Logan Lathe

INSTRUCTIONS

LOGAN ENGINEERING COMPANY • Chicago, Ill.

915 - 917 - 920 - 922

Model 1922
Serial No 64452

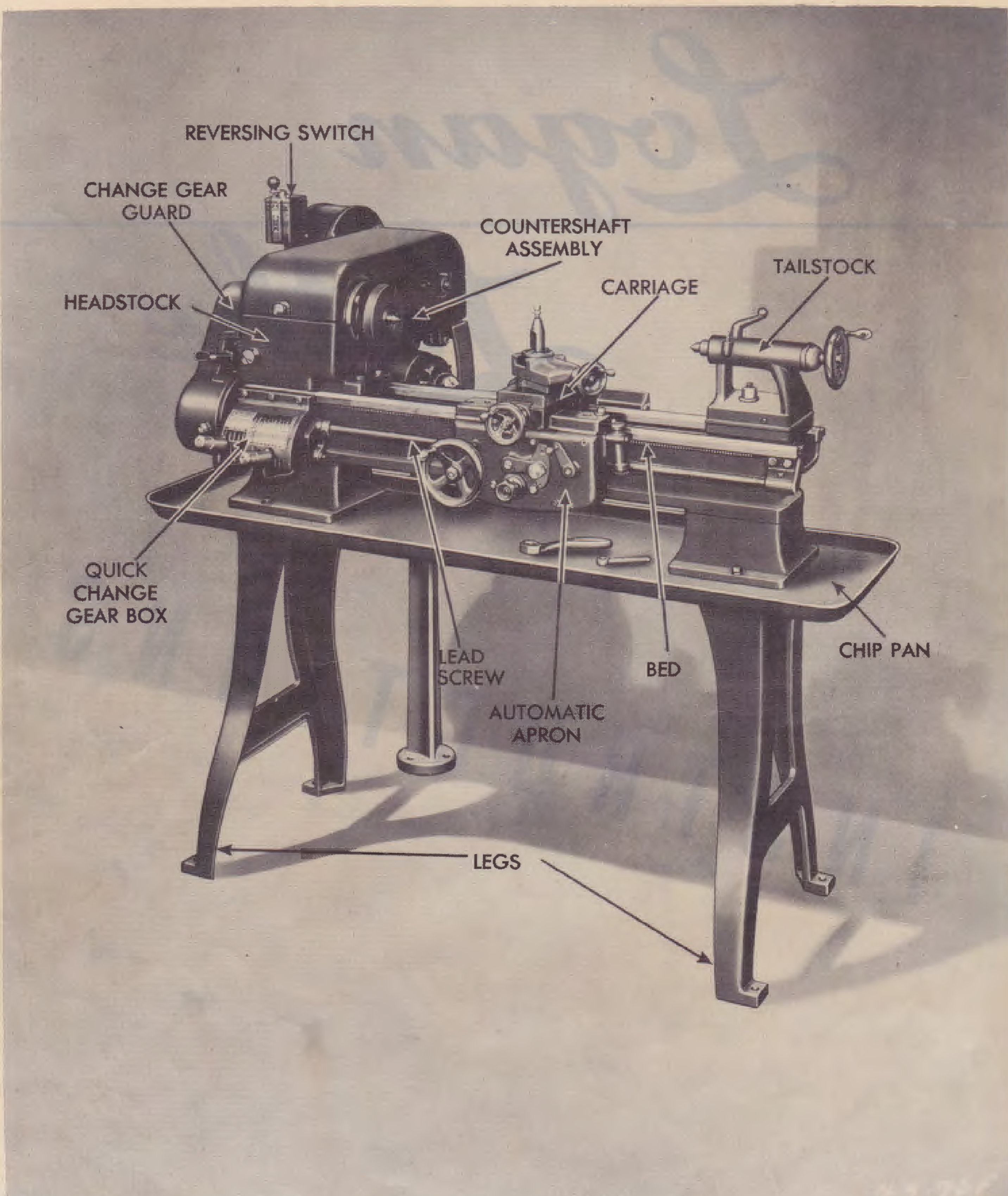


FIGURE 1—LOGAN NO. 920 FLOOR MODEL 11" SWING QUICK CHANGE GEAR LATHE

LOGAN LATHES

The cases in which your Logan Quick Change Gear Floor Model Lathe is delivered contain the following:

- 1 Logan Lathe with headstock, tailstock, and carriage mounted on the lathe bed
- 1 2-step V type motor pulley (screwed to base of lathe crate)
- 1 Bag tied firmly to lathe bed containing
  - 1 tool post
  - 1 tool post ring
  - 1 tool post screw
  - 1 tool post wedge
  - 1 tool post block
  - 1 tool post wrench
  - 1 tailstock wrench
  - 2 60° centers
  - 1 Headstock Adapter Sleeve
  - 1 knob and quill
- 1 Countershaft assembly—floor type
- 1 V Belt (attached to countershaft)
- 1 Six conductor cable (in bag attached to headstock)
- 1 Instruction book (inside the change gear guard)
- 1 Parts List (inside the change gear guard)
- 1 Chip pan
- 1 Set of floor legs

For the Bench Model Lathe the chip pan and floor legs are omitted and the countershaft assembly will be the bench type instead of the floor type.

Unpack carefully and check to be certain that you have removed all the pieces. After removing the lathe from its shipping case, clean it thoroughly with a stiff brush and kerosene. Then cover all the unpainted surfaces with a film of good machine oil to prevent rusting. These surfaces should be covered with a film of oil at all times and the lathe should be covered with canvas when not in use.

Setting Up the Lathe

FLOOR MODEL. Mount the lathe on the chip pan and the floor legs, using the bolts furnished, and attach the countershaft assembly to the rear of the headstock as shown in Fig. 2. When mounting the lathe on the pan and legs, notice that the holes in the pan are not drilled an equal distance from the sides of the pan. The short side is to be mounted towards the back of the lathe to keep the pan from interfering with the motor. Locate the lathe on a **solid level floor,** preferably concrete, in a dry well lighted location, using lag screws or bolts to fasten the legs to the floor. If the lathe is set on a concrete floor, mark the location of the bolt holes and drill in the concrete with a star drill setting the lag screws or bolts in expansion shields or in melted lead.

It is of the greatest importance that the lathe be level; if it is not, its weight will cause the lathe bed to be twisted, throwing the lathe out of true. It is impossible to do accurate work on a lathe that is not level and the lathe will be damaged beyond repair.

When the lathe is in position, place a sensitive machinist's level on top of the lathe bed and adjust any variation from level by placing thin shims under the feet. Be certain the lathe is level across the ways and parallel to them, both at the headstock and tailstock ends. When the lathe is level bolt down tightly and check the leveling. It may be necessary to loosen the bolts and add more shims. Remember the lathe **must be level** if it is to perform accurately.

BENCH MODEL. Attach the countershaft assembly and place the lathe in position on the bench. The bench for the lathe should be 31 to 33 inches high of heavy construction and suitably reinforced for steadiness and should have a top of seasoned wood at least two inches thick. We suggest that the top either be doweled or that 4 or 5 steel rods with end nuts be run crosswise through the top and the nuts turned tight, pulling the boards together. Plane the bench top level and place the lathe upon it. Mark and drill four ⅜-inch holes under the corresponding holes in the legs at each end of the lathe. Through these holes place four machine bolts to fasten the lathe to the bench and to aid in leveling. Then proceed to level the lathe bed with shims as described above for the floor model.

Mounting the Motor

The Logan Lathe is designed to be powered by a 1750 RPM motor. When the lathe is in place mount the motor on the motor bracket beneath the countershaft. Do not tighten bolts until the motor position has been adjusted.

To adjust the motor position, align motor pulley and the pulley on the countershaft by moving the motor until the two are in line. Tighten the base bolts, but do not place the belt on the pulley until the motor wires have been connected and the motor pulley tested for direction of rotation.

Connect the drum reversing switch mounted on the countershaft with the motor, using rubber covered 6 conductor cable in accordance with the wiring diagram pasted on the inside of the switch cover. Motors furnished by Logan have a wiring diagram packed with the motor to assist in making the proper connections. Connect the motor to the current source. The motor pulley should then rotate clockwise, viewed from the motor pulley end, when the switch is in the forward position. Combined switch and motor wiring diagrams are shown on the last page of this booklet for use with the motors we furnish. We recommend the use of a good three phase motor that is electrically balanced and will not transmit vibration through the belts to the headstock, causing chatter. Split phase motors are not recommended, especially where fine work is required.

Adjusting the Belts

The belt from the motor to the countershaft and the one from the countershaft to the lathe are easily adjusted for tension. Neither of these belts should be too tight, the tension depending on the load. Excessive belt pressure will shorten the life of the belt, place a strain on the bearings and cause a loss of power through excessive friction. When adjusted for normal work a moderate pressure on the middle of either belt should depress it about 1½ inches.

The motor bracket is hinged at one side with a bolt and nut adjustment that raises or lowers it, thereby decreasing or increasing the tension on the V belt. The V belt rides in a V groove of the two step motor pulley and on a flat face of the two step countershaft pulley.

When the cone pulley guard is raised, the countershaft automatically moves toward the headstock, thereby releasing the tension on the flat belt. With the tension released, the belt may be easily changed from one step to another. When the cone pulley guard is closed the belt is automatically brought into tension again, the amount of tension being regulated by a slotted head screw located at the rear of the cone pulley guard. Turning the screw to the right increases the belt tension; to the left decreases it.

The Countershaft

The countershaft assembly of the Logan Lathe is a patented development that is a distinct improvement over previous design. This special unit assembly is carried by two hinged pins attached to a bracket in the headstock and by a pedestal to the floor or the bench giving three point suspension. To prevent vibration being transmitted to the lathe, the entire assembly is insulated by rubber at all points of contact. The two hinge pins are rubber cushioned and the cone pulley guard rests on rubber buttons. Provision is made to adjust belt tension easily. An adjustable motor mounting bracket is included in the assembly. All pulleys and belts are completely guarded, yet easily accessible. A patented tension release operates automatically when the cover for the cone pulleys is raised to permit quickly changing the flat belt from one step to another. And finally, the entire assembly is designed to appear as a streamlined part of the lathe.

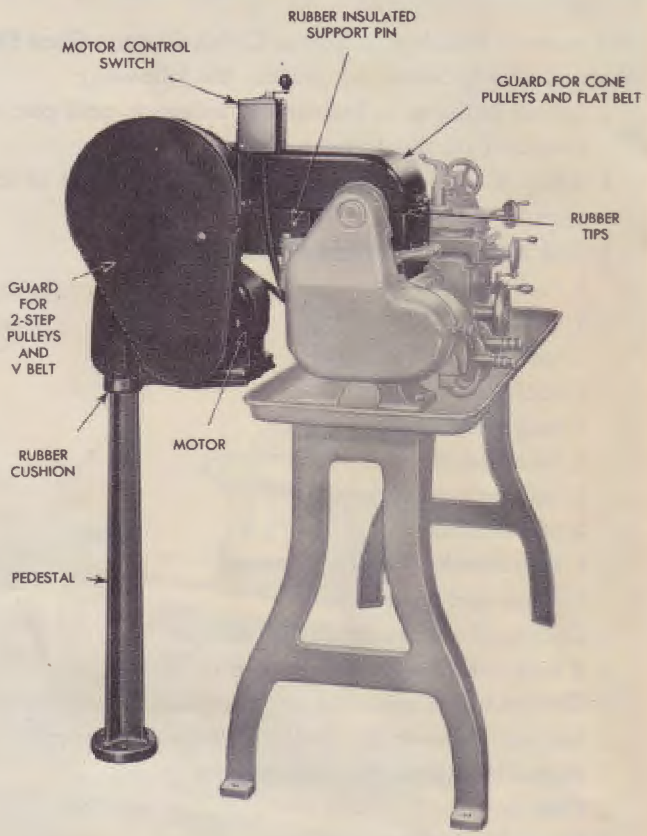


FIGURE 2—END VIEW OF COUNTERSHAFT ASSEMBLY

Fig. 2 above illustrates the floor model lathe and countershaft assembly in position. The bench model uses the same countershaft design adapted for bench use.

The Headstock

The headstock of the Logan Lathe is made of high grade gray iron and is totally enclosed. It contains the headstock spindle and bearings, the bull gear, the cone pulley and the back gears. The cone pulley is turned by the belt from the countershaft, and thereby turns the bull gear, or transmits its power through the back gears to the bull gear if lower speed or greater power are desired.

High carbon machinery steel has been used in making the spindle, which has been machined and ground to a fine finish. The nose is 2¼-in. diam. with 8-pitch National Form threads.

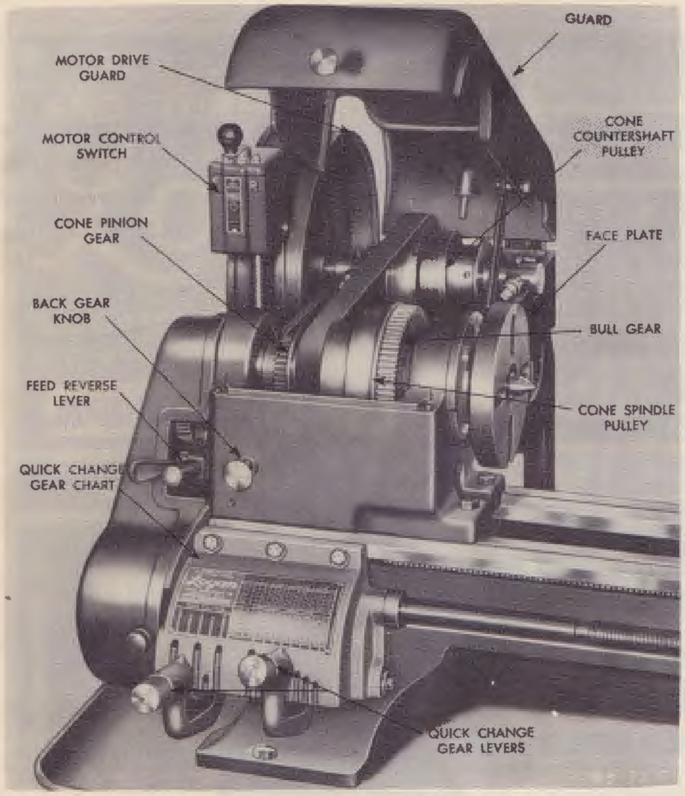


FIGURE 3—HEADSTOCK AND COUNTERSHAFT

A reducing sleeve permits the use of a No. 2 Morse Taper Center. The 1⅜-in. hole permits work as large as 1-in. to be fed through the spindle. A draw-in collet attachment taking collets up to 1-inch capacity can be used through the hollow spindle.

The spindle is mounted on two New Departure precision ball bearings which are sealed in grease. The use of ball bearings in the headstock to mount the spindle is advanced design that, although more expensive, gives finer results. Ball bearings are the ideal friction reducing bearings—"nothing rolls like a ball." Technical advances in ball bearing manufacture make it possible now to obtain special pre-loaded ball bearings of extreme precision that will carry the loads for which they are designed with less wear, greater accuracy and with no adjustment required.

The three-step cone pulley and the cone pinion gear are fastened together rigidly and revolve freely on the spindle. For direct drive, the pulley is locked to the large bull gear which is keyed to the spindle. This is accomplished by means of a plunger-type lock located on the side of the bull gear. When this lock is "in" the pulley turns the bull gear with it; when "out" the pulley and the cone pinion gear turn free of the bull gear.

Should it ever be necessary to remove the headstock spindle the following procedure should be followed.

First, remove the take-up nut, the spindle gear, Woodruff key, collar, and bearing grease seal in the order named from the left hand end of the spindle.

Second, remove the four fillister head screws from the bearing cap, then the bearing cap and next the grease seal from the right hand end of the spindle.

Third, loosen the set screws in the bull gear and carefully drive the spindle with a wooden mallet toward the tailstock end of the lathe, being careful to hold the bull gear and cone pulley parts as the spindle is removed so they will not drop.

Important

Ball bearings can be ruined by improper handling. When pressing a bearing into or out of the seat, pressure should be applied to the outer race only, but when pressed on to or off of shaft, pressure should be applied on the inner race only. Bearings should be carefully kept **free of dirt and grit** and except in extreme cases should not be tapped into place with a hammer.

The Back Gears

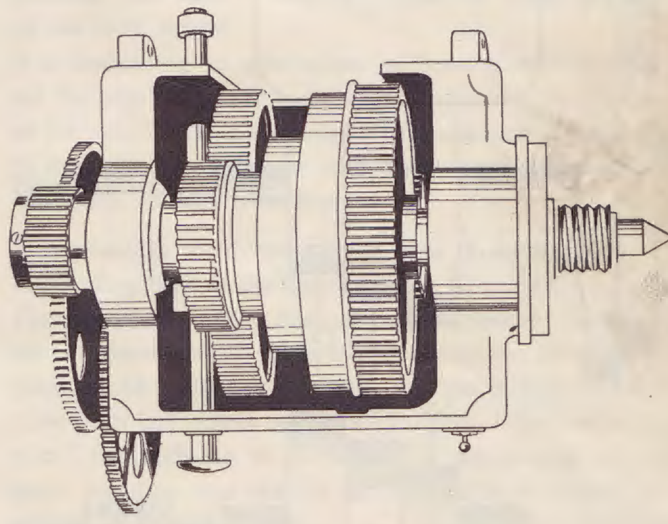


FIGURE 4—BACK GEAR DRIVE

The back gear mechanism on the Logan Lathe is enclosed in the headstock instead of being located in an exposed position as in the usual construction. Also, instead of having to reach over the top of the headstock to throw a back gear lever, the Logan design permits controlling the back gear by a knob on the front of the headstock. The back gear is mounted on a quill which turns on self-lubricating bronze bearings on an eccentric shaft. The knob operates a rack engaging a pinion which rotates the eccentric shaft, thereby swinging the back gears into mesh. When the knob is pulled out, the back gears are engaged and are locked in position by a pawl just back of the knob. The lock is released by pressing the pawl with the finger.

The cone pulley and small gear turn freely on the spindle and are locked to the bull gear for direct drive by a lock pin located in the side of the bull gear. When slower turning speed or greater power than could be obtained from a direct drive is required, the back gears are used. To engage the back gear drive first pull out the direct drive lock pin so that the cone pulley and cone pinion gear turn free of the bull gear. Then engage the back gears so that the power is transmitted through the cone pulley and cone pinion gear to the large back gear, and from the small back gear to the bull gear. The bull gear, being keyed to the lathe spindle, turns the spindle.

Spindle Speeds

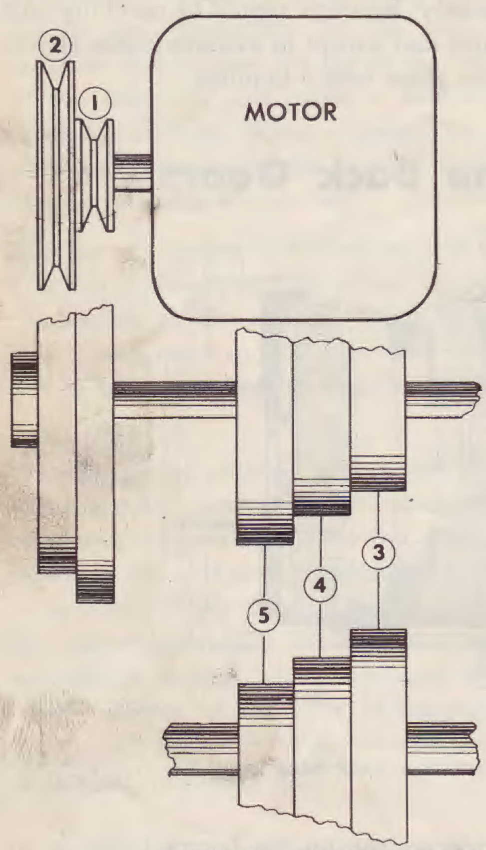


FIGURE 5—BELT DRIVE DIAGRAM

The following table shows the spindle speeds which can be obtained using the various belt positions shown in Fig. 5, both with direct drive and with the back gear drive.

Motor Belt Position	Spindle Belt Position					
	Back Gear Drive			Direct Belt Drive		
	3	4	5	3	4	5
1	45	63	89	270	380	535
2	125	177	250	753	1060	1500

The Lathe Bed

The bed of the Logan Lathe is an extra heavy one-piece casting of hard iron containing the correct proportion of steel and alloys to give the maximum in wear and to withstand all strains. Extra width (6-15/16" across

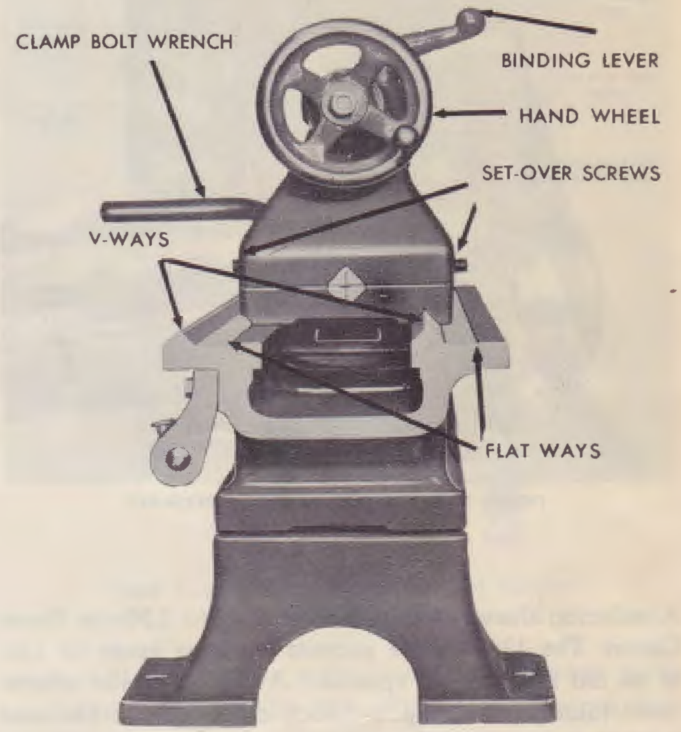


FIGURE 6—LATHE BED AND TAILSTOCK

the ways) extra heavy walls, heavier and closer spaced box type cross ribs combine to give greater strength and a more solid foundation for the lathe mechanisms. The accuracy of the lathe bed and the ways on which the carriage and the tailstock are mounted is of primary importance. To insure extreme accuracy in the bed two prismatic V-ways and two flat ways are employed. They have been planed, milled and precision ground, giving an accurate, heavy, well ribbed bed of the type found on large engine lathes. In order to retain this accuracy, the instructions for setting up the lathe emphasize the necessity for carefully levelling the bed both across and parallel to the ways.

With proper care and normal use there will be no appreciable wear on the bed or ways of a level lathe, but the surface may be damaged by a lack of oil or by abrasion. Be careful not to drop tools or work on the ways. Keep them well oiled when not in use, wiping them off and re-oiling before continuing work and, if possible, keeping them covered during filing or grinding operations.

SCREW CUTTING AND TURRET LATHES

Logan

LOGAN ENGINEERING CO.
CHICAGO, ILL. U. S. A.

MODEL NO.

LEVER POSITIONS

A B C D E

STUD GEAR	LEFT HAND LEVER	THREADS PER INCH							
48	A	4	4½	5	5½	5¾	6	6½	7
24	A	8	9	10	11	11½	12	13	14
24	B	16	18	20	22	23	24	26	28
24	C	32	36	40	44	46	48	52	56
24	D	64	72	80	88	92	96	104	112
24	E	128	144	160	176	184	192	208	224
		LONGITUDINAL TURNING FEEDS							
48	A	.1000	.0888	.0800	.0728	.0696	.0666	.0616	.0572
24	A	.0500	.0444	.0400	.0364	.0348	.0333	.0308	.0286
24	B	.0250	.0222	.0200	.0182	.0174	.0166	.0154	.0143
24	C	.0125	.0111	.0100	.0091	.0087	.0083	.0077	.0072
24	D	.0062	.0055	.0050	.0045	.0043	.0041	.0038	.0036
24	E	.0031	.0027	.0025	.0023	.0021	.0020	.0019	.0018

AUTOMATIC CROSS FEED .25 TIMES LONGITUDINAL FEEDS

FIGURE 7—THREAD AND FEED CHART ON LOGAN QUICK CHANGE GEAR LATHES

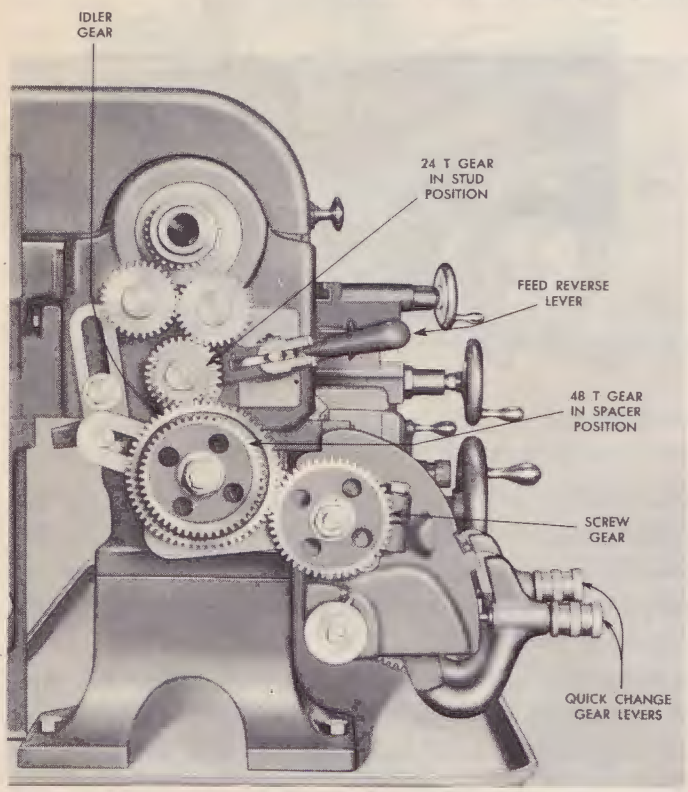


FIGURE 8—CHANGE GEAR TRAIN ON LOGAN QUICK CHANGE GEAR LATHE

Power Feeds

The left end of the headstock spindle is fitted with a gear for the transmission of spindle power through a gear train and through the quick change gear box to the lead screw along the front of the lathe which is used in power feeding. The rate of feed is dependent upon the speed of the lead screw.

It is necessary in operations such as thread cutting to set the rate of feed in a definite relationship to the speed of the spindle. This is done by the selection of gear sizes in the gear train together with the setting of the levers on the quick change gear box.

It is possible to obtain 48 different threads or feeds in either direction on the Logan Quick Change Gear Lathe. For threads from 8 to 224 per inch, inclusive, the change gear train is set up as in Fig. 8, using the 24 tooth stud gear. A 48 tooth gear is mounted as a spacer on the idler gear but serves no active purpose. For threads from 4 to 7 per inch the 48 tooth gear is mounted in the stud gear position and the 24 tooth gear is mounted as a spacer on the idler gear.

All other adjustment for the various thread or feed requirements is made by the two levers on the quick change gear box. Fig. 7 shows a reproduction of the thread and feed chart mounted on the gear box. As an example, assume that the 24 tooth stud gear is engaged in the change gear train (with the 48 tooth stud gear being used as a spacer) and that it is required to cut 18 threads per inch. Locate 18 on the gear chart. Set the left hand lever in position "B" as indicated and set the right hand lever directly under the column in which 18 appears. Similarly, if a longitudinal feed of .0045 inches per revolution of the spindle is required, set the left hand lever in position "D" and the right hand lever under the column in which .0045 appears.

Power cross feeds are .25 times the chart figures shown for power longitudinal feed.

The feed reversing lever, which extends from the gear train housing has three positions—Up, Down, and Center.

When in the center position the two gears on the end of the lever, which turn on bronze bearings, are free of the gear train and all power feeds are disconnected.

When "Up," the lead screw turns to move the longitudinal and cross feeds in one direction. When "Down," the longitudinal and cross feeds are in the opposite direction.

The alloy steel lead screw which runs along the front of the lathe bed has an Acme thread accurately cut with a pitch of ⅛ inch (8 threads to an inch) and is mounted at each end in a bearing. Clean and oil the lead screw frequently to maintain its accuracy.

The Tailstock

The tailstock slides on a V and flat way of the bed as illustrated in Fig. 6. It is locked in position along the bed by tightening the clamp bolt with the clamp bolt wrench furnished with the lathe.

The tailstock spindle is controlled by the tailstock hand wheel. Turning the wheel in a clockwise direction brings the spindle out of the tailstock. The spindle is of special steel with a ground finish and has been reamed for a No. 2 Morse Taper Center, which may be ejected by turning the tailstock wheel in a counter clockwise direction until the spindle reaches the end of its travel.

The spindle is graduated up to 4 inches in sixteenth inch graduations for accuracy in boring and drilling. Lock spindle in place by turning the binding lever to the right. A cup and quill are mounted on the top of the tailstock. Fill with a heavy grease or a mixture of white lead and machine oil to be used to lubricate the centers when work is mounted between them.

The tailstock may be set-over 11/16 inch for turning tapers by loosening the tailstock clamp nut and adjusting the headless set screws located on either side. To align the tailstock again the index line on the tail stock and tailstock base will indicate the approximate posiion. To obtain the exact position it is necessary to place a 12 or 15 inch check bar between centers. Take a light cut, then check the diameter at each end of the bar with a micrometer. If there is a variation adjust the set-over screws until the diameters at each end are the same after a cut.

Lathe Centers

The headstock spindle is ground to take a special adapter for a No. 2 Morse Taper Center. The tailstock is fitted for a No. 2 Morse Taper Center.

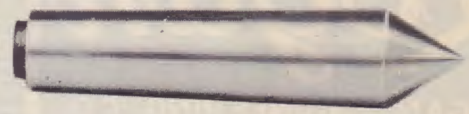


FIGURE 9—60 DEGREE CENTER

While the tailstock spindle should be kept oiled on the outside, the interior should be dry and clean. Before placing either of the centers in the lathe, they and the tapers into which they fit should be wiped free of oil and dirt, for the presence of a bit of dirt or a slight film of oil will interfere with the accuracy.

The Carriage

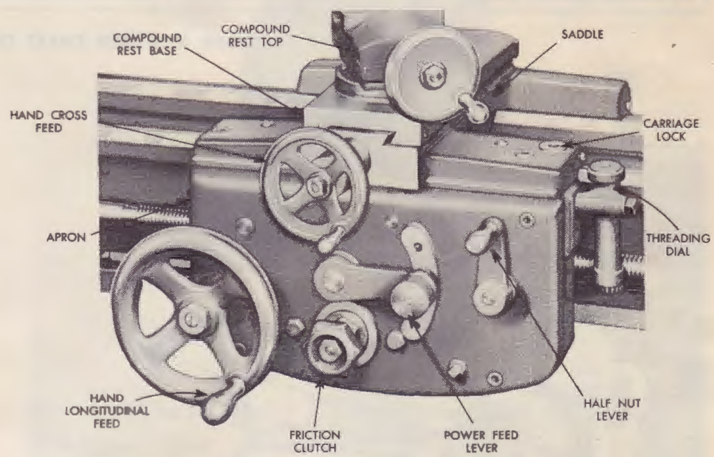


FIGURE 10—CARRIAGE

The carriage of the lathe is made up of four parts, the apron assembly, the saddle assembly, the compound rest assembly and the tool post assembly. Since the carriage supports the cutting tool and controls its action it is an important unit.

APRON. The apron which is suspended from the front of the saddle contains the power feed mechanism and the longitudinal hand feed together with the threading dial.

The large hand feed wheel on the front of the apron moves the carriage along the ways by means of gears which engage a rack on the underside of the front way.

The power feed lever is located in the center of the apron and can be set in three positions. When "Up," the apron mechanism is set for power longitudinal feed; when "Down," for power cross feed, and when in the central position, is in neutral. To engage the power after having set the power feed lever in the required position, the friction clutch knob located immediately below is turned to the right. Similarly, it is turned to the left to disengage. The feed reverse lever on the headstock controls left or right longitudinal feed, and forward and backward movement of cross feed.

In thread cutting, the half nuts are used for longitudinal feed. The half nut lever is located at the right side of the apron. The half nuts can only be engaged when the power feed lever is in the neutral position, and also the power feed lever cannot be engaged while the half nuts are engaged.

Power is fed through the friction drive from the spline in the lead screw, whereas the half nuts drive from the lead screw thread. To minimize wear and thereby retain the accuracy of the half nuts and lead screw, they should only be used for thread cutting.

The threading dial on the right end of the apron indicates the proper position in which to engage the half-nut lever during threading operations so that the tool will enter the same groove for each cut, thereby eliminating the need for reversing the drive at the end of each cut. (Fig. 11 Threading Dial.)

When cutting even numbered threads, the half nuts may be engaged at any point on the threading dial.

When cutting odd-numbered threads (5, 7, 9, 11, etc. per inch), engage the half-nut lever when the outer mark is in line with either the mark numbered "1" or that numbered "2."

When cutting half-numbered threads (4½, 5½, 6½, 11½, etc.), engage the half-nut lever at the same point on the dial for each cut.

The saddle, which moves longitudinally on the front V-way and the back flat way, has been machined from a semi-steel casting, and is held down on the bed by gibs which bear on the underside of the front and back ways. These gibs are adjustable and should be set just tight enough to give a firm sliding fit between the carriage and the bed.

The compound rest base moves across the top of the saddle on dovetailed ways to form the cross slide. The hand cross feed is operated by a hand wheel at the end of the cross feed slide. This slide is equipped with a gib which may be tightened by adjustment of the set screws on the outside of the slide. The cross feed gib should fit snugly and should be adjusted whenever play develops. The cross slide is moved by an Acme threaded screw mounted in self lubricating bronze bearings. The hand wheel of the cross feed is of polished steel and is calibrated in thousandths of an inch for measurement of feed when a definite cut is to be taken.

The compound rest is mounted on top of the cross-slide on a base calibrated in degrees from 0° to 90° in both directions. Two screws with tapered plugs, one on each side of the rest, hold the base in position, and by loosening these screws the rest may be swivelled to the desired angle. Two self-lubricating bronze bearings are mounted in the bushings of the rest which is moved over the slides by an Acme threaded screw. The slide is dovetailed with gib take-up for wear.

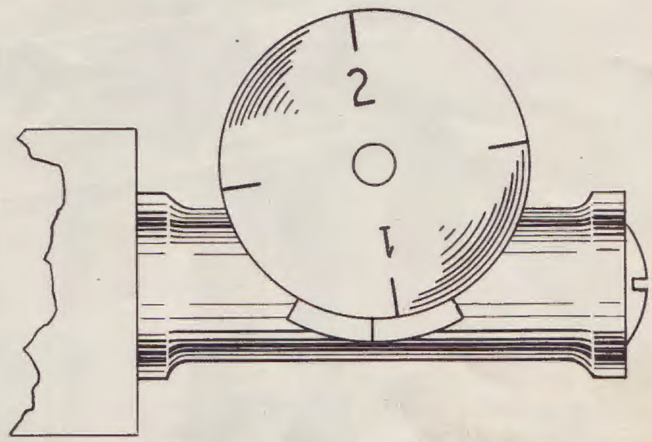


FIGURE 11—THREADING DIAL

The compound rest motion is controlled from a hand wheel by which the tool may be moved into the work for short tapers. The compound rest handle is calibrated for measurement in thousandths of an inch.

The tool post fits into a T slot in the compound rest and holds the tool holder by means of a square head screw.

Oiling the Lathe

The design of the Logan Lathe provides for correct lubrication with a minimum of attention. The ball bearings in the headstock are sealed in grease and require no further lubrication for the life of the bearing. At 31 separate points there are self-lubricating bronze bearings, where in ordinary construction plain bearings with oil holes are used. The bronze in these bearings is of an absorbent texture and has been thoroughly impregnated with lubricant. The correct film of lubricant is constantly maintained at the bearing surface without the necessity of frequent renewal.

Those points in the lathe requiring regular lubrication should be gone over every time the lathe is used and in a definite order so that no parts will be missed. Use a good machine oil no heavier than SAE No. 10, wiping away excess oil that would cause dirt to adhere to the lathe. Do not attempt to oil the lathe while it is running.

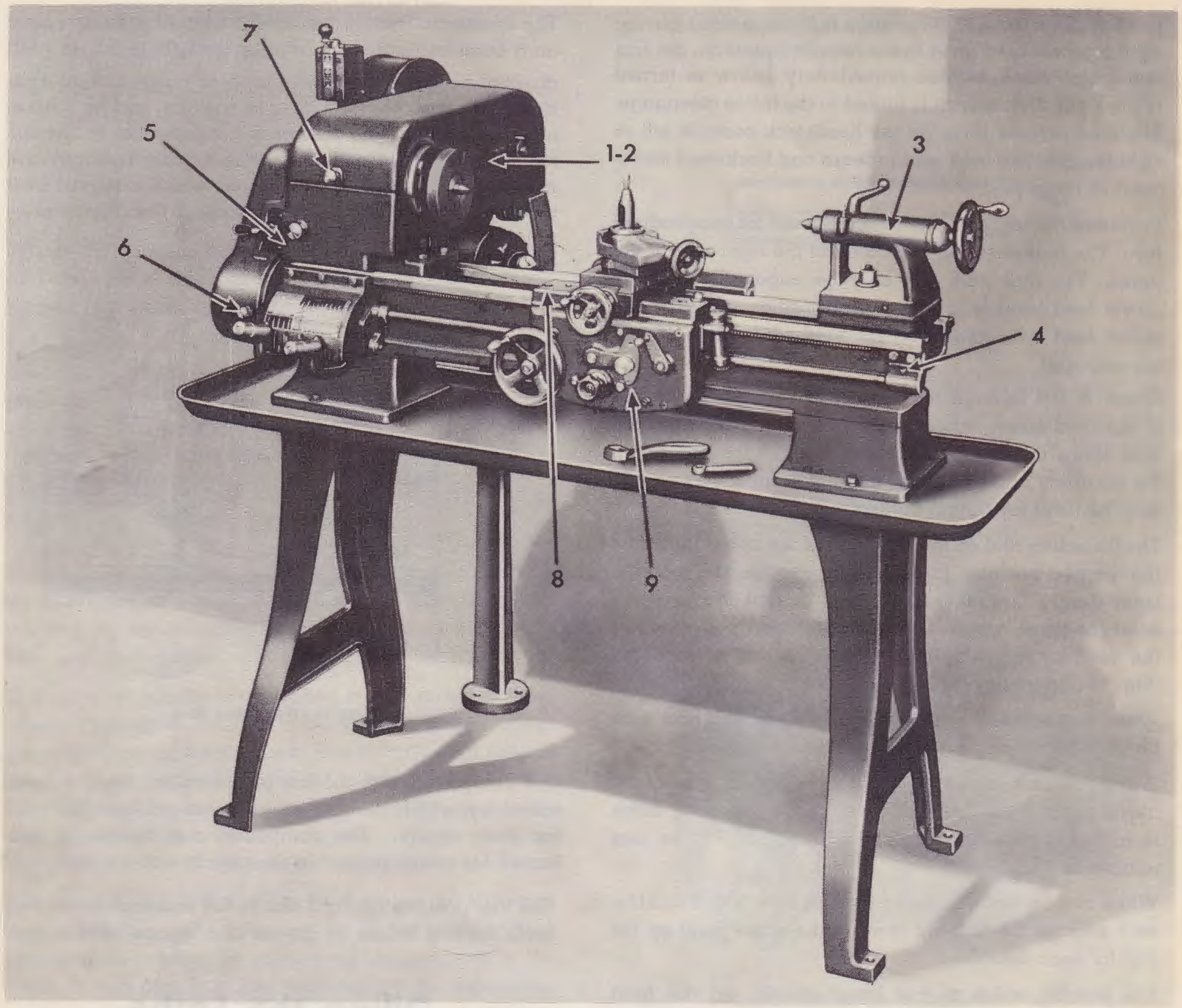


FIGURE 12—OILING DIAGRAM

Using a long-spouted can, oil the following points each time the lathe is used:

1.-2. Two oil cups on top of the countershaft bearings.
3. The spring well on top of the tailstock.
4. One oil cup on top of the bearing at right end of the lead screw.
5. The feed reverse lever. (A hole has been drilled in the base of the lever to receive oil.)
6. The bearings on each of the change gears.
7. The spindle pulley. (Remove the headless set screw on the second step of the pulley and oil freely before using the back gears.)
8. Remove set screw and fill this oil well so that when petcock set screw (9) is removed, oil just drips out.

Keep the following surfaces clean, free of chips and covered with a film of oil:

The lead screw.
The cross slide.
The compound slide.
The lathe bed ways, both V and flat.
The outside of the tailstock ram.
Spindle taper area.

A small amount of graphite grease should be kept on the teeth of all gears in the headstock, the apron and on the teeth of the rack on the underside of the front way.

Lathe Belts

The Logan Lathe is delivered equipped with a flat belt of web and rubber composition connecting the cone pulley on the lathe with the countershaft. A V Belt is also furnished to connect the 2 step V groove motor pulley with the 2 step flat face pulley on the countershaft. The life and efficiency of both these belts will be increased by keeping them clean and free from oil and by slipping them off the pulleys to release the tension, if the lathe is to be unused for any considerable length of time.

The use of a flat belt makes removal of the spindle unnecessary when replacing or changing the belt providing an endless belt is not required. This arrangement has two distinct advantages. First, the belt may be changed quickly and easily with a minimum of effort, for it may be laced, glued or hooked on the spindle, a simple procedure when compared with the task of removing the spindle and slipping an endless belt over it. Second, there is no risk of losing the alignment that has been accurately achieved at the factory through the use of precision gauges. Because of the high grade materials used and the accurate workmanship in assembling the headstock, under ordinary circumstances it need not be taken apart during the life of the lathe. However, should you desire to remove the spindle, you may do so, as was explained in the spindle description.

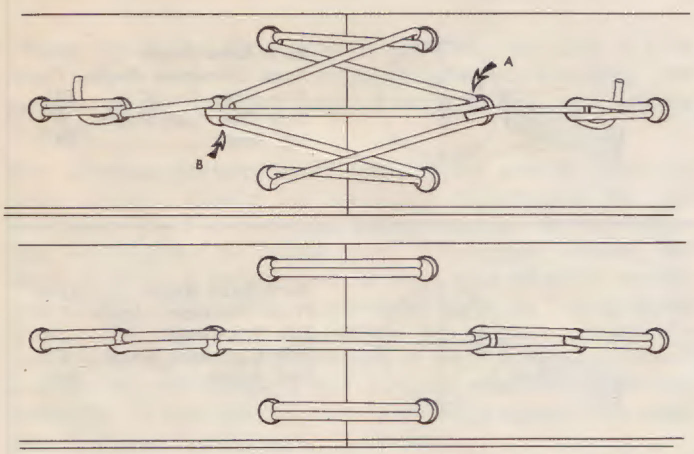


FIGURE 13—LACED BELT

Fastening the flat belt over the spindle pulley is a simple matter and may be done in any one of the following ways.

The belt, if laced, may be joined by either gut or rawhide throngs as follows. When the belting has been cut to the desired length, square the ends and punch ten holes as shown in Figure 13. Start the lace through holes A and B, pulling both ends through, working one to the right and one to the left, as shown. Do not cross one layer of lacing over another on the pulley side and do not allow it to kink or turn or the belt will not run smoothly. Fasten the ends as shown. If round gut is used cut shallow trenches between the holes on the pulley side and sink the gut in them.

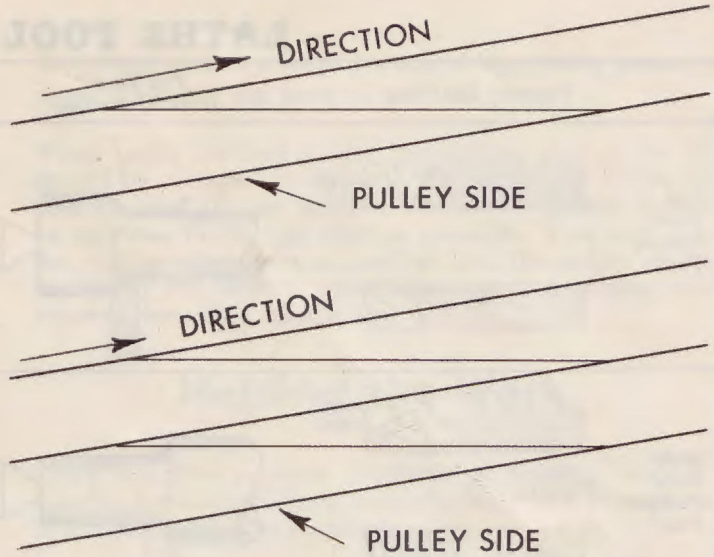


FIGURE 13A—GLUED BELT

If the belt is to be glued, make allowance for overlap and taper the overlap at each end so that ends will join as shown. See Figure 13A. Double belts should be split and each part tapered. Full directions are usually supplied with the glue; follow carefully.

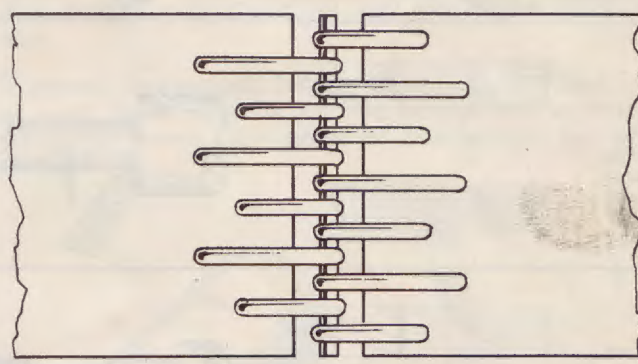


FIGURE 13B—BELT HOOK

The simplest and quickest method of fastening belt ends is by means of wire hooks, as shown in Figure 13B above. A number of different types are available which are easily attached by forcing the ends of the hooks through the belting and folding them over.

The V Belt supplied is a standard ½ inch endless belt which is easily slipped into place over both the two step V motor pulley and the 2 step flat face countershaft pulley.

Cutting Tools

There are a great variety of cutting tools used on a lathe; each shape being adapted to the work to be done and the finish to be left on the metal. Basically, however, all employ the same principle for all operate with a tearing action. The cutting edge of the tool tears a chip from the work and breaks it into separate sections as shown in Picture 14.

LATHE TOOL BIT SHAPES

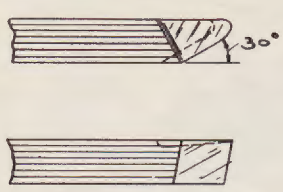
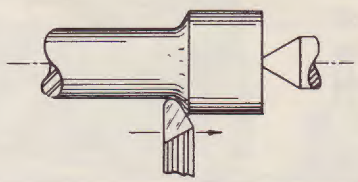
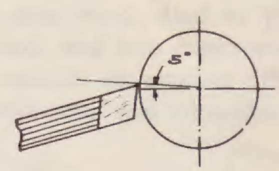
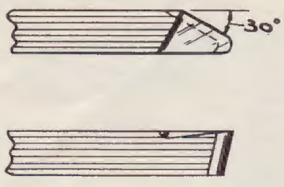
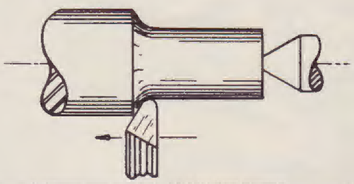
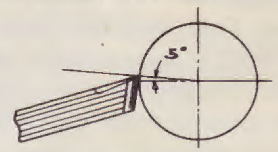
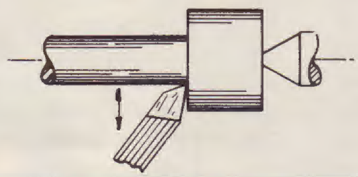
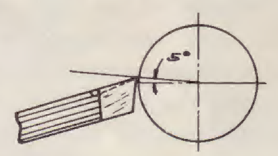
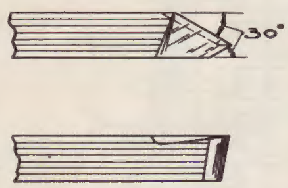
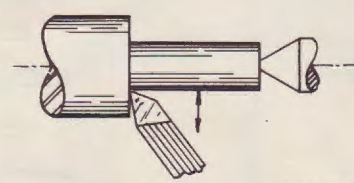
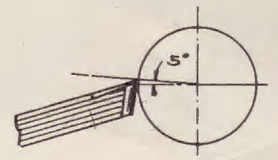
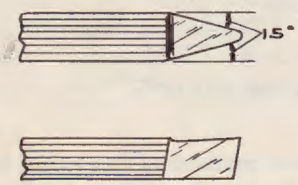
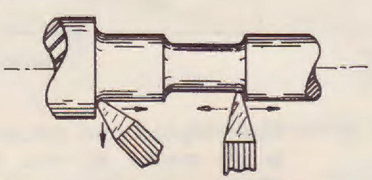
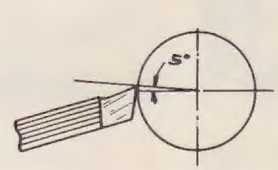
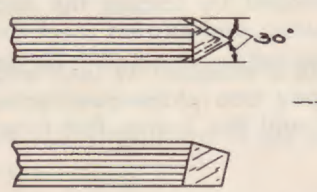
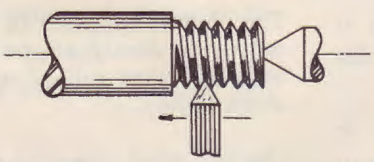
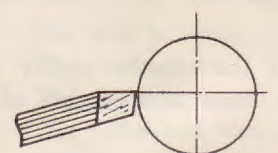
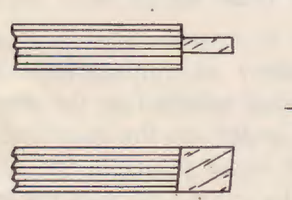
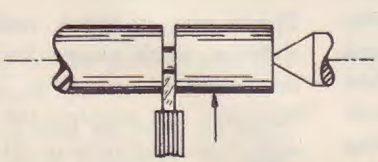
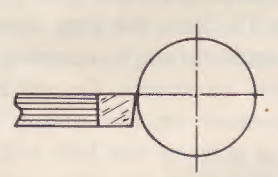
	Top and Side View	Top View Working Position	Side View Working Position	Grinding Angles
Left Hand Turning Tool				Back Rake Angle ....16½° Front Clearance Angle.. 7° Side Rake Angle ....18° Side Clearance Angle.... 8° Lip Angle ....64°
Right Hand Turning Tool				Back Rake Angle ....16½° Front Clearance Angle.. 7° Side Rake Angle ....18° Side Clearance Angle.... 8° Lip Angle ....64°
Left Hand Facing Tool				Back Rake Angle ....16½° Front Clearance Angle.. 7° Side Rake Angle ....18° Side Clearance Angle.... 8° Lip Angle ....64°
Right Hand Facing Tool				Back Rake Angle ....16½° Front Clearance Angle.. 7° Side Rake Angle ....18° Side Clearance Angle.... 8° Lip Angle ....64°
Round Nose Turning Tool				Back Rake Angle ....16½° Front Clearance Angle .. 7° Side Rake Angle .... 0° Side Clearance Angle .... 8° Lipe Angle .... 82°
Threading Tool				Back Rake Angle.......... 0° Front Clearance Angle . 5° Side Rake Angle .... 0° Side Clearance Angle ...10° Lip Angle .... 80°
Cut-Off Tool				Back Rake Angle.......... 0° Front Clearance Angle . 5° Side Rake Angle .... 0° Side Clearance Angle ... 3°

FIGURE 17

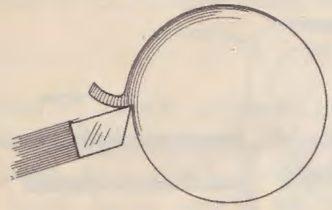


FIGURE 14—CUTTING ACTION OF TOOL BIT

Because of this the cutting edge of the tool must be sharp enough to separate the chip from the work with a minimum of power, but must also be large enough to support the cutting surface and to carry the heat of friction away from the point. These two opposing requirements can be accomplished by carefully working out the angle at which the tool will enter the work and the angles of clearance between the tool and the work.

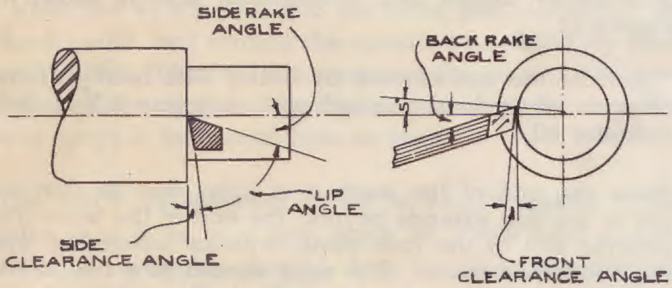


FIGURE 15—CUTTING ANGLES

Figure 15 above illustrates a cross-section and a side view of a tool bit in working position showing the names of the various angles for grinding and setting the bit.

For efficient performance, each of the angles and settings shown should be specially determined for the particular kind of material being worked on, the material the tool bit is made from, the cutting speed, the kind of coolant being used, if any, and whether roughing, finishing, parting or forming work is being done. Figure 17 illustrates the seven bit shapes commonly used and the working position of each with the correct angles for an average cut in mild steel at a cutting speed of 80 feet per minute using high speed tool steel bits and machining without coolant.

In shaping the bits use a good medium grit grinding wheel being careful not to burn the edges. Cool the bit in water to prevent drawing the temper.

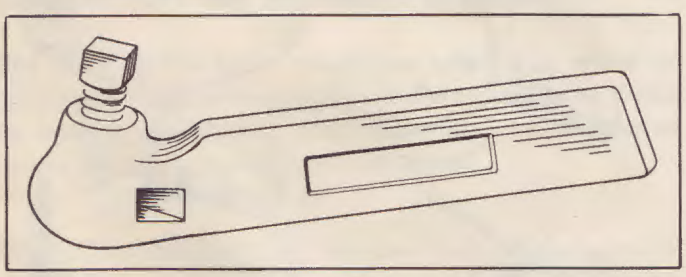


FIGURE 16—TOOL HOLDER

A tool bit holder for holding ¼- by ¼-inch tool bits eliminates the use of large and more expensive tools of high speed steel and also holds the bit at an angle. This angle directs a large portion of the cutting pressure directly toward the base of the tool post.

When using the tool holder, the cutting end of the bit should be clamped as close to the end of the holder as possible and the bit holding end of the holder should be as close to the tool post as possible. This will give the cutting edge rigid support so that the action of the work will not force it downward, causing chatter and possibly breaking off the bit.

Holding the Work

There are five common methods of holding work in a lathe; between centers, in a chuck, on the face plate, in a collet, and on a mandrel.

MOUNTING BETWEEN CENTERS

Whenever possible the work is turned between centers as this method is most accurate and permits removing the work from the lathe and replacing it without affecting the accuracy.

The first step in turning between centers is to find the center of the ends of the work and drill center holes. This operation is important and should be done with care.

If square, hexagonal, or any other regular sided stock is used lines may be scribed across the ends from corner to corner, the point of intersection being the center.

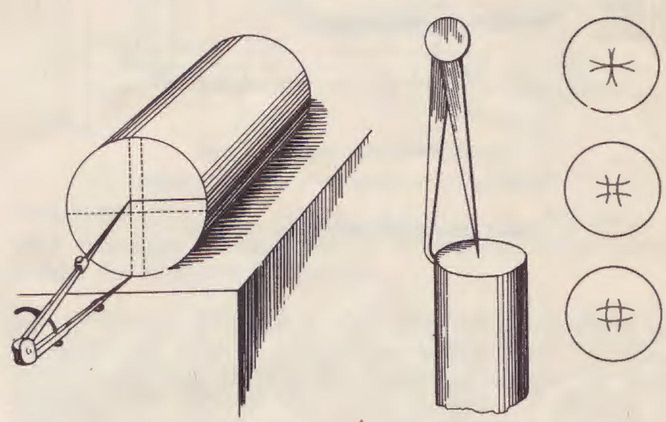


FIGURE 18—FINDING CENTERS

If round stock is used the center may be found either with dividers or with hermaphrodite calipers. When using dividers open them to approximately half the diameter, and laying the stock on a flat surface place one point on the work, the other on the flat surface, and scribe a line along the end as shown in Fig. 18. Turn the stock a quarter turn and scribe another line and so on until the four lines are drawn as shown. If the dividers are held at the same angle each time, the center of the small square formed will be the center of the stock.

If hermaphrodite calipers are used open them to approximately half the diameter of the stock and holding the bent leg on four quarter points of the circumference, scribe four arcs across the end, forming a four-sided central figure. The center of this figure will be the center of the stock. Rubbing chalk on the ends will make the scribing more easily seen.

When the center of the stock has been found, place a center punch vertically on the center mark and strike with a hammer, making an indentation sufficiently deep so that the work will revolve on the center points of the lathe.

The stock, especially if close to finish size, should be placed in the lathe and the center tested before countersinking. This is done by revolving the stock by hand while it is held between the centers and holding a piece of chalk so that it will touch any high spots on the work

If the chalk encounters high spots move the center holes toward these high spots by placing the work in a vise and driving the center punch toward them at an angle, then bringing it back to a vertical position.

The countersink drill is usually used in drilling center holes since it both drills the hole to the proper depth and countersinks at the proper angle.

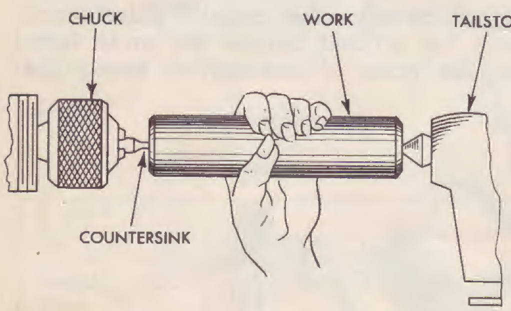


FIGURE 20—COUNTERSINKING CENTERS

The countersink drill is mounted in a chuck in the headstock spindle and the work held with the tailstock center in one center hole, the drill in the other. With the spindle turning at about 600 R.P.M. the tailstock ram is then advanced moving the work into the drill as shown in Figure 20.

If this method is not used the center holes may be drilled by placing the work in a drill press, or the work may be held in a universal three-jaw scroll chuck and the countersink drill held in the tailstock in a drill chuck. When this method is used the end of the shaft should be faced smooth before drilling the center hole

When drilled and countersunk the holes should be deep enough to prevent the points of the lathe center touching the bottom, and the tapered sides should exactly fit the 60° angle of the centers. If they do not the work

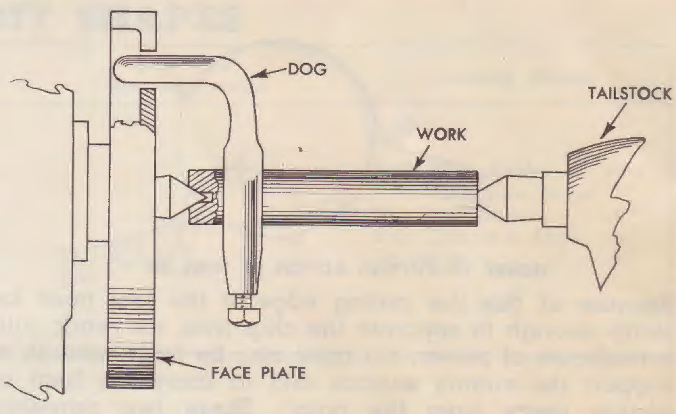


FIGURE 21—MOUNTING BETWEEN CENTERS

will not turn evenly or smooth and will be inaccurate. A correctly drilled and countersunk hole is shown in Figure 22.

Lubricate the end centers by filling with heavy grease or with white lead thinned with machine oil or light cylinder oil.

Place the end of the work in a lathe dog so that the tail of the dog extends beyond the end of the work and into the slot of the face plate, without interfering with the headstock center. The work should now rest firmly on both centers but should not bind. To test the mounting, place a finger on the tail of the dog and move it back and forth within the face plate slot. You should be able to move it easily, but not too easily. When the pressure on the ends has been adjusted lock the tailpost ram by turning the binding lever to the right.

CHUCKS

Two types of chuck commonly used are the 3-JAW UNIVERSAL CHUCK and the 4-JAW INDEPENDENT CHUCK. These are used in turning the work that can not be readily turned between centers. See Figure 23.

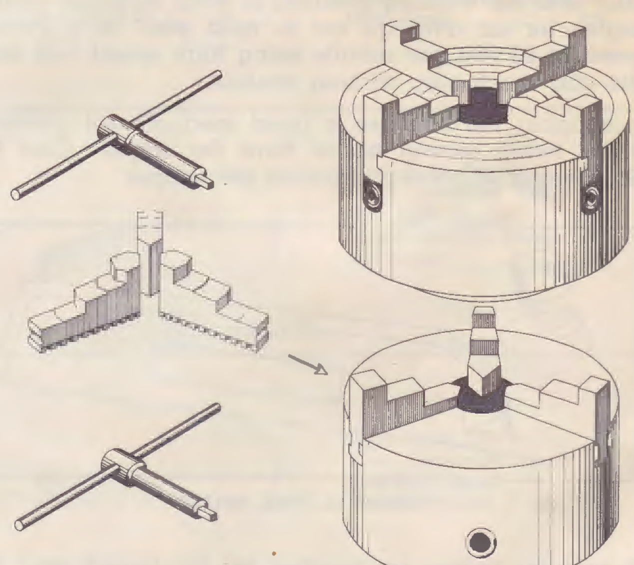


FIGURE 22—3 AND 4 JAW CHUCKS

Some chucks mount directly on to the spindle nose, while others are bolted to an adapter plate which fits on to the spindle.

Before mounting a chuck or face plate clean the spindle shoulder and chuck back and oil the threads of the spindle head and chuck thoroughly. Turn the chuck on by hand, being careful not to spin it up to the shoulder as it may jam. Never use lathe power to screw a chuck on or off of the spindle.

The chuck can be loosened for removal by (1) Engaging the back gears while the bull gear is connected to the spindle pulley, so that the spindle will not turn, and turning the chuck by placing the chuck wrench in its hole and pulling on it. (2) Placing a block of wood between the chuck jaw and the lathe bed, engaging the back gears, and turning the spindle by pulling by hand on the belt. Take care in removing the chuck. You may damage the spindle threads or you may damage the bed ways if the chuck falls on them.

The 4-jaw independent chuck is recommended if the lathe is to have only one chuck as it will hold square, round or irregular shaped work in either a concentric or eccentric position. Each jaw is controlled by a head screw, a number of concentric circles scribed on the face permitting the approximate centering of the work by moving all jaws to the same line or to the same distance from the same line.

The work is then revolved by hand and a piece of chalk held lightly against the work to mark the high spots. The jaw opposite the high point is loosened and that behind it tightened until the work is centered.

The 3-jaw universal chuck is self-centering, all jaws working from one screw which saves time and trouble in centering round or hexagonal work but it can not be used for square or irregular shapes.

The 4-jaw chuck can be adjusted to any degree of accuracy required. 3-jaw chucks are usually accurate to .003 when new. If greater accuracy than this is required, the jaws may be shimmed as needed.

The jaws of the 4-jaw chuck are reversible, while an additional set of jaws are supplied with the 3-jaw chuck for internal chucking in which case the jaws are placed inside the work and the outside turned.

DRILL CHUCKS (Fig. 23A) are used both on the tailstock of a lathe with the work turning and on the headstock of the lathe with the work held. Although for production drilling, a drill press is generally used, there are many small jobs of drilling, reaming, tapping, etc., that are conveniently handled by means of a lathe drill chuck.

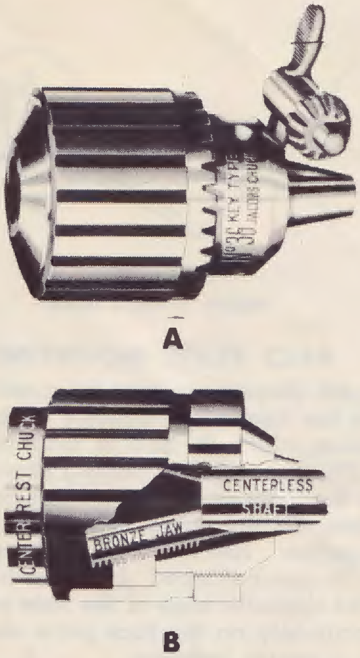


FIGURE 23—LATHE CHUCKS

THE CENTER REST CHUCK (Fig. 23B) is mounted in the tailstock by means of a solid tapered arbor which replaces the center. The stationary bronze jaws provide an accurate support for turning round work where a center cannot be used.

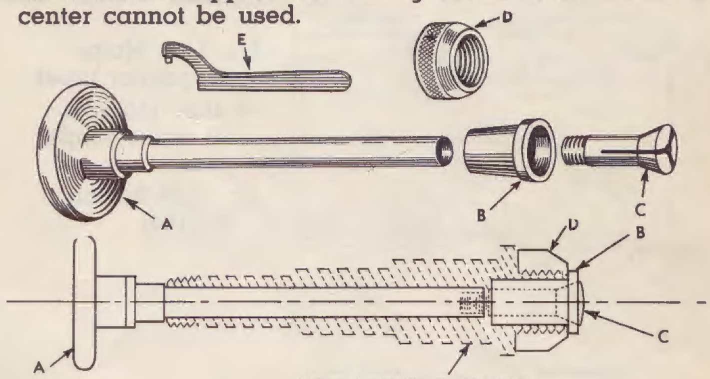


FIGURE 24 –DRAW-IN COLLET ATTACHMENT

DRAW-IN COLLET CHUCK. Small work that must be very accurate is mounted in a draw-in collet placed within the headstock spindle.

The assembly consists of a draw-in spindle (A in Fig. 25) threaded at the right end to receive the collet; a tapered closing sleeve (B); a split holding collet (C); spindle nose cap (D); and spindle nose cap wrench (E). The tapered closing sleeve fits into the headstock spindle and adapts it to the collet. The work is placed in the split end of the collet and the collet closed by pressure as it is drawn into the taper by the draw-in spindle which enters the headstock spindle from the other end.

Never use a collet for work more than .005 inch larger or smaller than its rated diameter. Before mounting work in a collet, all parts—work, collet, spindle, and taper—must be wiped clean and dry.

When removing the collet assembly unscrew the draw-in spindle a couple of turns and press the collet loose. To remove the tapered closing sleeve, unscrew the spindle nose cap with spanner wrench which forces the sleeve out of the lathe spindle.

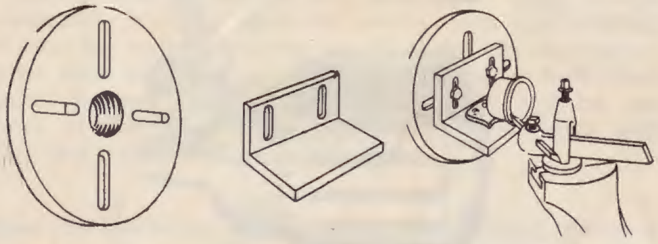


FIGURE 27—FACE PLATE

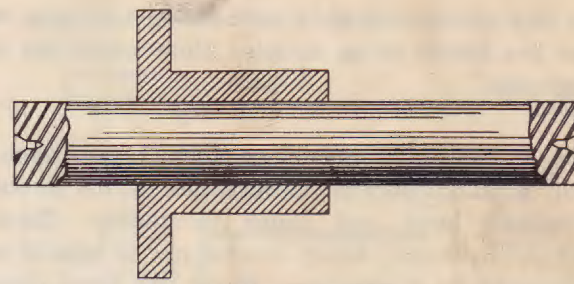


FIGURE 28—MANDREL

FACE PLATE MOUNTING

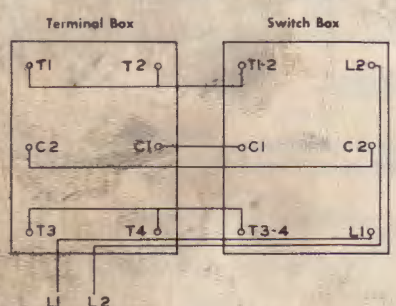
Many irregular shapes are best mounted for turning by clamping to the face plate directly or by fastening to an angle plate which in turn is mounted on the face plate. (Fig. 27) Be careful in bolting down not to spring the work on the plate and use the same care in screwing the face plate on the lathe spindle as described for mounting chucks. Heavy work mounted off center should be counterbalanced by attaching balancing weights to the opposite edge of the face plate. To locate the work accurately on the face plate use either a dial indicator or a center indicator.

MANDREL MOUNTING

Hollow pieces may be mounted on a mandrel and the mandrel mounted between centers, allowing the entire outer surface to be turned instead of the limited surface that would be available if the piece were held in a chuck.

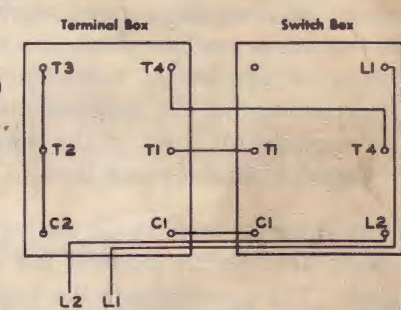
Although mandrels are available which may be expanded to fit the hole by forcing out grips on the sides, a mandrel is usually a piece of steel with a slight taper (.006 inches per foot) the ends flattened for the lathe dog and the piece held to the mandrel by friction. When mounting the work it is advisable to oil both the mandrel and the hole to prevent the work "freezing" on the mandrel. In driving the mandrel out of the work do not use a steel hammer without protecting the end of the mandrel from damage. Make sure that mandrel is driven off in the opposite direction than that from which it entered the work.

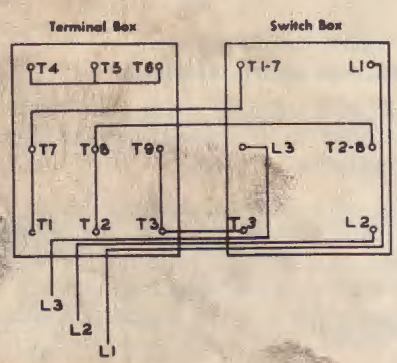
Fig. 29 Motor and Switch Wiring Diagram



No. 1105 Motor
(Capacitor type)
½ H.P. 115 volt, 60 cycle, single phase
No. 0639 Switch
(R-1144)

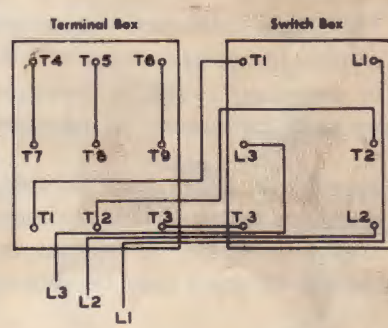
No. 1105 Motor
(Capacitor type)
½ H.P. 230 volt, 60 cycle, single phase
No. 0639 Switch
(R-1144)

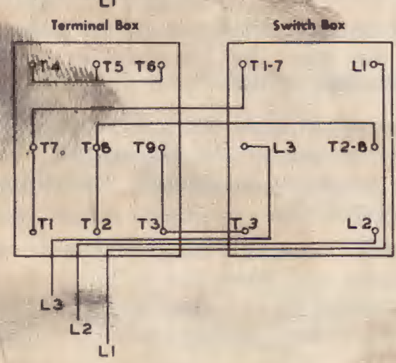




No. 1110 Motor
½ H.P. 220 volt, 60 cycle, three phase
No. 0636 Switch
(R-1143)

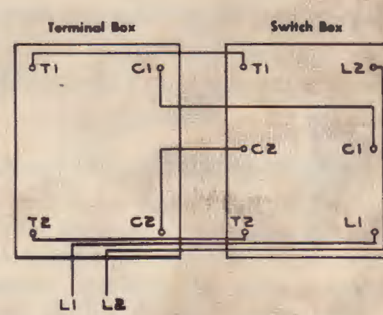
No. 1110 Motor
½ H.P. 440 volt, 60 cycle, three phase
No. 0636 Switch
(R-1143)





No. 1111 Motor
¾ H.P. 220 volt, 60 cycle, three phase
No. 0636 Switch
(R-1143)

No. 1115 Motor
(Capacitor type)
¾ H.P. 115 volt, 60 cycle, single phase
No. 0639 Switch
(R-1144)



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