

*Mach. 386*

BULLETIN No. 17

# INSTRUCTION BOOK

## "AMERICAN"

**14" 16" 18" 20" 22"**

**9-18-27 SPEED**

*Pacemaker  
Lathes*

Covered by Patents Pending



**THE AMERICAN TOOL WORKS CO., Cincinnati, U.S.A.**

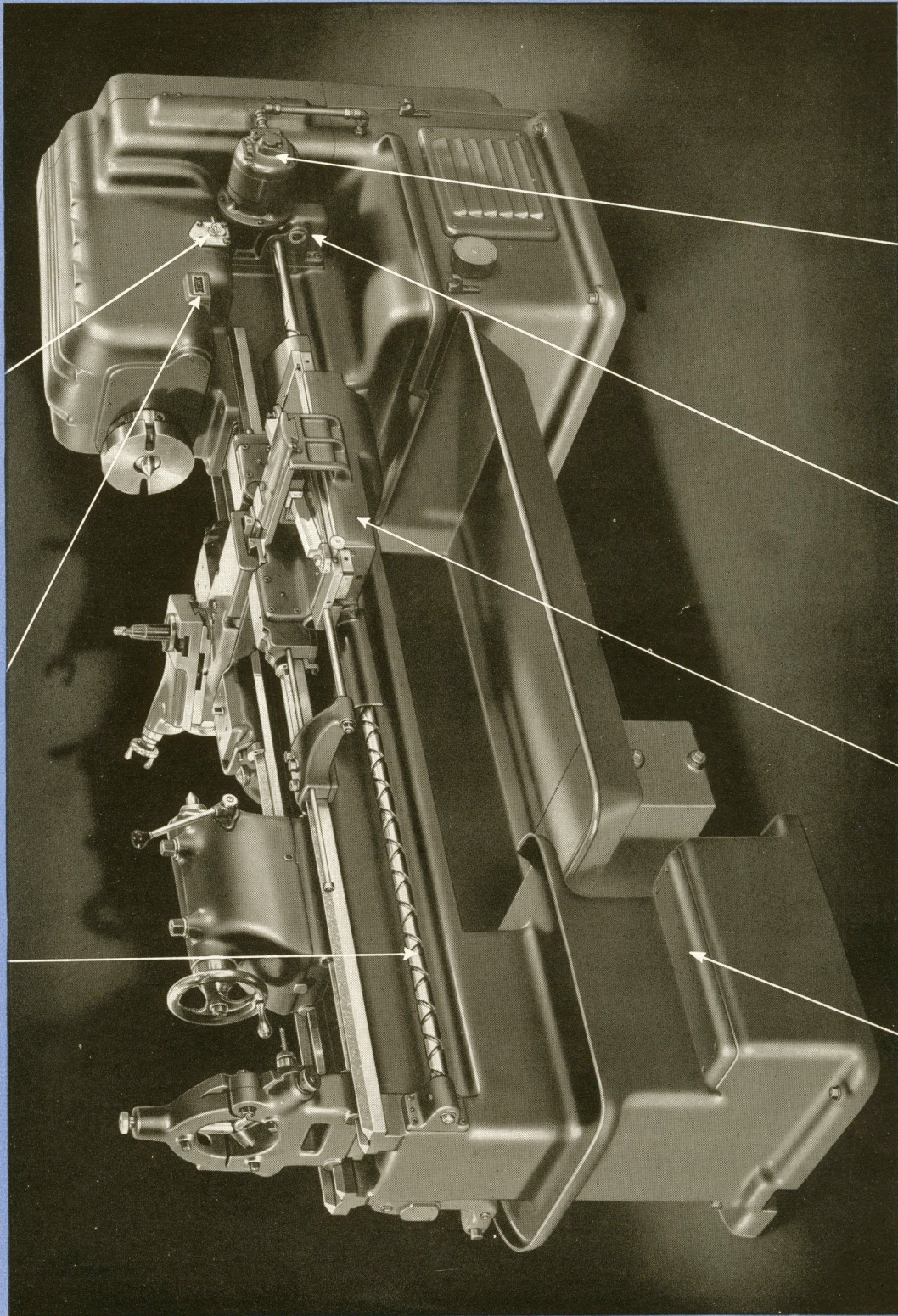
*Lathes · Radials · Shapers*



POWER TRAVERSE  
SCREW

SPINDLE BEARING  
ADJUSTMENT

OIL FILTER



MOUNTING FOR  
PUMP

ANTI-FRICTION  
TAPER ATTACHMENT

POWER TRAVERSE  
DRIVE UNIT

POWER TRAVERSE  
MOTOR

# ERECTING

UNLOADING. Hoisting weights are as follows:

14" x 30" between centers.....	4400 lbs.
For each additional 24" between centers, add.....	450 lbs.
16" x 30" between centers.....	4600 lbs.
For each additional 24" between centers, add.....	470 lbs.
18" x 30" between centers.....	7200 lbs.
For each additional 24" between centers, add.....	600 lbs.
20" x 48" between centers.....	8000 lbs.
For each additional 24" between centers, add.....	600 lbs.
22" x 48" between centers.....	8200 lbs.
For each additional 24" between centers, add.....	600 lbs.

CAUTION—When moving:

Place sling (preferably manila rope) around the bed between the headstock and carriage. Use wood blocking under the outside ways and heavy padding under the bottom edges of the bed to protect the sling. Take a slight strain with the crane to make sure that everything is all right before hoisting. Use no chains!

“NOTE”—When moving lathe do not use SLING or PINCH BAR under the covers at the head end.

SETTING UP. Study foundation plan sent with machine.

FOUNDATION. A concrete foundation or floor is preferable, but a solid wood floor is satisfactory. When preparing footing for setting up lathe, allow one inch (1") in either direction around the hold-down bolts to allow for variations or slight errors in locating these bolts. Hold-down bolts pass through the center of the leveling screw bushings. A steel plate should be placed between the leg and the foundation for supporting the leveling screw bushings.

LEVELING. Use a good PRECISION level about 18" long and graduated to at least .001" per foot. (A common carpenter's or machinist's level is not accurate enough.) Place level longitudinally on front carriage wings, position No. 1 of leveling diagram, Figure No. 1, page 5, and adjust leveling screw bushings until bed is level lengthwise. Then place level in position No. 2 across the vees, close to the headstock and squared against the carriage, and adjust screw bushings of head end leg until level reading is obtained. Next place level in position No. 3 across the vees, close to the end of the bed and squared against the bed end, and adjust screw bushings of tail end leg until level reading is obtained. Retest at position No. 2 and then again at position No. 3 until

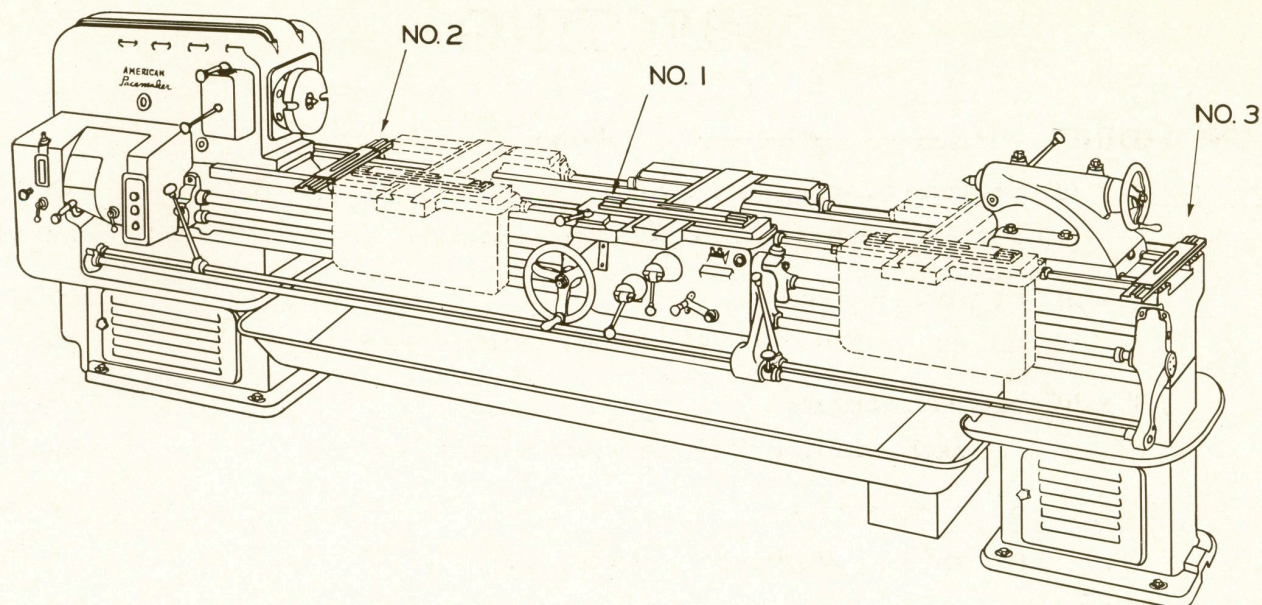


Figure No. 1, Leveling Diagram

readings differ by less than a full graduation. To insure accurate readings make certain that the level is square against the carriage or bed end and always pointing in the same direction.

When lathe has a center leg, follow the same operations, and when the headstock end and the tail end are level, place level over the center leg and adjust its screw bushings until the reading of the level differs less than a full graduation from that of the first two positions.

After machine is leveled tighten nuts on hold-down bolts until slight tension is secured. Too much tension will spring bed out of level. It is important to check level of lathe at least every six months to insure accurate work.

**CLEANING.** Do not move carriage until bed has been thoroughly cleaned and oiled. For cleaning the machine, kerosene is preferable to gasoline, as it does not evaporate and leave dried slushing compound on finished surfaces. The kerosene must be absolutely clean. It is very important to clean the ways of the bed carefully and thoroughly. Lubricate freely all bearing surfaces before operating machine. See that no oil holes are clogged.

**OILING INSTRUCTIONS.** The machine when shipped (unless dismantled) is lubricated according to directions appearing on the oiling instruction plate attached to the inside of the swinging cover at the head end of the lathe; the headstock is provided with automatic pump lubrication. Oil passing through the flow gauge at the front of the head shows that the lubricating pump is working. Follow instructions on oil filter at rear of head. Caution—If oil filter handle becomes too tight to turn by hand, remove filter and cleanse with kerosene and compressed air. **DO NOT FORCE HANDLE.**

To lubricate, observe the following:

**Head**—Fill to gauge line with high-grade machine oil—viscosity 275-290 seconds Saybolt at 100 degrees Fahrenheit. Change every six months.

**Change Gears**—Oil quadrant gear stud inside of swinging cover daily. Place a few drops of high-grade machine oil at point marked "OIL". All other anti-friction bearings are oiled directly by the automatic lubricating system in the head or by the "Plunger Type" oiling in the gear box.

**Gear Box**—The gear box is oiled by a "Plunger Type" oiling system. Fill plunger reservoir to high level gauge line with a high-grade machine oil, Viscosity 275-290 seconds Saybolt at 100 degrees Fahrenheit; the opening to the reservoir is inside swinging cover. Actuation of the plunger, consisting of several depressions, once daily before starting is sufficient to oil all moving parts in gear box, except the tumbler. Oil tumbler per instructions on box.

**Carriage and Apron**—The carriage and apron are also oiled by a "Plunger Type" oiling system. Several depressions of the plunger daily before starting are sufficient to oil all moving parts in apron and carriage, bed and carriage ways, and cross feed screw and nut. Fill plunger reservoir to high level gauge line with an oil compounded for high film strength, Socony Vacuum Heavy Medium "X", or equivalent. Remove large set screw marked "OIL" in right front carriage wing to fill reservoir. To lubricate the half-nuts and leadscrew, remove small set screw marked "OIL" and apply two or three shots from oil can.

**Tailend Bushing**—Leadscrew bearing is an oilite bushing which requires oiling about twice a year. The feed rod anti-friction bearing is grease packed and should be checked once a year.

**Taper Attachment**—The anti-friction taper attachment is provided with permanent oil-sealed ball bearings. When attachment is in use the dove-tail slide bearing should be oiled daily.

**Power Rapid Traverse**—Fill drive unit to high level gauge line with extreme pressure oil No. S. A. E., E. P. 160. Change every six months. The screw end bearing is an oilite bushing which requires oiling about twice a year.

**Hand Oil Stations**—Lubricate once every month with a high-grade machine oil.

**Important**—After lathe has been set up, ready for operation, or has been idle for two or three weeks, the "Plunger Type" oiling systems in apron and gear box should be operated at least 7 or 8 times to fill up all the feed lines to the various bearings. Also, the spindle should be run at slow speed at first to give the oil a chance to circulate.

**Note**—The lubricating periods mentioned apply to normal working service. In extreme conditions lubricate more often.

# OPERATING AND ADJUSTING

**STARTING**—Observe the following instructions carefully: Before starting make sure that control levers are in their off position, close to the lathe bed; that the two friction “drop” levers on the apron are in their lowered, or disengaged, positions; and that the top speed change lever is in its blue, or slow, position. Press starting button on the gear box to secure current thru the main line.

**MOTOR DRIVE**—All “Pacemaker” lathes are motor driven, with motor mounted either in head-end leg or on platform at rear of leg. In either case there is means of adjusting belt tension. The motor in leg is mounted on a hinged plate which can be adjusted for height by means of a screw conveniently located inside the hinged door on the front of the leg. The motor on pedestal is mounted on a sliding plate that is provided with screw adjusting means.

**STARTING CLUTCH AND BRAKE UNIT**—The starting clutch and brake unit is a self-contained trouble-free unit bolted and doweled to the headstock and under the swinging cover. It is automatically oiled by the circulating system of the head and mounted 100% on anti-friction bearings, thus requiring absolutely no attention from the operator.

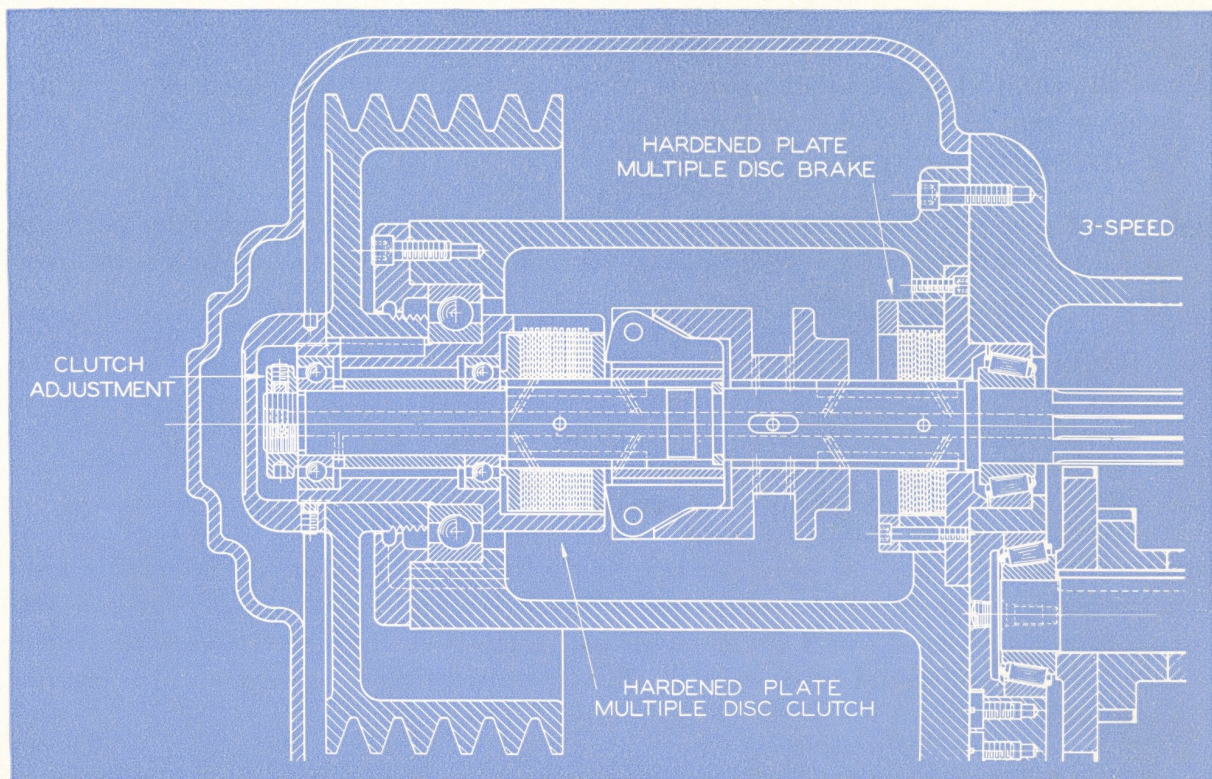


Figure No. 2, Diagram of Clutch and Brake Unit

To adjust the multiple disc clutch, swing open cover at head-end of lathe, loosen set screw in pulley hub cover, unscrew cover, loosen set-screw in nut designated by CLUTCH ADJUSTMENT in Figure No. 2, page 7, and turn nut until the toggle fingers can be felt to have ridden over the taper and snapped onto the neutral point. Do not adjust clutch so tightly that snap cannot be felt. When adjustment has been completed, make sure that both of the set-screws have been tightened.

The multiple disc brake is self-adjusting for wear.

**HEADSTOCK**—The headstock is automatically oiled by a pump circulating system and all bearings are 100% anti-friction; therefore, no attention is necessary except following the previously outlined oiling instructions.

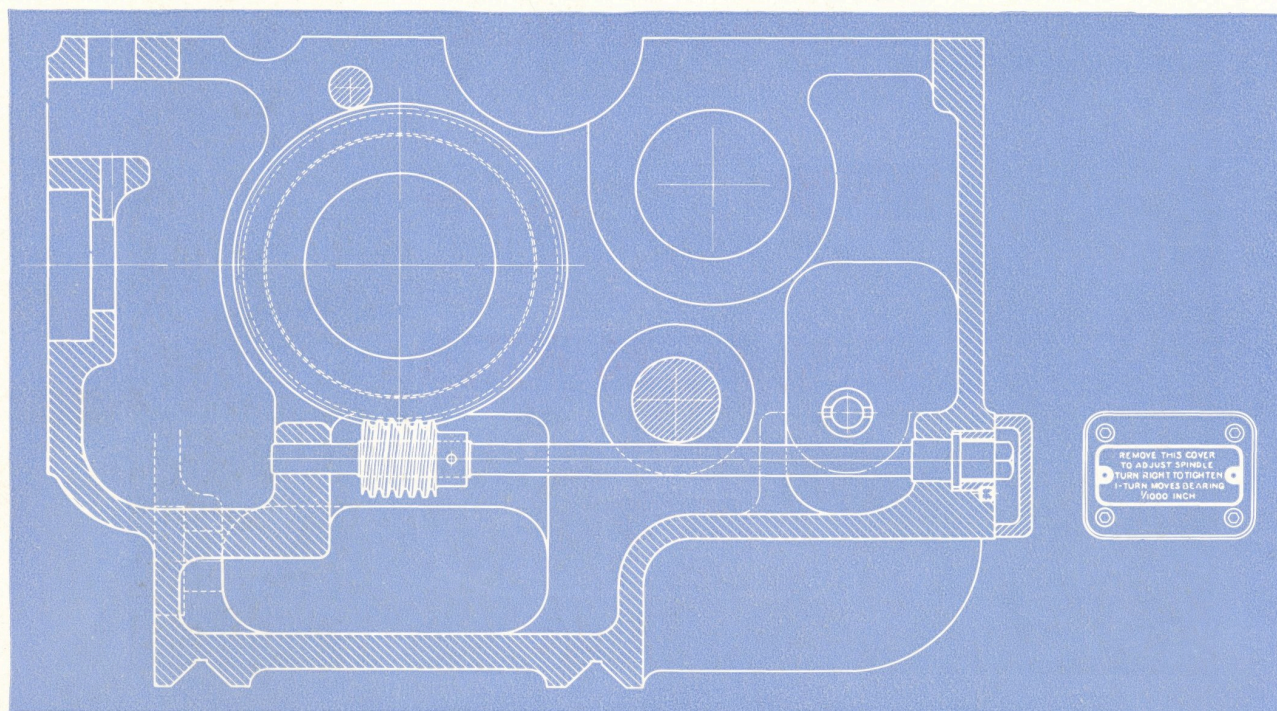


Figure No. 3, Diagram showing means for adjusting Spindle Bearings

To adjust spindle bearings remove small cover cap on rear of headstock, Figure No. 3, and follow instructions on cap, which state that one complete turn of the shaft adjusts bearing .001". This unit is self-locking because of the worm and wormwheel used to actuate the adjusting nut.

**SPINDLE SPEED SELECTION**—On the 9-speed head all speeds are procured through the action of one lever whose positions clearly and directly indicate on the speed plate the R. P. M. of the spindle at any setting. To obtain the desired R. P. M. merely place the lever at the circle designating that speed.

On the 18-speed and 27-speed heads all speeds are procured through the action of two levers whose positions clearly and directly indicate on the speed plate the R. P. M. of

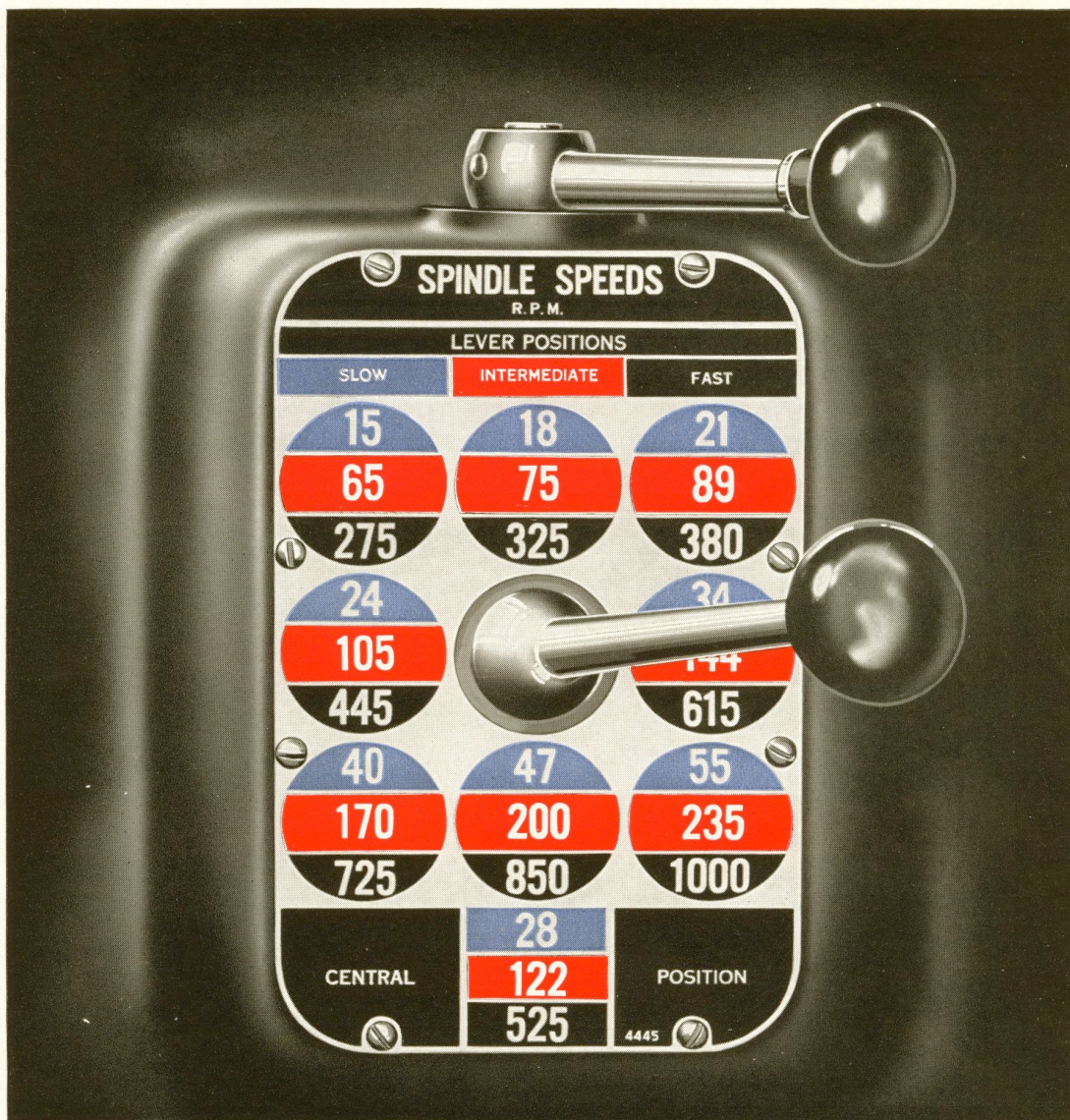


Figure No. 4, Direct Reading Speed Control, 27-Speed Head

the spindle at any setting, Figure No. 4. The top lever has three positions, one for the slow range, indicated in blue, one for the intermediate range, indicated in red, and one for the fast range, indicated in black. The bottom lever on the 18-speed head has six positions and on the 27-speed head nine positions, each of which is designated on the speed plate by a circle which in turn contains three speed rates, indicated in corresponding colors. To select a desired speed, place the lower lever at the circle containing that rate, then place the upper lever in the blue, red, or black position to correspond to the color indicated in the circle.

The NEUTRAL POINT for the spindle to be completely disengaged from the headstock gears is the top lever position between the red and the black. At this point the notch on the lever hub coincides with the neutral line on the small plate attached to the top of the speed change unit.

**SPINDLE SPEED CHANGE**—Speed changes should be made only after the clutch has been disengaged, and preferably just before the spindle stops. Sometimes when shifting gears after spindle has come to a complete stop it is necessary to jog the spindle a bit with the head end control lever to allow gears to mesh.

**REVERSE FOR LEADSCREW AND FEED ROD**—Except when the leadscrew reverse from apron is supplied, the leadscrew and feed rod are reversed by operating the pull-rod at the end of the headstock inside the swinging cover, Figure No. 5. There are no binder bolts to loosen and tighten. The direction plate on the pull-rod states that for right-hand threads the pull-rod should be pushed in, and for left-hand threads, pulled out; there is a center neutral position which completely disengages the change gears and the gear box from the spindle.

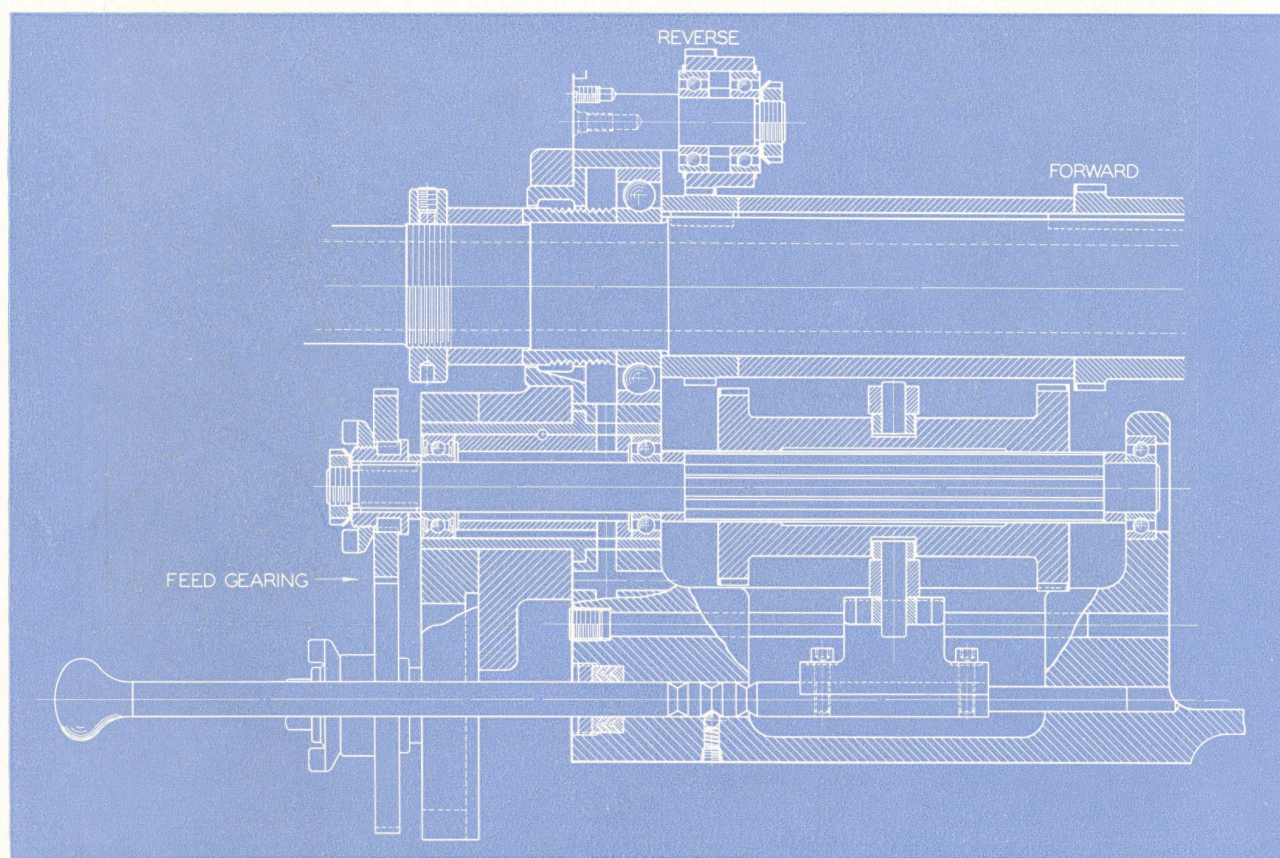


Figure No. 5, Diagram of Mechanism for Reversing the direction of the Leadscrew and Feed Rod.  
(This is standard equipment and is not what is known as "Leadscrew Reverse from Apron")

**CHANGE GEARS AND GEAR BOX**—On all English lathes a standard English range is furnished and every change on the index plate on the front of the box is obtained without changing any of the head end gears. The two outside gears, "A" and "B", Figure No. 6, page 11, should never be removed on English lathes. In addition to the standard range, other ranges may be secured by the addition of suitable gearing, namely:

Coarse leads.

Diametral pitch leads.

Transposed metric leads, standard.

Transposed metric leads, coarse.

Transposed module leads, standard.

Transposed module leads, coarse.

To obtain these additional ranges, the change gears must be arranged to correspond to the stud, quadrant, and box gears shown on the plate which is furnished for that particular range and which is attached to the inside of the swinging cover.

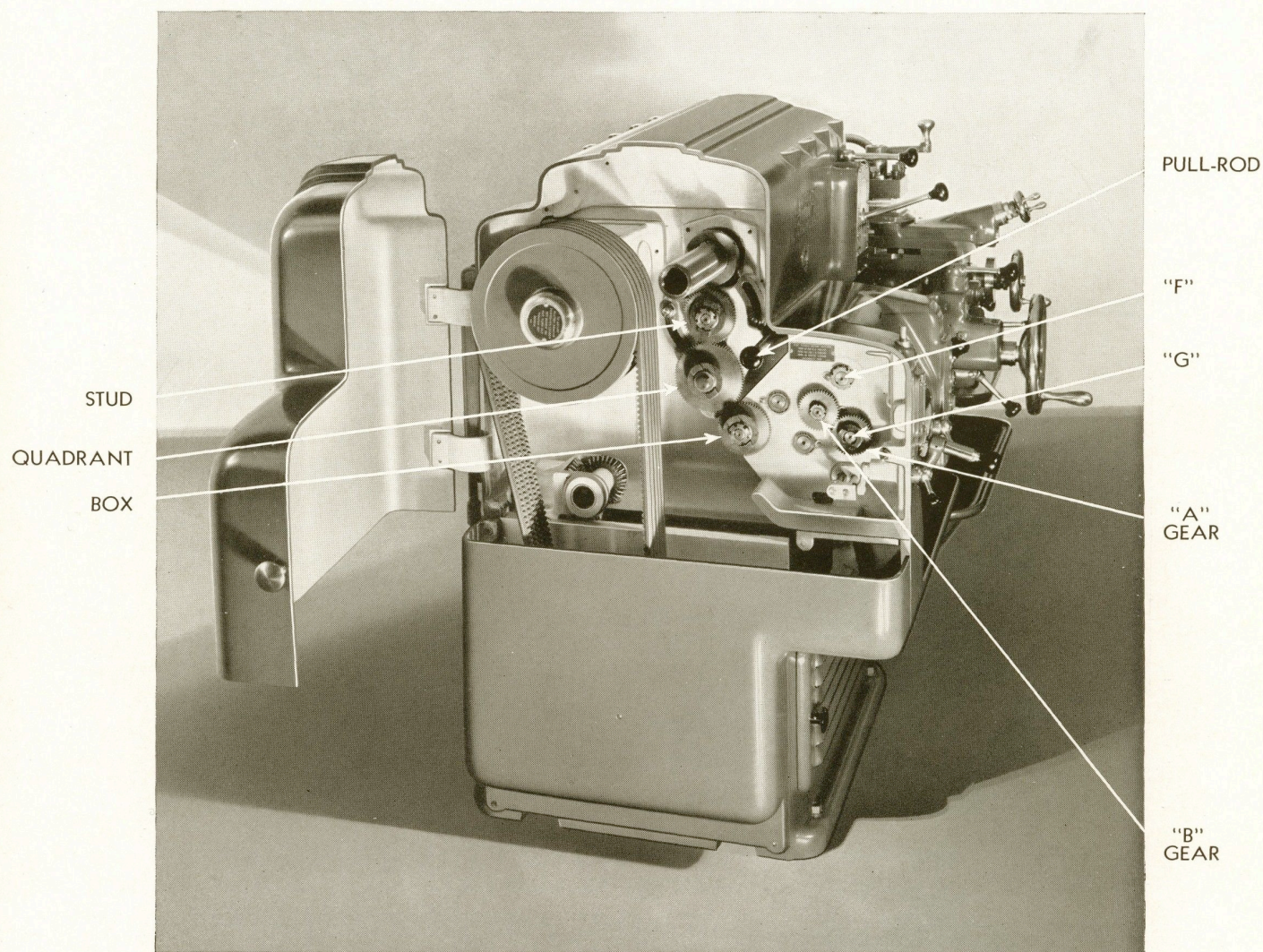


Figure No. 6, Head-End, showing Swinging Cover open.

On all metric lathes a standard metric range is furnished, but to obtain the feeds and leads shown on the index plate on the front of the box, the change gears must be arranged to correspond to the stud, quadrant, and box gears shown on the plate.

In addition to the standard metric range, other ranges may be secured by the use of special gearing, namely:

- Coarse leads.
- Module leads, standard.
- Module leads, coarse.
- Transposed diametral pitch leads.
- Transposed English leads, standard.
- Transposed English leads, coarse.

To obtain these additional ranges, first arrange the change gears to correspond to the stud, quadrant, and box gears shown on the plate which is furnished for that particular range and which is attached to the inside of the swinging cover. Second, make sure that for all metric leads and feeds the "A" gear, Figure No. 6, page 11, is on the cone shaft "F" and the small conversion lever on the opposite side of the box, Figure No. 7, is at position No. 1; and make sure that for transposed English leads and feeds the "A" gear is on the tumbler shaft "G" and the small conversion lever on the opposite side of the box is at position No. 2.

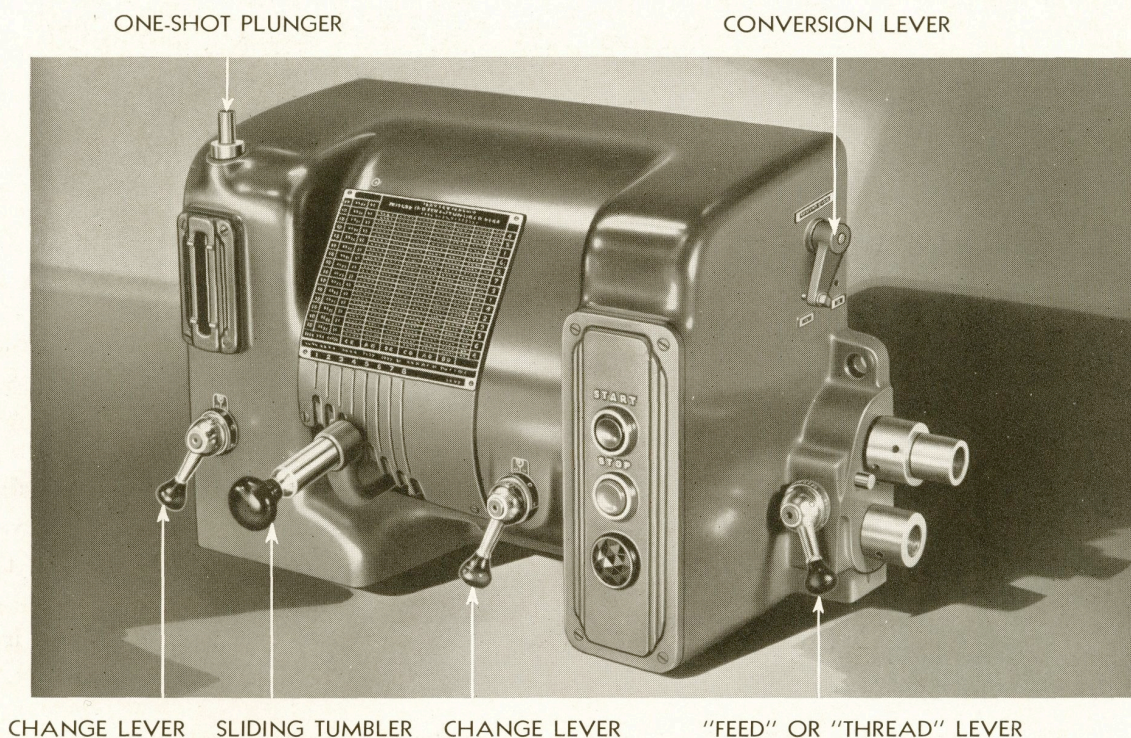


Figure No. 7, Metric Quick Change Gear Box.

All special threads and leads for any of the fore-mentioned ranges are obtained through the use of special gears on the stud, quadrant, and box. When a special thread is furnished by the manufacturer, an additional plate is attached to the inside of the cover to show the change gears used and the correct lever positions.

To change any of the change gears, simply unscrew the large wing nut, slip gear off, fit the desired gear onto sleeve, and replace wing nut.

To adjust quadrant gear along the slot, loosen the hex-head screw, slip gear along into place, and tighten screw.

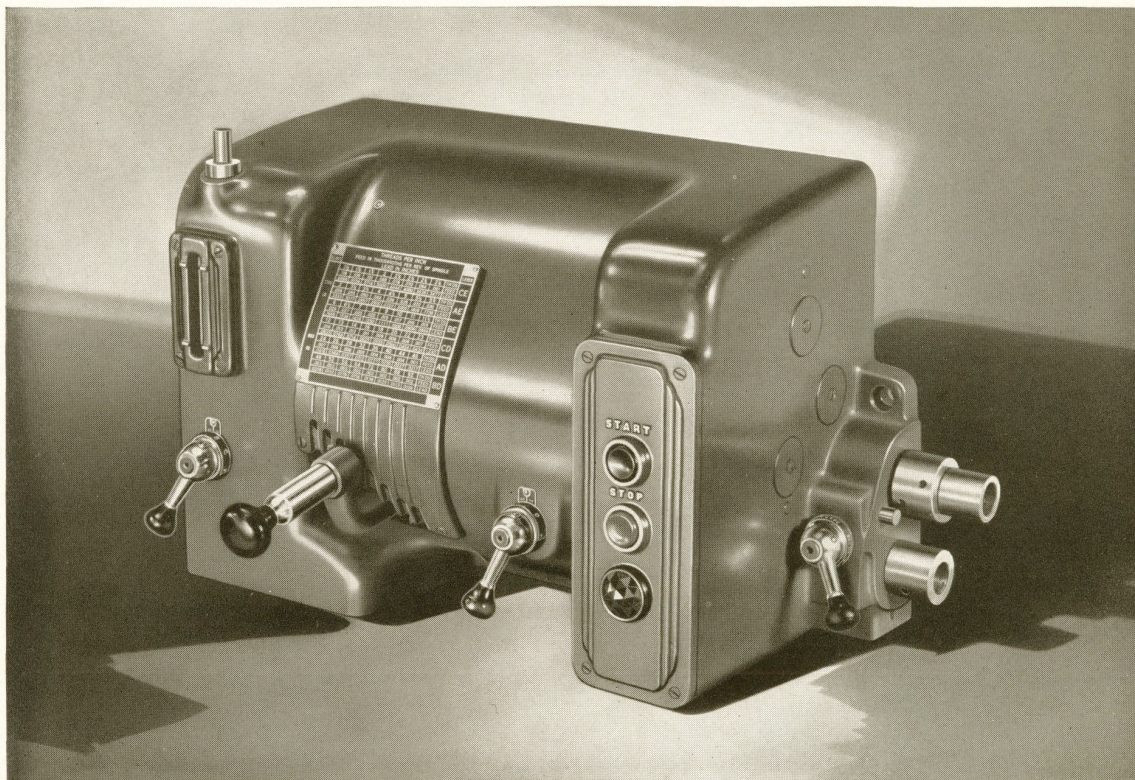


Figure No. 8, English Quick Change Gear Box.

**LEAD AND FEED SELECTION**—The changes of leads and feeds of any range are made by manipulating the sliding tumbler in combination with the two levers on the gear box. The positions are clearly noted on the index plate directly over the tumbler or on the plate or plates attached to the inside of the swinging cover. On the standard English lathe this plate is direct reading and all that is necessary is to locate the sliding tumbler under the column showing the desired rate and then set the two levers to the letters as shown in the right-hand column of the plate directly opposite the rate to be used. In all other ranges the tumbler must be set to the numbered position designated in the right-hand column of the plate directly opposite the desired rate, and the two levers must be set to the letters under the column showing this rate.

**LEAD AND FEED CHANGES**—These changes may best be made when spindle is running at a moderate speed, as this permits the gears to engage more readily. Before tumbler position may be changed, the spring locking pin must be pulled out of the locking holes in the guide plate on the box.

**FEED ROD AND LEADSCREW**—The feed rod and leadscrew are independent of one another and when one is running the other is stationary. To change the drive from one to the other merely position the small lever, Figure No. 7, page 12, on the side of the gear box to read "FEED" or "THREAD".

On the feed rod there are two adjustable collars for automatically stopping the longitudinal feeding of the carriage in either direction.

**CLUTCH AND BRAKE CONTROL LEVERS**—There are two levers for starting and stopping the spindle. One is positioned close to the headstock for use when changing speeds, and the other is on the right-hand side of the apron. To engage clutch the lever is moved toward operator, and to disengage clutch and engage brake the lever is moved away. It is best, particularly at high spindle speeds, to apply brake gently to prevent too sudden a stop.

**APRON**—The apron, Figure No. 9, is driven by either the feed rod or the leadscrew, depending upon whether the double-bevel pinion or the half-nuts are engaged. The double-bevel pinion is actuated by the forward-reverse lever on the front of the apron and controls the direction of automatic feeding, both longitudinal and cross. The half-nuts are engaged by the half-nut lever, but the direction of travel is controlled by the direction of rotation of the leadscrew. These two levers are interlocking and one must be in its neutral or disengaged position before the other can be moved. The neutral position for the forward-reverse lever is the center hole, and the disengaged position for the half-nut lever is at the top of its arc.

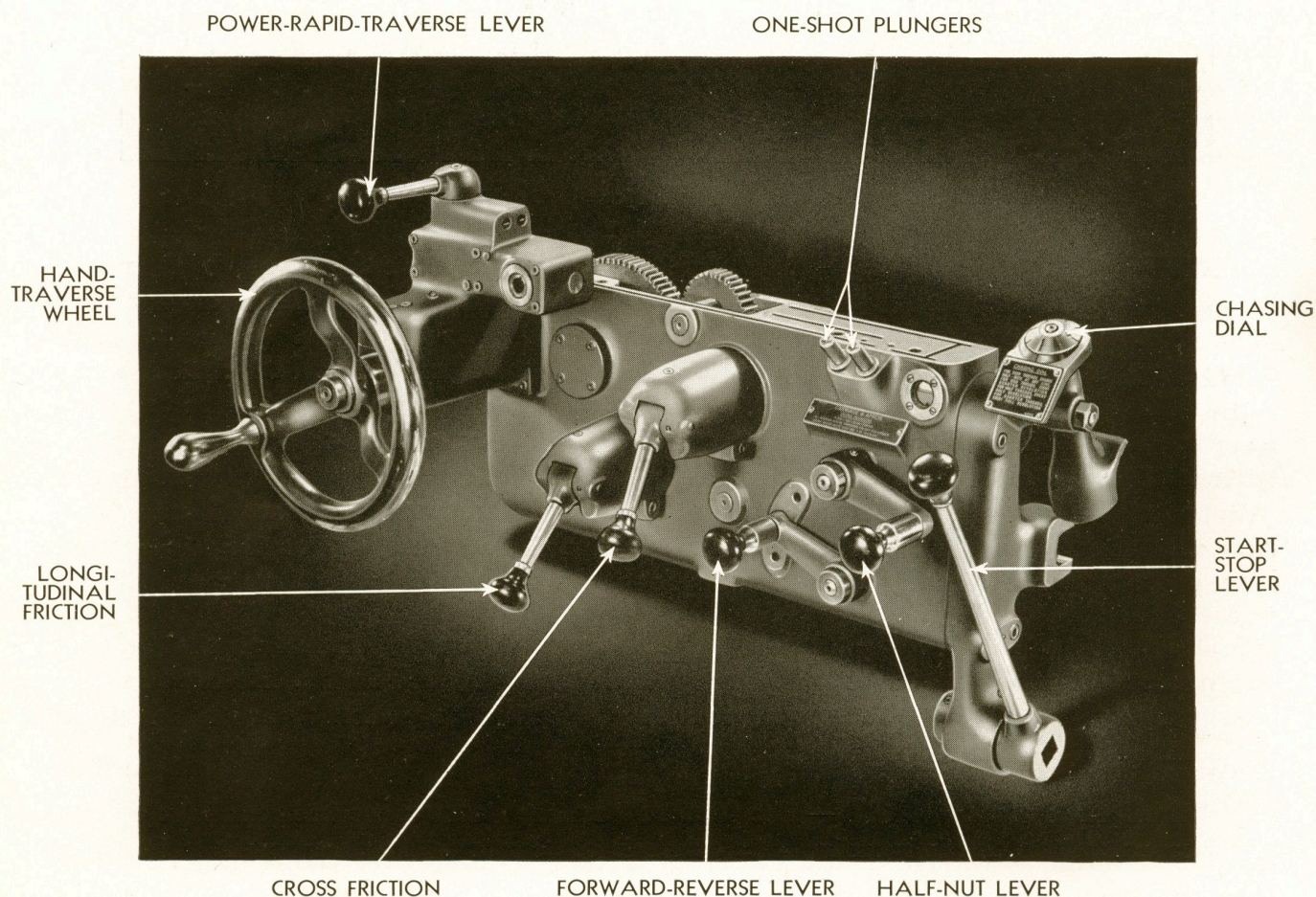


Figure No. 9, Front View of Apron.

The instruction plate under the chasing dial on the extreme right of the apron clearly states the correct procedure for engaging the half-nuts. The chasing dial unit can be disengaged entirely from the leadscrew by loosening its binder nut and setting the unit in a vertical position instead of its normal angular position.

**FRICTION DROP LEVERS**—The two drop levers on the front of the apron actuate clutches which control the longitudinal feed of the carriage and the cross feed of the tool slide. The lower lever controls the longitudinal and the upper the cross feeding. Each clutch is provided with a safety overload feature. When the control levers are in the raised position the clutches are engaged, and in the dropped position, disengaged.

When turning with cemented-carbide tools, disengage friction before stopping spindle, for the carbide bit is too brittle to withstand the shock of stopping in a cut.

To adjust "play" in drop levers, stop spindle, raise lever to engaged position, loosen set-screw on the top side of friction housing, loosen the binder screw at the bottom of housing one-quarter to one-half turn, tap housing toward apron until "play" is removed from lever, and tighten binder and set-screws.

To adjust friction, stop spindle, raise lever to engaged position, remove set-screw on the top side of housing, loosen binder screw at the bottom of housing, and remove housing completely. Make sure that the anti-friction thrust washer inside adjusting nut "A", Figure No. 10, has not fallen off shaft. Adjust nut "A" for desired tension, and then replace housing, taking care to have set-screw countersink "line-up" with set-screw hole. Tighten binder screw, first making sure that there is no "play" in drop lever, and then replace and tighten set-screw.

**LEADSCREW REVERSE FROM APRON**—When the direction of the leadscrew is reversed from the apron, a small lever is employed at the right-hand side of the control lever. This lever has three positions: up, when cutting right-hand threads; center, or neutral; and down when cutting left-hand threads. With this attachment adjustable stops are provided for chasing in both directions.

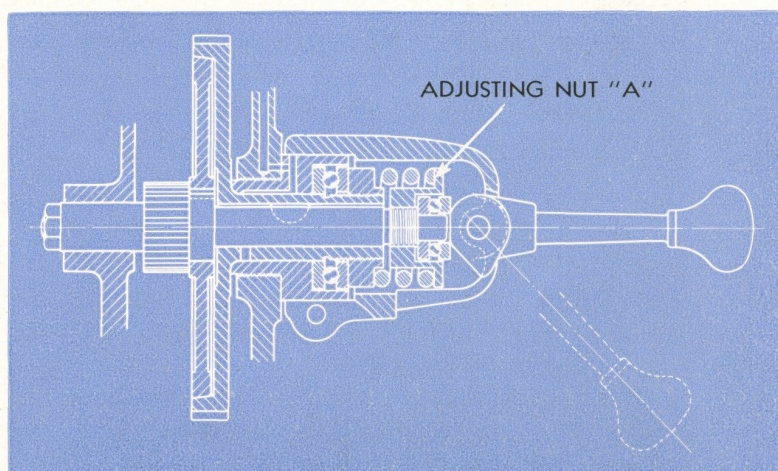


Fig. No. 10, Diagram of Feed Friction

Use this reverse only for the leadscrew when chasing threads. The forward-reverse lever on the apron should always be used for reversing the direction of feeding.

Do not attempt to reverse leadscrew when spindle speed is over 200 R. P. M. When over this speed, disengage clutch then brake spindle to a moderate speed before reversing.

**POWER RAPID TRAVERSE**—When the power rapid traverse is furnished, an additional lever is supplied on the apron directly above the hand-traverse wheel, Figure No. 9, page 14. This lever is directional and so designed that upon its release it snaps back into its neutral position. At the same time that this lever engages the power traverse frictions, it disengages the hand wheel.

To adjust the friction bands on the rear of the carriage, Figure No. 11, loosen the inside adjusting nuts, "B", a half to a full turn, and then tighten the outside adjusting nuts "A", against nuts "B". It will be very rare, if ever, that adjustment will be required.

**CARRIAGE**—The carriage is rigidly secured to the bed by clamps at the front and rear with an adjustable straight gib at the rear in every case except that in which the machine is equipped with power rapid traverse, in which instance two taper gibs are supplied. To adjust the straight gib, loosen the lock nuts, adjust the set-screws, and relock the nuts. The taper gibs are adjusted by means of their adjusting screws at the head end. Turning screws to the right tightens the gibs, and to the left loosens them.

The bottom slide is secured to the carriage bridge and the top slide to the swivel also by means of adjustable taper gibs, located on the right-hand sides. In the slot on each side of the swivel is a clamp nut for tightening the swivel to the bottom slide. The swivel can be swung in a 360° arc.

The carriage is clamped to the bed by means of the square-head screw located on the front, right-hand carriage wing. Directly behind both micrometer dials is found a knurled nut for binding the graduated dials to the screws. The knurled collar on the dial is merely for convenience in setting.

To adjust the cross feed nut for wear and accompanying backlash, loosen the hex-head screw "D" in the center of the carriage bridge just behind the swivel about a quarter turn and turn small hollow-head screw "C" to the right to draw up the adjusting wedge, Figure No. 12, page 17. The correct procedure is to adjust the small screw a quarter turn and then to tap the hex-head screw with a babbitt or wood block, at the same time turning the cross feed hand wheel to the right and left to feel for the correct adjustment. When the wedge has been drawn up a sufficient amount, tighten the hex-head screw. Do not loosen the large hollow-head screw "B" at any time. The hardened cross feed screw causes all the wear to take place in the nut, and for this reason the nut may be adjusted at any point along the screw.

On carriages without taper attachment, when backlash develops because of end play in the anti-friction thrust bearings on the screw, tighten the round nut "A" at the

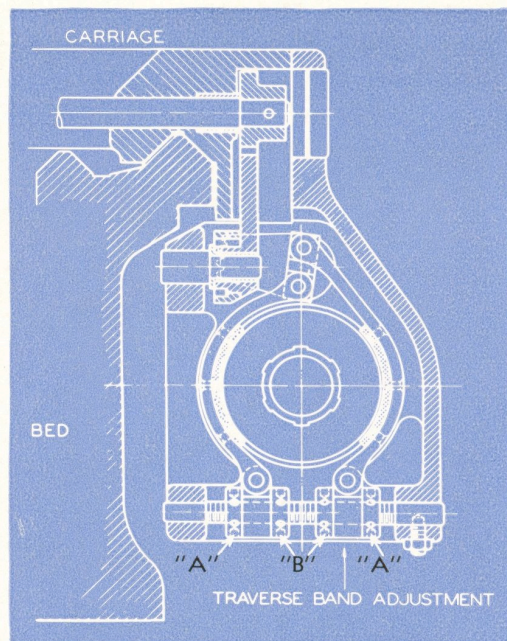


Figure No. 11, Power Rapid Traverse, End View.

front end of the screw. On carriages with the taper attachment, unscrew the square plate "M", Figure No. 13, page 18, directly over the back end of the screw, loosen two small set-screws in round nut, and adjust nut until end play is removed.

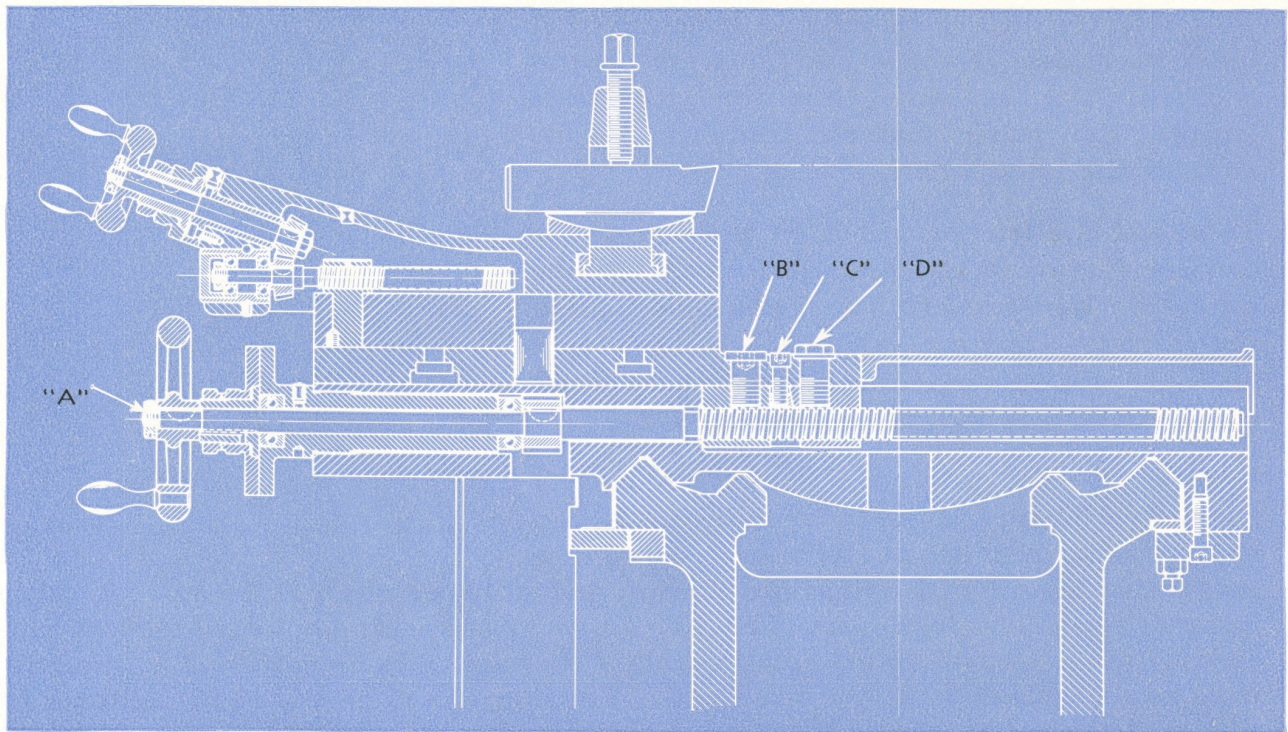


Figure No. 12, Diagram of the Carriage.

**TAPER ATTACHMENT**—The ball bearing taper attachment, Figure No. 13, page 18, is easily and quickly set up for action. Loosen draw bar binder nut "D", the two swivel nuts "E" and "F", and screw "G". By means of the knurled knob "H" set swivel to desired taper, either inches per foot at one end of swivel base or degree of angle at the other, then tighten nuts "E" and "F" and screw "G". Also tighten dog clamp nuts "J" and "K". To change from taper to straight turning loosen nuts "J" and "K" and tighten nut "D". Make sure that nut "D" is tight when turning straight work.

In order to face the maximum swing of the lathe either the swivel of the taper attachment must first be set at zero, or the shoe must be positioned at the exact center of the swivel guide bar.

**TAILSTOCK**—The tailstock, Figure No. 14, page 19, is provided with four clamping bolts for binding it securely to the bed. The spindle is clamped and unclamped in the barrel by raising and lowering clamping lever on rear of tailstock.

To remove center from spindle, back spindle all the way into the barrel, and to remove spindle itself, run it all the way out until spindle nut runs off of screw. Any end play in the spindle anti-friction thrust bearing may be adjusted by the nut on the hand-wheel end of the screw.

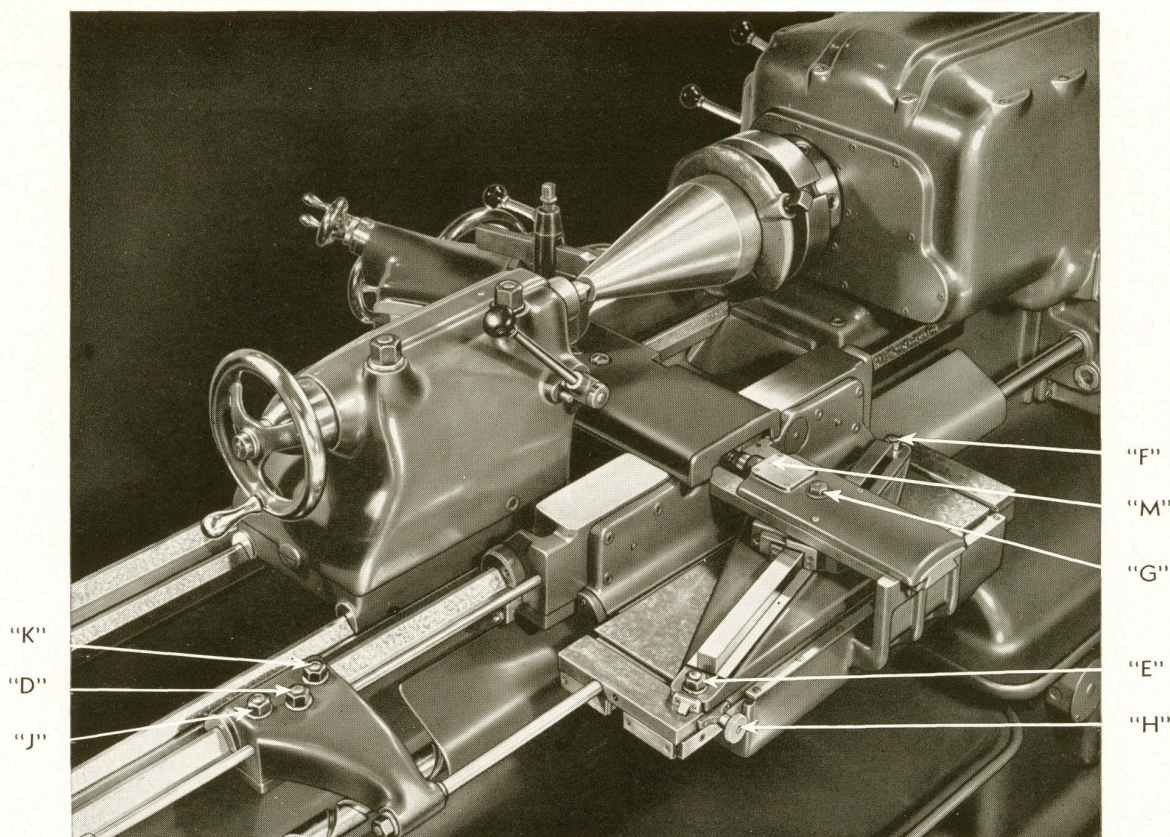


Figure No. 13, Ball Bearing Taper Attachment.

There is a  $\frac{1}{8}$ " set-over adjustment possible which can be measured on the graduated pad on the handwheel end. To adjust the center alignment from the front to the rear, loosen the hollow hex screw on the rear side two or three turns, adjust the hollow hex screw on the front side to the right until the desired position is obtained, and then tighten the screw on the rear side.

To adjust the center alignment from the rear to the front, loosen the hollow hex screw on the front side two or three turns, adjust the hollow hex screw on the rear side to the right until the desired position is obtained and then tighten the screw at the front.

These same operations hold true for the built-in anti-friction center tailstock except that of removing the center. The anti-friction mounted center, by itself, is non-removable, and must be removed along with its complete anti-friction unit. To do this, remove the set-screw on the rear side of the front end of the spindle, remove the plate on the end of the spindle, and draw out the complete anti-friction unit by the center. If the unit is too tight to draw out, remove the spindle and then tap it out. However, it will be rare, if ever, that this center unit must be removed. Even when regrinding the center is left in position and rotated by means of a thin belt placed around the cylindrical portion.

**RELIEVING ATTACHMENT**—The relieving attachment can be used for right or left-

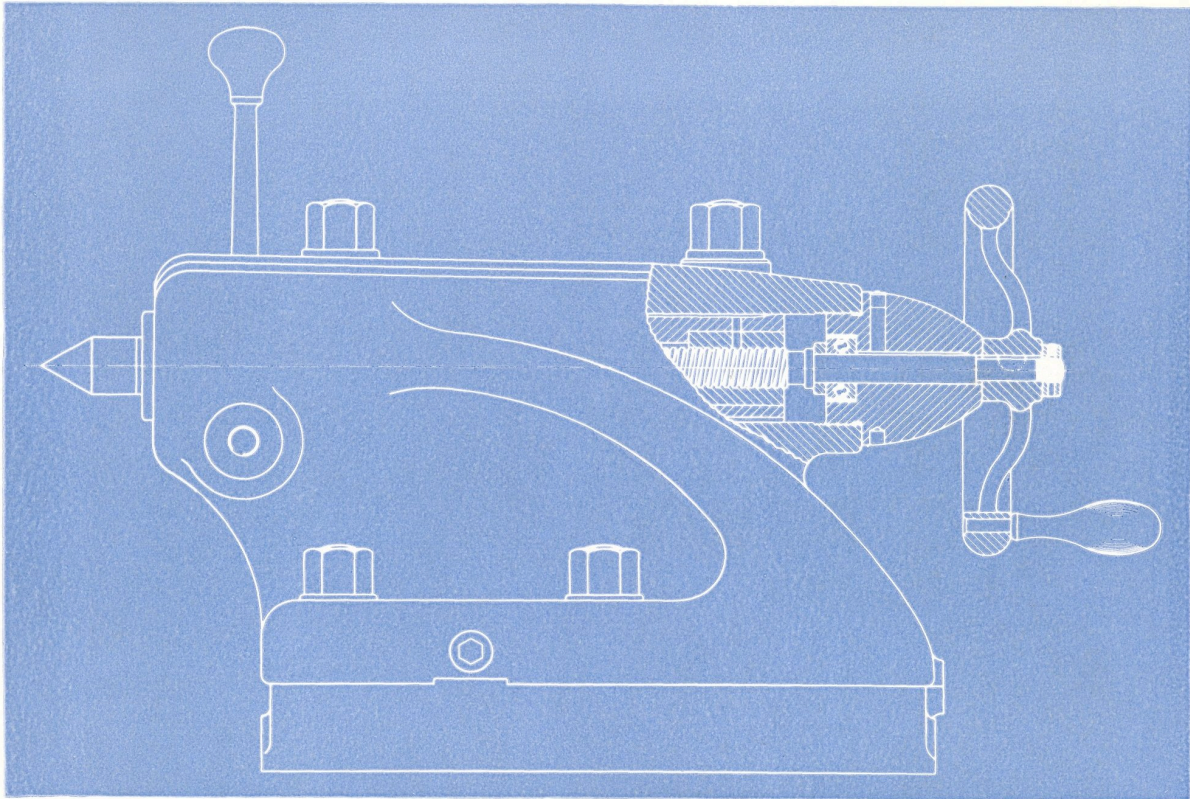


Figure No. 14, Tailstock.

hand leads, end, internal or external, plain, angular, and spiral relieving work. It may be used in conjunction with the taper attachment or without it.

A quadrant and change gears, separate from the regular change gears, inside the swinging cover at the head-end of lathe, provide the full range of standard flute requirements as well as any special number that may be required. A three-position pull-knob between the spindle and the change gears affords means either of selecting the drive with or without a sub-head attachment or of disconnecting the entire mechanism. The drive to the single lobe cam is through a one-way clutch to permit reversing the spindle without operating the attachment.

To apply the relieving attachment rest remove the regular compound rest swivel and top slide and substitute the relieving rest, using the same two bolts that are already in the circular T-slot. To connect the rest to the driving shaft slip the single spline shaft of the carriage bracket into the keyed sleeve attached to the rest, and then bolt this bracket onto the left front carriage wing, after first slipping the long splined shaft into the driving socket at the head-end of the lathe.

To quickly position the tool to the flute of the work, disengage the fine tooth clutch in the carriage bracket unit by backing out the knurled nut. After the tool is in the correct adjustment, engage the clutch.

To adjust the depth of relief follow the instructions on the plate attached to the knurled cover on top of rest. To remove the cover, twist and pull up in order to release taper fit.

To change from external to internal (push to pull) relieving, first remove knurled cover on top of rest and set the relief-adjusting dial on 0-0, then remove screw "A" from its "push" position and insert it in the "pull" position. The screw removed from the "pull" hole should be screwed into the "push" hole to keep out the dirt.

**EXTRA EQUIPMENT**—Various types of useful attachments can be furnished with all Pacemakers. For information covering any extra equipment, consult the dealer in your territory or write the factory direct.

**SERIAL NUMBER AND REPAIR PARTS.** Should it be necessary to order repair parts, always give the serial number of the machine and the key number of the part. This serial number is stamped on the front of the tailstock end of the bed. It is very important as it enables us to give prompt service, something we positively cannot do unless we know the exact machine on which the new parts are to be used. The key number of the part will be found in the parts catalog. It is seldom advisable to make your own repair parts; this is particularly true with regards to numerous parts where the correctness of shape is extremely important. The manufacturer has an accurate record of all the parts of your "American" Pacemaker Lathe and can supply them on short notice.

In conclusion, remember there is no finer or better built lathe than the "Pacemaker". Remember, too, that no machine tool, regardless of how well it is designed and built, will stand up for a long period under abuse, neglect or indifferent treatment. Read and study this book carefully. If this is done and the instructions carried out in detail you should get years of uninterrupted service.