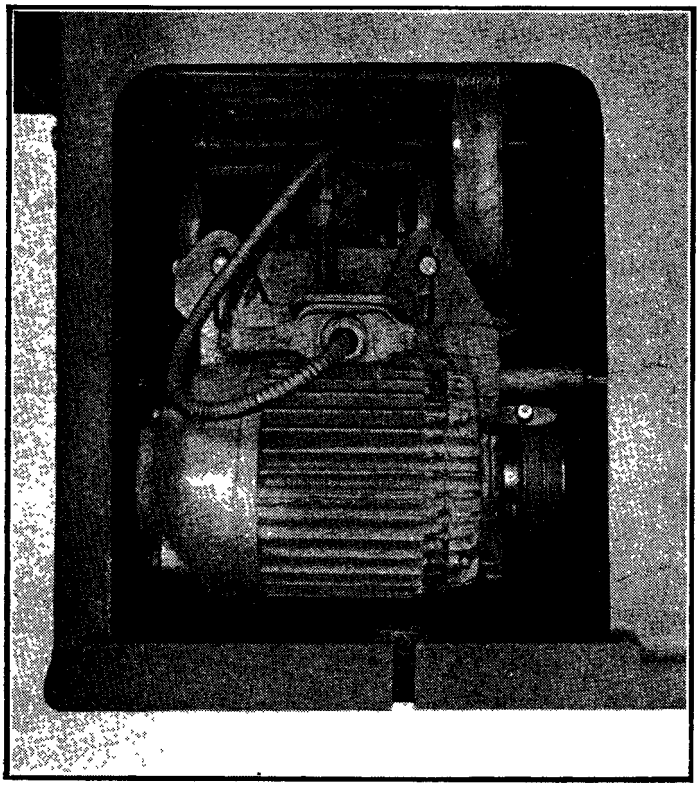


Fig. 29.

1° Introduce a small quantity of grease, with the grease gun, in the six lubricators placed on the front door (fig. 28). However, the lubricators which are marked with a double arrow, and which control much longer circuits, should receive a larger amount of grease;

2° The hub of the operating lever is lubricated in the same way;

3° For the grooves of the two taper discs and the splines of the shafts (fig. 29), use a brush dipped in grease; this should be done when the mechanism is hard to operate;

4° The shaft end of the variable speed unit, on the belt tension adjustment side should be greased in the same way.

« NORTON » GEAR BOX.

Four points require lubrication :-

1° Remove the top cover of the box; this cover is kept in position by two pins; the continuous lubrication of the bearings is insured by wicks dipping in two oil wells (fig. 30). These wells must be filled after 50 hours run;

2° Open the swing frame cover; two similar wells must be filled in the same manner.

At the same time, verify if the teeth of the various gears are effectively covered with a film of oil.

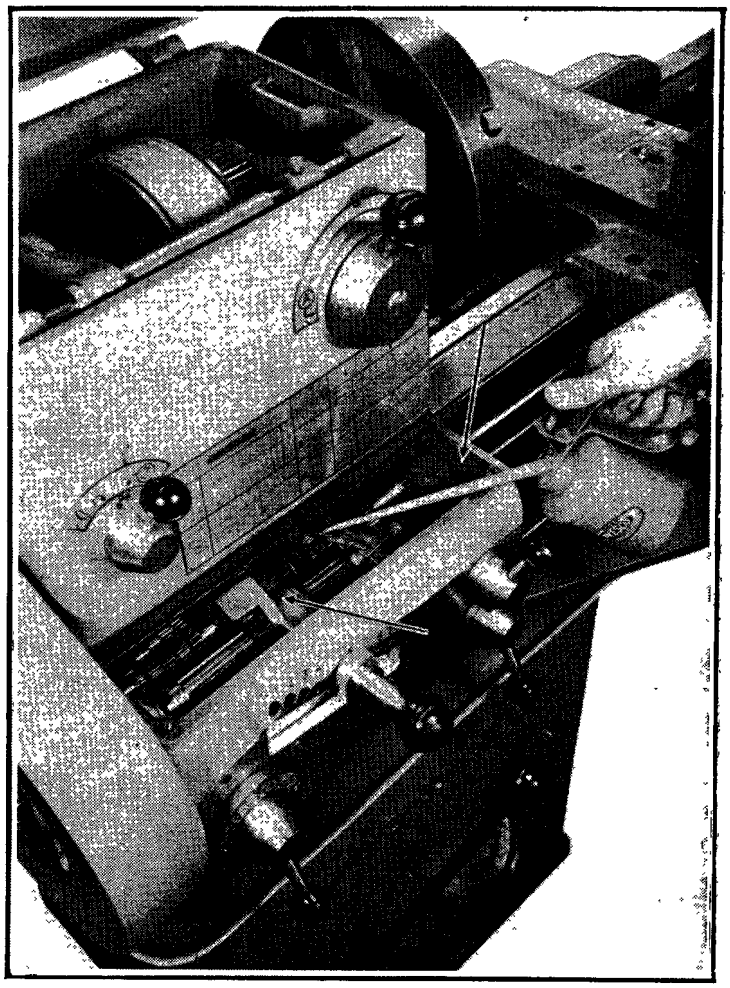


Fig. 30.

SWING FRAME.

The cover being open, the oil cup at the end of the shaft of the intermediate gears must be filled daily (fig. 31).

HEADSTOCK.

Six points require lubrication ·

1° Daily :—

a) Lift the cover and fill the two wells which supply the oil for the continuous lubrication of the spindle bearings;

b) Lubricate the bearing of the pulley by means of the lubricator on the hub (fig. 32);

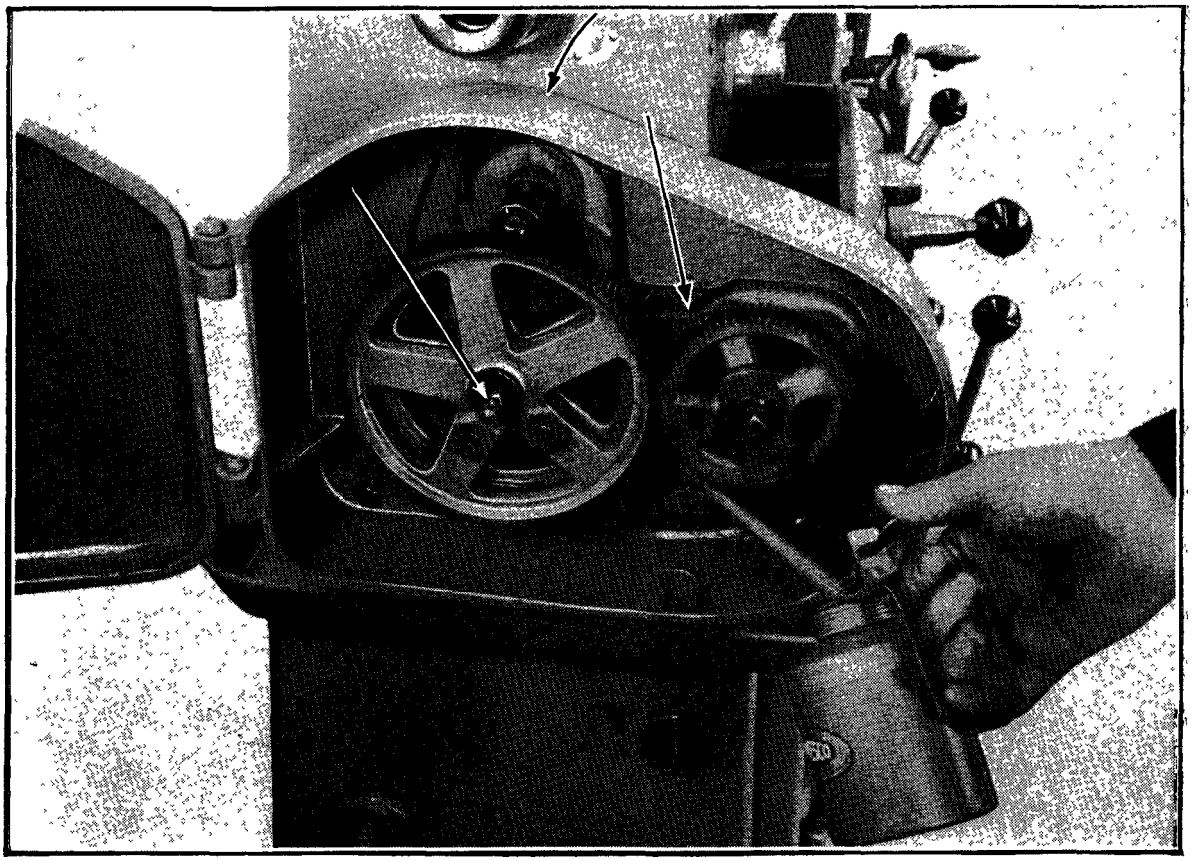


Fig. 31.

2° The three oil wells (one on the side face and two at the back), indicated by small plates, must be filled every 50 hours. The wells supply the oil for the continuous lubrication of the back gears and coarse pitch shaft bearings (fig. 33).

When attending to the lubrication of the various parts, make sure that the gears, splines, sliding pinions and shafts are covered with a film of oil.

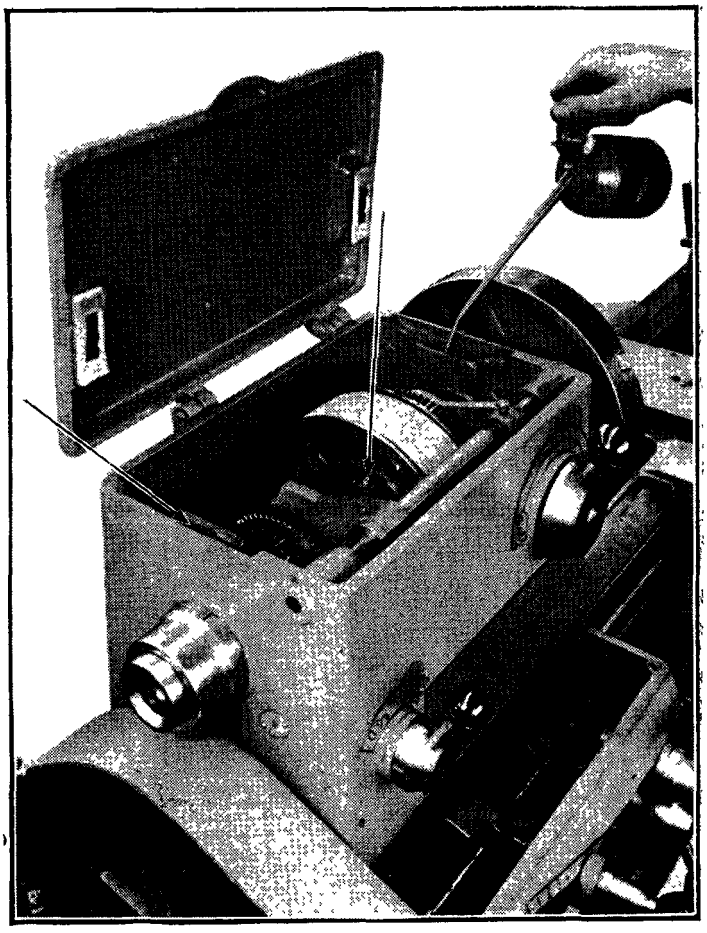


Fig. 32.

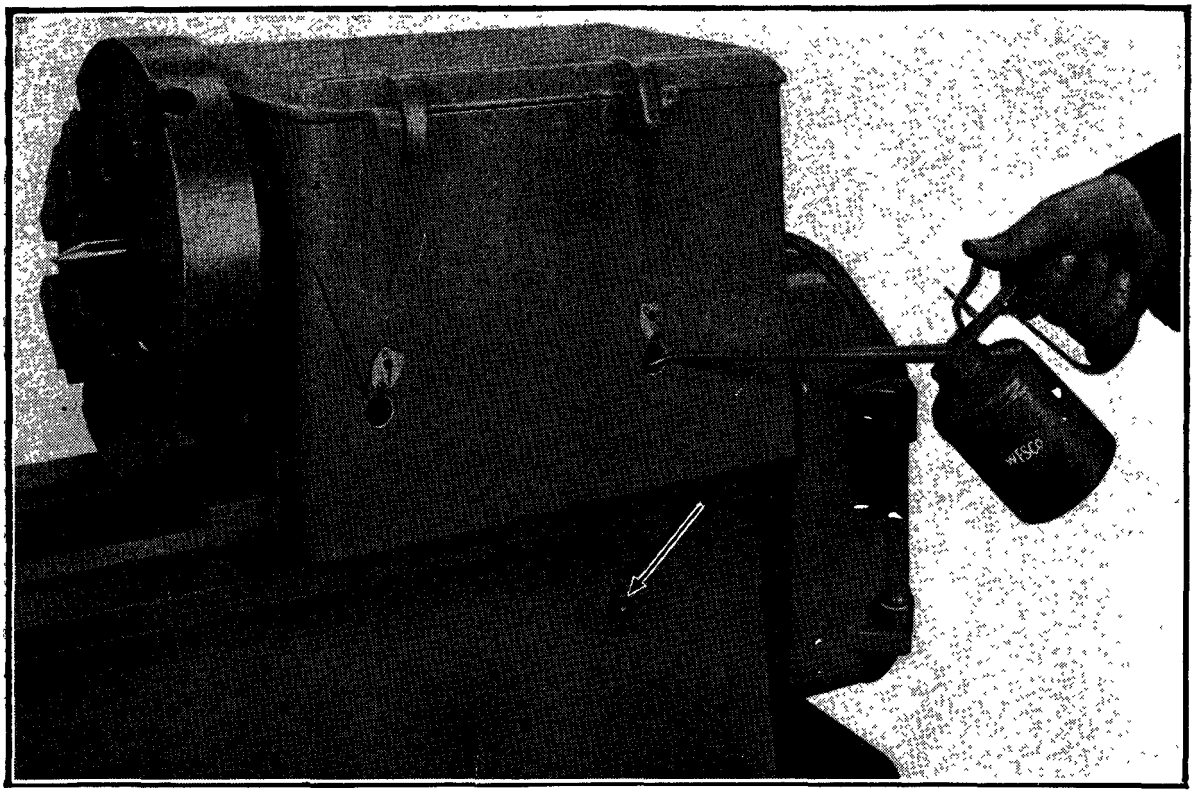


Fig. 33.

TENSION PULLEY.

After 50 hours run, this part must be oiled by means of the lubricator under the headstock at the rear of the bed (fig. 33).

APRON.

This unit is lubricated by oil circulation. The casting serves as an oil container provided with a gauge; a mark on this gauge shows the maximum level. The minimum level is indicated by the end.

The oil level should be maintained between these two limits.

SADDLE.

First of all, the guides should be cleaned and all chips and metal dust removed.

Afterwards, and after 25 hours run, the four felt wipers must be oiled.

CROSS SLIDE.

The screw of the feed motion must be lubricated every week by means of the lubricator on the bearing and the nut by means of the lubricator at the back of the tool slide (fig. 34).

TOOL SLIDE.

The screw of the feed motion must be lubricated every week by means of the lubricator on the bearing. Periodically, the tool slide must be dismounted; the screw and its nut also lubricated.

BED.

The guides of the bed must always be covered by a film of oil; this applies also to the guides of the cross and tool slides. The guides of the saddle and slides must be cleaned and all chips and metal dust carefully removed.

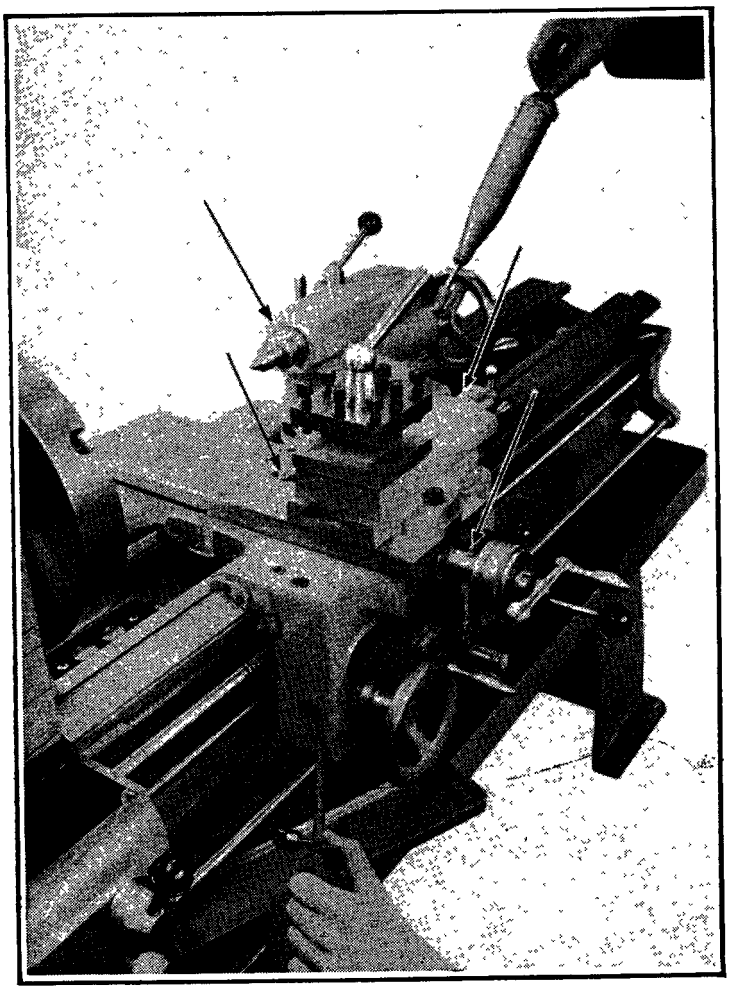


Fig. 34.

TAILSTOCK.

The sleeve must be oiled daily, using an oil can, and at the same time traversing the sleeve, in order to spread the oil.

Periodically, the rack should be smeared with grease and the bearings of the screw lubricated by means of the two lubricators.

REAR BEARING OF THE FEED SHAFT AND LEADSCREW.

Two oil wells supply the oil to the wicks for the continuous lubrication of the shaft and of the leadscrew. The wells must be filled twice a week.

At the same time, the end of the reversing rod which turns in the same bearing (fig. 35) should receive a few drops of oil.

IMPORTANT. — Your lathe will give you better service if it is correctly lubricated. It will retain its precision, appearance and all the qualities of a new machine.

Each day, spare the few moments required for this indispensable work. This will enable you at the same time to check the correct working of all parts.

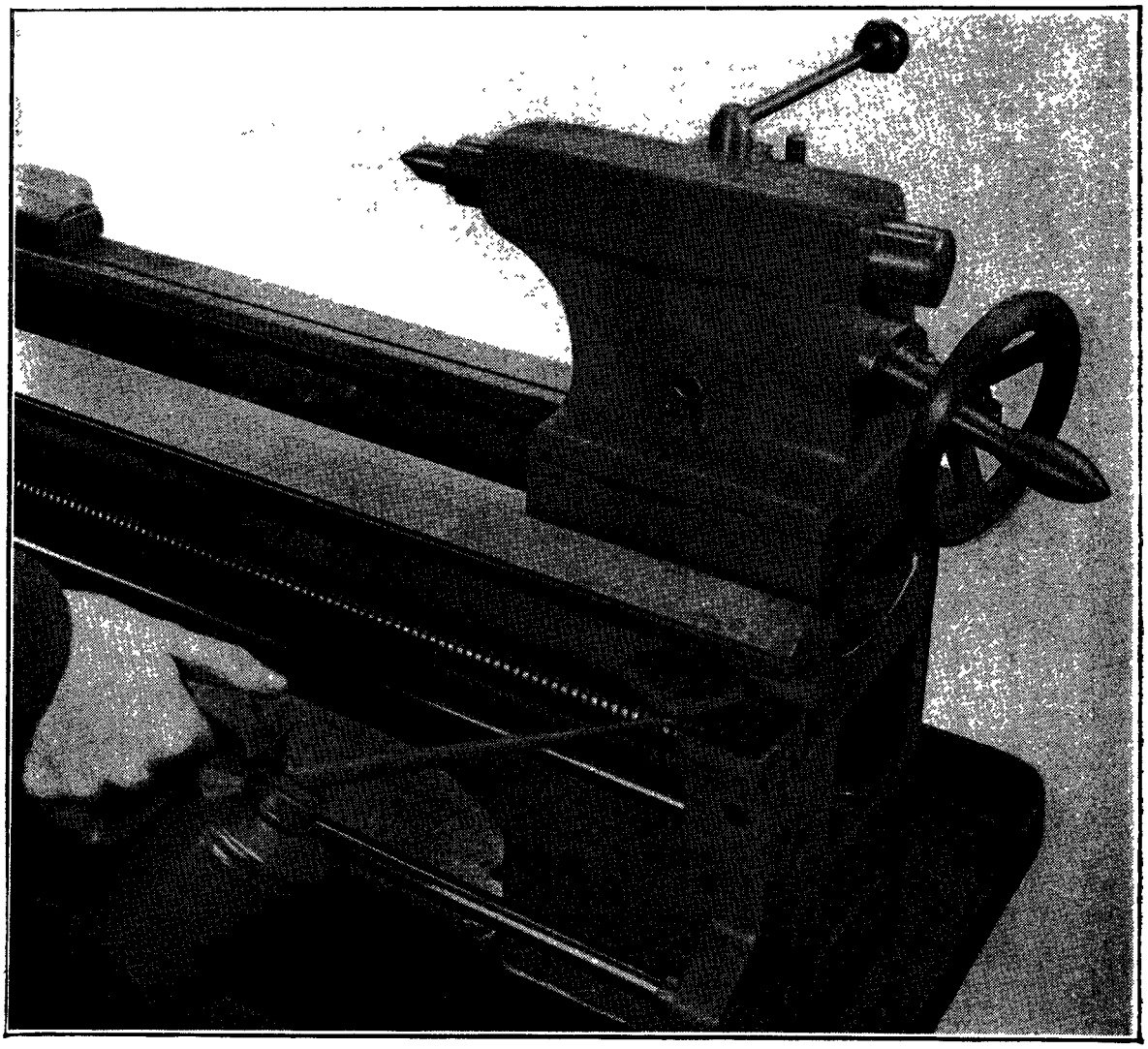


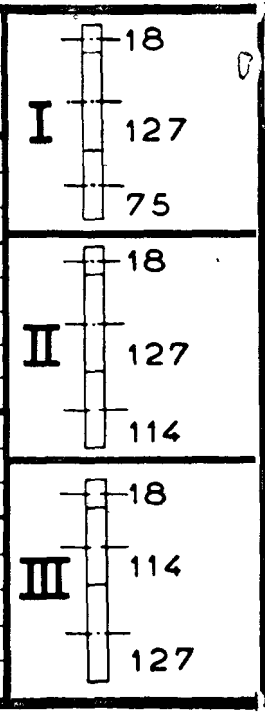
Fig. 35.

LUBRICATE YOUR LATHE

R E G U L A R L Y !

n / 1″			I W1 7	6	5	4	3	2	1	II W2 5
C	A & B	E	56	52	48	44	40	36	32	19
		F	28	26	24	22	20	18	16	
		G	14	13	12	11	10	9	8	
D	B	F	7	6 ½	6	5 ½	5	4 ½	4	
		G	3 ½	3 ¼	3	2 ¾	2 ½	2 ¼	2	

mm			III M1 1	2	3	5	7	M2 3	4	5	7
C	A & B	G			0,25	0,3	0,35				
		F	0,4	0,45	0,5	0,6	0,7			0,75	
		E	0,8	0,9	1			1,25		1,5	1,75
D	B	F			2			2,5		3	3,5
		E			4			5	5,5	6	7



.001″ ⟷			I M1 1	M2 1	2	3	4	5	6	7
C	A & B	G	3	4	4.5	5	5.5	6	6.5	7
		F	6	8	9	10	11	12	13	14
		E	12	16	18	20	22	24	26	28
D	B	F	24	32	36	40	44	48	52	56
		E	48	64	72	80	88	96	104	112

.001″ ⟷			III M1 1	M2 1	2	3	4	5	6	7
C	A & B	G	2	2.5	2.7	3	3.2	3.6	4	4.2
		F	4	5	5.5	6	6.5	7.2	8	8.5
		E	8	10	11	12	13	14.5	16	17
D	B	F	16	20	22	24	26	29	32	34
		E	32	40	44	48	52	58	64	68

Fig. 36.

IV. — OPERATING THE LATHE

SCREW-CUTTING.

As indicated on the screw-cutting index plate (fig. 36), all metric threads from 0,25 to 7 mm. pitch and all « Whitworth » threads from 56 to 2 T.P.I. can be cut by the combined use of the various handles and of the three combinations of gears on the swing frame (fig. 37).

METRIC PITCHES.

All metric pitches are obtained by combination III, i.e. by mounting the gear with 127 teeth on the « Norton » gear box and by using the gear with 114 teeth as intermediate gear on the swing frame.

The pitches between the 0,25 mm. and 1,75 mm. are considered as standard pitches and can be obtained by placing lever 2 in C.

The lathe spindle can be driven with the back gears engaged or disengaged according to the spindle speed required; the lever 1 of the back gears may therefore be placed either in A or in B.

On the other hand, the pitches between 2 and 7 mm. are considered as coarse pitches and can only be obtained when lever 3 is placed in D; in that case, the lathe spindle must be driven through the back gears and the speed must be selected in the corresponding range, i.e. :— 37,5 to 225 r.p.m.

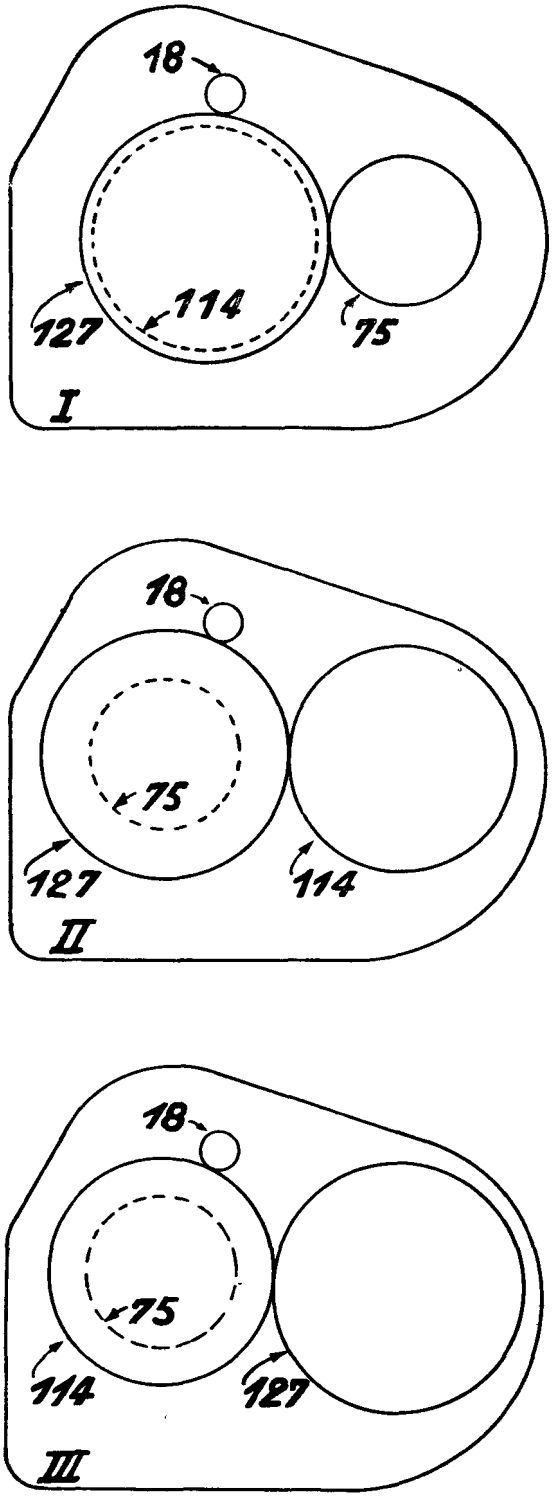


Fig. 37.

Examples :

1. To cut a 1 mm. pitch screw.

The combination III being mounted :

Move lever 2 in position C;

Move lever 3 in M;

Move lever 5 in E;

Move the tumbler lever in position 3.

The back gears lever may be placed either in A or in B according to the spindle speed which has been chosen.

II. To cut a 3 mm. pitch screw.

The combination of gears is the same as above, however :

Lever 2 must be placed in D;

Lever 3 must be placed in M2;

Lever 5 must be placed in F;

Tumbler lever of the gear box is placed in 5.

As regards the back gears lever I, **it must** be placed in **B.**

« WHITWORTH PITCHES ».

All « Whitworth » pitches, except the 19 threads per inch, are obtained by the gear combination I on the swing frame, i.e., by mounting the gear with 75 teeth on the « Norton » gear box and using the gear with 127 teeth as intermediate gear on the swing frame.

The 19 threads per inch pitch is obtained by using combination II, the 114 teeth gear being mounted on the « Norton » gear box and the 127 teeth gear being used as intermediate gear.

The pitches between 56 and 8 threads per inch are considered as standard pitches; those from 7 to 2 threads per inch are called coarse pitches.

The levers are placed in the same manner as for the metric pitches.

Examples :

I. To cut a screw with 11 threads per inch.

The gear combination I having been mounted on the swing frame :

Move lever 2 in C;

Move lever 3 in W1;

Move lever 5 in G;

Move the tumbler lever of the gear box in 4.

The back gears lever I may be placed either in A or in B, according to the speed which has been selected.

II. To cut a screw with 3 threads per inch.

The combination of gears on the swing frame is the same as above, however :

Lever 2 is placed in D;

Lever 3 is placed in W1;

Lever 5 is placed in G;

Tumbler lever is placed in 5.

As regards the back gears lever I, **it must** be placed in **B.**

HOW TO USE THE SCREW-CUTTING INDICATOR.

The screw-cutting indicator (fig. 38), which is used only in the case of pitches designated by the number of threads per inch, has a dial divided in four main and four secondary positions, i.e., eight positions in all.

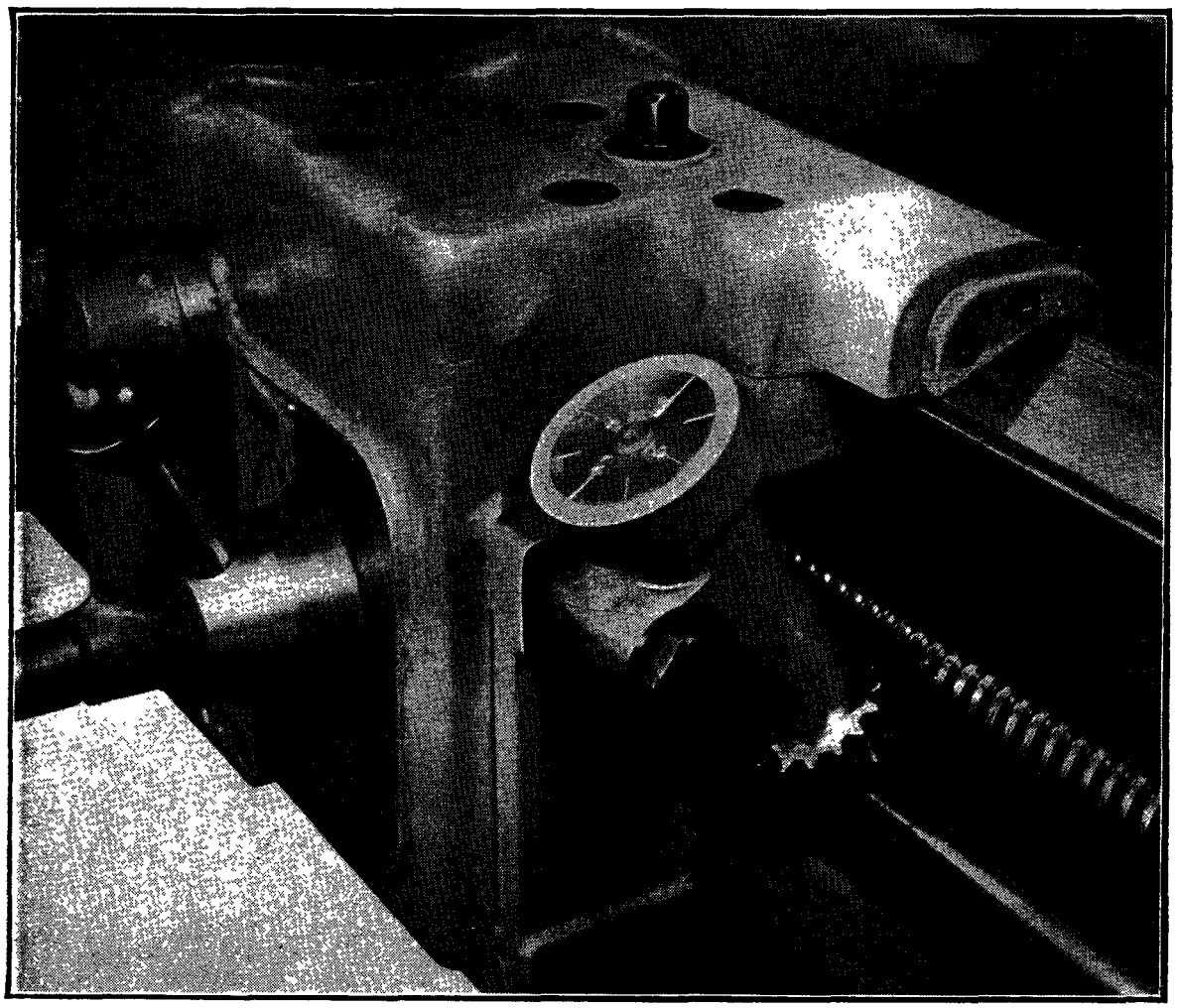


Fig. 38.

The indicator is not required for the pitches having 4, 8, 16 and 32 threads per inch, because, after the tool has been withdrawn and the saddle returned, the leadscrew may be engaged at any point, the tool being always in the correct position for a second cut.

As regards pitches with an even number of threads per inch :— 2, 6, 10, 12, 14, 18, 20, 22, 24, 26, 28, 36, 40, 44, 48, 52 and 56 threads per inch, the tool will be in the correct position for a second cut at any of the 8 positions of the dial.

Example :

A 22 threads per inch pitch is rough cut by engaging the leadscrew when number I of the dial passes the line marked on the rim. For further cuts, the leadscrew can be engaged at any of the 8 positions of the dial.

For pitches having an odd number of threads per inch, 3, 5, 7, 9, 11, 13 or 19, the leadscrew can be reengaged only in 4 perpendicular positions.

For half pitches such as 2 1/2, 3 1/2, 4 1/2, 5 1/2, 6 1/2 T.P.I., the leadscrew can be reengaged in 2 opposite positions only.

Example :

A 4 1/2 threads per inch pitch is rough cut by engaging the leadscrew when the indicator is in position 1. For further cuts, the leadscrew can only be reengaged in position 1 or 3.

For the « quarter » threads, i.e , 2 1/4, 2 3/4, 3 1/4 T.P.I., only the initial position of the indicator may be used when reengaging the leadscrew.

Example :

A 2 3/4 T.P.I. pitch is rough cut by engaging the leadscrew in position 1 of the indicator. When engaging the leadscrew for further cuts, position 1 only may be used.

MODULE PITCH.

These pitches are cut by using the gear combination M on the swing frame (fig. 39). The gear with 58 teeth must be fixed on the stud of the « coarse pitches » and the 127 teeth gear on the « Norton » gear box, whereas the intermediate gears are the 80 teeth gear, which meshes with the 58 teeth gear, and the 78 teeth gear in mesh with the 127 teeth gear.

This combination multiplies by π or 3,1416 all the metric pitches obtained with the gear combination III of the swing frame.

For cutting a module 3 pitch, the levers are placed in the same manner as when cutting a 3 mm. metric pitch, but the combination M for module pitches is used on the swing frame.

CIRCULAR PITCH.

For these pitches, the combinations of gears P1 and P2 (fig. 39) are mounted on the swing frame. The latter combination is required for the 19 circular pitch.

A circular pitch is obtained by placing the levers in the same position as when cutting a pitch having the same number of threads per inch.

Therefore, a 12 D.P. will be obtained with gear combination P1, the position of the levers being the same as for cutting a 12 T.P.I. screw.

FEEDS.

The three combinations of gears on the swing frame and the three positions of handle 3 give nine series of feeds.

We give below the nine series of longitudinal feeds which can be obtained with each of the combinations of gears on the swing frame. This will enable the operator to determine a feed which may have been used casually, or to use a feed which does not appear on the index plate.

As mentioned previously, the transversal feeds are half the longitudinal feeds.

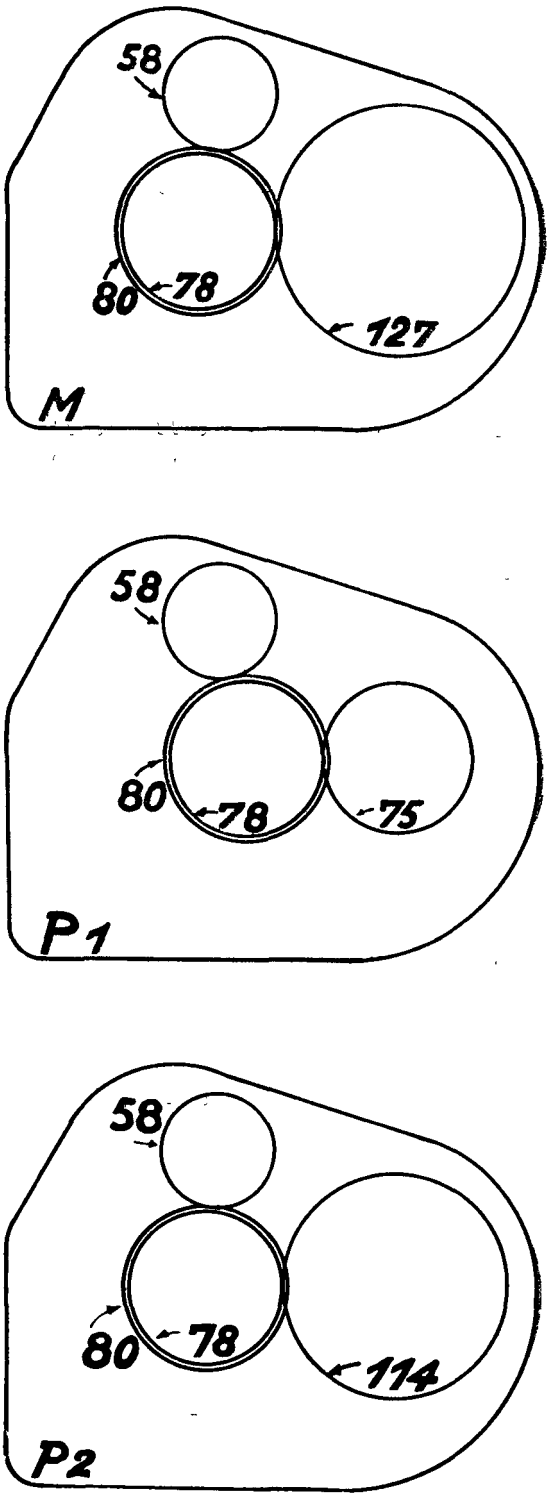


Fig. 39.

The feeds are given in millimeters.

m m ⟷			I						
			W-1						
			7	6	5	4	3	2	1
C	A and B	E	0,11	0,12	0,13	0,14	0,155	0,175	0,20
		F	0,22	0,24	0,26	0,28	0,31	0,35	0,40
		G	0,44	0,48	0,52	0,56	0,62	0,70	0,80
D	B	F	0,88	0.96	1.04	1,12	1,24	1,40	1,60
		G	1,76	1.92	2,08	2,24	2,48	2,80	3,20

m m ⟷			I						
			M-1 and W-2						
			1	2	3	4	5	6	7
C	A and B	G	0,08	0,09	0,10	0,115	0,115	0,135	0,15
		F	0,16	0,18	0,21	0,23	0,25	0,27	0,30
		E	0,32	0,36	0,42	0,46	0,50	0,34	0,60
D	B	F	0,64	0,72	0,84	0,92	1	1,08	1,20
		E	1,28	1,44	1,68	1,84	2	2,16	2,40

m m ⟷			I						
			M-2						
			1	2	3	4	5	6	7
C	A and B	G	0,10	0,12	0,13	0,14	0,15	0,17	0,18
		F	0,20	0,24	0,26	0,28	0,30	0,34	0,36
		E	0,40	0,48	0,52	0,56	0,6	0,68	0,72
D	B	F	0,80	0,96	1,04	1,12	1,2	1,36	1,44
		E	1,6	1,92	2,08	2.24	2.4	2,72	2,88

m m ⟷			II						
			W-1						
			7	6	5	4	3	2	1
C	A and B	E	0,075	0,08	0,085	0,095	0,1	0,115	0,125
		F	0,15	0,16	0,17	0,19	0,2	0,23	0,25
		G	0,3	0,32	0,34	0,38	0,4	0,46	0,5
D	B	F	0,6	0,64	0,68	0,76	0,8	0,92	1
		G	1,2	1,28	1,36	1,52	1,6	1,84	2

m m ⟷			II						
			M-1 and W-2						
			1	2	3	4	5	6	7
C	A and B	G	0,035	0,06	0,07	0,075	0,08	0,09	0,035
		F	0,11	0,06	0,14	0,15	0,16	0,18	0,19
		E	0,22	0,24	0,28	0,3	0,32	0,36	0,38
D	B	F	0,44	0,48	0,56	0,6	0,64	0,72	0,76
		E	0,88	0,96	1,12	1,2	1,28	1,44	1,52

m m ⟷			II						
			M-2						
			1	2	3	4	5	6	7
C	A and B	G	0,07	0,075	0,085	0,095	0,1	0,11	0,12
		F	0,14	0,15	0,17	0,19	0,2	0,22	0,24
		E	0,28	0,3	0,34	0,38	0,4	0,44	0,48
D	B	F	0,56	0,6	0,68	0,76	0,8	0,88	0,96
		E	1,12	1,2	1,36	1,52	1,6	1,76	1,92

m m ⟷			III						
			W-1						
			7	6	5	4	3	2	1
C	A and B	E	0,065	0,07	0,075	0,085	0,09	0,1	0,115
		F	0,13	0,14	0,15	0,17	0,18	0,2	0,23
		G	0,26	0,28	0,3	0,34	0,36	0,4	0,46
D	B	F	0,52	0,56	0,6	0,68	0,72	0,8	0,92
		G	1,04	1,12	1,2	1,36	1,44	1,6	1,84

m m ⟷			III						
			M-1 and W-2						
			1	2	3	4	5	6	7
C	A and B	G	0,05	0,055	0,06	0,065	0,075	0,08	0,085
		F	0,1	0,11	0,12	0,13	0,15	0,16	0,17
		E	0,2	0,22	0,24	0,26	0,3	0,32	0,34
D	B	F	0,4	0,44	0,48	0,52	0,6	0,64	0,68
		E	0,8	0,88	0,96	1,04	1,2	1,28	1,36

m m ⟷			III						
			M-2						
			1	2	3	4	5	6	7
C	A and B	G	0,06	0,07	0,075	0,085	0,09	0,1	0,11
		F	0,12	0,14	0,15	0,17	0,18	0,2	0,22
		E	0,24	0,28	0,3	0,34	0,36	0,4	0,44
D	B	F	0,48	0,56	0,6	0,68	0,72	0,8	0,88
		E	0,96	1,12	1,2	1,36	1,44	1,6	1,76

V. — ADJUSTMENTS AND DISMOUNTING

FRONT LEG.

Belts.

a) **From motor to variable speed unit.**

Tension : The two 13 × 8 V. bets have a pitch length of 33".

In order to increase the belt tension, the motor must be raised in regard to the variable speed unit; this is done by loosening the 4 screws (3 above and 1 on the side) fixing the motor to the variable speed unit, and by tightening the nut of the tensioning rod.

Too much tension may overload the bearings and cause the premature wear of the belts. The correct tension will be obtained when the belts can be deflected approximately 3/4" either side of their position.

Replacement : Can be done without difficulty.

b) **From the variable speed unit to the headstock pulley.**

Tension : The 2" × 3/16" flat leather belt is 6'2" long. The tension is regulated as follows :

1° Loosen the screw at the bottom of the front door;

2° Insert a rod in the tension eccentric and move downwards;

3° Tighten the screw.

Should the tension device be at the end of its traverse, it will be necessary to shorten the belt about an inch. It is advisable to use the same kind of belt fastening as the existing one (clipper or similar).

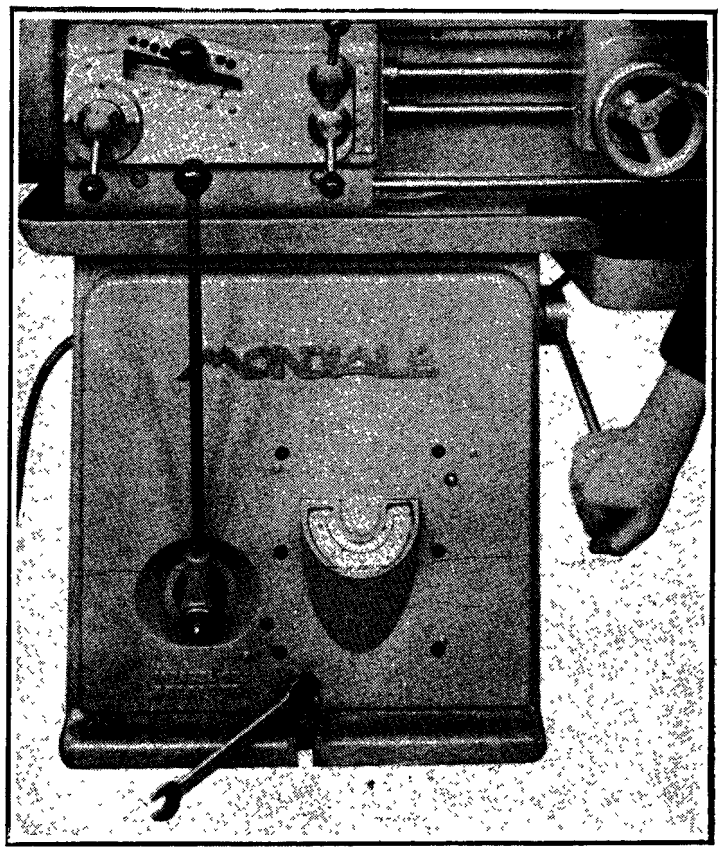


Fig. 40.

Replacement : This is done by following above instructions. However, when measuring the belt, the tension eccentric must be brought to the top of its traverse.

Note : If the lathe is not used during a long period, the belt should be loosened.

c) **Of the variable speed unit.**

Tension : The 5 V belts 13 × 8 have an pitch length of 33".

They are identical to those connecting the motor to the variable speed unit.

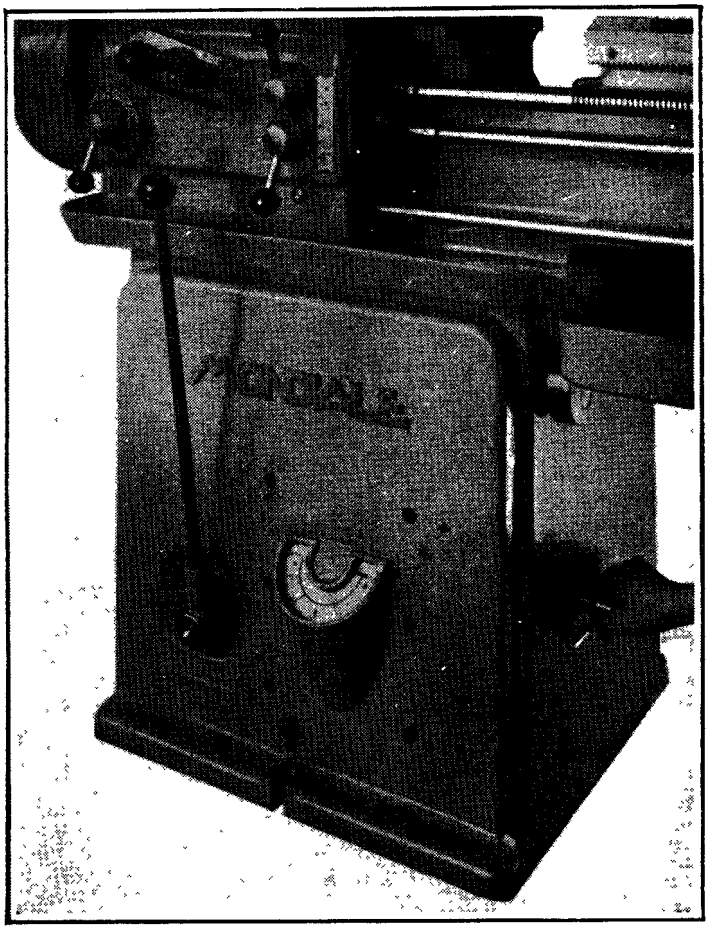


Fig. 41.

The tension is obtained by tightening the square head at the end of the sliding shaft (fig. 41).

The tension will be correct when the belts have a light tension which allows a deflection of 10 mm. on either side.

Any incorrect tension will result is premature wear. Care should be taken, therefore, to maintain the normal tension of the belts.

Replacement : Requires the removal and opening of the variable speed unit.

These operations should be carried out with care and attention as follows :

First of all, select the maximum speed, then :

1° Remove the front door and the complete motor and variable speed unit.

This should be done as follows

a) Lower the motor as much as possible and dismount the belt tension device and its bracket;

b) Lift the front door as high as possible and shift the main belt from the pulley on the variable speed unit;

c) Remove the set screw on the flat of the belt tension eccentric, and the set screw with a lock nut on one of the door brackets, inside the leg of the lathe (fig. 42);

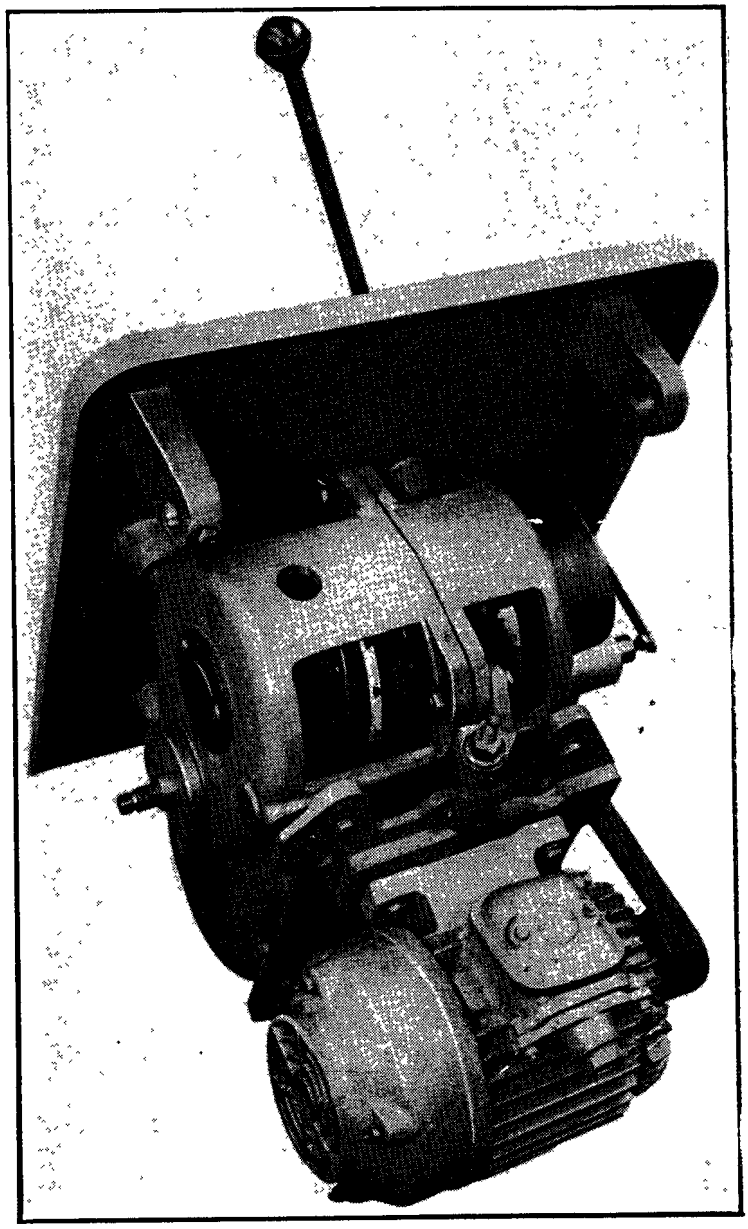


Fig. 42.

d) Support the variable speed unit with wooden wedges, disconnect the motor, marking the cables, and draw out the front door bar in the opposite direction to the tailstock;

e) After the wedges have been removed from under the unit, the door will swing forward round the bottom edge.

2° Removal of the variable speed unit :

a) Dismount the motor saddle;

b) Withdraw the central screw fixing the operating lever and remove the lever, the gear remaining on the shaft;

c) Detach the indexing cable spring from the cover and also the other end of the cable;

d) Unscrew the six screws on the front side of the door and the unit is released.

VARIABLE SPEED UNIT.

Opening of the variable speed unit.

a) Remove the pulley driven by the motor. The thread of the shaft nut is « right hand »;

b) Unbolt the two half-housings;

c) Remove the half-housing opposite to the pulley side (fig. 37).

After these operations, slacken the belts as much as possible, leaving, however, two or three threads of the adjusting screw engaged. In order to remove the worn belts and replace them by new ones it is necessary to reduce the diameter of the pulley which has been completely expanded; this is done by giving light and repeated blows, with a mallet, on the end of the shaft carrying this pulley.

The belts having been replaced, the pulley is expanded to its original diameter by operating in the same manner on the other end of the shaft.

The unit can be reassembled by reversing the above sequence of operations.

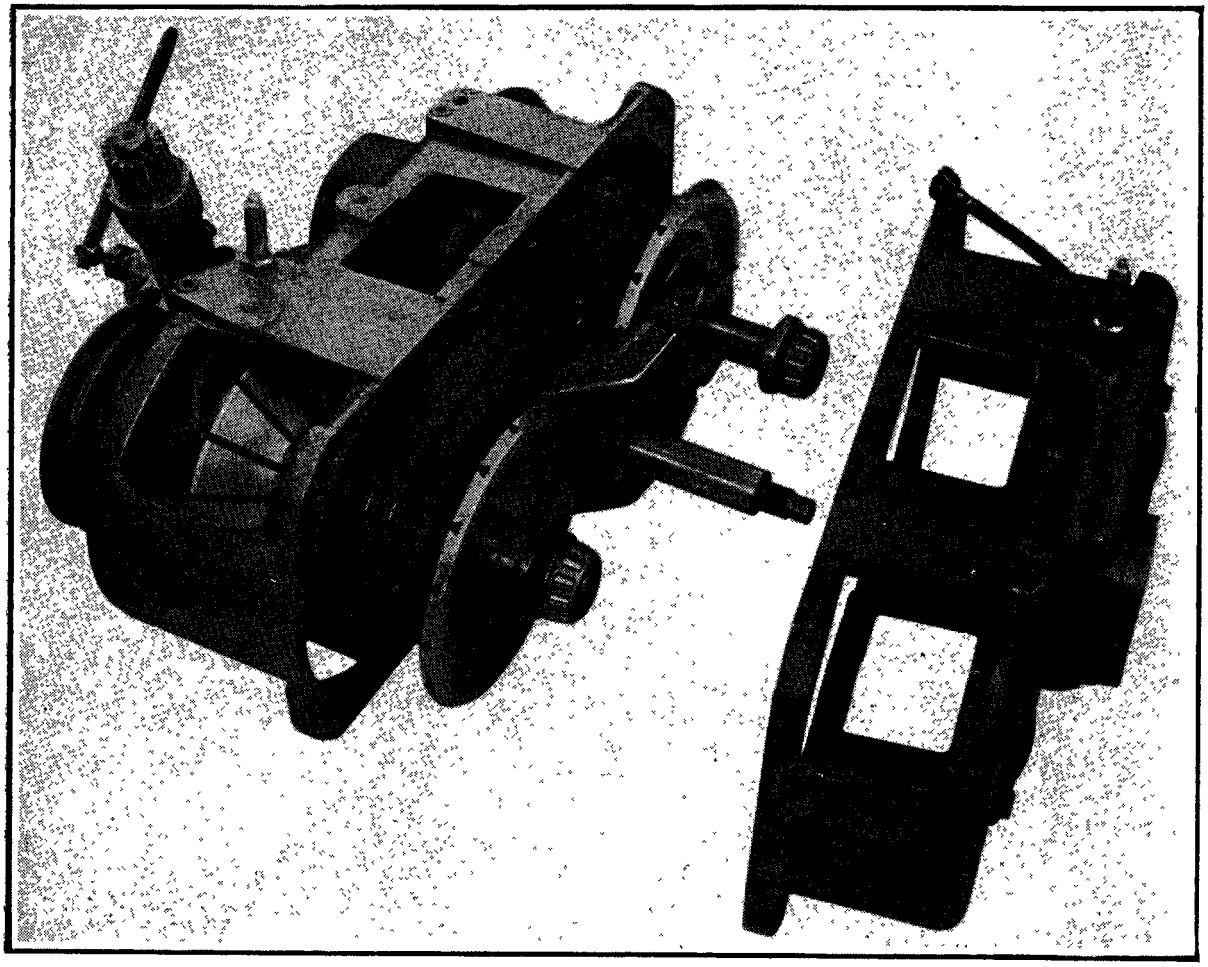


Fig. 43.

Roller bearings.

The side play of the roller bearings' (S.K.F. - 30.304) is taken up as follows :

a) Loosen by several turns, the pulley nut at the end of the shaft;

b) Lift the tongue of the safety washer from one of the slots of the castle nut behind each fixed taper;

c) Loosen this nut, the shaft being prevented from turning by holding the pulley;

d) As soon as the side play has been taken up, bend the tongue of the safety washer in one of the slots of the nut.

N. B. — The bars of the expanding pulley must not be used to prevent the shaft from turning.

Adjustment of the operating lever indexing device.

The hand of the dial will be in the correct position if it indicates the lowest speed on the dial when the variable speed drive runs at the lowest speed; at the same time, the angle between the hand and the large axis of the eccentric, on which it is mounted must be 90°. The adjustment is made by moving the hand as well as the fixture at the end of the sliding shaft.

HEADSTOCK.

Bearings.

To adjust the bearings in order to take up the radial play of the spindle, two special spanners are provided (fig. 44).

For the front bearing, the nut outside the headstock must be loosened and the inside nut tightened.

As regards the rear bearing, remove the spindle end guard, loosen the inside nut and tighten the outside nut.

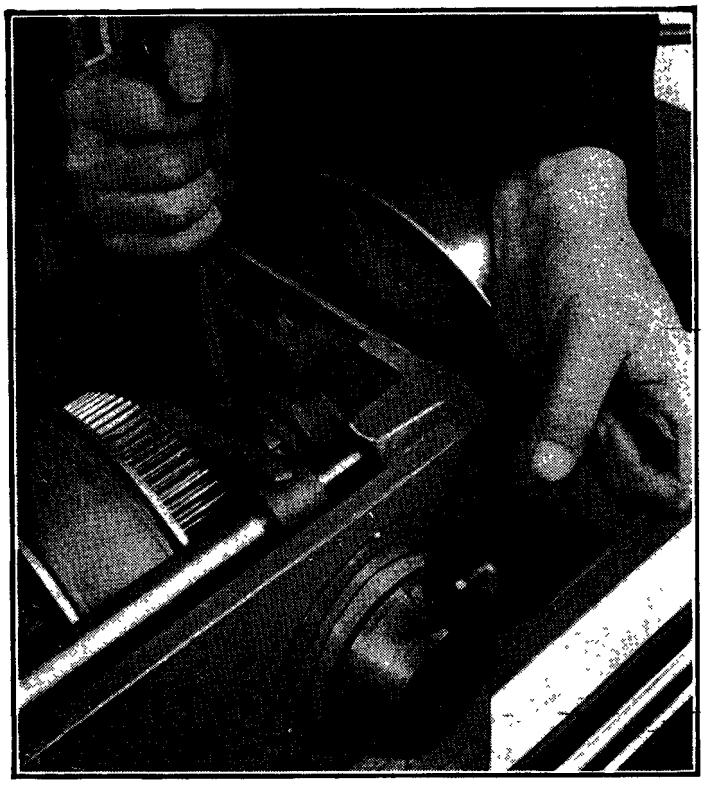


Fig. 44.

Note :

1° The play of the spindle should be taken up as soon as it is noticed, in order to prevent an exaggerated ovalization of the bearings;

2° The play must be taken up gradually and the spindle turned after each adjustment. The temperature of a bearing which has been correctly adjusted must not exceed 120° F.;

3° Check the correct adjustment of one bearing before adjusting the other;

4° Lubricate generously by injecting oil in the channels of the wicks;

5° Do not tighten the nuts excessively.

Stops.

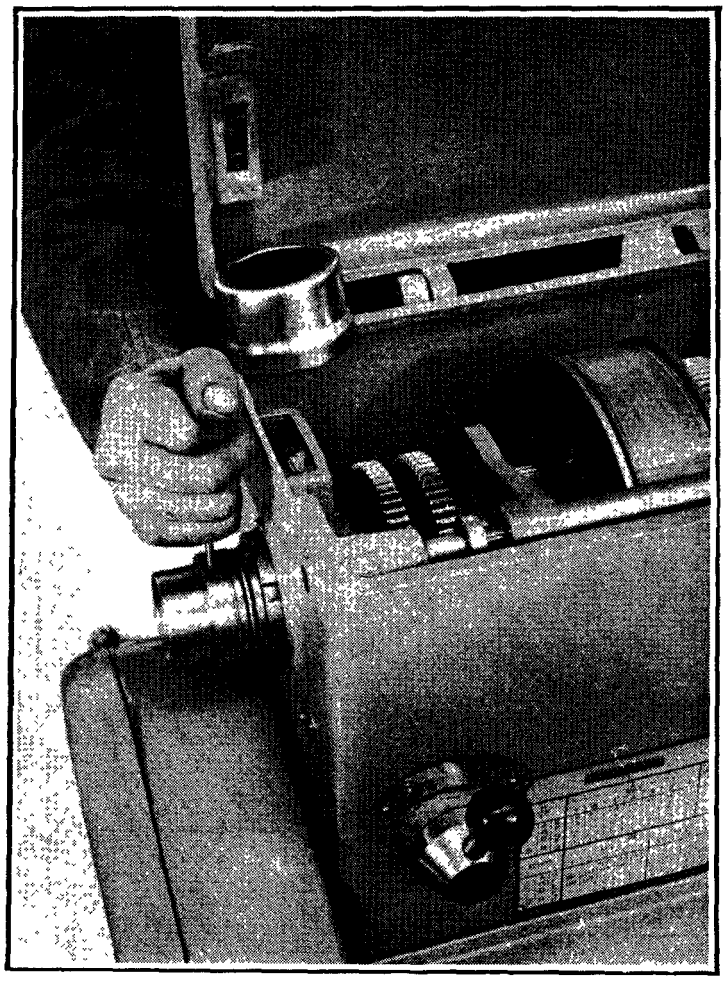
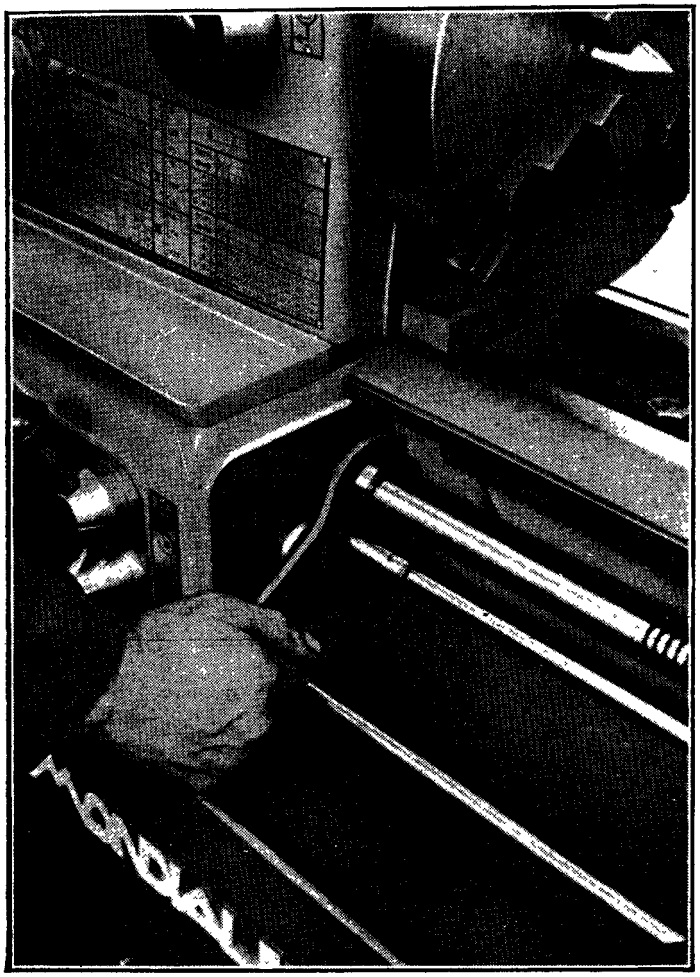


Fig. 45.

The axial play of the spindle is taken up by tightening the nut at the rear end of the spindle, under the guard.

This is done by bending the tongue of the safety washer in order to release the nut, and tighten this nut until all the play has been taken up; at the same time, rotate the spindle as the adjustment must not be too close.

This adjustment can be done also by tightening the nut until the spindle is hard to rotate, then unscrew the nut just enough to obtain the free rotation of the spindle.



Lock the nut by bending the tongue of the washer in one of the slots (fig. 45).

« NORTON » GEAR BOX.

Adjustment of the leadscrew axial play.

This is done by means of two castle nuts at the end of the leadscrew, near the gear box. The adjustment must not be too close; a play of 0,002" to 0,004" should be maintained (fig. 46).

Fig. 46.

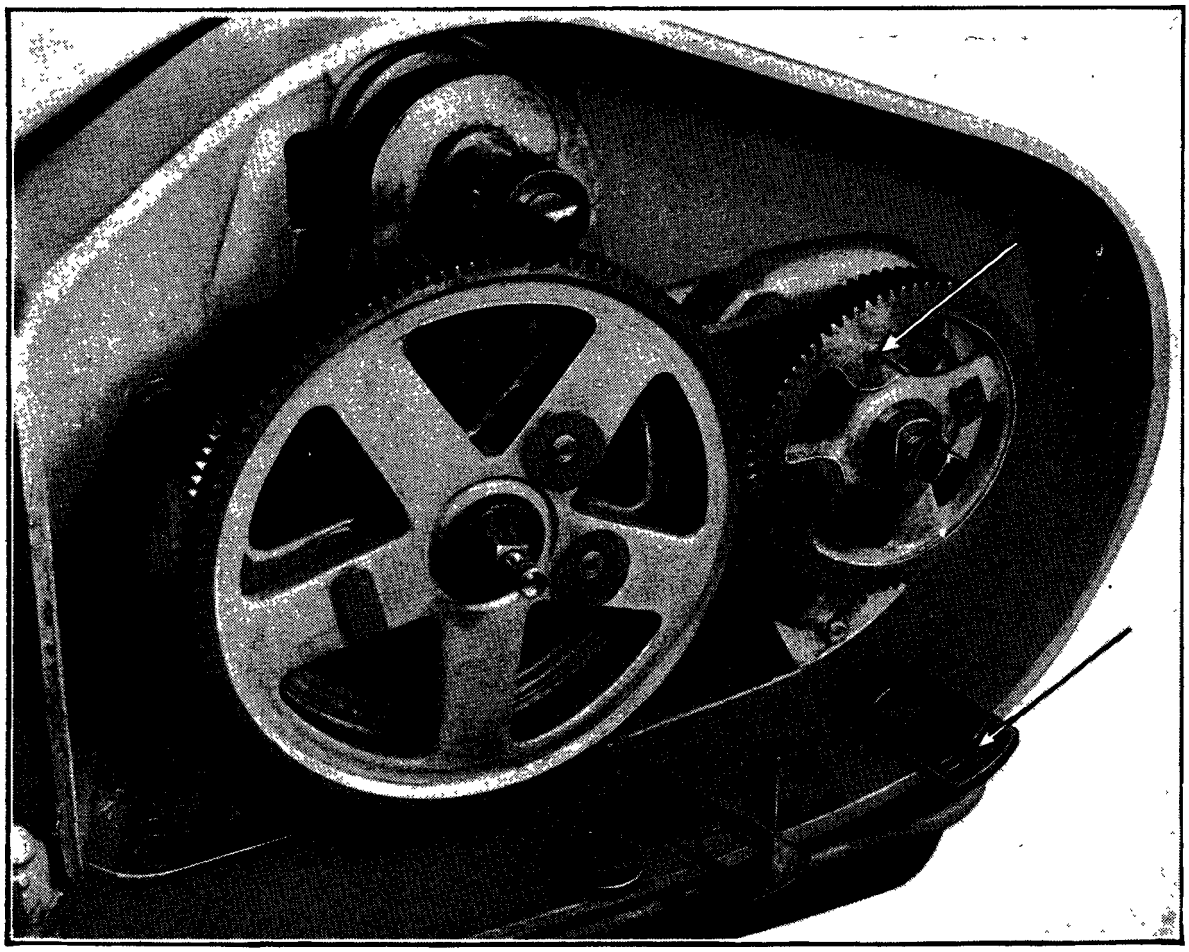


Fig. 47.

SWING FRAME.

Shear pin.

The feed mechanism is protected against abnormal efforts by a shear pin (fig. 47) which can be replaced as follows :

1° Unscrew the square head bolt at the end of the « Norton » gear box shaft and remove the split washer;

2° Remove the small plates and the pinion;

3° Drive the remains of the shorn pin;

4° Insert a new shear pin (3 mm. diameter, 24 mm. long, mild steel, 19 to 25 tons per square inch maximum tensile).

Never use a piece of drill or hard steel pins;

5° Reassemble by reversing the above sequence of operations.

Swing frame change wheels.

When mounting the change gears, leave enough play at the bottom of the teeth as the gears must run smoothly and not jam. The screws must be perfectly locked.

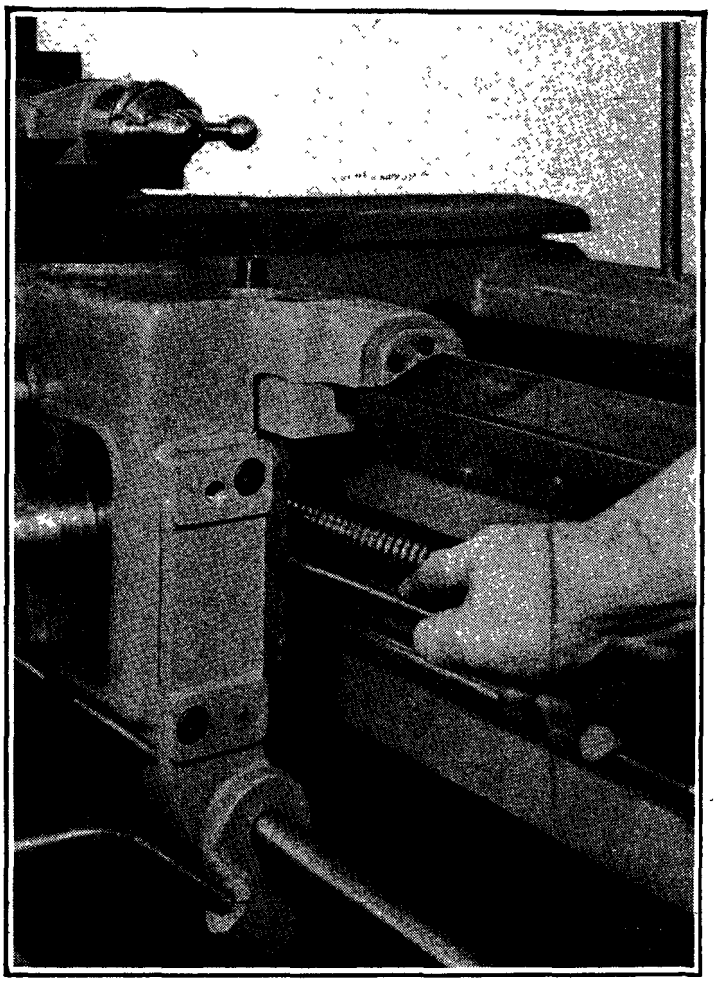


Fig. 48.

APRON.

Leadscrew nut guide.

The adjustment of the guide gib is by means of three screws with lock nuts on the side face of the apron. These screws are turned until a smooth sliding, exempt of any noticeable play is obtained (fig. 48).

Leadscrew half-nuts stop screw.

The adjustment is by means of two screws; one which acts as a stop is fitted in the bottom half-nut, the second one being screwed against the stop to prevent unscre-

wing. The stop screw rests against the top half-nut insuring the correct clearance between nut and leadscrew.

If, on account of excessive play, the saddle can be traversed by hand when the leadscrew is engaged, an adjustment must be made as follows (fig. 49)

1° Remove the lock screw;

2° Loosen the stop screw;

3° Close the nut completely on the leadscrew;

4° Bring the stop screw against the top half-nut;

5° Tighten the lock screw.

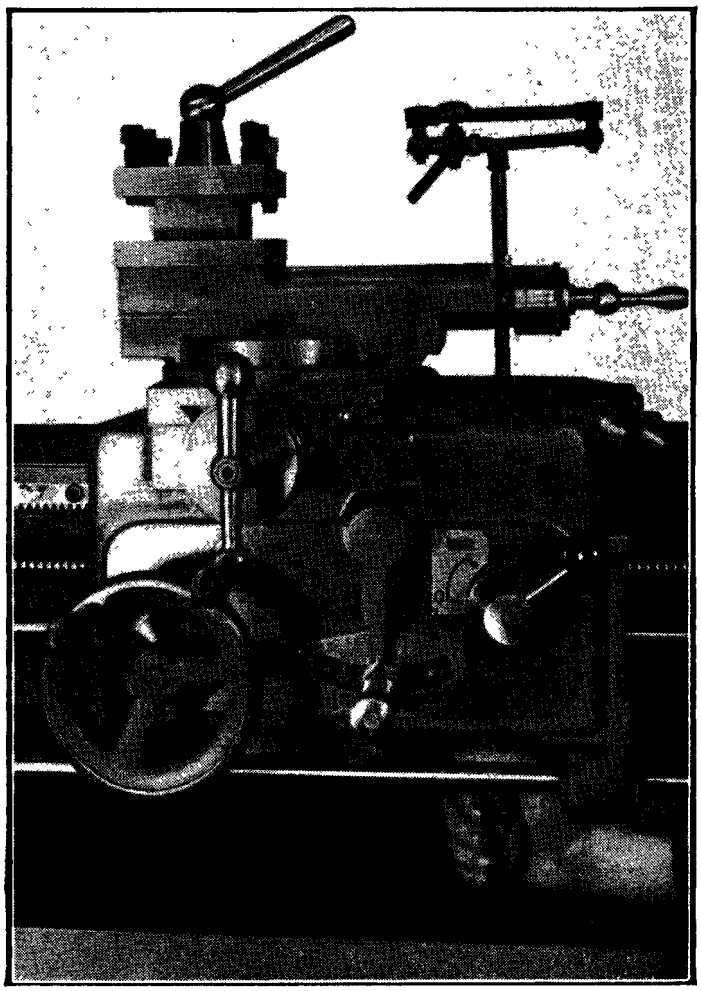


Fig. 49.

SADDLES AND SLIDES.

Guides.

The guides of the cross slide and tool slide have tapered gibs for taking up wear.

The adjustment is made (fig. 50) by loosening the safety spring screw until the slides move smoothly without any noticeable play.

Cross slide screw nut.

The play can be taken up by tightening the flat head screw on the side of the nut lubricator.

Gibs of the bed.

If the saddle has any play on the bed, the four gibs under the flat guide of the bed must be dismounted and sufficiently scraped to compensate the wear.

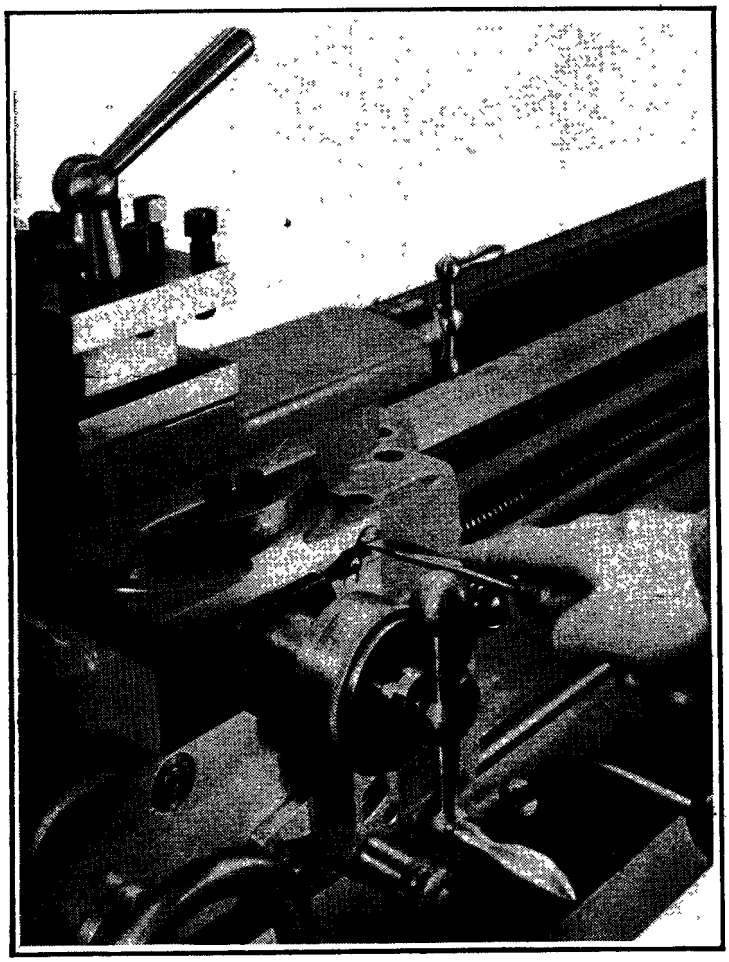


Fig. 50.

TAILSTOCK.

Setting over.

When the tailstock must be set over for taper turning :

1° Loosen the two screws at the front of the tailstock base plate;

2° The setting over screw is turned in the required direction, bearing in mind, however, that the maximum displacement must not exceed 1/2" either side of the initial position (fig. 45);

3° Tighten the screws at the front.

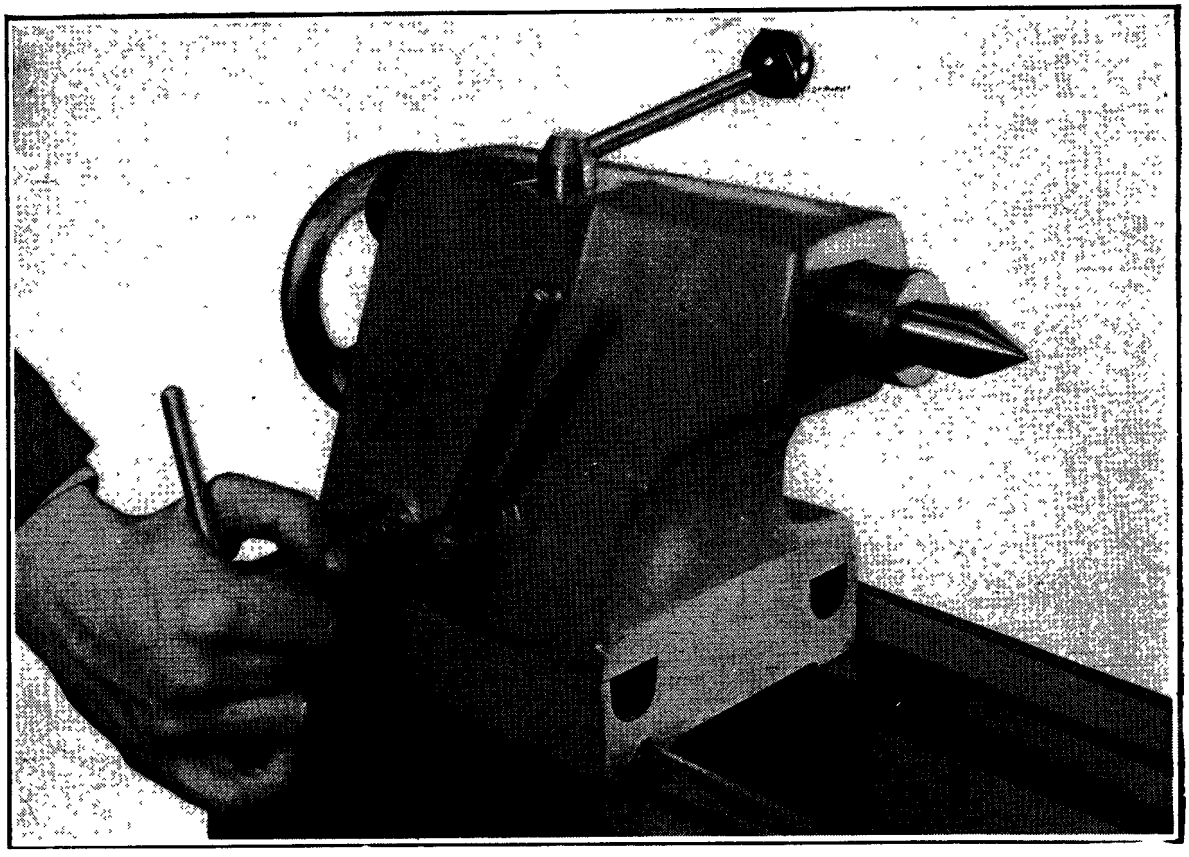


Fig. 51.

The tailstock can be replaced in the axial position by reversing the above sequence of operations, but the correct position must be checked as follows :

1° **With a dial indicator.**

A perfectly cylindrical bar, not less than 16" long, is placed between centres; with the indicator mounted on the square turret, check the eccentricity of the tail centre. The maximum tolerance is 0,001" on the diameter;

2° **Without a dial indicator.**

A bar not less than 16" long is turned between centres. The tailstock is adjusted until a precision of 0,001" on the diameter is obtained.

Clamping on the bed.

When the clamping is insufficient, an adjustment must be made as follows :

1° Remove the tailstock with its base plate;

2° The clamping blocks can be moved sideways by screwing the tapered wedge with the tool post spanner. In most cases, an eight of a turn is sufficient to ensure a new powerful clamping (fig. 52).

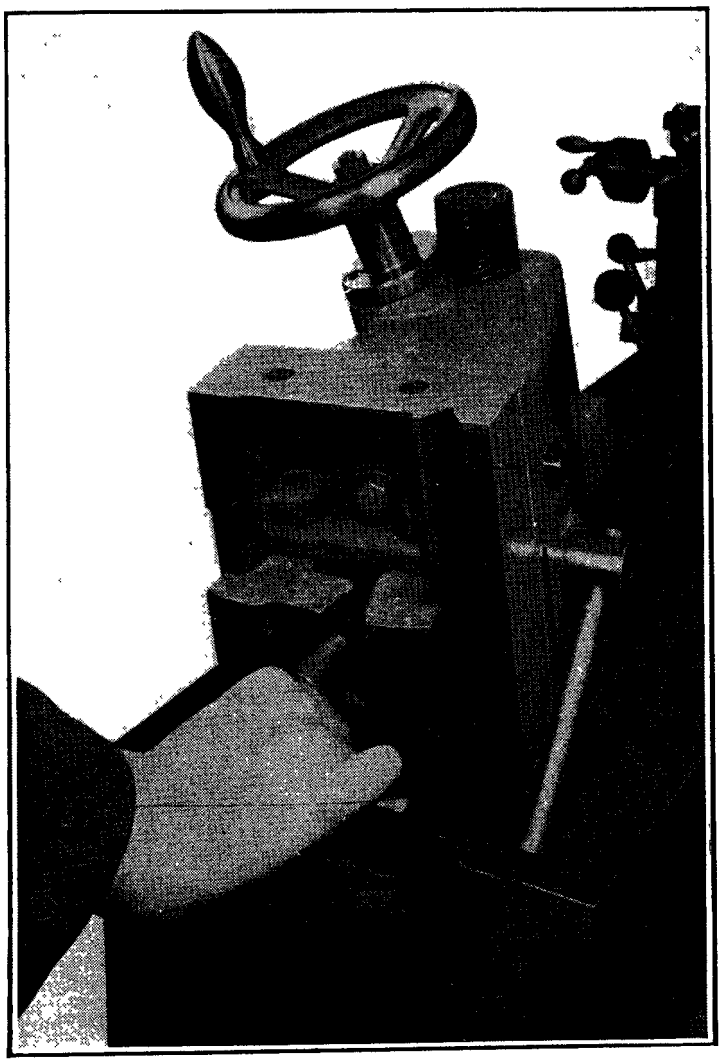


Fig. 52.

ELECTRICAL EQUIPMENT.

In case of breakdown, the installation must be checked as follows :

1° Verify the fuses;

2° Ascertain the arrival of the current on each side of the fuses by means of a test lamp;

3° Ascertain the arrival and out going of the current in the three positions of the reversing switch, by means of the test lamp;

4° Ascertain the arrival of the current at the motor terminal.

This method will enable the defective section to be located. If the trouble is due to the motor, a specialist should be called.

When the reversing switch must be inspected :

1° Withdraw the pin from the reversing rod stop ring against the rear bearing;

2° Draw the reversing rod from the switch housing;

3° Unscrew the two nuts which hold the housing;

4° Remove the housing.

These operations will be facilitated if the ball of the « Norton » gear box is removed.

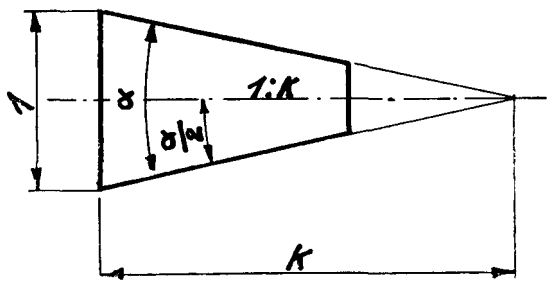
Besides, when cleaning the machine, care should be taken not to let any oil get inside the switch housing, and especially on the contacts as this may cause trouble.

VI. — APPENDIX

ALPHABETICAL INDEX

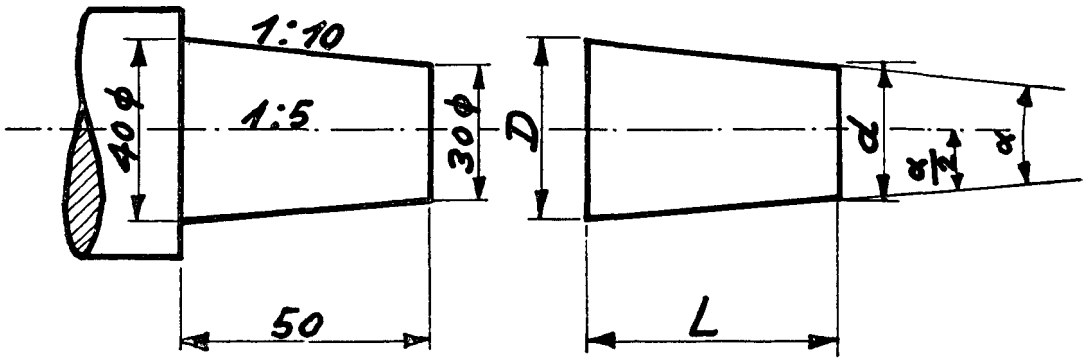
USUAL TAPERS

Taper 1 : K	Angle of taper α	Angle of work of the lathe $\frac{\alpha}{2}$
1 : 0,289	120°	60°
1 : 0,350	110°	55°
1 : 0,500	90°	45°
1 : 0,652	75°	37°30'
1 : 0,866	60°	30°
1 : 1,207	45°	22°30'
1 : 1,5	36°52'12"	18°26'6"
1 : 1,866	30°	15°
1 : 3	18°55'30"	9°27'45"
1 : 5	11°25'16"	5°42'38"
	9°31'38"	4°45'49"
1 : 10	5°43'30"	2°51'45"
1 : 15	3°49'6"	1°54'33"
METRIC & MORSE TAPERS		
1 : 30	1°54'34"	57'17"
1 : 50	1°8'46"	34'23"



Taper 1 = K means :—

On a length of K mm. there is a reduction of 1 mm. on the diameter.



1. **Reduction** = $\frac{D - d}{L} = 1 : K$

Example :— $\frac{40 - 30}{50} = \frac{10}{50} = \frac{1}{5} = 1 : 5$

2. **Gradient** =

$$\frac{D - d}{2} : L = 1 : \frac{K}{2}$$

Example :— $\frac{40 - 30}{2} : 50 = 5 : 50 = 1 : 10$

3. **Angles** =

$$\frac{D - d}{2} : L = \text{tg} \frac{\alpha}{2}$$

$\frac{\alpha}{2}$ = Angle of work of the lathe.

α = Angle of cone.

Example :— $\frac{40 - 30}{2} : 50 = 1 : 10 = 0{,}1$

$$0{,}1 = \text{tg} \frac{\alpha}{2}; \quad \frac{\alpha}{2} = 5°42'38''$$

$$\alpha = 11°25'16''.$$

CIRCUMFERENCES AND AREAS OF CIRCLES

Diam.	Circ.	Circle
1	3.1416	.7854
2	6.2832	3.1416
3	9.4248	7.0686
4	12.5664	12.5664
5	15.7080	19.635
6	18.850	28.274
7	21.991	38.485
8	25.133	50.266
9	28.274	63.617
10	31.416	78.540
11	34.558	95.033
12	37.699	113.1
13	40.841	132.73
14	43.982	153.94
15	47.124	176.71
16	50.265	201.06
17	53.407	226.98
18	56.549	254.47
19	59.600	283.53
20	62.832	314.16
21	65.973	346.36
22	69.115	380.13
23	72.257	415.48
24	75.398	452.39
25	78.540	490.87
26	81.681	530.93
27	84.823	572.56
28	87.965	615.75
29	91.106	660.52
30	94.248	706.86
31	97.389	754.77
32	100.53	804.25
33	103.67	855.30
34	106.81	907.92
35	109.96	962.11
36	113.10	1017.88
37	116.24	1075.21
38	119.38	1134.11
39	122.52	1194.59
40	125.66	1256.64
41	128.81	1320.25
42	131.95	1385.44
43	135.09	1452.20
44	138.23	1520.53
45	141.37	1590.43
46	144.51	1661.90
47	147.65	1734.94
48	150.80	1809.56
49	153.94	1885.74
50	157.08	1963.50
51	160.22	2042.82
52	163.36	2123.72
53	166.50	2206.18
54	169.65	2290.22
55	172.79	2375.83
56	175.93	2463.01
57	179.07	2551.76
58	182.21	2642.08
59	185.35	2733.97
60	188.50	2827.43
61	191.64	2922.47
62	194.78	3019.07
63	197.92	3117.25
64	201.06	3217.99
65	204.20	3318.31
66	207.34	3421.19
67	210.49	3525.65
68	213.63	3631.68
69	216.77	3739.28
70	219.91	3848.45
71	223.05	3959.19
72	226.19	4071.50
73	229.34	4185.39
74	232.48	4300.84
75	235.62	4417.86
76	238.76	4536.46
77	241.90	4656.63
78	245.04	4778.36
79	248.19	4901.67
80	251.33	5026.55
81	254.47	5153.00
82	257.61	5281.02
83	260.75	5410.61
84	263.89	5541.77
85	267.04	5674.50
86	270.18	5808.80
87	273.32	5944.68
88	276.46	6082.12
89	279.60	6221.14
90	282.74	6361.73
91	285.88	6503.88
92	289.03	6647.61
93	292.17	6792.91
94	295.31	6939.78
95	298.45	7088.22
96	301.59	7238.23
97	304.73	7339.81
98	307.88	7542.96
99	311.02	7697.69
100	314.16	7853.98

TABLE OF DECIMAL EQUIVALENTS

Fraction of an inch	Milli-meters	Decim. equi-valent inches	Fraction of an inch	Milli-meters	Decim. equi-valent inches	Fraction of an inch	Milli-meters	Decim. equi-valent inches	Fraction of an inch	Milli-meters	Decim. equi-valent inches
	0.1	.0039	5/32		.1562		7.7	.3031	17/32		.5312
	0.2	.0079		4.0	.1575		7.75	.3051		13.5	.5315
	0.3	.0118		4.1	.1614		7.8	.3071	35/64		.5469
1/64		.0156		4.2	.1654		7.9	.3110		14.0	.5512
	0.4	.0157		4.25	.1673	5/16		.3125	9/16		.5625
	0.5	.0197		4.3	.1693		8.0	.3150		14.5	.5709
	0.6	.0236	11/64		.1719		8.1	.3189	37/64		.5781
	0.7	.0276		4.4	.1732		8.2	.3228		15.0	.5906
1/32		.0312		4.5	.1772		8.25	.3248	19/32		.5937
	0.8	.0315		4.6	.1811		8.3	.3268	39/64		.6094
	0.9	.0354		4.7	.1850	21/64		.3281		15.5	.6102
	1.0	.0394		4.75	.1870		8.4	.3307	*5/8*		*.6250*
	1.1	.0433	3/16		.1875		8.5	.3346		16.0	.6299
3/64		.0469		4.8	.1890		8.6	.3386	41/64		.6406
	1.2	.0472		4.9	.1929		8.7	.3425		16.5	.6496
	1.25	.0492		5.0	.1968	11/32		.3437	21/32		.6562
	1.3	.0512		5.1	.2008		8.75	.3445		17.0	.6693
	1.4	.0551	13/64		.2031		8.8	.3465	43/64		.6719
	1.5	.0590		5.2	.2047		8.9	.3504	11/16		.6875
1/16		.0625		5.25	.2067		9.0	.3543		17.5	.6890
	1.6	.0630		5.3	.2087		9.1	.3583	45/64		.7031
	1.7	.0669		5.4	.2126	23/64		.3594		18.0	.7087
	1.75	.0689		5.5	.2165		9.2	.3622	23/32		.7187
	1.8	.0709	7/32		.2187		9.25	.3642		18.5	.7283
	1.9	.0748		5.6	.2205		9.3	.3661	47/64		.7344
5/64		.0781		5.7	.2244		9.4	.3701		19.0	.7480
	2.0	.0787		5.75	.2264		9.5	.3740	*3/4*		*.7500*
	2.1	.0827		5.8	.2283	*3/8*		*.3750*	49/64		.7656
	2.2	.0866		5.9	.2323		9.6	.3780		19.5	.7677
	2.25	.0886	15/64		.2344		9.7	.3819	25/32		.7812
	2.3	.0905		6.0	.2362		9.75	.3839		20.0	.7874
3/32		.0937		6.1	.2402		9.8	.3858	51/64		.7969
	2.4	.0945		6.2	.2441		9.9	.3898		20.5	.8071
	2.5	.0984		6.25	.2461	25/64		.3906	13/16		.8125
	2.6	.1024		6.3	.2480		10.0	.3937		21.0	.8268
	2.7	.1063	*1/4*		*.2500*		10.25	.4035	53/64		.8281
	2.75	.1083		6.4	.2520	13/32		.4062	27/32		.8437
7/64		.1094		6.5	.2559		10.5	.4134		21.5	.8465
	2.8	.1102		6.6	.2598	27/64		.4219	55/64		.8594
	2.9	.1142		6.7	.2638		10.75	.4232		22.0	.8661
	3.0	.1181	17/64		.2656		11.0	.4331	*7/8*		*.8750*
	3.1	.1220		6.75	.2657	7/16		.4375		22.5	.8858
1/8		*.1250*		6.8	.2677		11.25	.4429	57/64		.8906
	3.2	.1260		6.9	.2717		11.5	.4528		23.0	.9055
	3.25	.1280		7.0	.2756	29/64		.4531	29/32		.9062
	3.3	.1299		7.1	.2795		11.75	.4626	59/64		.9219
	3.4	.1339	9/32		.2812	15/32		.4687		23.5	.9252
	3.5	.1378		7.2	.2835		12.0	.4724	15/16		.9375
9/64		.1406		7.25	.2854		12.25	.4823		24.0	.9449
	3.6	.1417		7.3	.2874	31/64		.4844	61/64		.9531
	3.7	.1457		7.4	.2913		12.5	.4921		24.5	.9646
	3.75	.1476		7.5	.2953	*1/2*		*5.000*	31/32		.9687
	3.8	.1496	19/64		.2969		12.75	.5020		25.0	.9842
	3.9	.1535		7.6	.2992		13.0	.5118	63/64		.9844
						33/64		.5156	*1 Pouce*	*25.4*	*1.0000*