INSTRUCTION BOOK

and

PARTS CATALOG

for

SUPER SERVICE RADIALS

having 11, 13, 15, 17 and 19 inch diameter columns

THE CINCINNATI BICKFORD TOOL CO.

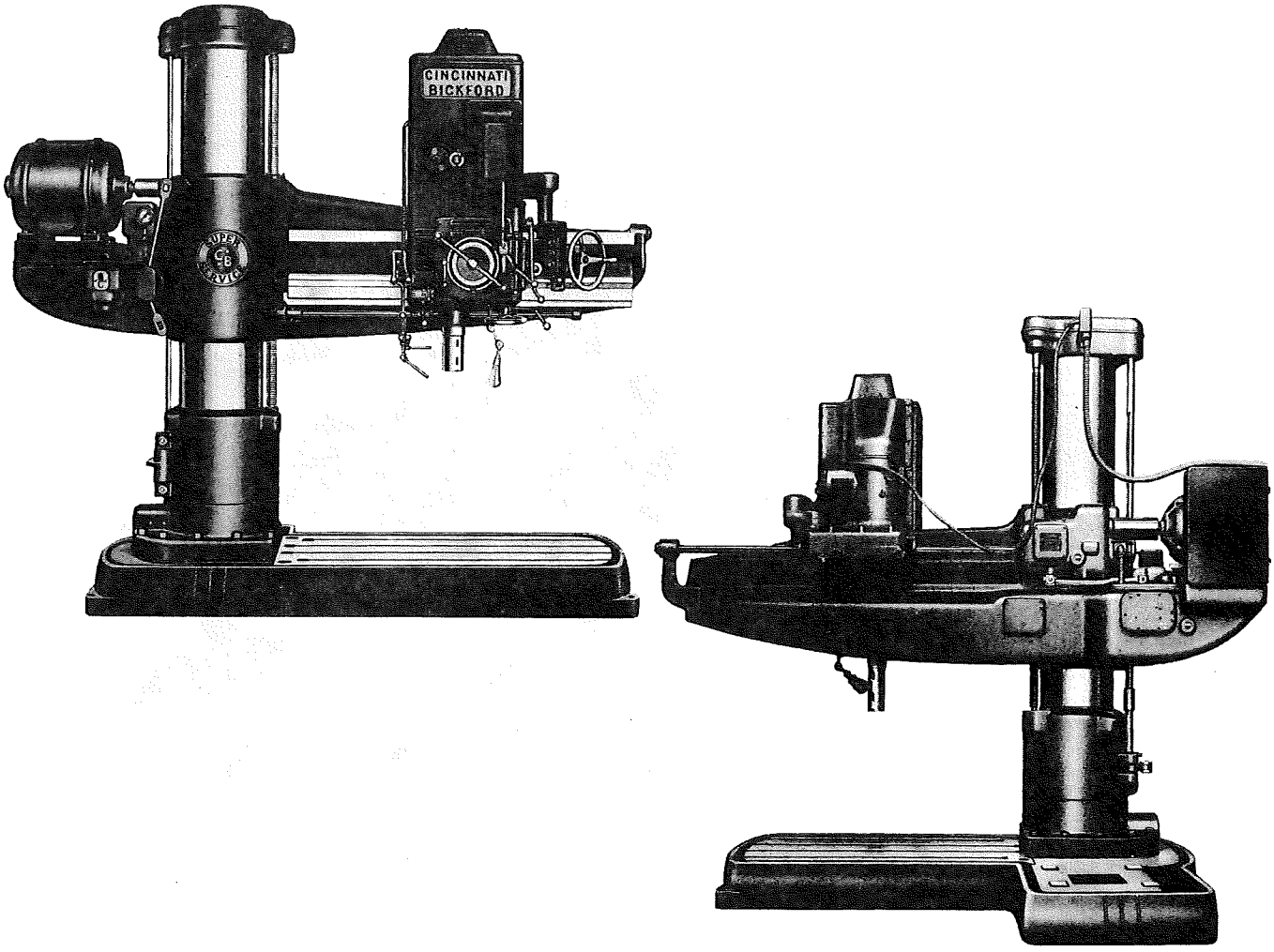
OAKLEY, CINCINNATI, OHIO

Litho in U. S. A. 4M-CLC

Booklet R-18 C

G&L Form No. 2498 - 3/79 - 150

Give Your Radial Drill A Square Deal



Your SUPER SERVICE Radial Drill is a finely made tool. It has been built with painstaking care and accuracy to insure your having the best in radial drills.

All of its mechanism is completely enclosed. Its oiling is automatic and it is protected by every practical accident prevention feature - - but, if you want years of uninterrupted service with low upkeep cost, there are two things that must be observed:

> The machine should be properly installed. It should receive intelligent care and treatment, after it has been placed in service.

This booklet contains detailed instructions for the installation, operation and care of the SUPER-SERVICE RADIAL. It should be thoroughly studied by the man in charge of erection, the radial drill foreman, the operator and by the man in charge of maintenance. The instructions in this book should be carried out in detail.

In conclusion, remember that no radial is better built than the SUPER-SERVICE Radial. Remember, too, that no machine tool, regardless of how well it is built, will stand up for a long period under abuse, neglect or indifferent treatment.

Give your SUPER-SERVICE Radial a square deal and it will serve you well.

ERECTING

Unloading

For the information of the erecting crew, the following hoisting weights of the 36 Speed Head SUPER-SERVICE Radials are given; the same size machines with 12 Speed Head are 500 lbs. less.

3' arm, 11"	column,	10,000 lbs.
4' arm, 11"	"	10,500 lbs.
5' arm, 11"	"	11,000 lbs.
4' arm, 13"	"	12,900 lbs.
5' arm, 13"	"	13,600 lbs.
4' arm, 15"	"	14,400 lbs.
5' arm, 15"	"	14,700 lbs.
6' arm, 15"	"	15,500 lbs.
5' arm, 17"	"	20,000 lbs.
6' arm, 17"	"	21,200 lbs.
7" arm, 17"	"	22,400 lbs.
6" arm, 19"	"	22,800 lbs.
7' arm, 19"	"	24,400 lbs.
8' arm, 19"	"	26,000 lbs.

Before unloading from car, observe the following precautions:

1. Do not remove the waterproof covering from the machine until it has been set in place.

2. Place a sling, preferably of manila rope, around the arm as shown on Fig. 1. The ways of the arm and the arm shaft are covered with heavy blocking to protect them from the sling. Care should be taken when placing the sling to see that it rests on this blocking. Put a rope hitch around the top of the column and the sling as shown. Take a light strain on the sling with the crane to make sure everything is all right before hoisting.

Fig. 1

Foundation

Where the machine is located on the ground floor, we recommend that a concrete foundation, having a depth of at least three feet, be provided in accordance with foundation plans shown in Fig. 5. The foundation bolts should be so arranged before pouring, that they can be moved about one inch in any direction after the foundation has set. This is to allow for slight errors in locating these bolts. Fig. 2 illustrates such an arrangement.

Where most of the work has considerable height, it is good practice to locate the top of the foundation so that the work-

ing surface of the base is about 2½" above the floor level. This brings the machine considerably lower than would be the case if it were resting on the floor. This is much more convenient for the operator when handling large work. However, where most of the work has very little height, nothing would be gained by such an arrangement. When figuring the height of the foundation, an inch to an inch-and-a-half should be allowed, between the base and the top of the foundation for grouting.

In the case of a machine installed above the ground floor of a building, we recommend placing it on the strongest part of the floor, preferably near a column. It should be so located, however, that the building column does not offer any objectionable interference to the swing of the arm. If the floor is of concrete, the base should be grouted in. If the floor is of wood, wooden wedges should be packed in all around the base. In both cases the machine should be bolted to the floor, either with expansion bolts or bolts going through to the ceiling of the floor beneath.

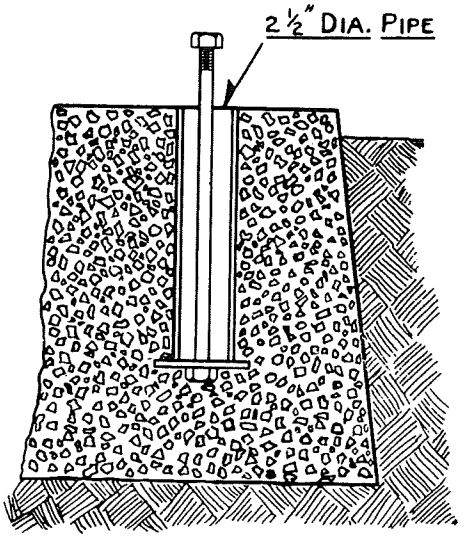


Fig. 2

Leveling

For the leveling operation, the most accurate level obtainable should be used. We recommend a level, 18" to 20" in length, having a bubble several inches long and a graduated glass tube. The ordinary machinist's level is not sufficiently accurate for high grade results and should only be used where nothing better is available.

A dozen steel wedges, 2" wide and 8" long, tapering from 1/16" to 1" in thickness should also be provided. After the machine has been set in place on the foundation, a wedge should be inserted at each of the points indicated by arrows that are painted on the base. Make certain that the machine is resting only on these wedges and is not touching the foundation at any point. If the top of the foundation is uneven, put steel plates under the wedges.

Clean the top of the base thoroughly and remove any burrs or nicks that might have been received in transit. Care must also be taken to insure that there is no grit on the finished surface of the base or on the under side of the level. Grit can only be detected by rubbing these surfaces with the bare hands. Follow the instructions given in Fig. 4 and check the final readings several times to be sure that they are within the limits.

The remaining wedges should be used for packing. Place them so that the base will be evenly supported on all sides. These packing wedges must be lightly and carefully driven. They must be tight enough to insure a good bearing between the base and the foundation, but not so tight as to loosen the wedges that were used for leveling and thereby disturb the level of the machine. When all wedges are in place, make a final check of the leveling as outlined in the preceding paragraph. If it is correct, the machine is ready for grouting in.

Grouting

A grout of one part sand and one part cement should be used. It should be thin enough to flow under the entire base. Good practice is to build a wall

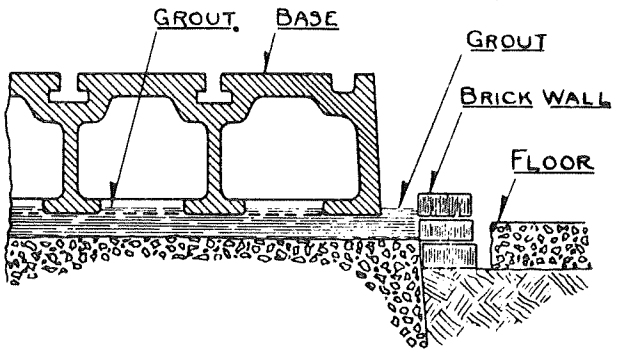


Fig. 3

of several courses of brick around the machine, leaving a space of several inches in width between the base and the wall as shown on Fig. 3. The grout is then poured into this space to about the level shown. After it has had sufficient time to harden, the brickwork can be removed. Incidentally, the grout should not be mixed near the machine. This precaution is necessary to prevent sand and cement dust getting on the finished surfaces.

CLEANING and OILING

Cleaning

For cleaning the machine, kerosene is preferable to gasoline. It does not evaporate and leave dried slushing compound on finished surfaces. The kerosene must be absolutely clean. The container that is used must be thoroughly cleaned before filling. Rags, if they are obtainable, are better than waste as they leave no lint or strings.

Do not move the head until the arm has been cleaned and oiled in the following manner. Take an ordinary scrub brush and clean the rack teeth thoroughly. Clean the finished surfaces of the arm on both sides of the head, being careful to remove all dirt and grit in the corners where the head fits on the arm. Rub the bare hands over the finished surfaces of the arm to make certain that all grit has been removed. This precaution is necessary to prevent cutting and scoring of the arm. With the fingers, rub plenty of oil on all of the finished surfaces of the arm.

Refer to the oiling chart, Fig. 6. At the point marked 11, is an oil pocket that supplies oil to the gibs and all of the surfaces of the head that bear on the arm. Fill this pocket level full with a good grade of medium machine oil. Clean and oil the drive shaft that is located on the rear of the arm.

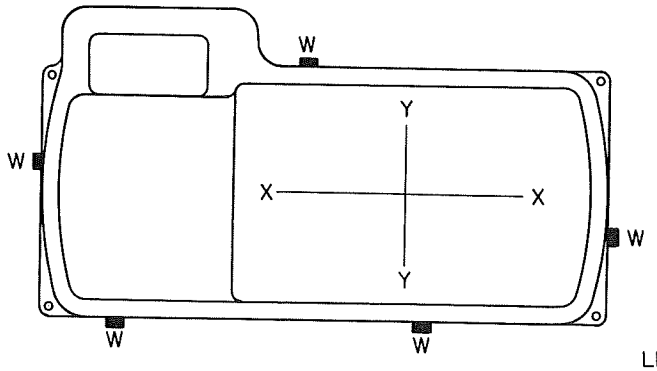
Swing the head clamping lever, Fig. 7, downward as far as it will go. The head may now be moved along the arm by means of the head moving handwheel, Fig. 7. If the head appears to move stiffly, it is because of the newness. This will ease up after the machine has been in use a short time. Do not loosen the head gibs to obtain a free movement.

Clean the spindle nose and sleeve as follows: Push the quick return levers, Fig. 7, toward the head and move the spindle downward as far as it will go. Do not raise the spindle as this will draw dirt and slushing into the spindle bearing in the head.

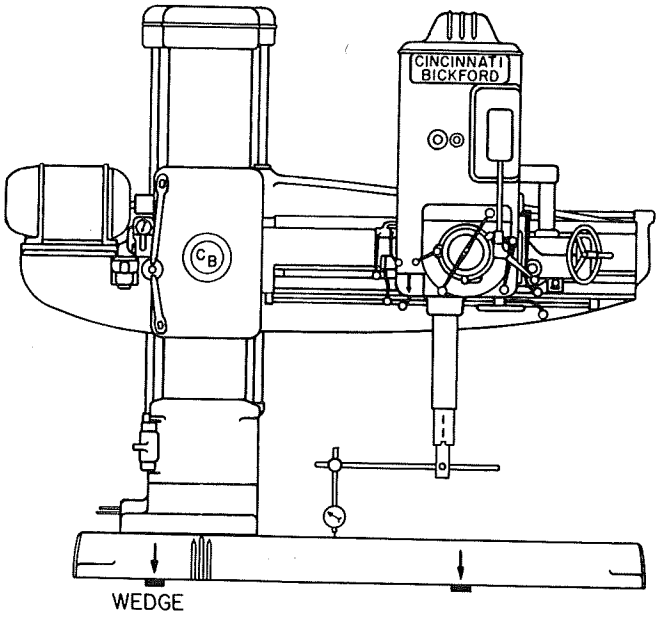
Clean thoroughly. Clean the rack teeth with a scrub brush. There is a metal-to-metal fit between the teeth of the rack and its pinion. Any dirt or slushing will interfere with the movement of the spindle. Oil the surface of the sleeve and the rack thoroughly. The spindle may now be moved either up or down.

Clean the elevating screw with a scrub brush and oil thoroughly. Be sure that all dirt and slushing is removed. Clean the column, above and below the arm. Clean thoroughly where the arm meets the finished surface of the column. Rub with the

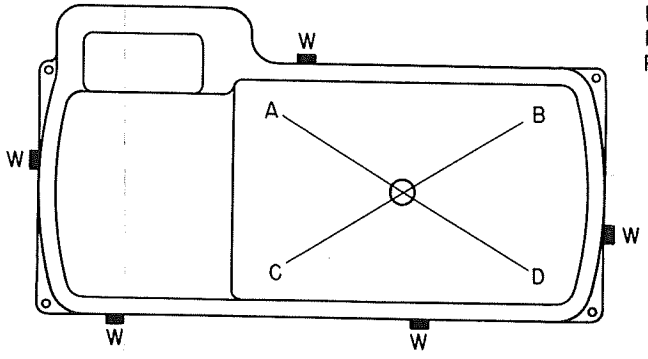
IN LEVELING YOUR SUPER SERVICE RADIAL
TRAM IT THIS WAY, BEFORE GROUTING.



LEVEL WITH SENSITIVE LEVEL ALONG X X & Y Y WHILE SUPPORTED ONLY ON WEDGES "W" AT THE POSITIONS MARKED WITH WHITE LINES ON BASE.

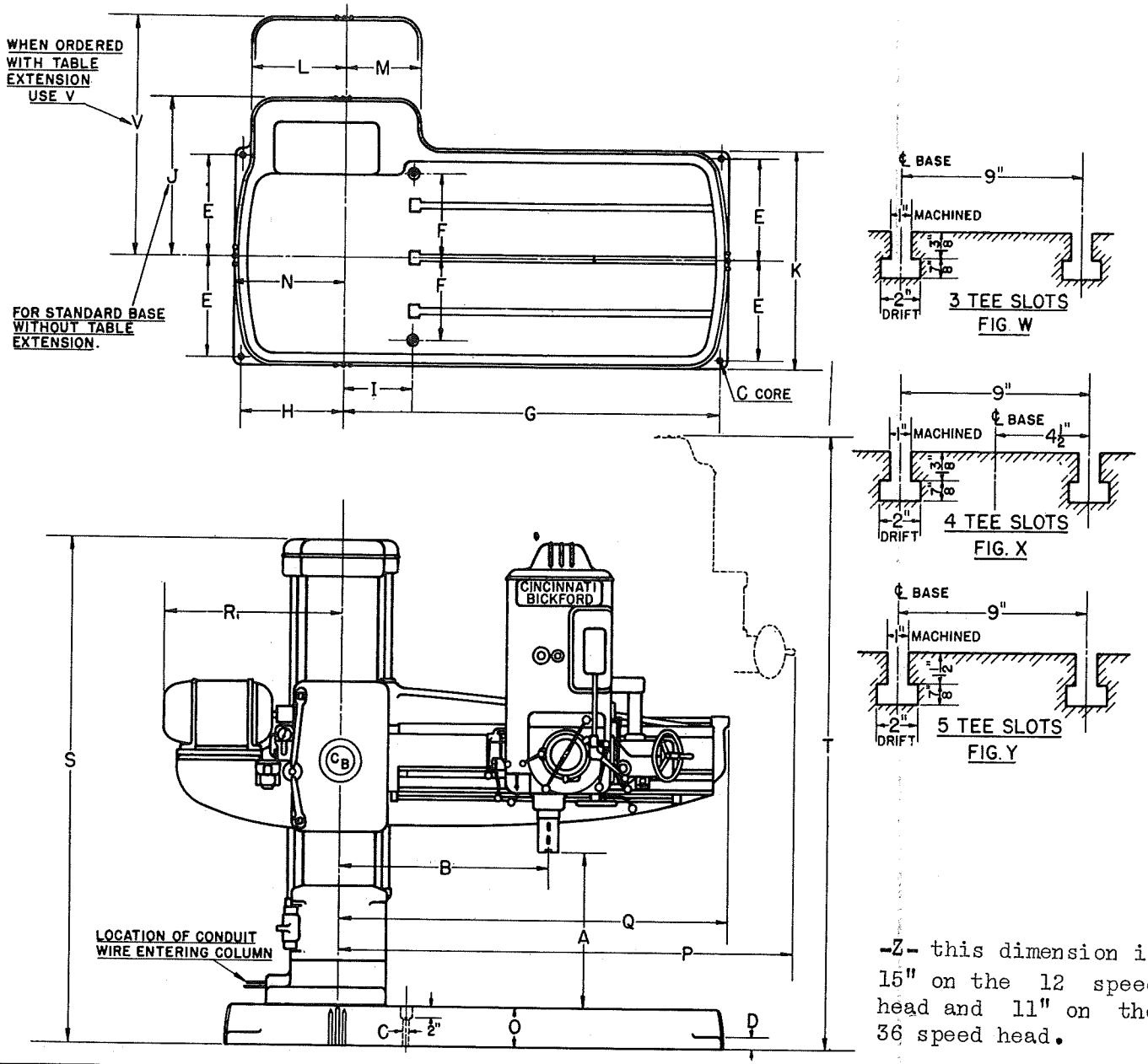


WITH BASE LEVELED INDICATOR IN SPINDLE AS SHOWN SHOULD READ WITHIN .005" ON THE FOUR CORNERS OF BASE (AN ERROR OF ONLY ABOUT .001" PER FOOT). IN THE EVENT THE BASE DOES NOT TRAM TO THESE LIMITS IT WILL BE NECESSARY TO RE LOCATE WEDGES TO FAVOR THE POINT SHOWING OUT OF TRAM.



MOVING THE HEAD ALONG THE ARM AND READING THE INDICATOR IS NO CHECK

Fig. 4



-Z- this dimension is 15" on the 12 speed head and 11" on the 36 speed head.

SIZE ARM	SIZE DIA. OF COL.	A MIN.	A MAX.	B MIN.	B MAX.	C	D	E	F	G	H	I	J	K	L	M	N	O	P HAND TRAV.	P POWER TRAV.	Q	R	S	T	V	TEE SLOTS
3FT.	11"	-Z-	52"	21¼"	42⅝"	1"	2¾"	17½"	12½"	55⅝"	19¼"	10⅞"	28"	38"	17¼"	16⅛"	20¾"	8"	72⅝"	74⅞"	63¾"	43"	94"	115"	49⅝"	W
4FT.	11"	-Z-	52"	21¼"	54⅝"	1"	2¾"	17½"	12½"	67⅝"	19¼"	10⅞"	28"	38"	17¼"	16⅛"	20¾"	8"	84⅝"	86⅞"	75¾"	43"	94"	115"	49⅝"	W
5FT.	11"	15"	52"	21¼"	66⅝"	1"	2¾"	17½"	12½"	79⅝"	19¼"	10⅞"	28"	38"	17¼"	16⅛"	20¾"	8"	96⅝"	98⅞"	87¾"	43"	94"	115"	49⅝"	W
4FT	13"	14"	60"	21¼"	57⅛"	1⅛"	2¾"	20¼"	14½"	67⅜"	21¼"	10¼"	31"	44"	18½"	16¾"	23"	9"	87⅛"	89⅜"	77½"	45"	103"	124"	60½"	X
5FT.	13"	14"	60"	21¼"	69⅛"	1⅛"	2¾"	20¼"	14½"	79⅜"	21¼"	10¼"	31"	44"	18½"	16¾"	23"	9"	99⅛"	101⅜"	89½"	45"	103"	124"	60½"	X
4FT.	15"	15"	66"	22"	58⅜"	1⅛"	2¾"	20¼"	14½"	68⅝"	20"	11½"	31"	44"	17¼"	18"	21¾"	9"	88⅜"	90⅝"	78¾"	45"	109"	130"	60½"	X
5FT.	15"	15"	66"	22"	70⅜"	1⅛"	2¾"	20¼"	14½"	80⅝"	20"	11½"	31"	44"	17¼"	18"	21¾"	9"	100⅜"	102⅝"	90¾"	45"	109"	130"	60½"	X
6FT.	15"	15"	66"	22"	82⅜"	1⅛"	2¾"	20¼"	14½"	92⅝"	20"	11½"	31"	44"	17¼"	18"	21¾"	9"	112⅜"	114⅝"	102¾"	45"	109"	130"	60½"	X
5FT.	17"	15"	72"	23⅜"	71⅝"	1¼"	3½"	24"	19⅜"	81⅝"	28⅜"	13"	36"	52"	23⅝"	19⅛"	30⅜"	10"	102⅜"	104⅝"	92⅞"	47"	123"	143"	65"	Y
6FT.	17"	15"	72"	23⅜"	83⅝"	1¼"	3½"	24"	19⅜"	93⅝"	28⅜"	13"	36"	52"	23⅝"	19⅛"	30⅜"	10"	114⅜"	116⅝"	104⅞"	47"	123"	143"	65"	Y
7FT.	17"	15"	72"	23⅜"	95⅝"	1¼"	3½"	24"	19⅜"	105⅝"	28⅜"	13"	36"	52"	23⅝"	19⅛"	30⅜"	10"	126⅜"	128⅝"	116⅞"	47"	123"	143"	65"	Y
6FT.	19"	17"	78"	24⅝"	85"	1¼"	3½"	24"	19⅜"	95"	27"	14⅜"	36"	52"	22¼"	20½"	29"	10"	115¾"	118"	106⅜"	48"	129"	149"	65"	Y
7FT.	19"	17"	78"	24⅝"	97"	1¼"	3½"	24"	19⅜"	107"	27"	14⅜"	36"	52"	22¼"	20½"	29"	10"	127¾"	130"	118⅜"	48"	129"	149"	65"	Y
8FT.	19"	17"	78"	24⅝"	109"	1¼"	3½"	24"	19⅜"	119"	27"	14⅜"	36"	52"	22¼"	20½"	29"	10"	139¾"	142"	130⅜"	48"	129"	149"	65"	Y

Fig. 5

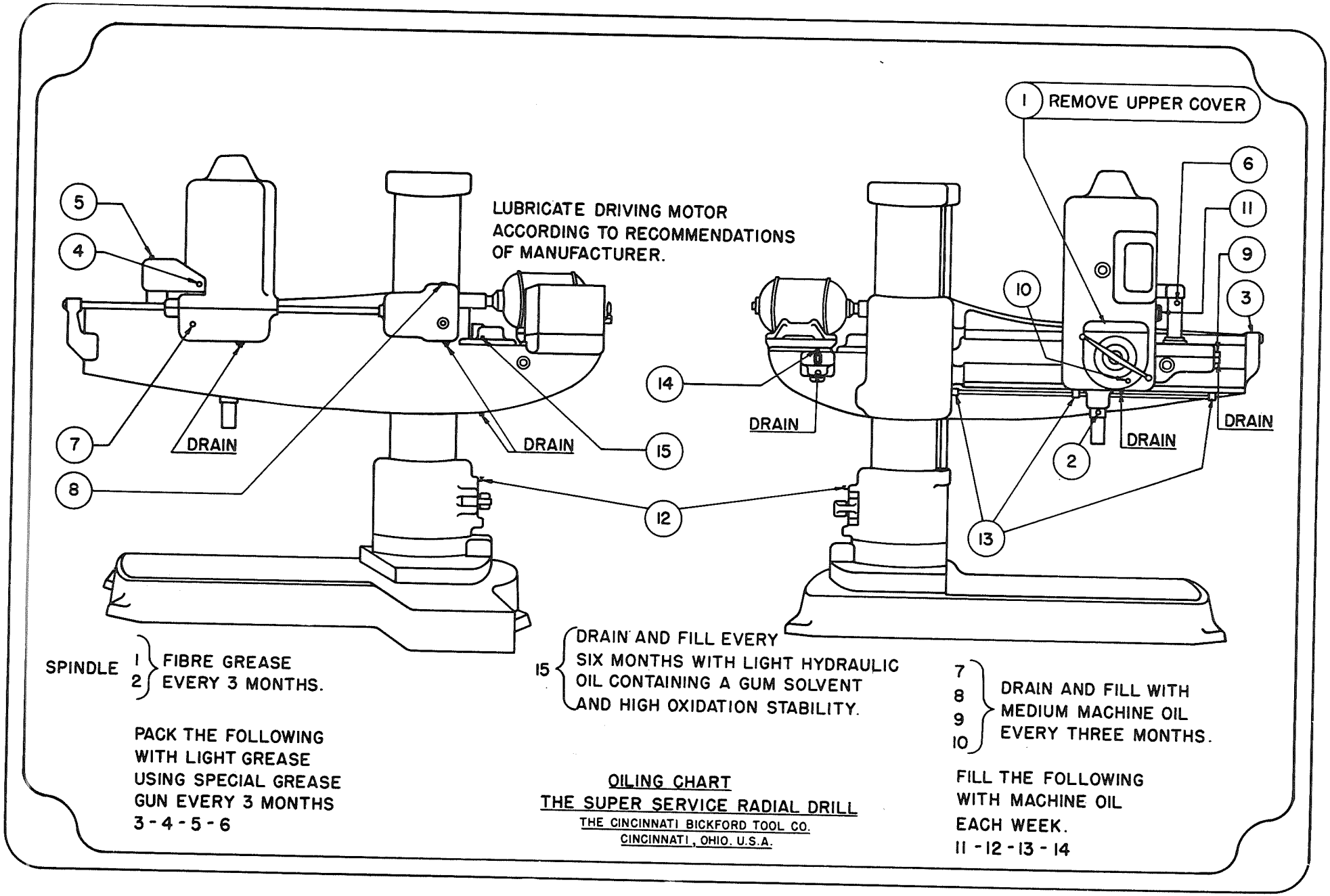

1 REMOVE UPPER COVER
LUBRICATE DRIVING MOTOR ACCORDING TO RECOMMENDATIONS OF MANUFACTURER.
DRAIN
DRAIN
DRAIN
DRAIN
DRAIN
SPINDLE 1 2 FIBRE GREASE EVERY 3 MONTHS.
PACK THE FOLLOWING WITH LIGHT GREASE USING SPECIAL GREASE GUN EVERY 3 MONTHS 3 - 4 - 5 - 6
15 DRAIN AND FILL EVERY SIX MONTHS WITH LIGHT HYDRAULIC OIL CONTAINING A GUM SOLVENT AND HIGH OXIDATION STABILITY.
7 8 9 10 DRAIN AND FILL WITH MEDIUM MACHINE OIL EVERY THREE MONTHS.
FILL THE FOLLOWING WITH MACHINE OIL EACH WEEK. 11 - 12 - 13 - 14
OILING CHART
THE SUPER SERVICE RADIAL DRILL
THE CINCINNATI BICKFORD TOOL CO.
CINCINNATI, OHIO. U.S.A.

Fig. 6

bare hands to make sure that all grit has been removed and oil thoroughly.

Oiling

The machine as received by you, has been completely drained of all oil. Before any attempt is made to run it ---- before any motor connections are made ---- every detail of the following oiling instructions must be complied with.

Oil according to the oiling chart, Fig. 6 using greases and oil specified.

All these bearings have been liberally greased or oiled before the machine was shipped and will require additional grease or oil.
Items 1 and 2 are the upper and lower spindle bearings respectively. These are, perhaps, the most important bearings on the machine. Using the special greasegun furnished with machine, the upper bearing is reached through a removable cover plate located on the front of the head and above the quick-return levers. Remove the brass plug in the spindle sleeve and give this bearing one-fourth of the contents of the grease gun at each oiling.To oil the lower spindle bearing, move the spindle downward to its lowest position and remove the brass plug in the lower part of the spindle sleeve. Give this bearing one-fourth the contents of the grease gun at each oiling.

Item 3 is the arm shaft outer bearing. Fill until clean light grease shows on the arm shaft.

Items 4,5 and 6 are bearings of the power rapid traverse unit. These should be liberally greased at each oiling.

Items 7 to 10 inclusive, are reservoirs for the mechanism that runs in oil. Before starting, remove the filler plugs and fill with a good grade of medium machine oil. Drain each reservoir every three months and fill with fresh oil. Check the oil levels once each month and replace any shortage.

Item 7 is the reservoir that supplies oil to the driving clutches and the entire speed and feed mechanism in the head. In the bottom of this reservoir is a high pressure oil pump that forces oil to the top of the head. From this point the oil cascades down through the gears and bearings and drains back to the reservoir. This oil pump is completely submerged and never loses its priming. The driving clutches are also located in this reservoir. They run in oil.

A sight feed glass on the front of the head indicates the oil flow. This should show, when the spindle is running, an oil stream about 1/8" in diameter. Oil will not appear in the sight feed glass when the spindle is stationary because the pump only runs when the spindle revolves. An Oil Filter is connected to the oil line on the discharge side of the pump. This filter should be renewed once in every two to three years. A pressure relief valve is also located in the oil line. If, at any time, the oil stream in the sight feed glass should show signs of diminishing, the oil flow can be increased by tightening the adjusting screw on the pressure relief valve.

Item 8 is the case that contains the motor reduction gears and the elevating mechanism.

Item 10 is the reservoir in the lower part of the head that oils the feed worm and worm wheel.

Item 9 is the power rapid traverse case.

Item 11 is the reservoir that supplies oil to the gibs and all surfaces of the head that bear on the arm. This oil works out of the head and onto the arm ways, covering them with an oil film.This reservoir must be filled every week with a good grade of medium machine oil. The driving motor should be oiled in accordance with instructions furnished by the motor manufacturer.

Note: Where the machine is run continuously on day and night shifts, it must be oiled twice as often as indicated on the above schedule.

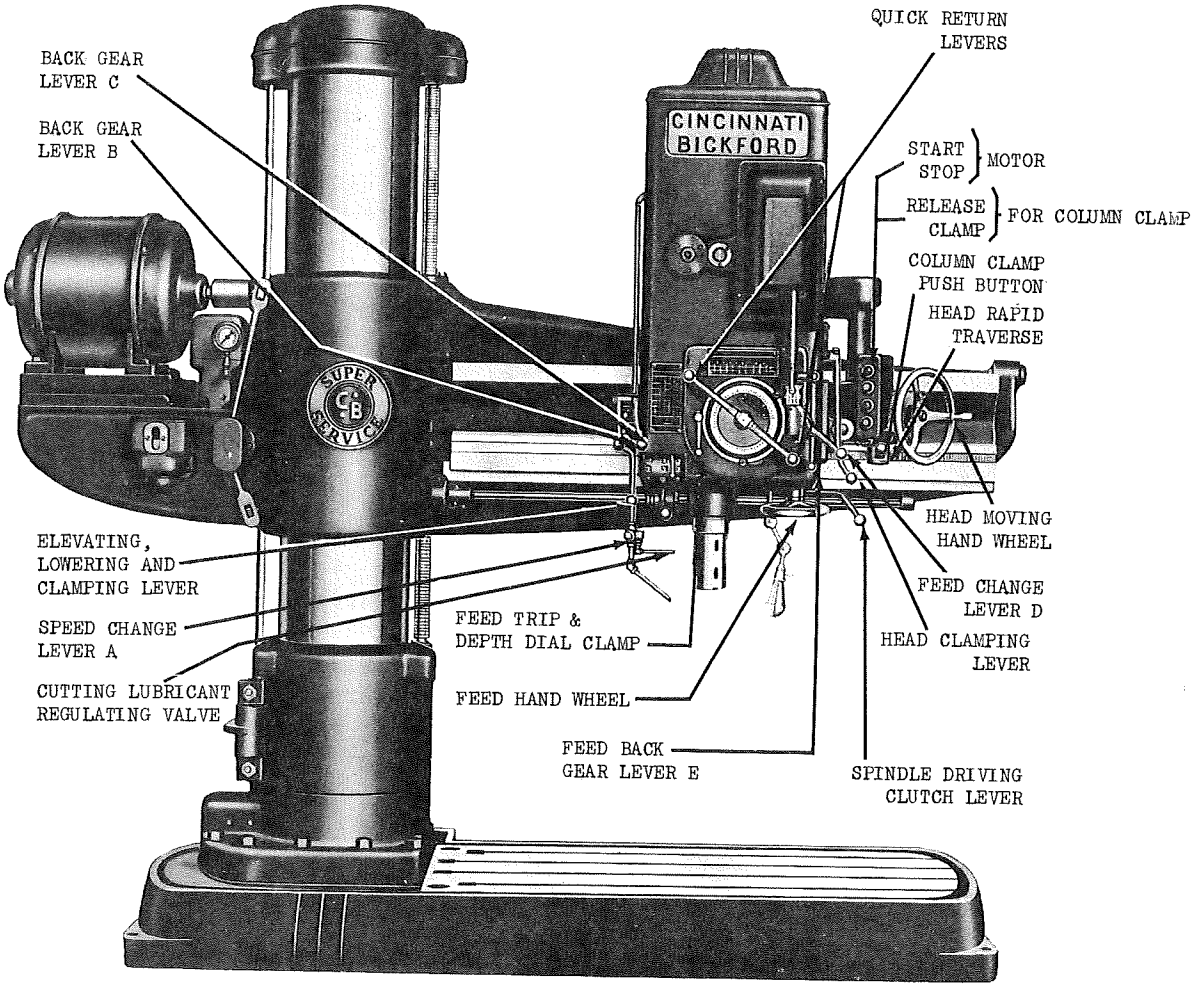

QUICK RETURN LEVERS
BACK GEAR LEVER C
BACK GEAR LEVER B
CINCINNATI BICKFORD
START STOP } MOTOR
RELEASE CLAMP } FOR COLUMN CLAMP
COLUMN CLAMP PUSH BUTTON
HEAD RAPID TRAVERSE
SUPER C B SERVICE
HEAD MOVING HAND WHEEL
ELEVATING, LOWERING AND CLAMPING LEVER
FEED CHANGE LEVER D
SPEED CHANGE LEVER A
FEED TRIP & DEPTH DIAL CLAMP
HEAD CLAMPING LEVER
CUTTING LUBRICANT REGULATING VALVE
FEED HAND WHEEL
FEED BACK GEAR LEVER E
SPINDLE DRIVING CLUTCH LEVER

Fig. 7

OPERATION

Starting

The following operating instructions must be gone over before any attempt is made to start the machine.

Before starting, put the spindle driving clutch lever, Fig. 7, in neutral, which is midway between its extreme positions. Push the quick-return levers, Fig. 7, toward the head as far as they will go. Then turn the machine over by hand to make sure that it revolves freely. By means of temporary connections, check the direction of rotation of the driving motor. When the motor runs in the direction indicated by the large bronze arrow, these connections can be made permanent.

To run the spindle right-handed, as in drilling, pull the driving clutch lever forward as far as it will go.

To run the spindle left-handed, as in backing out taps, push the driving clutch lever toward the arm as far as it will go.

To stop the spindle, put the driving clutch lever midway between these two positions.

Avoid running the spindle when the driving clutch lever is not in either of its extreme positions. A partially engaged clutch will slip, and slipping causes wear.

Selection of Spindle Speeds

The SUPER-SERVICE Radial has thirty-six spindle speeds. Speed change lever "A," Fig. 7, provides nine changes of speed. Back gear levers "B" and "C," Fig. 7, each provide two changes of speed. The nine speeds obtained through lever "A," when multiplied by the four speeds obtained through back gear levers "B" and "C," give a total of thirty-six spindle speeds.

The nine positions of speed change lever "A," are indicated by an arrow and a numbered plate at the upper end of the lever.

These numbers correspond with numbers on the first column of the speed plate, Fig. 8. The back gear levers, "B" and "C" have two positions each. One of these is a horizontal, the other a downward position. The positions of these levers are indicated by arrows at the top of the speed plate.

All of the thirty-six changes of spindle speed are obtained through sliding gears. To shift these gears, engage the driving clutch very lightly, just enough to cause the gears to roll slowly -- and then shift with a quick, decisive movement.

The speed plate is direct reading. It gives the spindle speeds in R.P.M. and the corresponding sizes of drills, boring and facing cutters for cast iron and steel. Drill diameters for cast iron or steel are based on a cutting speed of 80 ft. per minute and are shown in black. The size of boring and facing cutters for cast iron or steel is based on a cutting speed of 40 ft. per minute and is shown in red. The feeds recommended for both cast iron and steel are also given.

Selection of Feeds

The SUPER-SERVICE Radial has eighteen feeds. Feed lever "D," Fig. 7, provides nine changes of feed. These are doubled by feed lever "E," Fig. 7, making a total of eighteen feeds. The nine positions of lever "D" are indicated by an arrow and a bronze plate at the upper end of this lever. These numbers correspond with the top row of numbers on the feed plate, Fig. 9. Lever "E" has two positions, as shown on the feed plate. Between these two positions is a neutral position at which lever "E" may be set for hand feeding.

To start the spindle feeding downward, run the spindle in the direction for

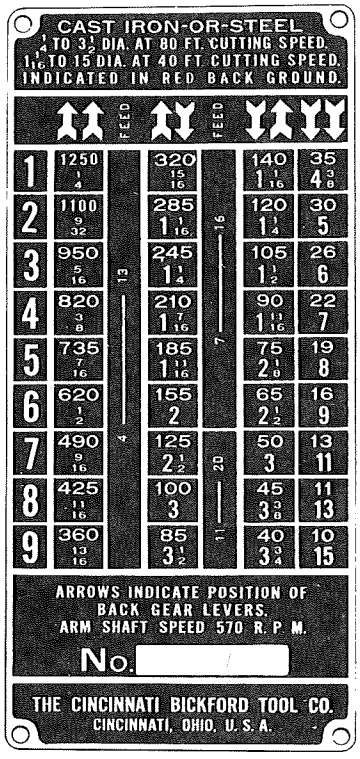


Fig. 8

drilling. Set feed levers "D" and "E" according to the positions indicated on the feed plate. Pull the quick-return levers, Fig. 7, away from the head as far as they will go. This engages the quick-return clutch. To stop the feed at any time, push the quick-return levers toward the head.

All of the eighteen feed changes are obtained through sliding gears. Feeds can be changed while the spindle is running idle without disengaging the driving clutch -- but, they should not be changed while drills or tools are cutting.

The feed plate, Fig. 9, gives feeds in thousandths of an inch per revolution of the spindle. Feeds shown in red correspond to standard pipe threads of 8, 11½, 14, 18, 20 and 27 threads per inch. For driving pipe taps, it is merely necessary to select the feed corresponding to the lead of the tap. The spindle will automatically advance the tap at its required rate.

There is a limit trip that disengages the power feed when the spindle comes within half an inch of its lower limit of travel. This prevents the teeth of the rack pinion from running into the spindle sleeve at the end of the rack.

There is also a safety clutch which will slip if the feed is overloaded and prevent damage to the mechanism even though the operator becomes careless in selecting or tripping the feed.

Compensating Dial Depth Gauge

The feed mechanism also includes a dial depth gauge of the compensating type. This depth gauge automatically disengages the feed when either the point or the body of the drill has penetrated to a re-

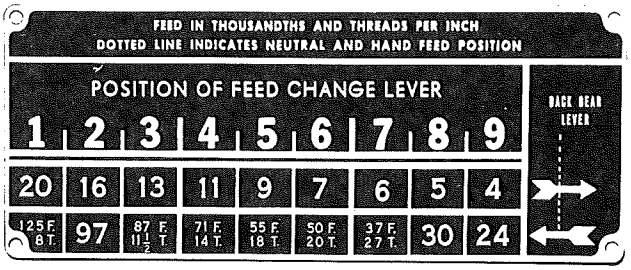


Fig. 9

quired depth. The graduations on the ring represent spindle travel in sixteenths of an inch. The graduations on the etched plate represent drill diameters in eighths of an inch.

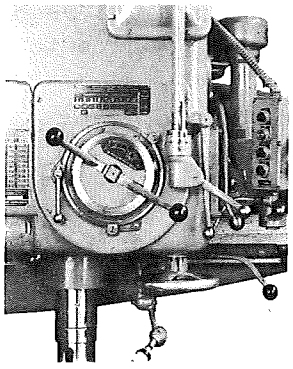


Fig. 10

To advance the drill to a given depth, set the point of the drill so that it touches the work. Unclamp the graduated ring by swinging the depth gauge clamping lever, Fig. 10, in a counterclockwise direction until it points downward.

If it is desired to advance the point of the drill to a given depth, revolve the graduated ring until the point on the ring, that corresponds to the required depth, registers with the zero on the etched plate. Fig. 11 shows the depth gauge set to trip the feed when the drill point has penetrated to a depth of 2-3/4 inches.

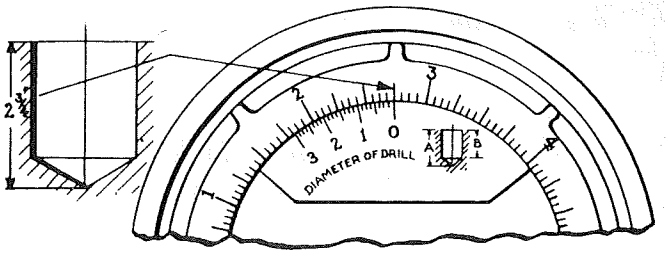


Fig. 11

If it is desired to advance the body of the drill to a given depth, revolve the graduated ring until the point on the ring, that corresponds to the required depth, registers with the drill diameter indicated on the etched plate. Fig. 12 shows the depth gauge set to trip the feed when the body of a 2" drill has penetrated to a depth of 5 inches.

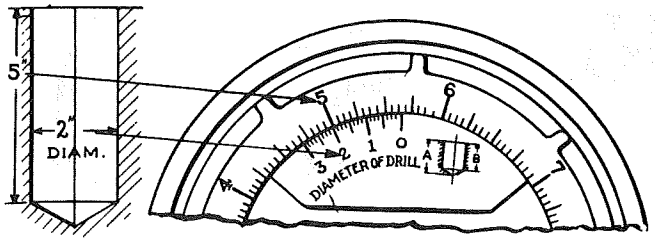


Fig. 12

In either case, when these settings have been made, swing the depth gauge clamping lever upward until the graduated ring is firmly clamped. Engage the feed. When the drill reaches the required depth the feed will automatically disengage.

Moving the Head on the Arm

The head can be moved along the arm by means of the head moving hand wheel, Fig. 7, or by means of the head rapid traverse lever, Fig. 7.

To move the head by power rapid traverse, pull the traversing lever down to its lowest position and move this lever to the right or left according to the direction in which the head is to be moved. When the head is in position, simply release the lever and it will return to neutral. The hand wheel can then be used for final, close positioning of the head.

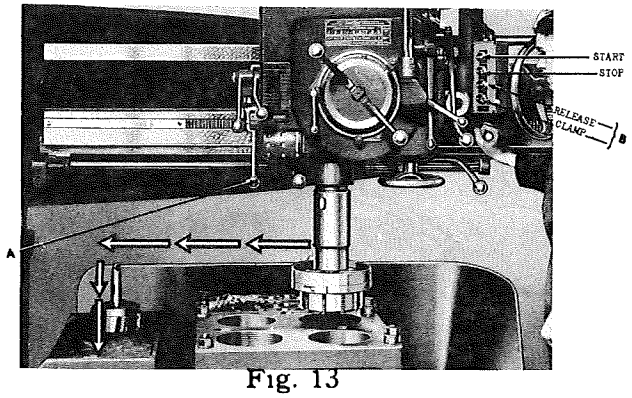


Fig. 13

In addition to moving the head swiftly and easily along the arm, the power rapid traverse offers another advantage. It can be used in very much the same manner as the traversing motor on an electric crane. As shown in Fig. 13, heavy tools can be placed on a bench or tool stand near the column and carried to and from the work by means of the power traverse. This will relieve the operator of a lot of heavy lifting in getting tools on and off the spindle.

The clamping of the head on the arm is accomplished by means of the head clamping lever, Fig. 7. To clamp, pull up hard on this lever. To unclamp, push it down.

Raising, Lowering and Clamping the Arm

Arm clamping and elevating is conveniently and safely controlled at the operating position by a free moving directional lever A, Fig. 13, at the lower left side of the head. On moving this lever up, the arm clamp is hydraulically released, the multiple disc clutch for elevating is automatically engaged and the arm raises. To stop elevation, the lever is moved to the "stop" or center position; this automatically disengages the elevating clutch and the arm is automatically clamped through a powerful hydraulic clamping mechanism. The cycle for lowering and clamping is similarly automatic and foolproof. Protective limit trips are provided at the upper and lower limits of travel and, in addition, there is a safety in the mounting of the elevating screw to prevent damage should the arm be lowered onto any obstruction within its limits of travel.

Hydraulic column clamping on the standard machine, is controlled from the head as shown in Item B, Fig. 13. Its push-button control at the head marked "clamp" and "release" operating a solenoid controlling the hydraulic mechanism that is built-in at the motor end of the arm. The hydraulic clamp, through two

bolts on the cuff of the column sleeve automatically applies up to 55,000 lbs. pressure on the column and sleeve clamping surfaces, joining these two members as effectively as if they were one solid part.

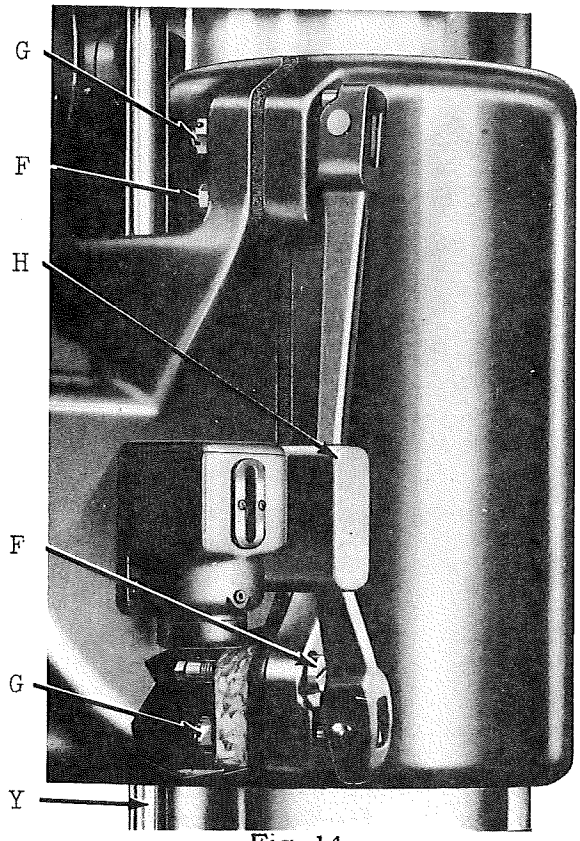


Fig. 14

Adjusting Arm Clamp

Stop the main driving motor of the machine and remove link "J" on clutch shifting mechanism, in rear of arm, (see figure #15, page 16) Also remove plate "H" on front of arm clamping mechanism as indicated (see figure #14 above).

CAUTION: Do not move or adjust the upper and lower limit screws indicated by letter "F" as these are merely for the purpose of controlling the amount of expansion of the arm, when the arm is unclamped. These are properly set at the factory.

Now start the main driving motor of the machine, set the arm control lever mounted on the head of the machine in either up or down position. This will unclamp the arm and as link "J" has been disconnected from the elevating clutches, naturally the arm will not raise or lower.

When clamping or unclamping the arm, the push rod and equalizing bar located in bracket under plate "H" should travel a total distance of between 1/2" and 9/16". Measure this travel by causing rod to move out when elevating control lever is moved to the neutral position. This measurement can easily be taken from the machine surface on end of bracket where plate "H" is fitted.

If the clamping rod is not traveling between 1/2" and 9/16", then either one or both the arm clamping levers are adjusted too tight and then nuts "G" as indicated, must be loosened to permit full travel of the clamping rod.

Now to adjust the clamp, unclamp the arm and adjust the upper and lower adjusting nuts "G" (see figure #14), so that equalizing bar on the end of the push rod is held in a vertical position when the arm is clamped. Make this adjustment slowly, that is between the upper and lower levers, being sure that the equalizing bar remains in a vertical position to insure proper clamping at top and lower portion of the arm.

When adjusting nuts "G" slowly, you should clamp the arm after each adjustment and when you find that they have been tightened to a point where the push rod fails to travel its full amount between 1/2" and 9/16" which you have previously checked, then back off each nut "G" one half turn. Now check to be sure that the push rod is making its full travel and that the equalizing bar is in a vertical position when the arm is clamped.

The arm is now properly adjusted. Stop the driving motor and with the arm in a clamped position, replace plate "H" and the elevating clutch connecting link "J".

The machine should now be ready for operation.

Adjusting Column Clamp

The column clamp is located at the rear of the machine and at the bottom of the column sleeve (see Figure #15A). To properly set this clamp have the main driving motor of the machine running and then push the column electric control button, mounted on the head of the machine, to the unclamped position. This will then rotate the vertical clamping shaft "Y" approximately 90 degrees. On the lower end of this shaft is mounted an eccentric which rotates against roller "D". In the unclamped position of the column, the high point of the eccentric is rotated away from the roller "D". When the column is adjusted at the factory,

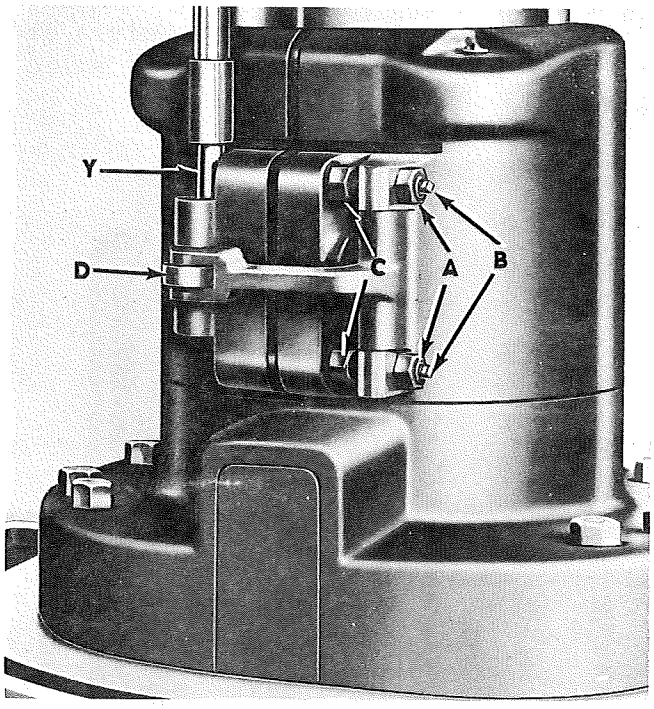
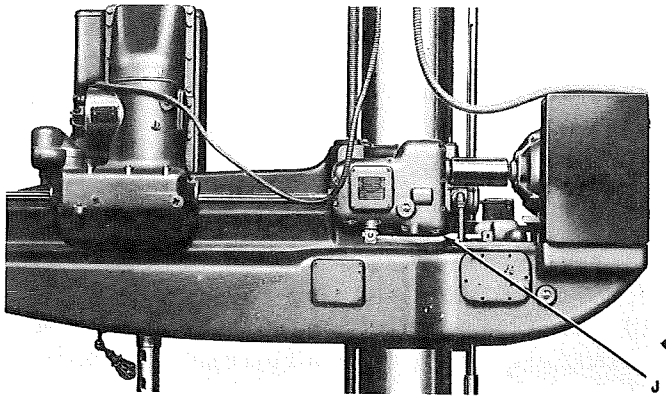


Fig. 15



←Fig. 15 A

nuts "C" are properly adjusted to control the amount the sleeve cuff will open when the column is in the unclamped position. These nuts are properly adjusted when the machine leaves the factory, and these should not be tampered with, as tightening them too much would cause the column sleeve to drag against the column, thus making it difficult to swing the arm.

To adjust the column clamp, be sure first that the column clamp is unclamped, and that the eccentric is away from roller "D". Now place a wrench on the end of clamp bolts "B" and adjust nuts "A" until you have approximately 3/16" (as indicated on column clamp adjusting plate) clearance between roller "D" and the eccentric. Care should be taken when adjusting nuts "A" to see that both the top and lower nuts have approximately the same tension when clamping. Now clamp the mechanism by pushing the column clamp button on the head of the machine, and then check to see that the high point of the eccentric is against roller "D" and that the shaft "Y" has rotated its full distance.

Care should be taken at this point to be sure that the eccentric or shaft "Y" has rotated its full distance as it must do so, otherwise, the arm clamp on the machine will not function properly.

After you are certain the eccentric shaft has traveled its full distance the column clamp thus adjusted should be satisfactory.

If for any reason, the column is not rigidly clamped, then additional adjustments should be made on nuts "A" as explained above, being sure that the high point of the eccentric will still rotate to its limit against roller "D".

Forward and Reverse Driving Clutches

The forward and reverse driving clutches, Fig. 16, are located in the lower, rear part of the head. These clutches are of the multiple disc type and run in oil. The discs are alternately of saw steel and phosphor bronze. While these clutches are so constructed that adjustments will seldom be required, it is extremely important that they be always kept in proper adjustment. They must not be allowed to run loosely adjusted. Loose adjustment causes slipping, and slipping causes wear

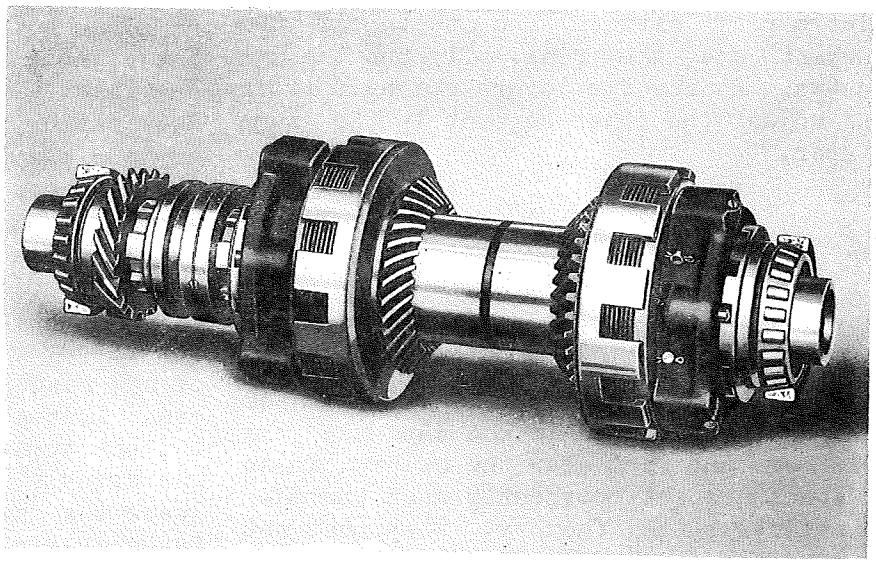


Fig. 16

These clutches are correctly adjusted when the machine leaves the factory. Before the machine is placed in service, the foreman should operate the clutch lever several times and note the amount of effort required for engagement. Occasionally, thereafter, he should check this clutch action. Whenever these clutches engage too easily, they should be tightened. These adjustments are easily made. Remove the pipe plugs in the clutch case. Turn the arm shaft slowly until the lock

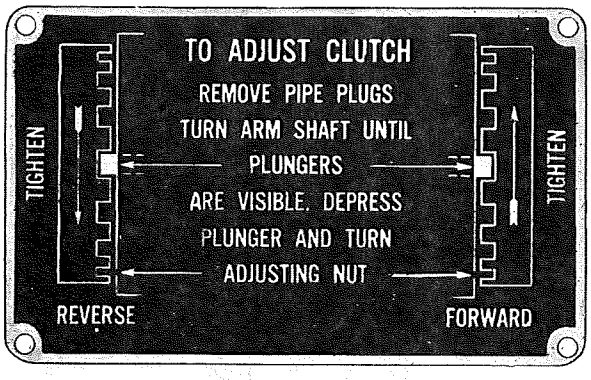


Fig. 17

plungers, Fig. 16, appear. Depress the plunger with a screw driver and turn the adjusting nut in the direction indicated by the arrow on the instruction plate, Fig. 17. One notch of the adjusting nut should be sufficient. This closes the plates .004".

Quick-Return Clutch

The quick-return clutch, Fig. 18, is of the positive type. The action of the quick-return levers expands two saw-tooth segments of hardened steel into a hardened steel ring having saw teeth in its inner circumference. This clutch may not require any adjustment for several years. But, should an adjustment be necessary, it is made in the following manner. Remove the narrow, horizontal cover plate located on the front of the head above the quick-return levers. Rotate these levers until the adjusting screw and the lock screws, Fig. 18, can be reached with a screw driver.

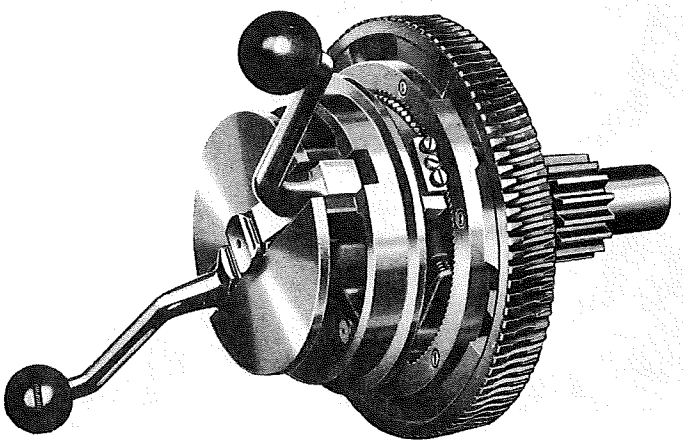


Fig. 18

Loosen the lock screws and tighten the adjusting screw so that there is very little play between the teeth of the segment and the ring. Tighten the lock screws. Rotate the levers one half a turn and adjust the other segment in the same manner.

Arm Elevating Clutches

Fig. 19 shows the arm-elevating clutches which are of the multiple-disc type. These clutches are located in the case in the rear of the arm near the column. These clutches are set correctly when the machine leaves the factory. They must not be operated with a loose adjustment. As is the case with any friction clutch, a loose adjustment will cause slipping and slipping will result in wear. These clutches will require only occasional adjustment, but--the original factory tightness must always be maintained. To properly adjust arm elevating clutches follow the instructions found on the arm gear case cover; that is, to adjust clutch, stop driving motor, then remove cover and turn arm shaft "A" until plungers are visable. Disengage plunger and turn adjusting nut. After clutch has been adjusted, place a 3/4" diameter rod 12" long in the clutch shifter "B" below this case and see that both sides can be fully engaged by hand before applying power.

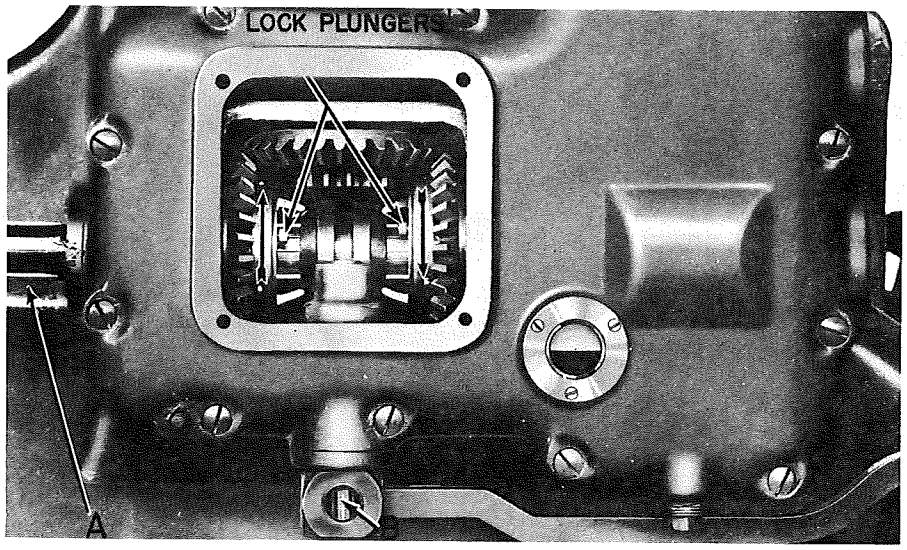


Fig. 19

Spindle Adjustment

The spindle revolves in ball and roller bearings. If these bearings are properly lubricated, it is highly improbable that any end play will develop in the spindle. Should there be end play in the spindle, it can be taken up in this manner. Put the two back gear levers in a neutral position to permit rotating the spindle by hand, then remove the narrow horizontal cover plate located on the front of the head above the quick-return levers. Loosen one of the lock screws, Fig. 20, one turn. Tighten the jam nut until the spindle is pulled up tight. Then release the jam nut until the spindle rotates freely. This will reduce the end play from .001 to .002.

After the adjustment has been made, set the lock screw in the jam nut as tightly as possible. With a center punch, burr the jam nut into the slot of the lock screw to keep it from turning. There are two lock screws in the jam nut, but only one of them should be loosened when making this adjustment.

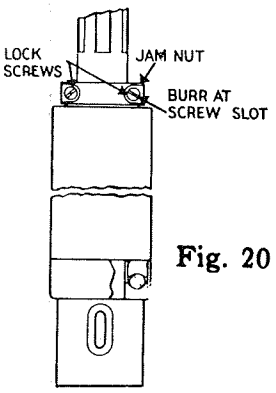
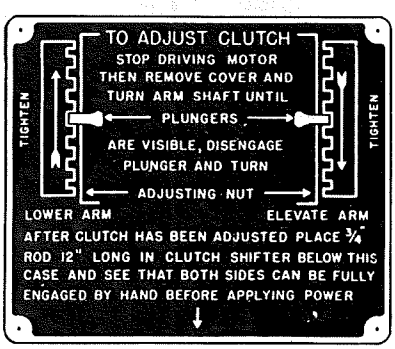


Fig. 20



Adjustment of the Spindle Counterbalance

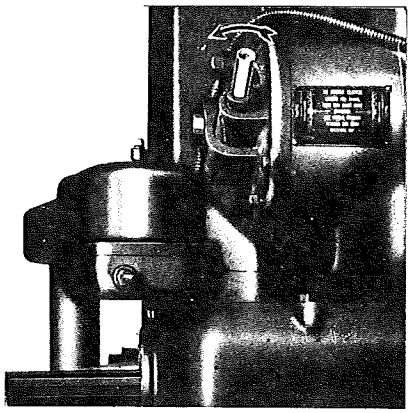


Fig. 21

The spindle is counterbalanced by means of a flat coil spring. The tension of this spring is adjustable. When the machine leaves the factory, this spring is set so that it exactly balances the spindle. If the machine is to be used for a considerable period on work that requires heavy taps, cutter heads, etc., the spring tension can be increased to offset the added weight of these tools.

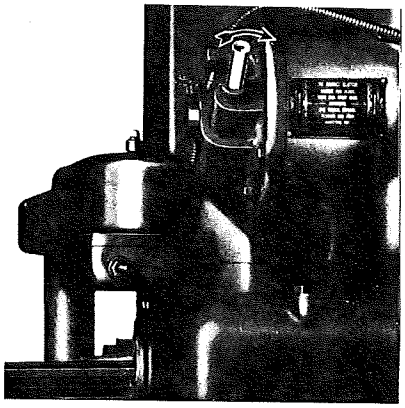


Fig. 22

To increase the spring tension on machines having 11", 13" and 15" diameter columns, turn the adjusting screw to the left as shown on Fig. 21. On machines having 17" and 19" diameter columns, turn the screw to the right as shown on Fig. 22.

In general, except where heavy tools are used, less effort will be required of the operator if the spring adjustment is such that the spindle is exactly balanced.

Adjustment of the Power Rapid Traverse Belt

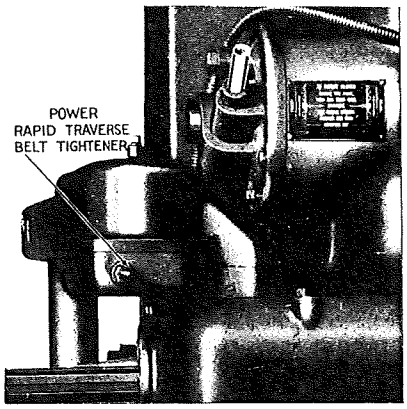


Fig. 23

The power rapid traverse unit is driven by a belt that runs across the top of the arm. The tension on this belt is supplied through a coil spring. Additional tension can be applied through the adjusting screw and lock nut, Fig. 23.

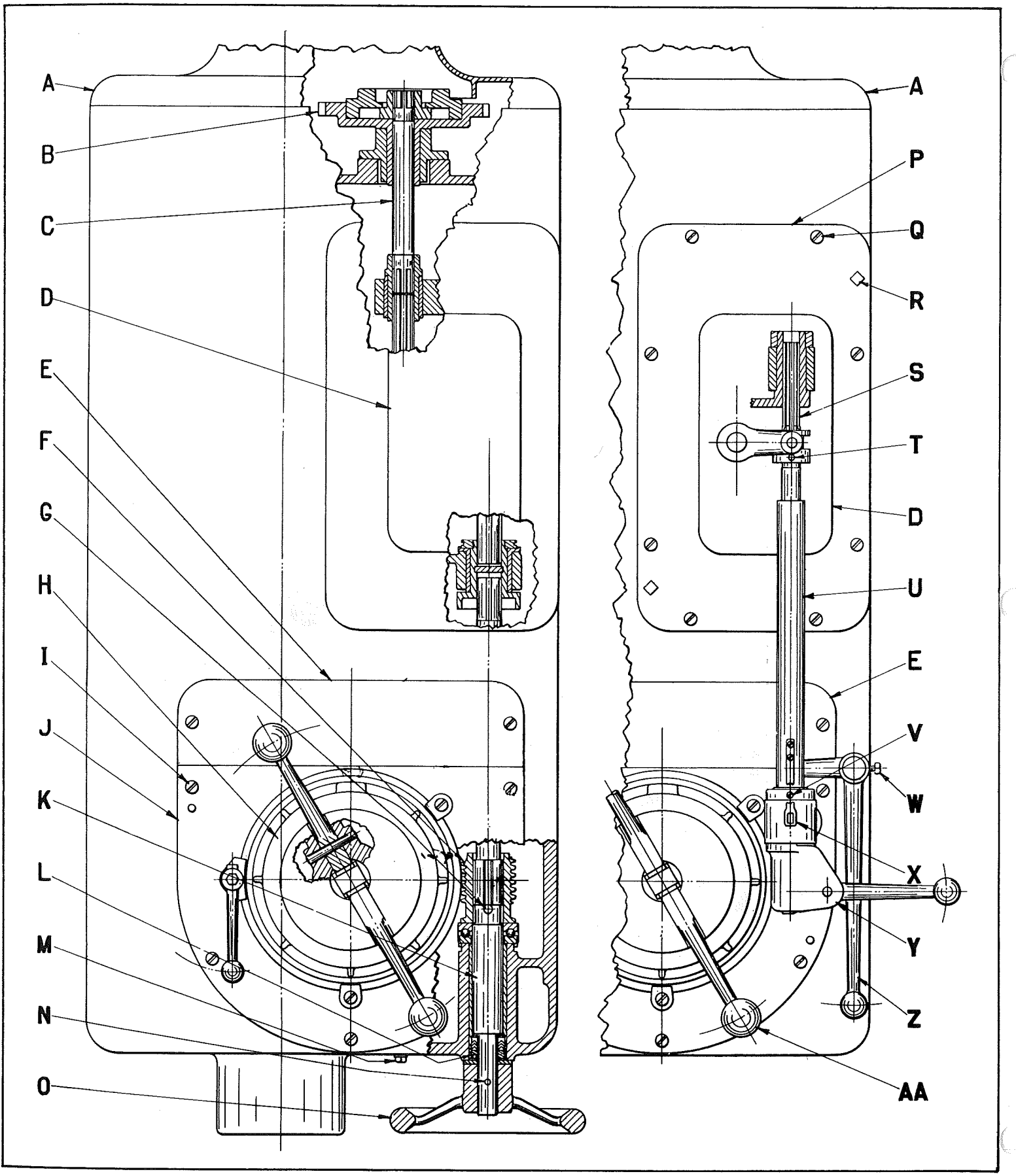


FIG. 25.

TAKING THE MACHINE APART

To remove quick-return clutch from head

Refer to Fig. 25

1. Remove plug "M" and drain oil.
2. Remove front feed cover "D".
3. Knock pin "T" in spool out.
4. Remove set screw "V" in collar.
5. Remove pointer "X".
6. Drop lever unit "Y" and shafts "S" & "U".
7. Remove square head taper pin "W" and pull feed back gear lever "Z" and shaft out.
8. Remove upper cover plate "E".
9. Remove 5 screws "I" in cover "J". Two taper pins in the cover will come out with it together with the entire quick return unit "H" by pulling on the Quick Return Lever "O" in the released position.

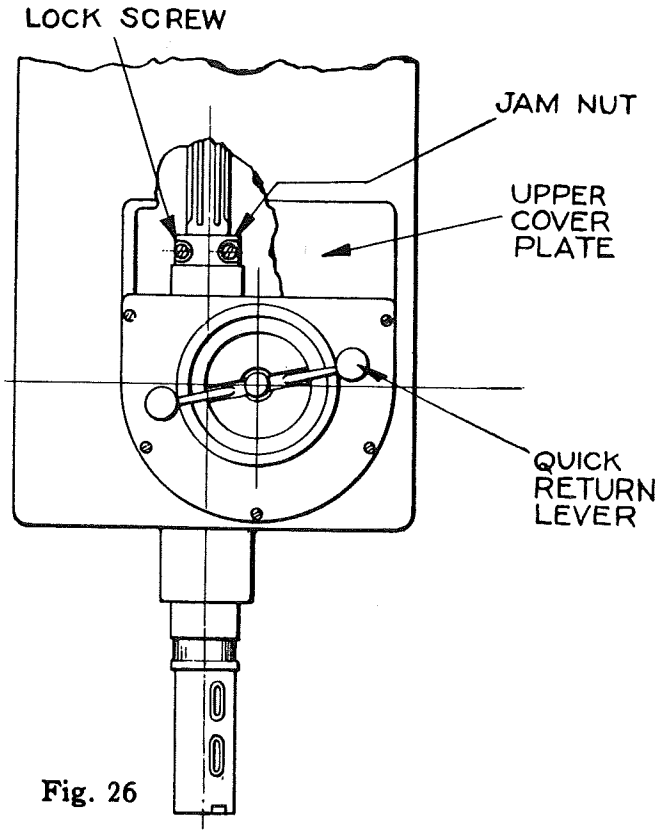


Fig. 26

To remove the feed unit

Refer to Fig. 25

Proceed as directed in items 1 to 9 above.

1. Remove large top cover "A" from head.
2. Remove oil pipe and lift Large Feed gear Unit "B" out together with shaft "C".
3. Knock out taper pin "N" in feed handwheel "O". Remove handwheel and washer, and unscrew packing nut "L".
4. Replace handwheel.
5. Knock taper pin "G" out of feed worm "F" and pull handwheel and shaft "K" out.
6. Remove 8 screws "Q" and 2 taper pins "R" and remove feed unit "P".

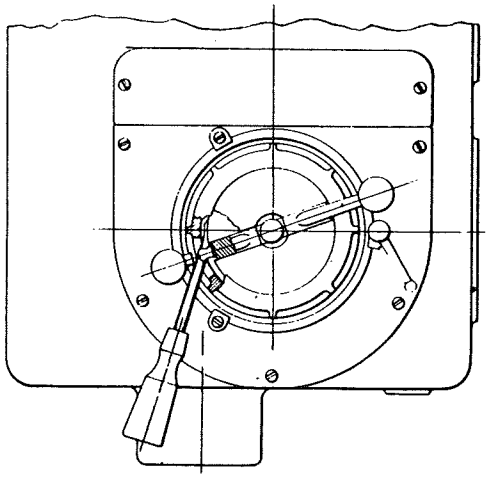


Fig. 27

To remove the spindle without removing the spindle sleeve

1. Clamp the column to prevent the arm

from swinging.

2. Raise or lower the arm until it is twelve inches above its lowest position.

3. Remove the upper plate, Fig. 26.

4. Raise or lower the spindle until the jam nut appears in the opening. Fig. 26.

5. Block up between the spindle and the base to prevent the spindle dropping when the jam nut is removed.

6. Lock the quick-return clutch by pulling the quick-return levers away from the head.

7. Wedge a screw driver behind one of the quick-return levers (as shown in Fig. 27) to prevent the quick-return clutch from becoming disengaged. Caution: Do not remove this screw driver until the spindle has been replaced and the jam nut has been tightened.

8. Loosen the lock screws and unscrew the jam nut.

9. Put a bar through the tang slot and hold the spindle securely. Remove the blocking and lower the spindle until it rests on the base.

10. Put the driving clutch lever, Fig. 7, in its neutral position. Raise the arm until the head clears the spindle.

11. When the spindle is replaced, adjust it for end play and burr the lock screws in accordance with the spindle adjustment instructions given in connection with Fig. 20.

To remove the spindle and sleeve

(These instructions refer to Fig. 28. unless otherwise noted.)

1. Clamp the column to prevent the arm from swinging.

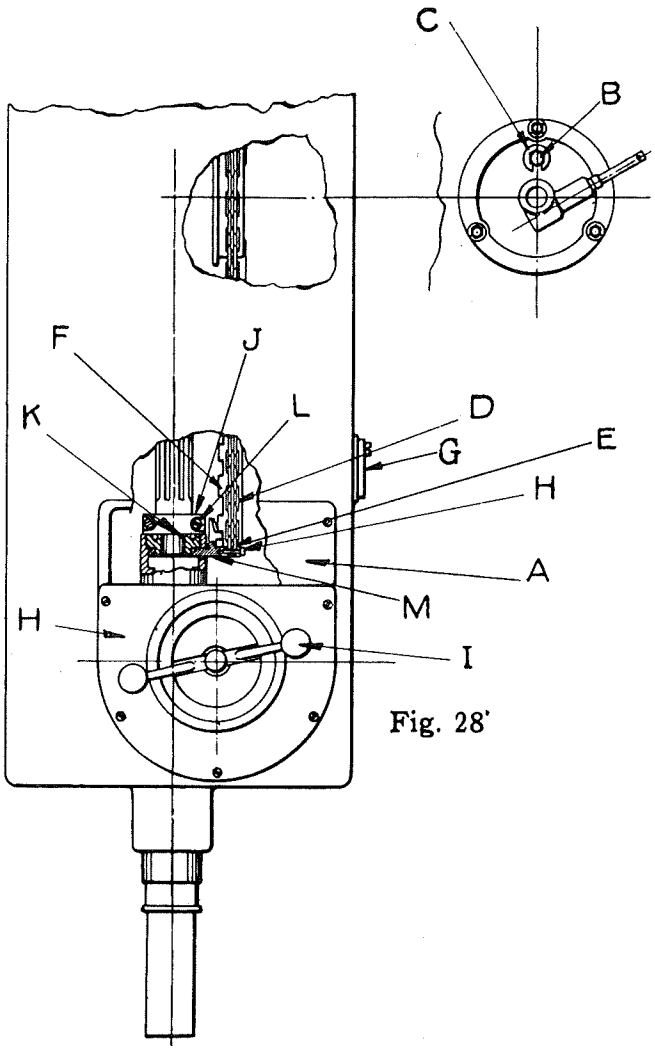


Fig. 28

2. Raise or lower the arm until it is twelve inches above its lowest position.

3. Remove the cover plate "A".

4. Move the spindle down to its lowest position.

5. Loosen cap screw "B" several turns and remove washer "C".

6. Run cap screw "B" into the head as far as it will go.

7. Raise the spindle until the counterweight chain "D" becomes slack and the safety catch "E" engages a notch in the guide bar "F".

8. Put blocking on the base that comes

within three or four inches of the spindle nose.

9. Open the swinging cover "G" on the side of the head and remove the counterbalance chain screw "H".

10. Grasp the quick-return lever "I" firmly, depress the safety catch "E" and lower the spindle until the jam nut "J" and the retaining plug "K" are in the position shown on Fig. 28.

11. Block up tightly under the spindle so that the blocking supports the weight of the spindle.

12. Remove the jam nut lock screws "L" and the jam nut "J". Unscrew the retaining plug "K" and remove the safety plate "M" from the spindle sleeve.

13. Remove the quick-return clutch in accordance with instructions in connection with Fig. 25.

14. Put a bar through the tang slot. Hold the spindle securely while the blocking is removed and lower the spindle, together with the spindle sleeve, until it rests on the base.

15. Put the driving clutch lever, Fig. 7, in neutral and raise the arm until the head clears the spindle.

Note: When replacing the spindle and sleeve, make certain that the spindle is securely blocked until the counterweight chain "D" has been connected.

To remove the friction driving clutches

Refer to Fig. 29

1. Remove pipe plug "A" and drain the oil from the clutch case.

2. Remove nine cap screws "B".

3. Remove cover "C".

4. Remove cover "D".

5. Disconnect the oil line at "E".

6. Unscrew and remove pipe "F".

7. Remove one screw "G".

8. On machines having 13" and 15" diameter columns, remove seven screws "H". On machines having 17" and 19" diameter columns, remove nine screws "H".

9. Remove two screws "I" located in the lower half of each of the end plates "J".

10. Remove the lower half of the clutch case "K", and remove screws "T".

11. Remove two taper pins "L" and two cap screws "M" from arm shaft end bracket "N", supporting end of shaft during this operation.

12. Have two men hold the arm shaft while a third man removes arm shaft "R" from gear case "S".

13. Remove the driving clutches.

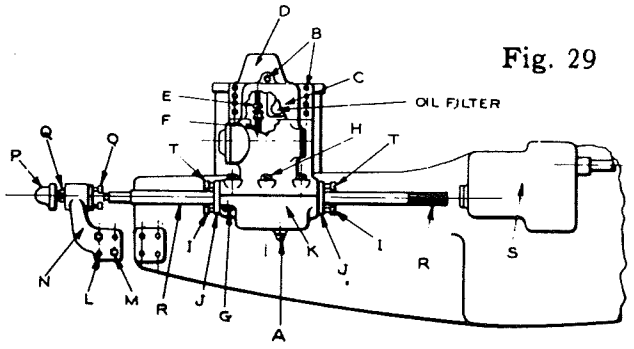


Fig. 29

To Adjust Column Roller Bearings so as to make the Column Sleeve Turn Easily on the Trunk, Follow the Procedure Outlined Below.

These parts are shown on page 28.

1. Release the column clamp and remove all lock plates at the top of the 4 studs and by putting a wrench on the top of the stud test to see if any

of these will turn completely around. If not, proceed as follows, but if so, advise us which one you are able to turn completely around. (A broken bearing is indicated by the ability to turn any of these studs 360°).

2. With the head at the end of the arm release all 4 eccentric studs.

3. Adjust 2 front studs until the arm swings freely, then run the head close up to the column.

4. Adjust 2 rear studs until the arm swings freely. Then run the head to the end of arm, and, if necessary, slightly readjust all the studs until the arm swing is satisfactory trying this with the head in various positions on the arm.

5. If satisfactory, replace the lock plates to definitely lock the studs and then babbitt in place.

Taper Pins

Square head, taper dowel pins are used throughout the machine for location purposes. To remove one of these pins use a wrench and turn it in one direction only. The pin will gradually loosen and can easily be extracted. If the pin is first turned to the right and then to the left, it has a tendency to score and cut and may have to be drilled out. It is also advisable to turn these pins to the left as a set screw may be encountered by mistake and the head twisted off. In replacing these pins observe the following: Clean the pin hole. Clean the pin and remove any burrs. Put a thin coating of oil on the pin and set in place with a hammer but not too tightly.

Taper pins, such as are used to pin collars on shafts etc., should always be removed in this manner. Use a piece of soft brass on the small end of the pin and hit it a sharp blow with a hammer. Ordinarily, one blow will loosen it and it can be readily removed. Never attempt to remove one of these pins with a steel punch. A steel punch will upset the end of the pin and destroy the pin hole. Next to lack of oil and failure to keep machine tools clean, more damage has resulted from the use of steel punches on taper pins than from any other source. These pins should be replaced in the same manner as the square head taper pins previously referred to. The use of soft hammers when repairing machine tools cannot be too strongly urged. There are very few driving fits on good machine tools. If the various members do not come apart readily, examine carefully for burrs and hidden set screws, etc., before driving or forcing them apart.

Serial Number and Repair Parts

Should it be necessary to order repair parts, always give the serial number. This number is stamped on the machine in two places: on the speed plate and on the face of the arm near its outer end.

Because it is impossible to obtain correct dimensions from original parts that have been worn, it is seldom advisable to make your own repair parts. This is particularly true with regard to cams and other parts where the correctness of their shape is extremely important. Springs, too, are difficult to duplicate because of their material and temper.

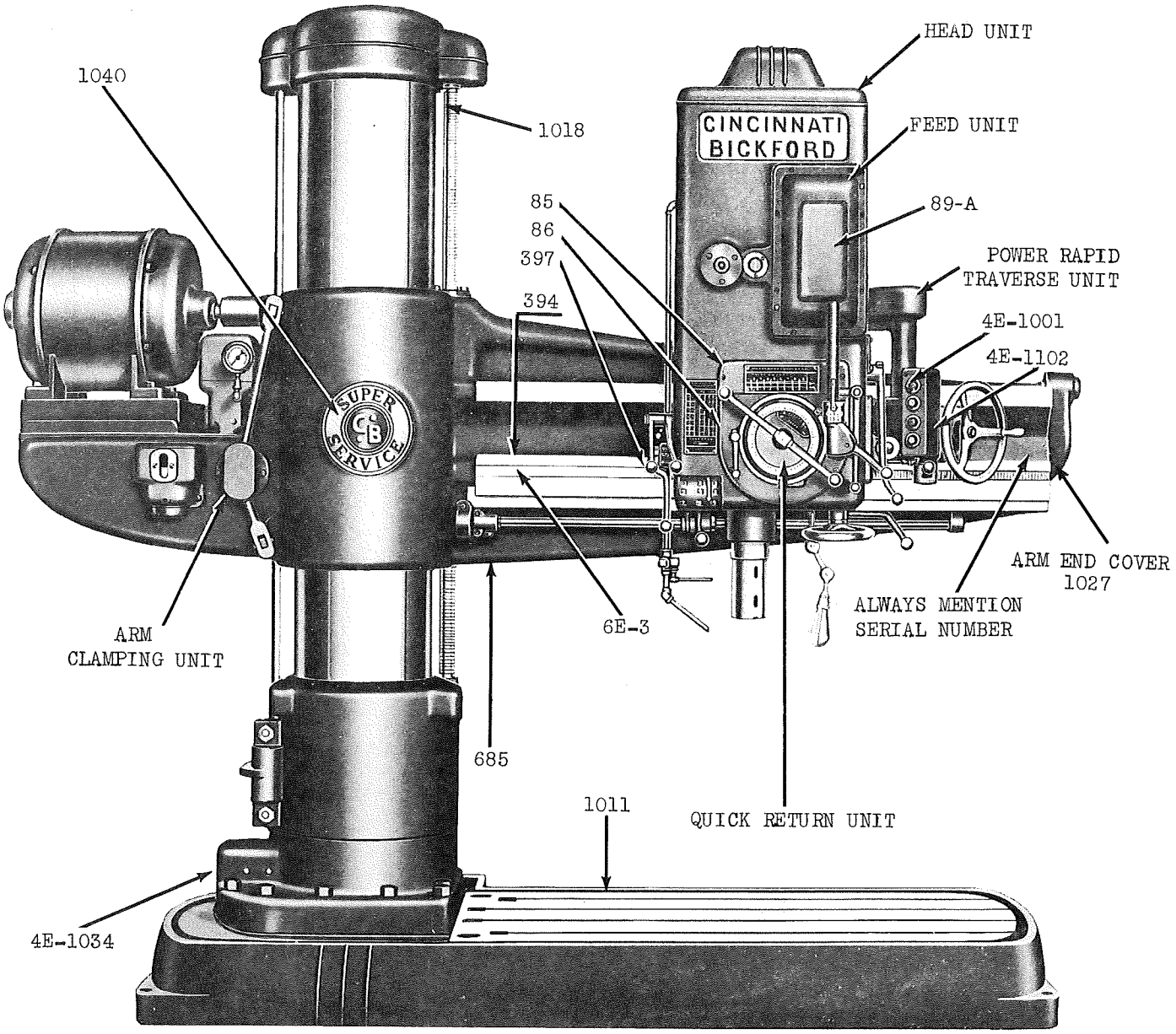
As a rule, no changes should be made in the design of any part of the machine or in any of the materials used. What may appear to be an improvement on certain parts, may lead to serious trouble on other parts. The Cincinnati Bickford Tool Company has an accurate record of all of the parts on your SUPER-SERVICE Radial and can supply them on short notice.

On the following pages photographs of the various parts are reproduced to assist you in ordering repair parts. If you cannot find the part desired tell us where it is and what it does. But always give the serial number of your machine and when possible the part number and part name as listed in the following pages. Also specify the quantity required.

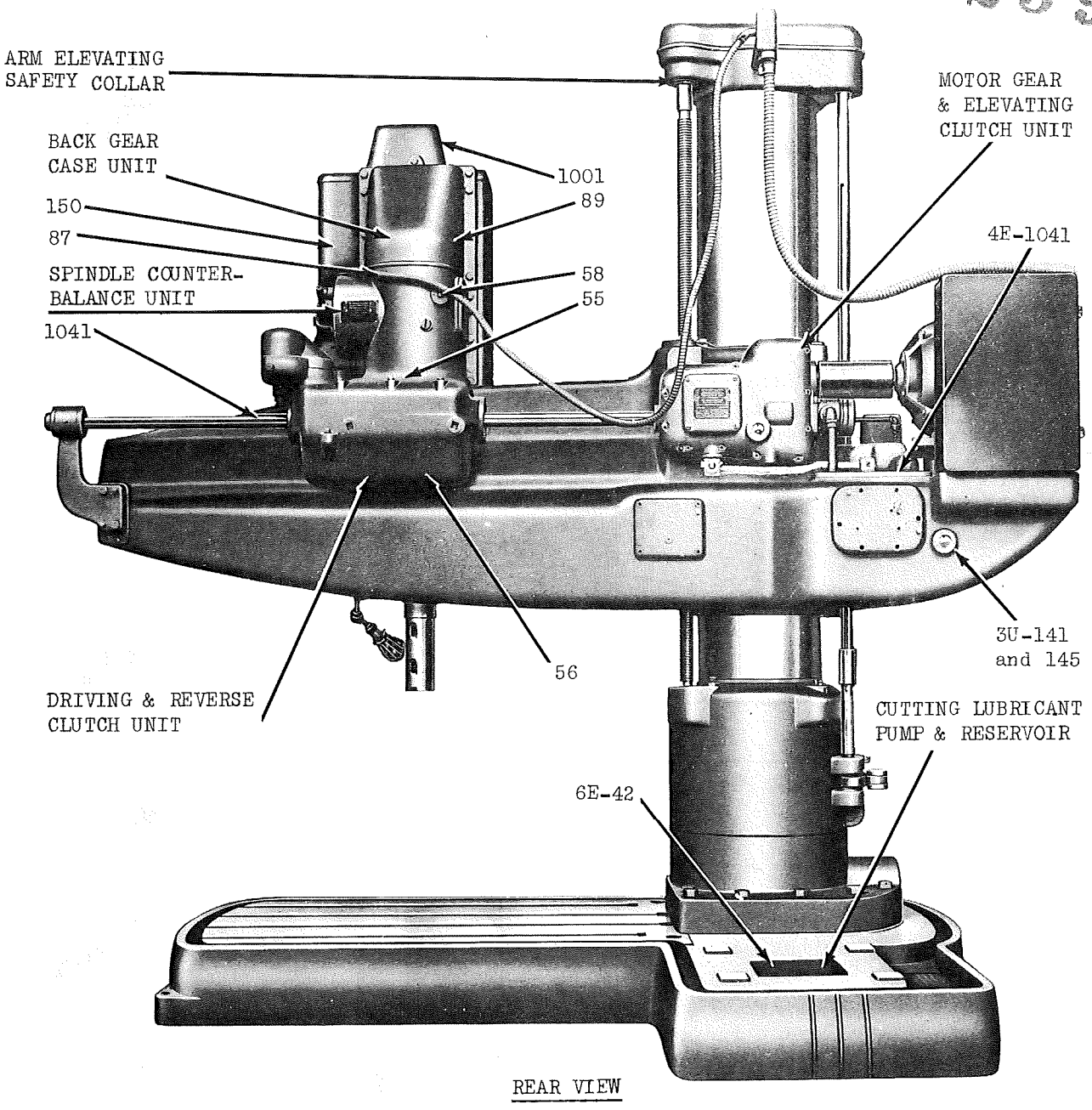
PARTS LIST

NOTE: Be sure to give the serial number of your machine when ordering parts.

For location of serial number see page 26.

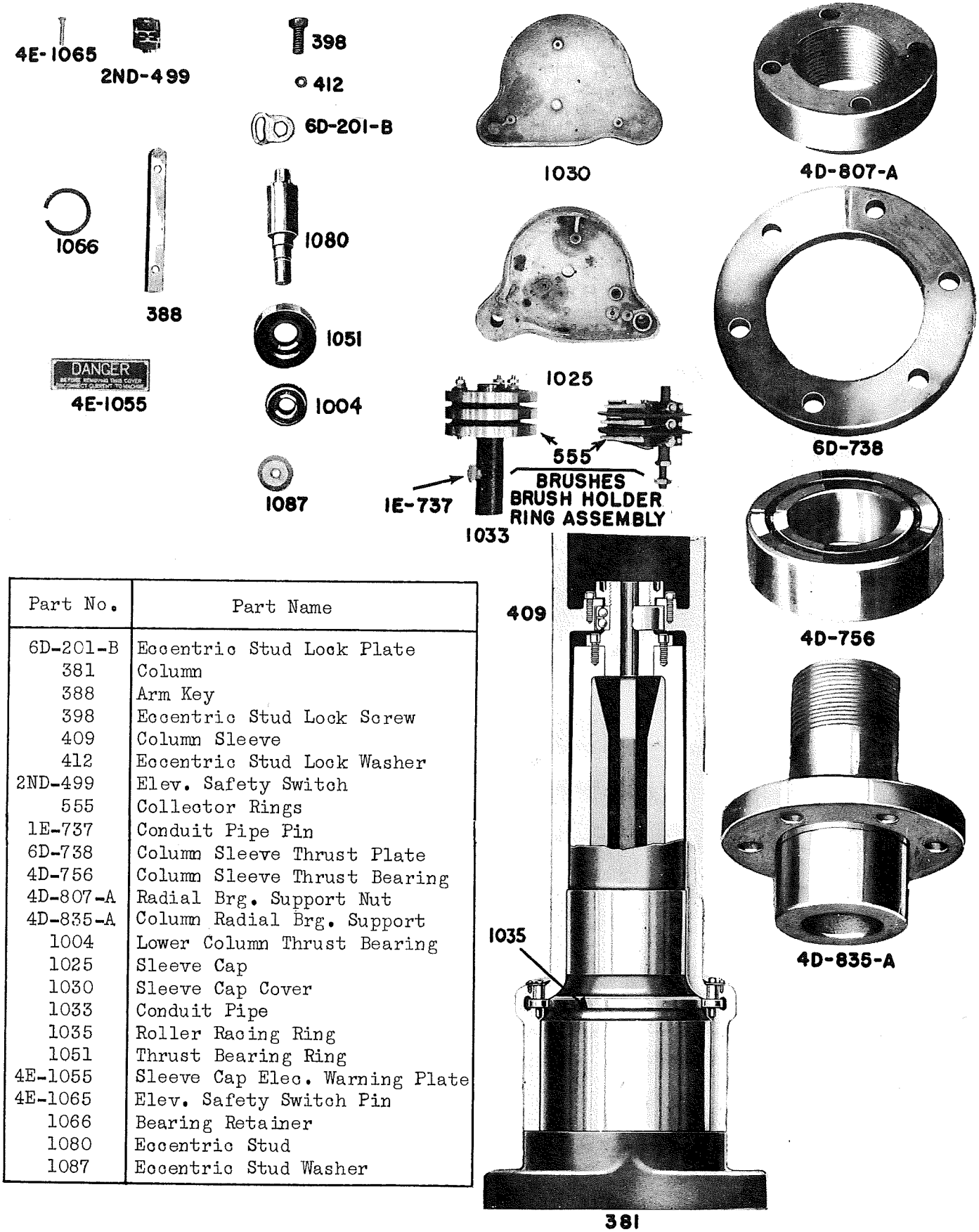


Part No.	Part Name	Part No.	Part Name
6E-3	Rack Spacer Bar	4E-1001	Clamp and Control Switch
85	Small Lower Head Cover	1011	Base
86	Large Lower Head Cover	1018	Elevating Screw
89-A	Feed Bracket Cover	1027	Arm End Cover
394	Hardened Way Arm Liner	4E-1034	Column Lower Cover
397	Armrack	1040	Trade Mark Plate
685	Arm	4E-1102	Clamp Switch Plate



REAR VIEW

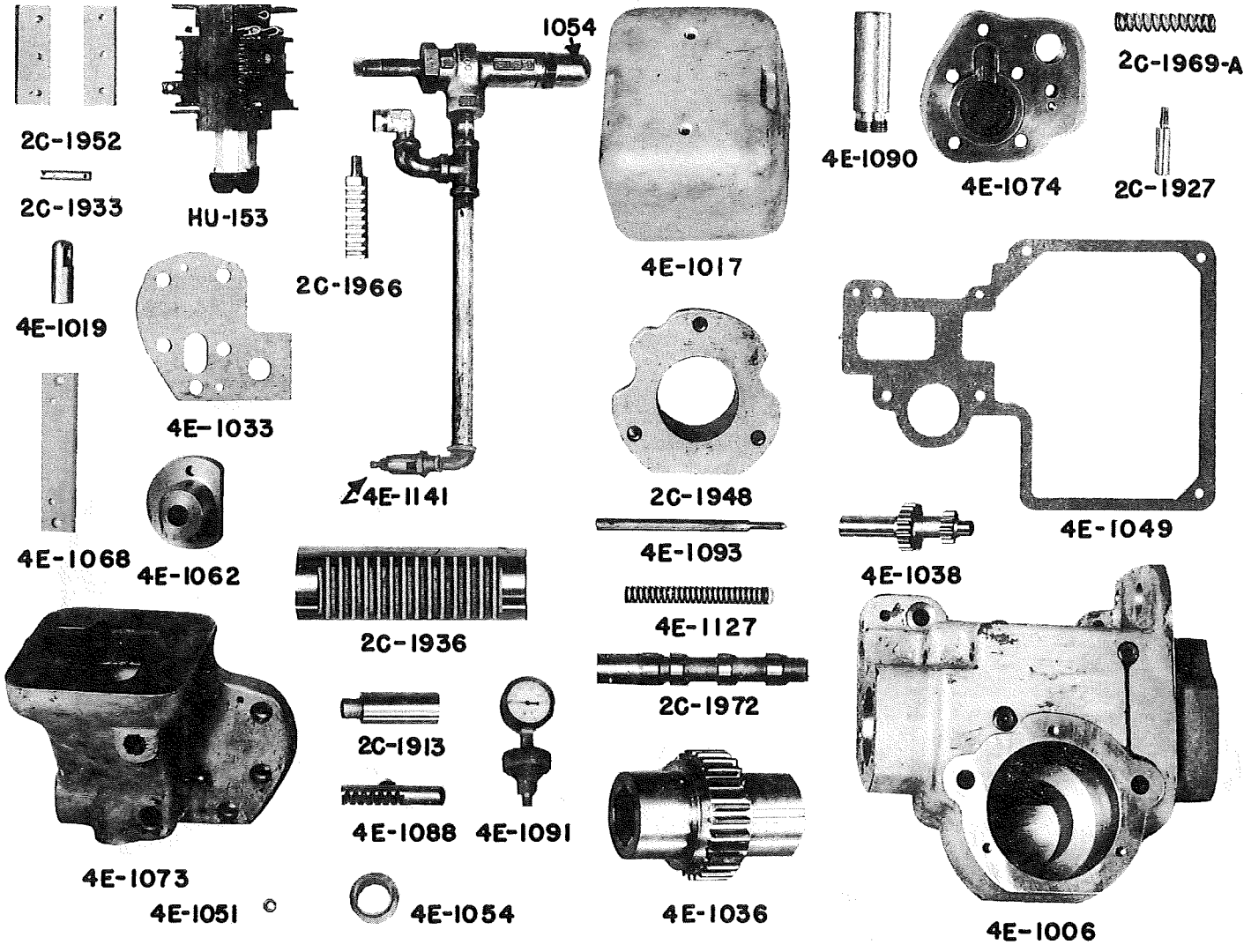
Part No.	Part Name	Part No.	Part Name
6E-42	Base Oil Strainer	3U-141	Oil Gauge Glass Washer
55	Back Gear Case	145	Oil Gauge Glass
56	Reverse Gear Case	150	Head
58	Conduit Clamp	1001	Head Upper Cover
87	Spring Case Conduit Clamp	4E-1041	Arm Hydraulic Clamp Cover
89	Back Gear Case Cover	1041	Arm Shaft



Part No.	Part Name
6D-201-B	Eccentric Stud Lock Plate
381	Column
388	Arm Key
398	Eccentric Stud Lock Screw
409	Column Sleeve
412	Eccentric Stud Lock Washer
2ND-499	Elev. Safety Switch
555	Collector Rings
1E-737	Conduit Pipe Pin
6D-738	Column Sleeve Thrust Plate
4D-756	Column Sleeve Thrust Bearing
4D-807-A	Radial Brg. Support Nut
4D-835-A	Column Radial Brg. Support
1004	Lower Column Thrust Bearing
1025	Sleeve Cap
1030	Sleeve Cap Cover
1033	Conduit Pipe
1035	Roller Racing Ring
1051	Thrust Bearing Ring
4E-1055	Sleeve Cap Elec. Warning Plate
4E-1065	Elev. Safety Switch Pin
1066	Bearing Retainer
1080	Eccentric Stud
1087	Eccentric Stud Washer

WHEN ORDERING BEARINGS GIVE MANUFACTURERS' NAME AND NUMBER

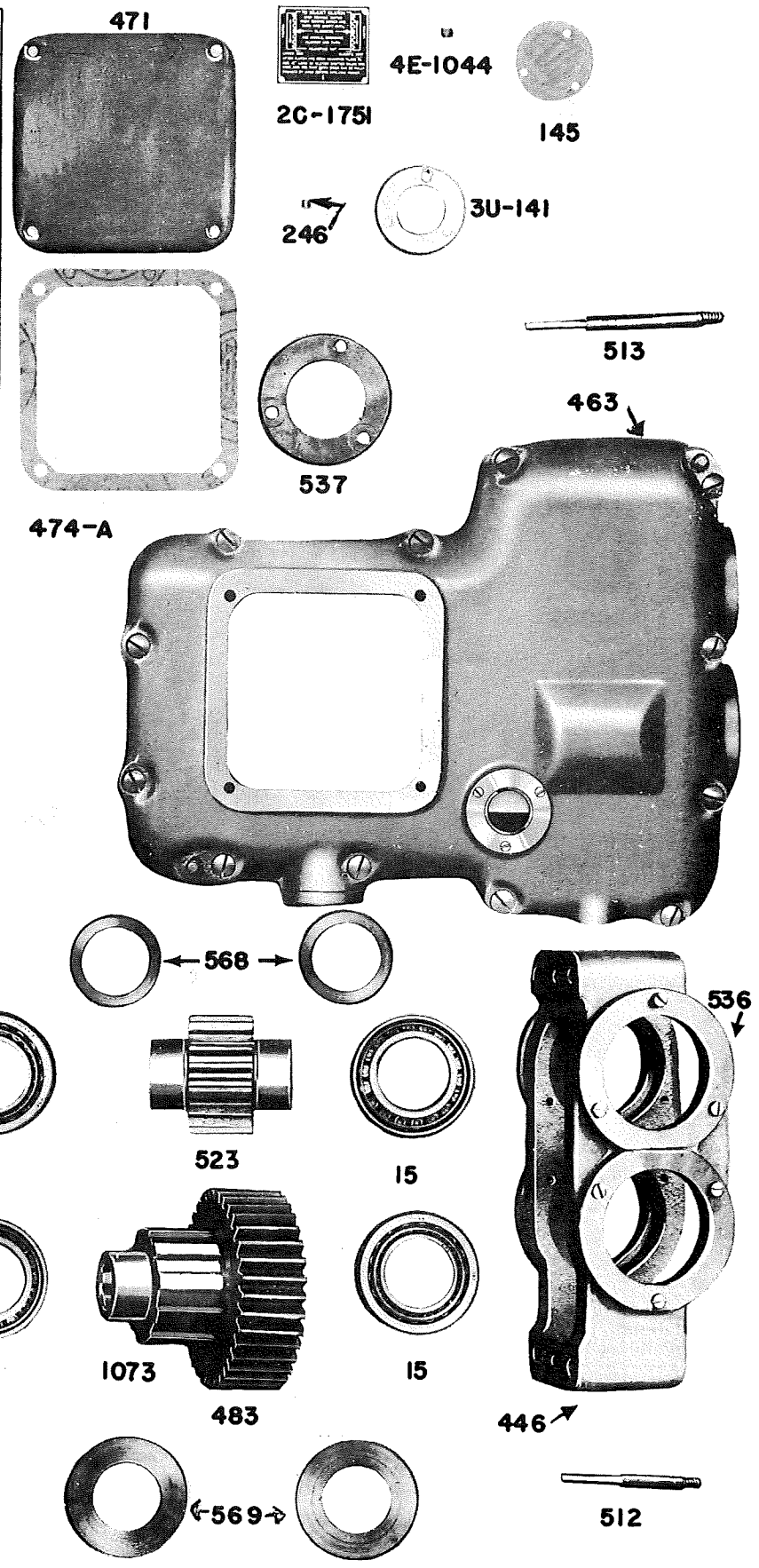
COLUMN CLAMP VALVE BODY



Part No.	Part Name	Part No.	Part Name
HU-153	Column Clamp Solenoid	4E-1088	Valve Stem Shifter Rack
4E-1006	Column Clamp Valve Body	4E-1090	Valve Stem Spring Retainer
4E-1017	Solenoid Cover	4E-1091	Pressure Gauge
4E-1019	Solenoid Connection	4E-1093	Column Clamp Spring Rod
4E-1033	Column Clamp Valve Gasket	4E-1127	Valve Stem Spring
4E-1036	Column Clamp Gear	4E-1141	Arm Clamp Relief Valve
4E-1038	Column Clamp Shifter Gear	2C-1913	Valve Compensator
4E-1049	Arm Reservoir Gasket	2C-1927	Compensator Spring Guide
4E-1051	Column Clamp Valve Body Oilseal	2C-1933	Clamp Solenoid Link Pin
1054	Relief Valve	2C-1936	Valve Piston (Column Clamp)
4E-1054	Column Clamp Shaft Oil Retainer	2C-1948	Column Clamp Gear Plate
4E-1062	Column Clamp Shifter Gear Plate	2C-1952	Column Clamp Solenoid Upper Plate
4E-1068	Column Clamp Solenoid Lower Plate	2C-1966	Column Clamp Shifter
4E-1073	Column Clamp End Plate (Front)	2C-1969-A	Valve Compensator Spring
4E-1074	Column Clamp End Plate (Rear)	2C-1972	Column Valve Stem

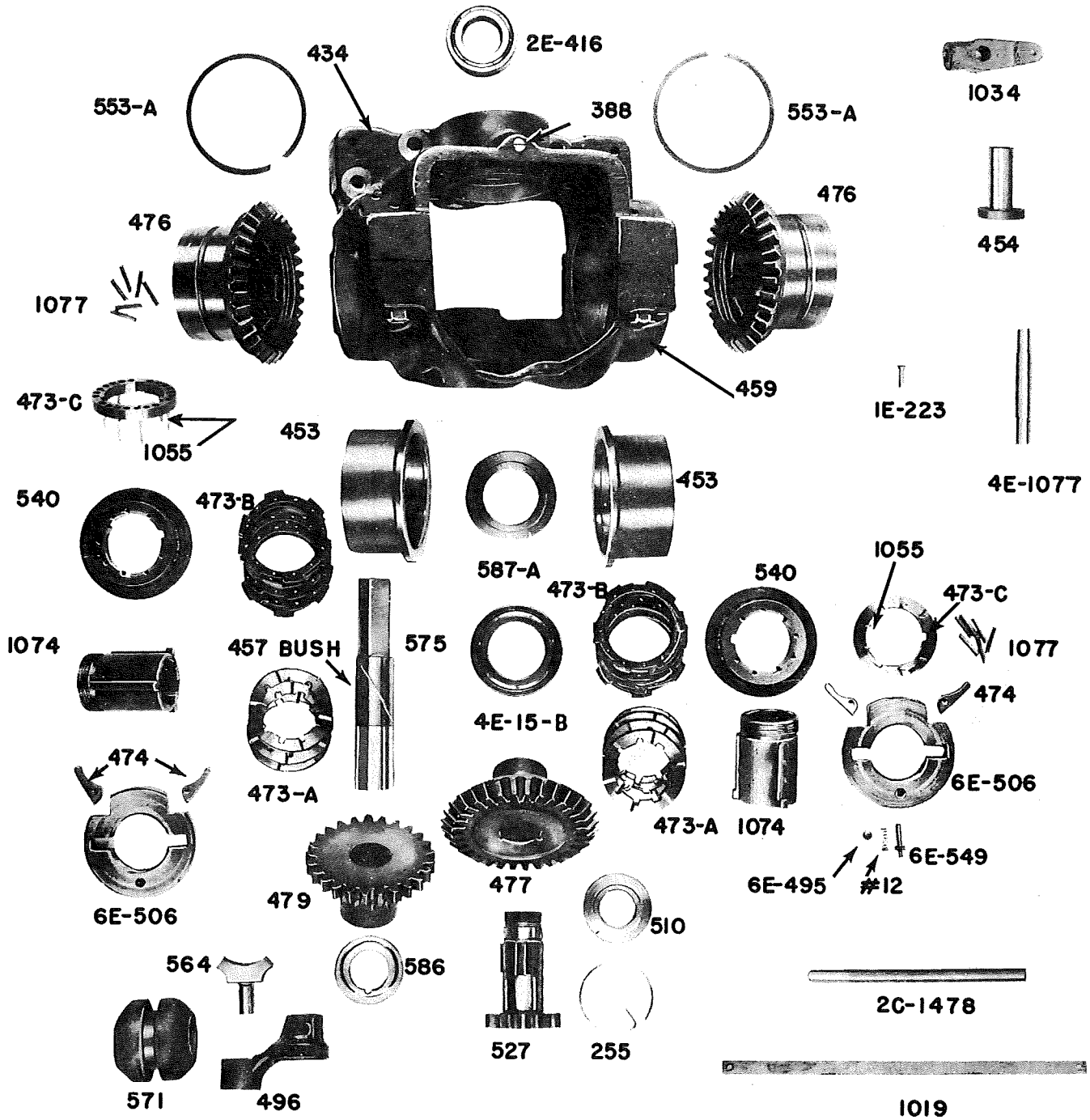
MOTOR GEAR BRACKET PARTS

Part No.	Part Name
3U-8	Roller Bearing
15	Roller Bearing
246	Oiling Plug
3U-141	Oil Gauge Glass Washer
145	Oil Gauge Glass
4E-433	Arm End Bearing
446	Motor Gear Bracket
463	Arm Gear Case
471	Arm Gear Case Cover
474-A	Gear Case Cover Gasket
483	Motor Gear (Give No. Of Teeth)
512	Motor Gear Bracket Pin
513	Gear Case Dowel Pin
523	Motor Pinion (Give No. Of Teeth)
534	Arm End (L.H.) Brg. Plate
535	Arm End (R.H.) Brg. Plate
536	Motor Gear Bracket Plate
537	Pinion Shaft End Plate
538	Arm Case End Plate
568	Motor Pinion Spacer
569	Motor Gear Spacer
583	Arm Shaft Washer
1020-A	Pump Supply Fitting
1026-A	Pump Coupling
4E-1044	Taper Pin Nut
1073	Motor Gear Sleeve
4E-1087	L.H. Sunstrand Pump
2C-1751	Elev. Clutch Adj. Plate



WHEN ORDERING BEARINGS GIVE MANUFACTURERS' NAME AND NUMBER
WHEN ORDERING GEARS GIVE NUMBER OF TEETH

ARM ELEVATING AND LOWERING PARTS

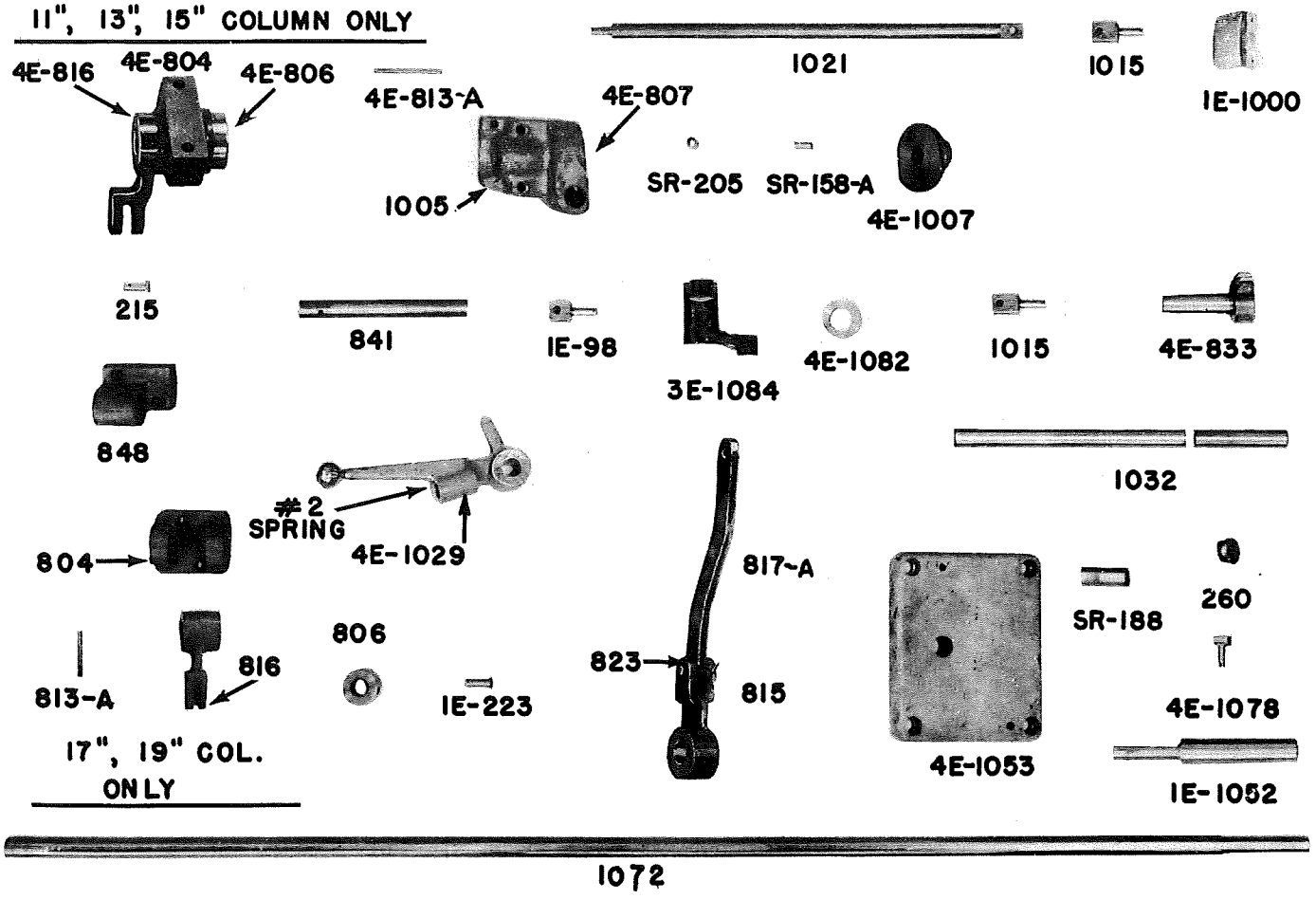


Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
#12	Plunger Spring	473-C	Elev. Clutch Friction Disc (Thk.)	564	Elev. Clutch Spool Shifter
4E-15-B	Elev. Miter Gear Bearing	474	Elev. Clutch Finger	571	Elev. Clutch Spool
1E-223	Change Lever Link Pin	476	Elev. Clutch Miter Gear	575	Elev. Inter Gear Stud
255	Elev. Pinion Nut Retainer	477	Elev. Clutch Driving Miter Gear	586	Elev. Inter Gear Washer
C-388	Oiling Plug	479	Intermediate Elevating Gear	587-A	Elev. Pinion Spacing Washer
2E-416	Elevating Pinion Bearing	6E-495	Plunger Knob	1019	Elev. Shifter Link
434	Elevating Gear Bearing	496	Elev. Clutch Shifter Lever	1034	Elev. Link Clutch Lever
453	Elev. Clutch Bevel Gear Bush	6E-506	Elev. Clutch Sleeve Nut	1055	Clutch Release Spring Pin
454	Clutch Shifter Brg. Bush	510	Elev. Pinion Nut	1074	Elev. Clutch Disc Sleeve
457	Elev. Inter. Gear Bush	527	Elev. Pinion	1077	Elev. Clutch Release Spring
459	Elev. Gear Bearing Cap	540	Elev. Clutch Adjusting Plate	4E-1077	Elev. Clutch Lever Shaft
473-A	Elev. Clutch Friction Disc (Thn.)	6E-549	Clutch Sleeve Nut Plunger	2C-1478	Elev. Clutch Adj. Rod
473-B	Elev. Clutch Driving Disc	553-A	Elev. Clutch Plate Retainer		

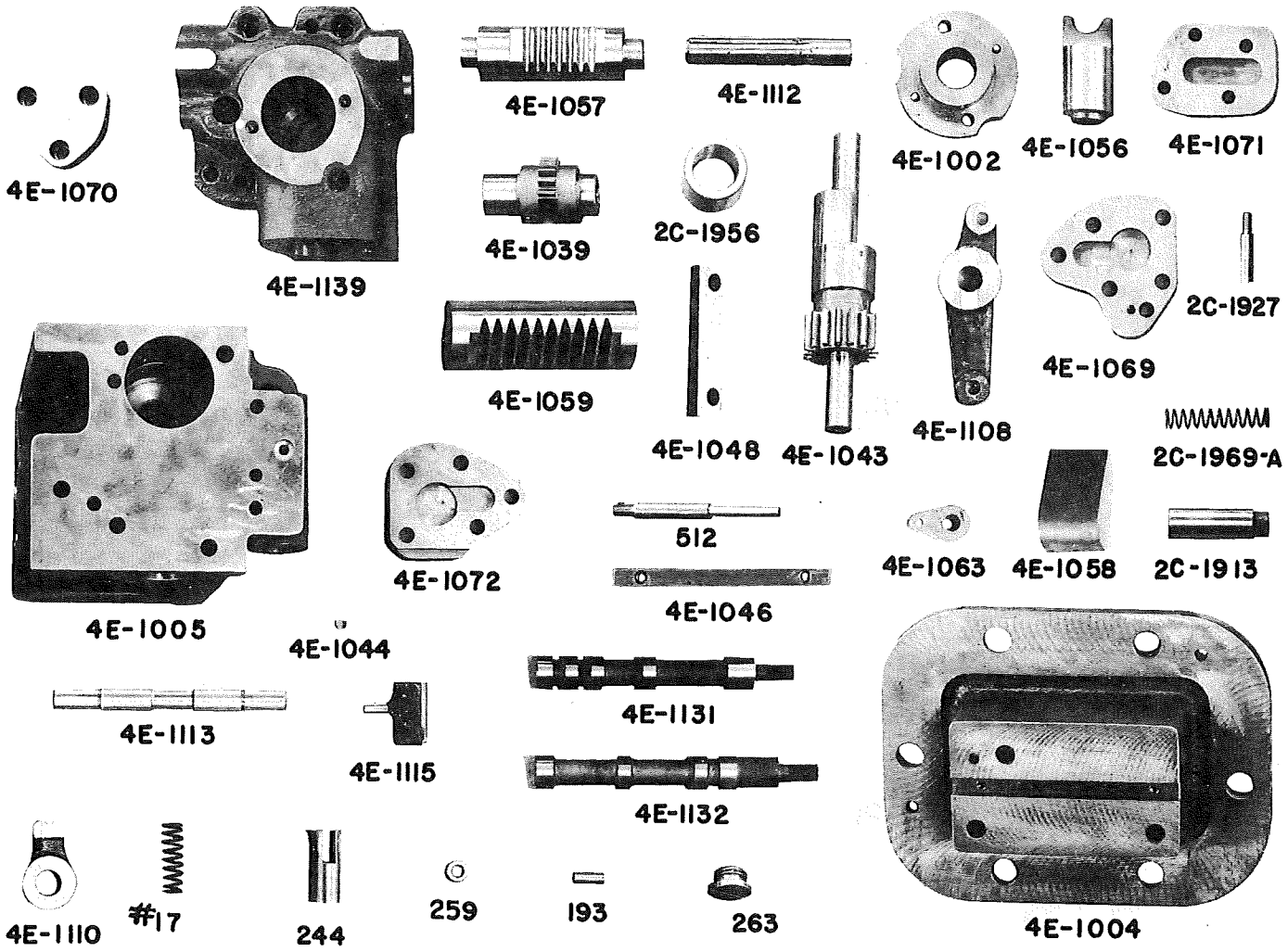
WHEN ORDERING BEARINGS GIVE MANUFACTURERS' NAME AND NUMBER
WHEN ORDERING GEARS GIVE NUMBER OF TEETH

ARM CLAMP PARTS

Part No.	Part Name	Part No.	Part Name
#2	Spring	817-A	Elevating Connecting Link
1E-98	Change Lever Link Fork	823	Forked Elevating Lever Upper Pin
SR-158-A	Elev. Lever Plunger Pin	4E-833	Elev. Shifter Shaft Segment
SR-188	Elevating Lever Plunger	841	Elevating Lever Shaft
SR-205	Elev. Lever Plunger Roller	848	Shifter Shaft Support
215	Shifter Lever Pin	1E-1000	Elevating Indicator Plate
1E-223	Change Lever Link Pin (2 Used)	1005	Shifter Shaft Bearing
260	Plunger Screw	4E-1007	Elevating Lever Bearing
804	Elevating Link Lever Bracket	1015	Elev. Lever Link Fork
806	Elevating Link Lever Collar	1021	Elev. Valve Link
4E-807	Elev. Shifter Segment Collar	4E-1029	Elevating Lever
813-A	Forked Elev. Lever (Lower) Key	1032	Elev. Segment Rack
815	Forked Elevating Upper Lever	1E-1052	Elev. Valve Shifter Stud
816	Forked Elevating Lower Lever	4E-1053	Elev. Valve Shifter Plate
11",13" & 15" Dia.Col. Mchne. 4E-804	Elev. Link Lever Bracket	1072	Shifter Shaft
11",13" & 15" Dia.Col. Mchne. 4E-806	Forked Elev. Lever Collar	4E-1078	Elev. Shifter Shoe
11",13" & 15" Dia.Col. Mchne. 4E-813-A	Forked Elev. Lever (Lower) Key	4E-1082	Elev. Valve Shifter Stud Washer
11",13" & 15" Dia.Col. Mchne. 4E-816	Lower Forked Elev. Lever	3E-1084	Elev. Valve Shifter

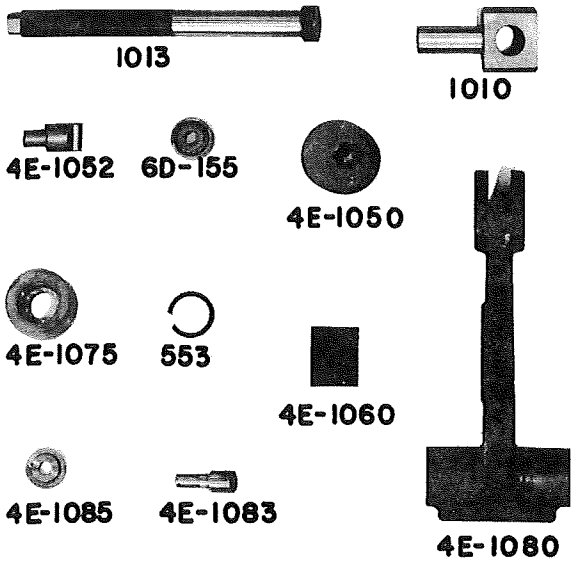


ARM CLAMP VALVE BODY

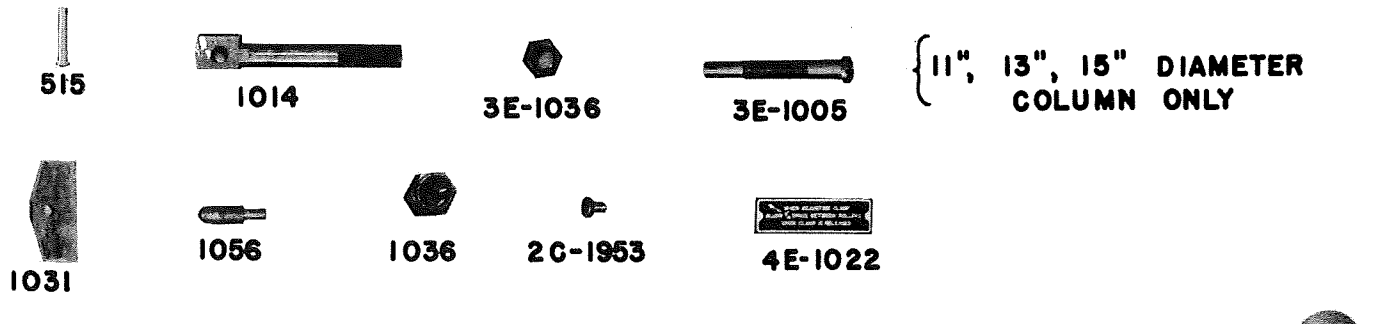


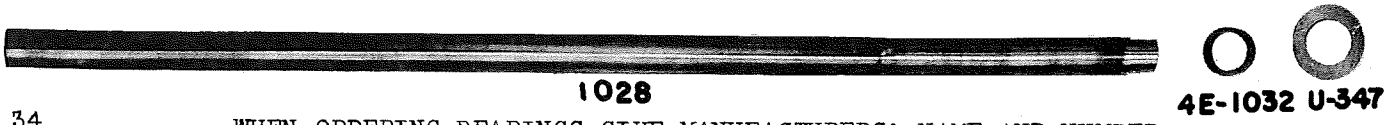
Part No.	Part Name	Part No.	Part Name
#17	Spring	4E-1059	Valve Piston (Arm Clamp)
193	Plunger Roller Pin	4E-1063	Clutch Valve Shifter Lever
244	Shifter Lever Plunger	4E-1069	Arm Valve End Plate
259	Plunger Roller	4E-1070	Clutch Shifter Cylinder Plate
263	Plunger Screw	4E-1071	Clutch Release Cylinder Plate
512	Arm Clamp Valve Pin	4E-1072	Arm Valve End Plate
4E-1002	Valve Clutch Shifter Bearing	4E-1108	Valve Stem Shifter
4E-1004	Arm Valve Bracket	4E-1110	Valve Shifter Segment
4E-1005	Arm Clamp Valve Body	4E-1112	Clutch Shifter Gear Shaft
4E-1039	Clutch Shifter Gear	4E-1113	Arm Valve Shifter Shaft
4E-1043	Arm Valve Clamp Gear	4E-1115	Valve Shoe
4E-1044	Arm Clamp Valve Pin Nut	4E-1131	Arm Valve Upper Stem
4E-1046	Arm Valve Key	4E-1132	Arm Valve Lower Stem
4E-1048	Valve Stem Link	4E-1139	Clutch Shifter Valve
4E-1056	Clutch Release Piston	2C-1913	Valve Compensator
4E-1057	Clutch Shifter Piston	2C-1927	Compensator Spring Guide
4E-1058	Baffle Plate	2C-1956	Valve Eccentric Roller
		2C-1969-A	Valve Compensator Spring

COLUMN CLAMPING LEVER AND ROLLER ASSEMBLY
AND ARE CLAMPING LEVER ASSEMBLY



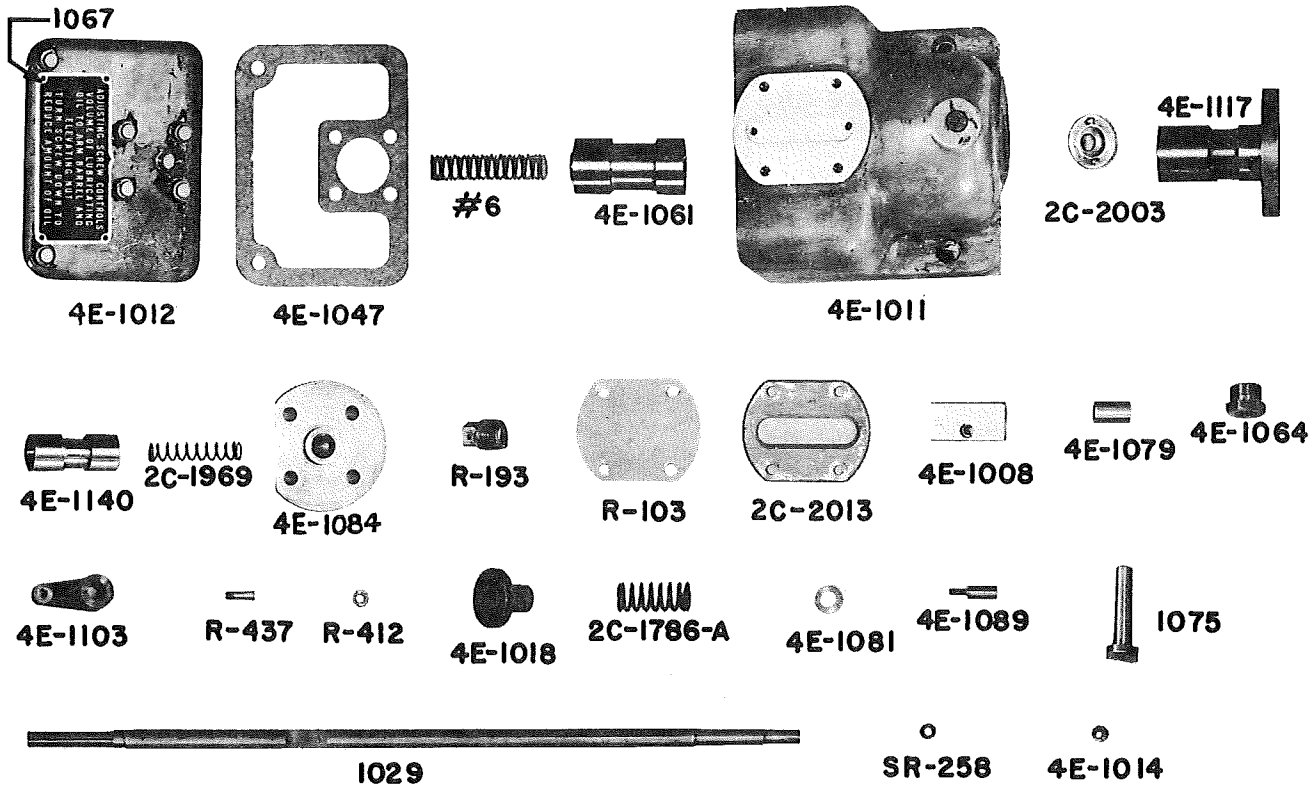
Part No.	Part Name
6D-155	Col. Clamp Roller Bearing
U-347	Clamp Shaft Collar
515	Clamp Bolt Pin
551	Arm Limit Bolt Plug
553	Col. Clamp Roller Brg. Retainer
3E-1005	Arm Adj. Bolt 11",13" & 15" Dia.Col.only
1010	Col. Clamp Bolt Pivot Block
1013	Col. Sleeve Clamp Bolt
1014	Arm Clamp Bolt
1016	Equalizer Rod Bracket
4E-1022	Col. Clamp Adj. Plate
1023	Short Arm Binder Lever
1024	Long Arm Binder Lever
1028	Sleeve Clamping Shaft
1031	Arm Clamp Equalizer
4E-1032	Clamp Shaft Bush
4E-1035	Clamp Shaft Coupling
1036	Col. Clamp Nut (Also 2 NC12 Used)
3E-1036	Arm Clamp Nut
1037	Arm Clamp Rod
4E-1050	Col. Clamp Eccentric
4E-1052	Clamp Lever Pivot Pin
1056	Binder Lever Pivot Pin
1059	Arm Binder Plug
4E-1060	Col. Clamp Lever Guide
4E-1066	Equalizer Pin
4E-1075	Col. Clamp Lever Roller
4E-1076	Lower Clamping Shaft
4E-1080	Col. Clamping Lever
4E-1083	Col. Clamp Roller Stud
4E-1085	Col. Clamp Roller Washer
1088	Elev. Screw Nut Washer
1089	Elev. Screw Slip Washer
2C-1672	Arm Rod Brk't Cover
2C-1953	Arm Clamp Rod Plug





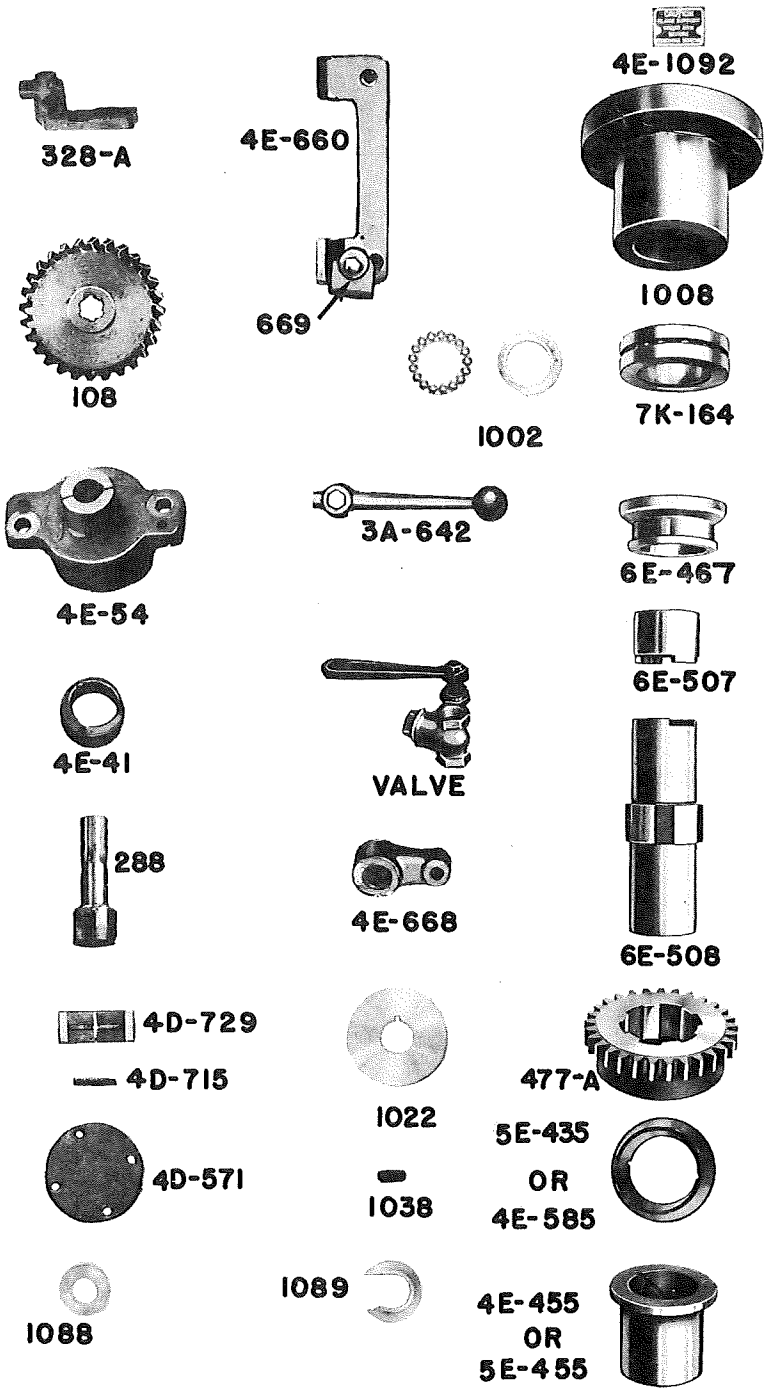
WHEN ORDERING BEARINGS GIVE MANUFACTURERS' NAME AND NUMBER

ARM BARREL LUBRICATOR



Part No.	Part Name	Part No.	Part Name
#6	Spring	4E-1064	Limit Trip Spring Nut
R-103	Gauge Glass	4E-1067	Arm Barrel Lub. Plate
R-193	Lubricator Pump Filler Plug	1075	Limit Trip Lever Shaft
SR-258	Lubricant Adjustment Washer	4E-1079	Limit Trip Rod Sleeve
R-412	Limit Trip Roller	4E-1081	Limit Trip Rod Washer
R-437	Limit Trip Roller Stud	4E-1084	Lubricator Pump End Plate
4E-1008	Lubricator Block	4E-1089	Limit Trip Rod Stud
4E-1011	Lubricating Pump Case	4E-1103	Limit Trip Lever
4E-1012	Lubricating Case Cover	4E-1117	Lubricating Valve Sleeve
4E-1014	Oil Pressure Plug Bush	4E-1140	Lubricator Valve
4E-1018	Arm Trip Lower Bush	2C-1786-A	Limit Trip Rod Spring
1029	Limit Trip Rod	2C-1969	Lubricator Valve Spring
4E-1047	Lub. Pump Case Gasket	2C-2003	Lubricating Spring Cup
4E-1061	Lubricator Pump Piston	2C-2013	Lubr. Gauge Glass Retainer

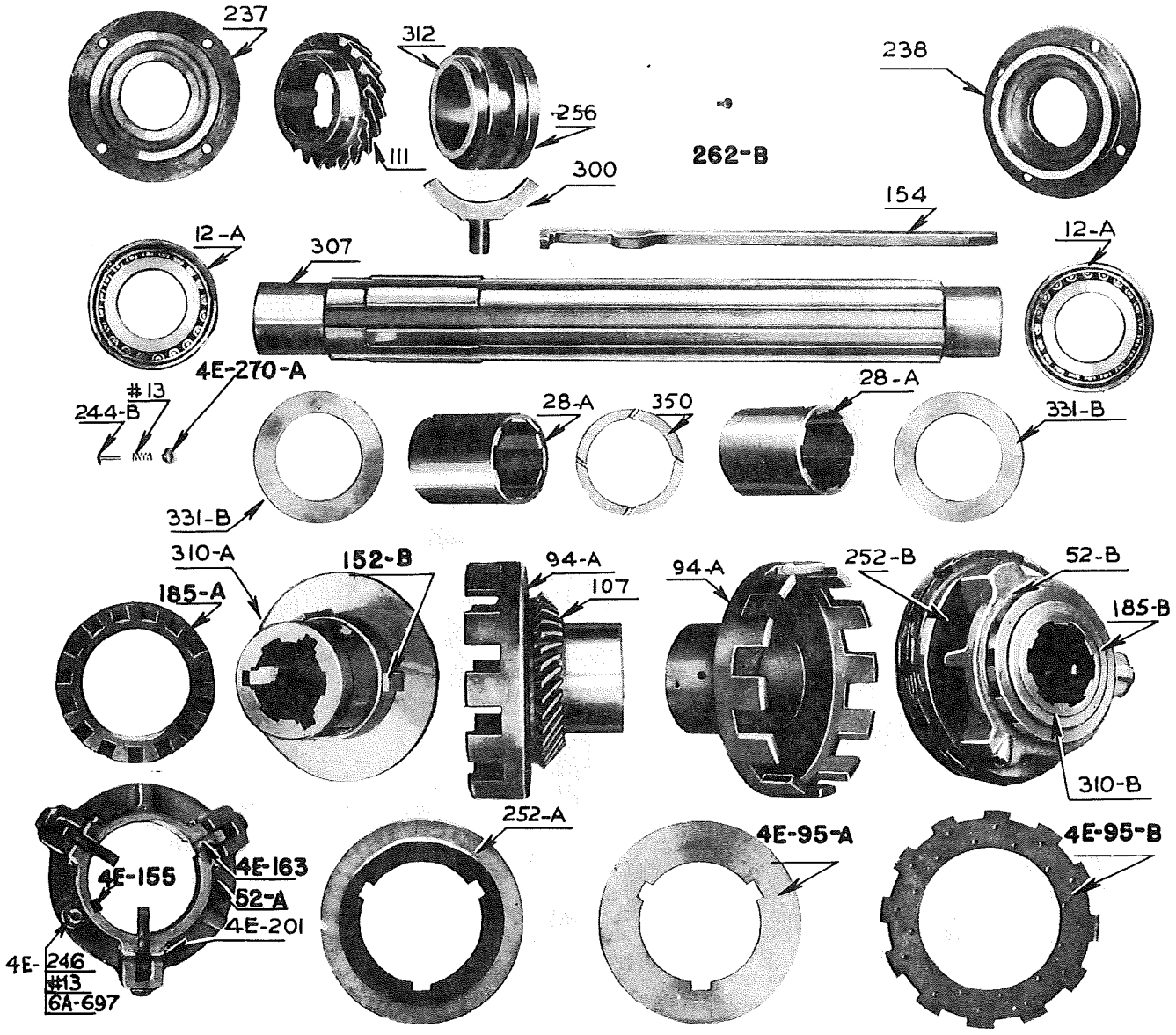
ELEVATION SCREW PARTS



Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
Valve	Ready Throttle	6E-467	Thrust Bearing Collar	4D-715	Pump Wing Spring
4E-41	Pump Eccentric Bush	477-A	Elev. Nut Gear	4D-729	Pump Wing
4E-54	Pump Case	6E-507	Short Elev. Nut	1008	Elev. Screw Thrust Bearing Bush
108	Spiral Pump Driving Gear	6E-508	Long Elev. Nut	1002	Elev. Screw Safety Thrust Bearing
7K-164	Elev. Screw Thrust Bearing	4D-571	Pump Case Cover		
288	Pump Shaft	4E-585	Long Elev. Nut Washer	1022	Elev. Screw Collar
328-A	Pipe Support	3A-642	Clamp Lever	1038	Elev. Screw Key
5E-435	Elev. Nut Lower Ball Bearing	4E-660	Pipe Bracket	1088	Elev. Screw Nut Washer
4E-455	Elev. Nut Bush (Flanged)	4E-668	Hose Support	1089	Elev. Screw Slip Washer
5E-455	Elev. Nut Bush (Without Flange)	669	Clamping Screw	4E-1092	Elev. Screw Bush Plate

WHEN ORDERING BEARINGS GIVE MANUFACTURERS' NAME AND NUMBER
WHEN ORDERING GEARS GIVE NUMBER OF TEETH

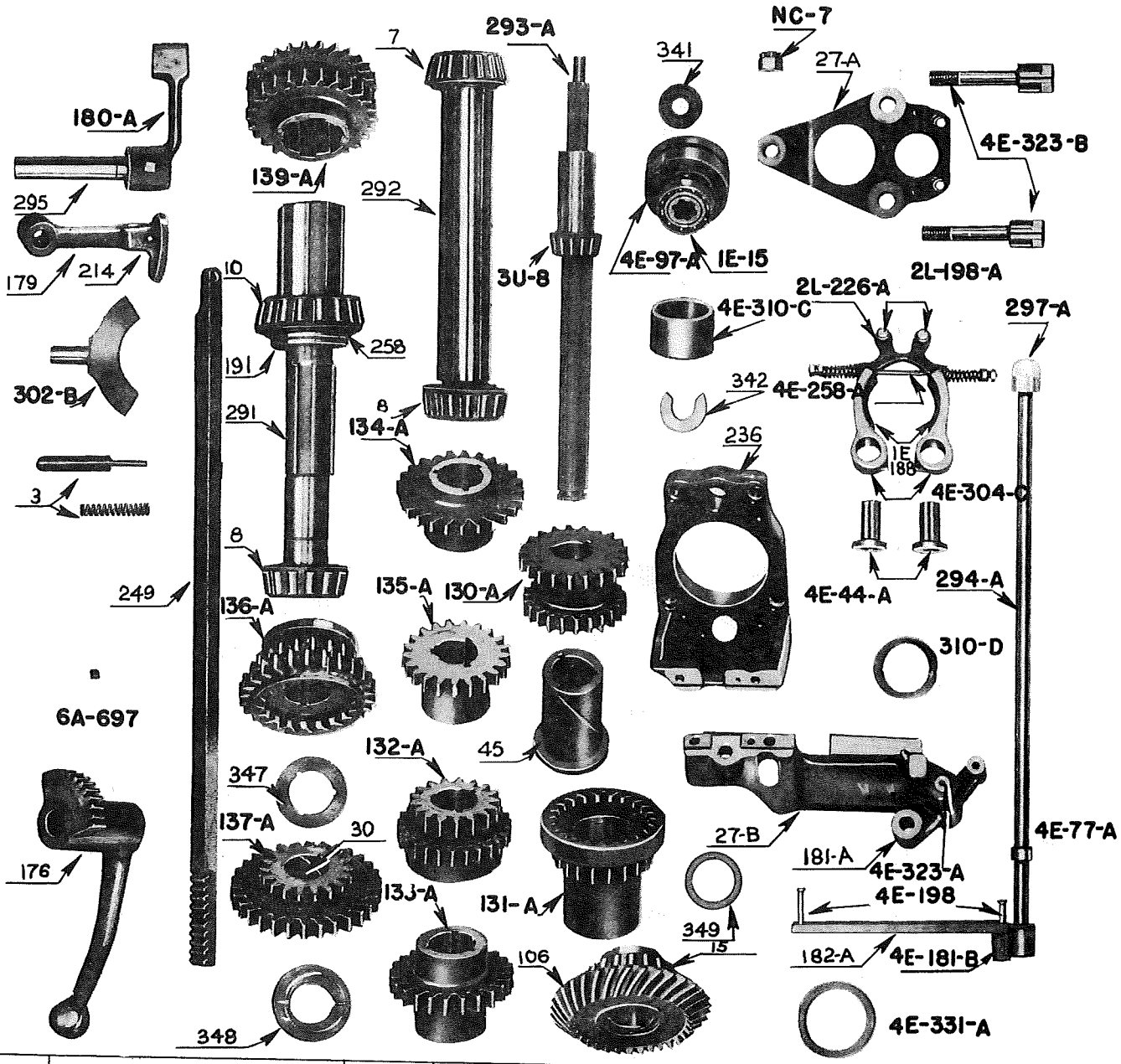
DRIVING CLUTCH PARTS



Part No.	Part Name	Part No.	Part Name
12-A	Driving Sleeve Roller Bearing	237	Left Reverse End Plate
#13	Clutch Adj. Plunger Spring (2 Req.)	238	Right Reverse End Plate
#13	Clutch Spring (6 Req.)	244-B	Clutch Plunger (6 Req.)
28-A	Reverse Clutch Cup Bush	4E-246	Clutch Adj. Plunger (2 Req.)
52-A	Clutch Finger (Small Bore) Carrier	252-A	Left End Clutch Ring
52-B	Clutch Finger (Large Bore) Carrier	252-B	Right End Clutch Ring
94-A	Reverse Clutch Cup	256	Clutch Spool Screw Retainer
4E-95-A	Clutch Friction Disc	262-B	Spool Retainer Screw
4E-95-B	Clutch Friction Driving Disc	4E-270-A	Clutch Screw
107	Spiral Clutch Mitre Gear	300	Reverse Spool Shifter
111	Traverse Spiral Gear (Large Bore)	307	Clutch Driving Sleeve
152-B	Clutch Disc Key (6 Required)	310-A	Clutch (Large Hub) Spider
154	Clutch Spreader Key (3 Req.)	310-B	Clutch (Small Hub) Spider
4E-155	Clutch Finger Carrier Key	312	Reverse Clutch Spool
4E-163	Clutch Finger Lever	331-B	Clutch Thrust Washer
185-A	Clutch Adj. (Large Bore) Nut	350	Clutch Mitre Spacing Washer
185-B	Clutch Adj. (Small Bore) Nut	6A-697	Clutch Adj. Plunger Screw (2 Req.)
4E-201	Clutch Finger Lever Pin		

WHEN ORDERING BEARINGS GIVE MANUFACTURERS' NAME AND NUMBER
WHEN ORDERING GEARS GIVE NUMBER OF TEETH

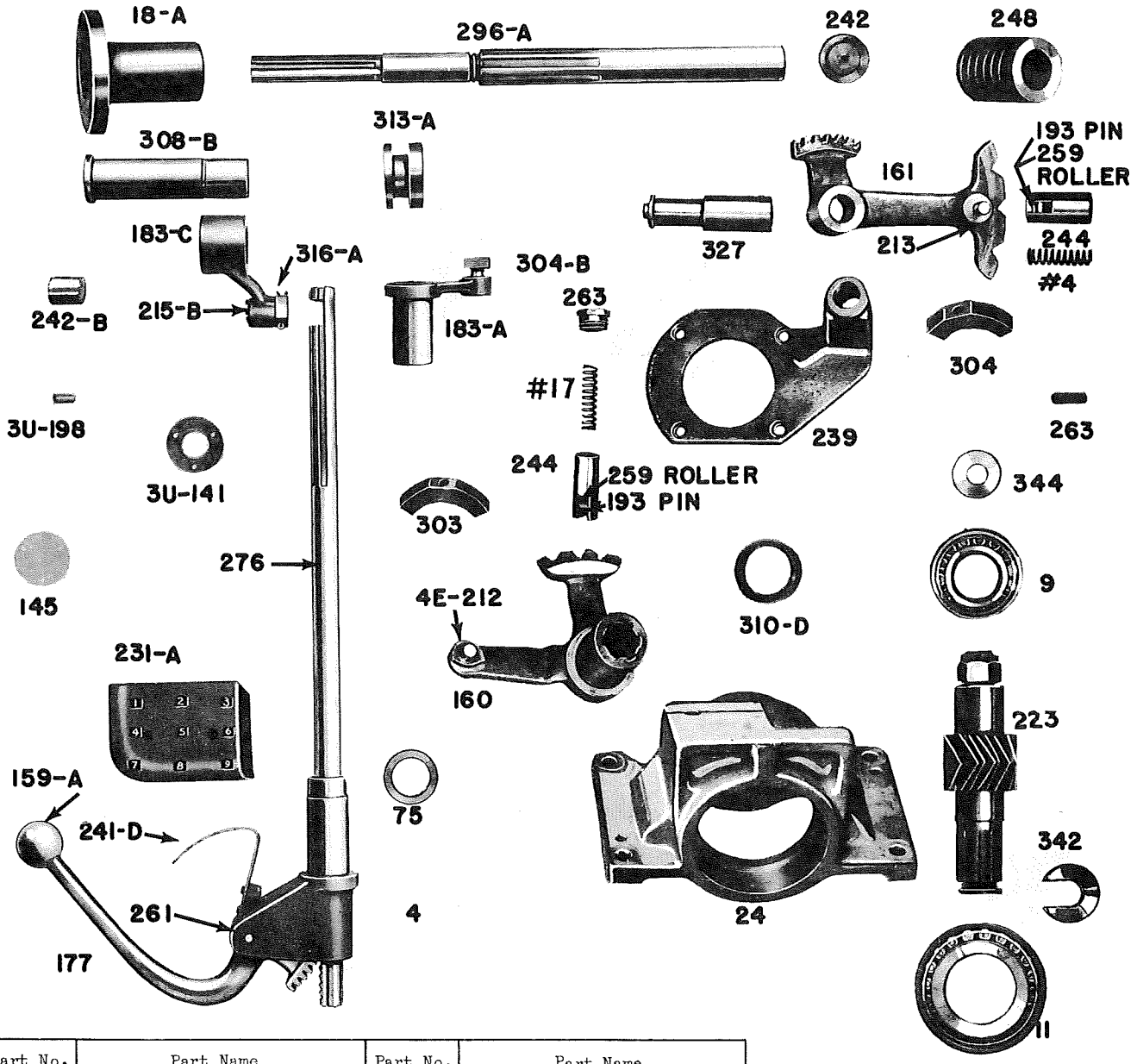
HEAD PARTS (BACK GEAR CASE)



Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
#3	Plunger and Spring	134-A	Change Gear	4E-258-A	Brake Shoe Rod
7	Roller Bearing	135-A	21-T Change Gear	291	Back Gear Shaft
NC-7	Driving Mitre Shaft Nut	136-A	Back Gear	292	Change Gear Shaft
8	Roller Bearing	137-A	Back Gear	293-A	Driving Mitre Shaft
3U-8	Roller Bearing	139-A	Spindle Drg. Gear	294-A	Brake Shifter Shaft
10	Roller Bearing	176	Spindle Driving Gear Lever	295	Shifter Lever Shaft
15	Driving Mitre Roller Bearing	179	Spdl. Drg. Gear Plunger Lever	297-A	Brake Shifter
1E-15	Mitre Shifter Upper Bearing	180-A	Spindle Drg. Gear Shifter Lever	302-B	Spindle Drg. Gear Shifter
27-A	Brake Shoe Bracket	181-A	Brake Shifter Lever	4E-304-C	Brake Shoe
27-B	Brake Shifter Link Bracket	4E-181-B	Brake Shifter Lower Lever	4E-310-C	Mitre Shaft Spacer
30	Back Gear Bush	182-A	Brake Shifter Link	4E-323-B	Brake Shoe Bracket Stud
4E-44-A	Brake Shoe Bush	1E-188	Brake Shoe Lining	4E-331-A	Mitre Shaft Fitting Washer
45	19-T Drawing Gear Bush	191	Change Shaft Lock Nut	341	Brake Shifter Washer
4E-77-A	Brake Shifter Shaft Collar	4E-198	Brake Link Pin	342	Back Gear Slip Washer
4E-97-A	Brake Drum	2L-198-A	Brake Roller Pin	347	Back Gear Shaft Washer
106	Spiral Drg. Mitre Gear	214	Spdl. Shifter Lever Pin	348	Back Gear Washer
130-A	21 & 23-T Sliding Change Gear	2L-226-A	Brake Roller	349	Change Shaft Bearing Washer
131-A	Driving Gear	236	Drg. Mitre Bearing Plate	6A-697	Plunger Screw
132-A	Change Gear	249	Spdl. Drg. Gear Shifter Lev. Rk.		
133-A	Driven Gear	258	Change Shaft Lock Nut Retainer		

WHEN ORDERING BEARINGS GIVE MANUFACTURERS' NAME AND NUMBER
WHEN ORDERING GEARS GIVE NUMBER OF TEETH

HEAD PARTS

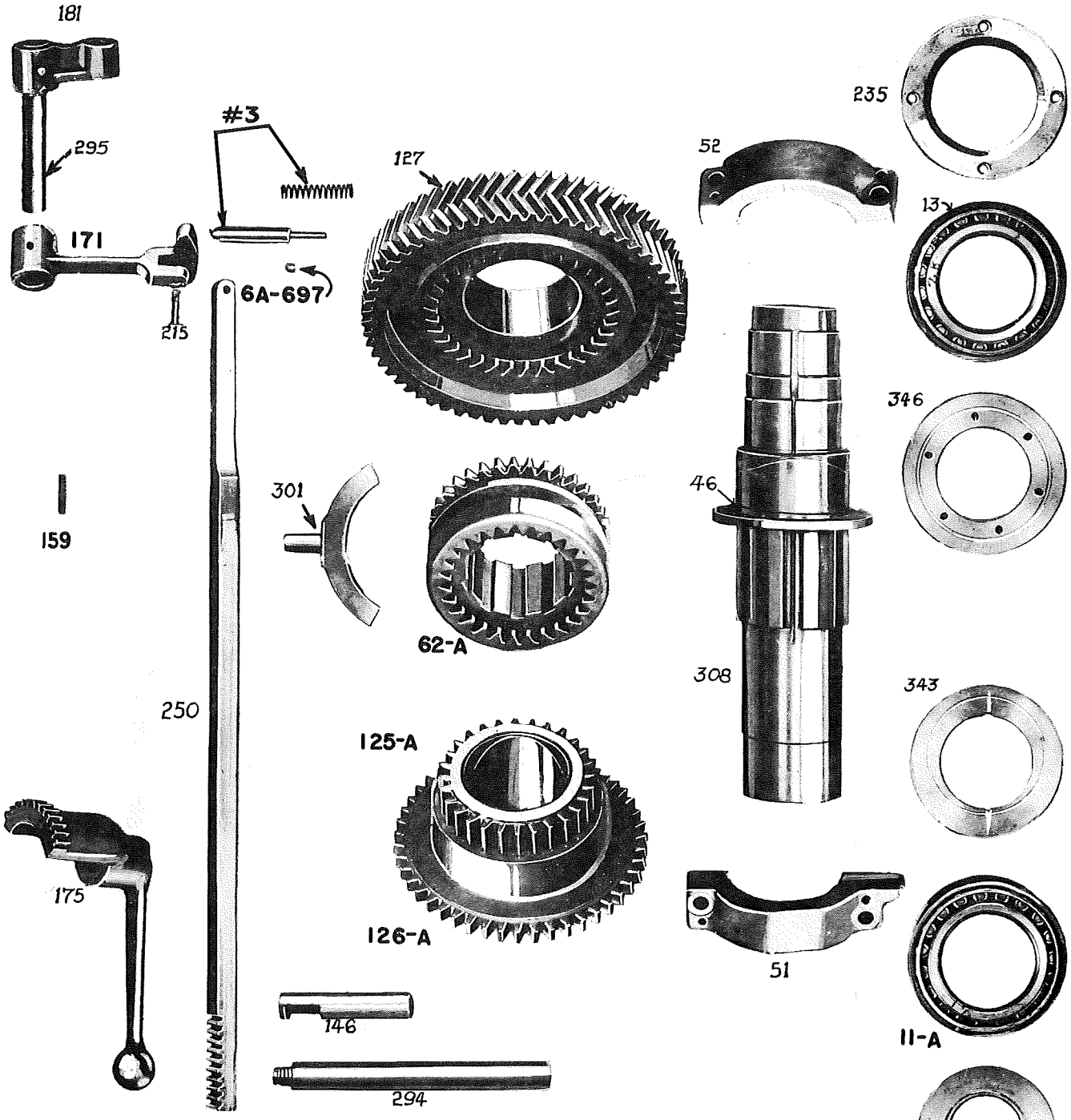


Part No.	Part Name	Part No.	Part Name
#4	Plunger Spring	213	Change Gear Shifter Pin
4	Speed Change Lever Bearing	215-B	Shifter Shoe Pin
9	Roller Bearing	223	12T. Spindle Driving Pinion
11	Roller Bearing	231-A	Speed Index Plate
#17	Plunger Spring	239	Upper B.G. Shaft Bearing Plate
18-A	Shifter Lever Sleeve Bearing	241-D	Speed Index Pointer
24	Back Gear Bracket	242	Back Gear Shifter Shaft Plug
75	Speed Change Lever Brg. Collar	242-B	Shifter Lever Sleeve Plug
138-A	Spindle Driving Gear	244	Shifter Lever Plunger
3U-141	Oil Gauge Glass Washer	248	Change Gear Shifter Lever Rack
145	Oil Gauge Glass	259	Plunger Roller
159-A	Speed Change Lever Knob	261	Change Lever Screw
160	Change B.G. Shifter Lever	263	Plunger Screw
161	Change Gear Shifter Lever	276	Speed Change Lever Shaft
177	Speed Change Lever	296-A	Horizontal Speed Change Shaft
183-A	Vertical Shaft Shifter Lever	303	Back Gear Shifter
183-C	Speed Shifter Lever	304	Change Gear Shifter
193	Plunger Roller Pin	304-B	Spool Shifter Shoe
3U-198	Drip Tube	308-B	Shifter Lever Sleeve
4E-212	Back Gear Shifter Pin	310-D	Change Shaft Brg. Spacer
		313-A	Shifter Spool

Part No.	Part Name
316-A	Speed Shifter Shoe
327	Change Shifter Lever Stud
342	Back Gear Slip Washer
344	Spindle Driving Pinion Washer

WHEN ORDERING BEARINGS GIVE MANUFACTURERS' NAME AND NUMBER
WHEN ORDERING GEARS GIVE NUMBER OF TEETH

HEAD PARTS (SPINDLE DRIVING SLEEVE)

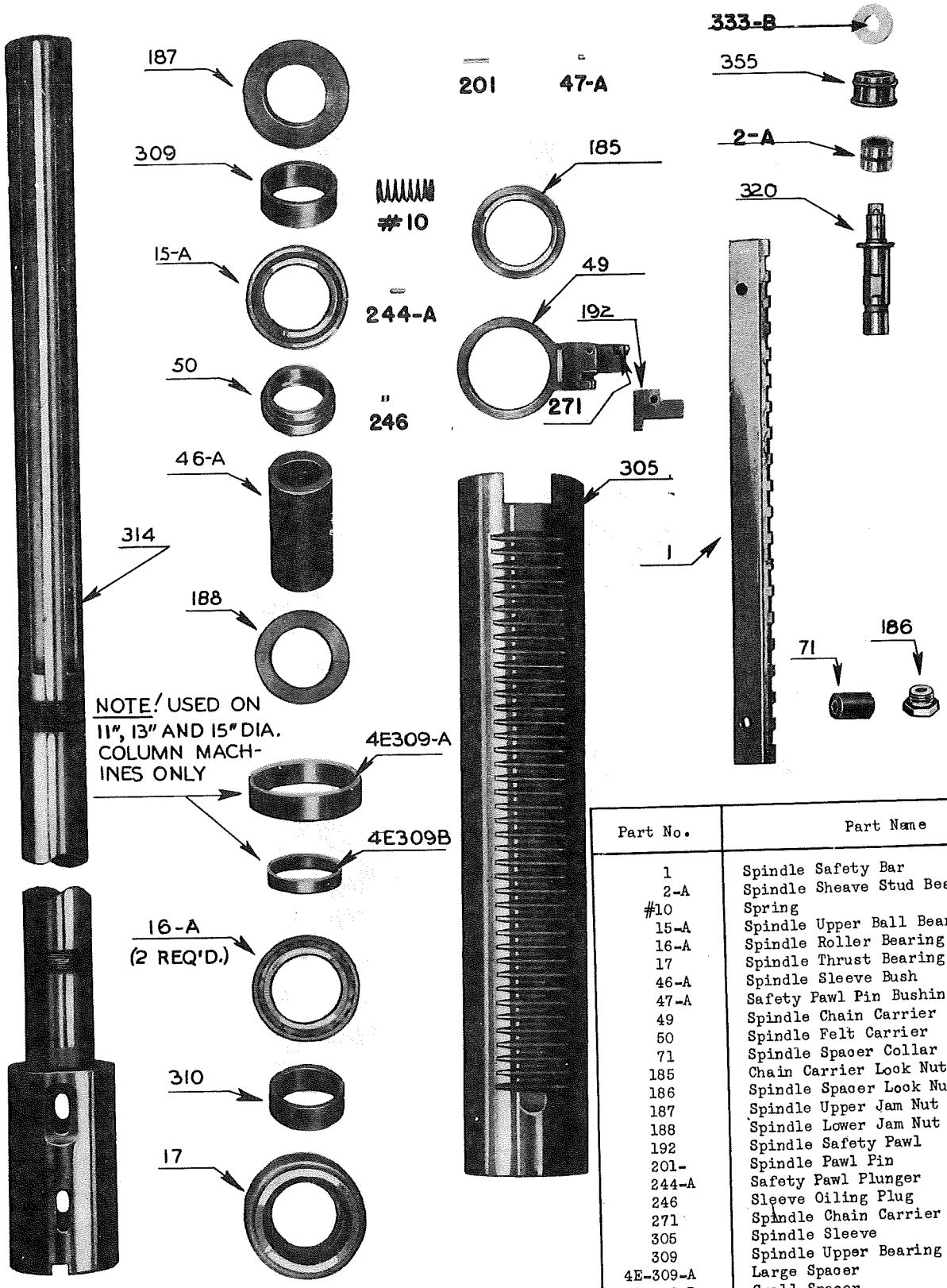


Part No.	Part Name	Part No.	Part Name
#3	Plunger and Spring	159	Spindle Gear Key
11-A	Roller Bearing (Lower)	171	Spindle Gear Plunger Lever
13	Roller Bearing (Upper)	175	Spindle Gear Lever
44	Head Upper Brg. Bush	181	Spindle Gear Shifter Lever
46	61-T Spindle Gear Bush	215	Spdl. Drg. Shifter Lever Pin
51	Lower Drg. Sleeve Bearing Cap	235	Driving Sleeve Bearing Plate
52	Upper Drg. Sleeve Bearing Cap	250	Spindle Gear Shifter Rack
62-A	Spindle Gear Clutch (34-T)	294	Spindle Lever Shaft
125-A	Spindle Gear (26-T)	295	Shifter Lever Shaft
126-A	Spindle Gear (50-T)	301	Spindle Gear Shifter
127	Spindle Gear (61-T)	308	Spindle Driving Sleeve
146	Shifter Rack Guide	343	Spindle Gear Washer

Part No.	Part Name
346	Driving Sleeve Upper Bearing Washer
6A-697	Plunger Screw

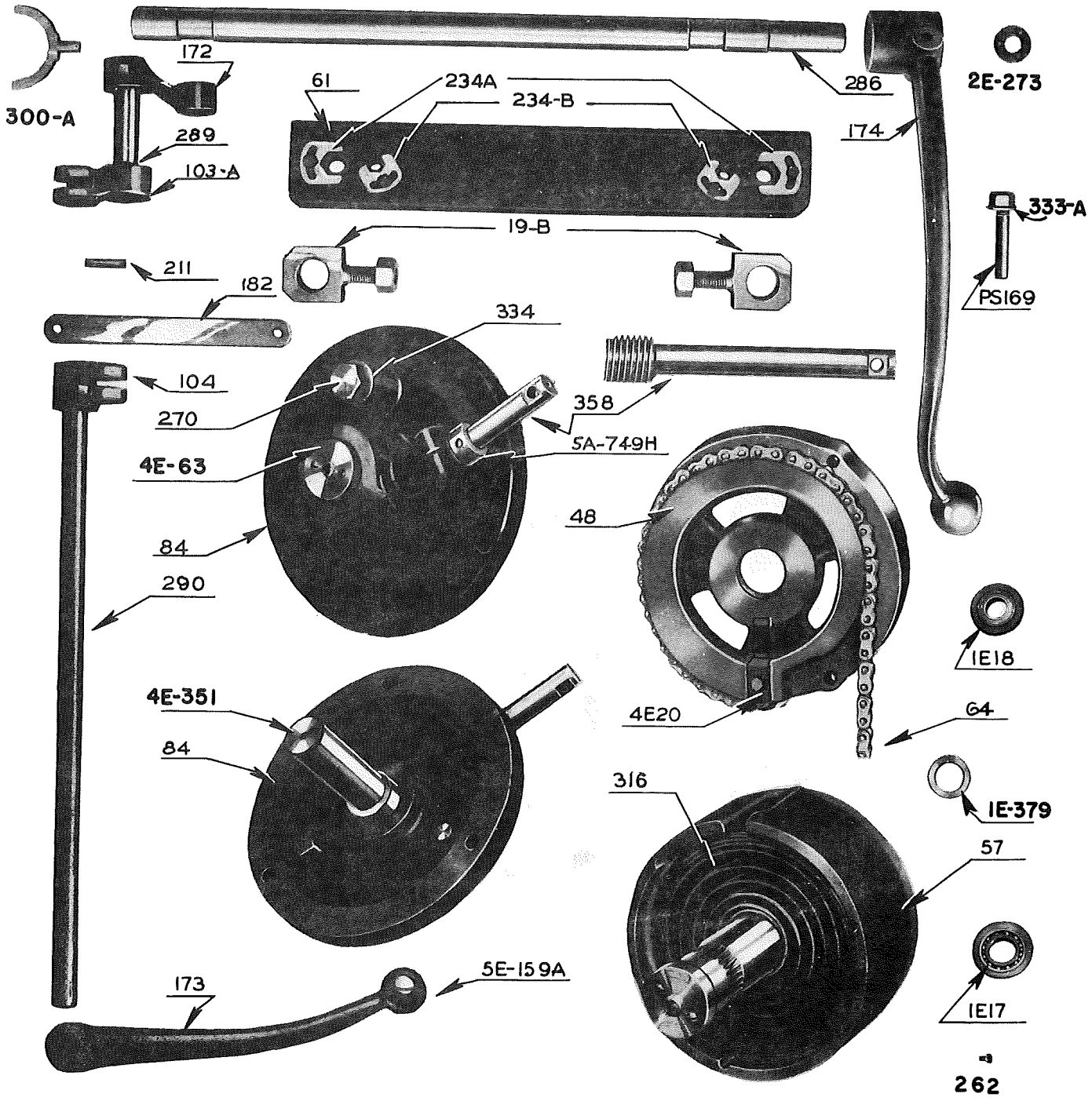
WHEN ORDERING BEARINGS GIVE MANUFACTURERS' NAME AND NUMBER
WHEN ORDERING GEARS GIVE NUMBER OF TEETH

HEAD PARTS(SPINDLE UNIT)



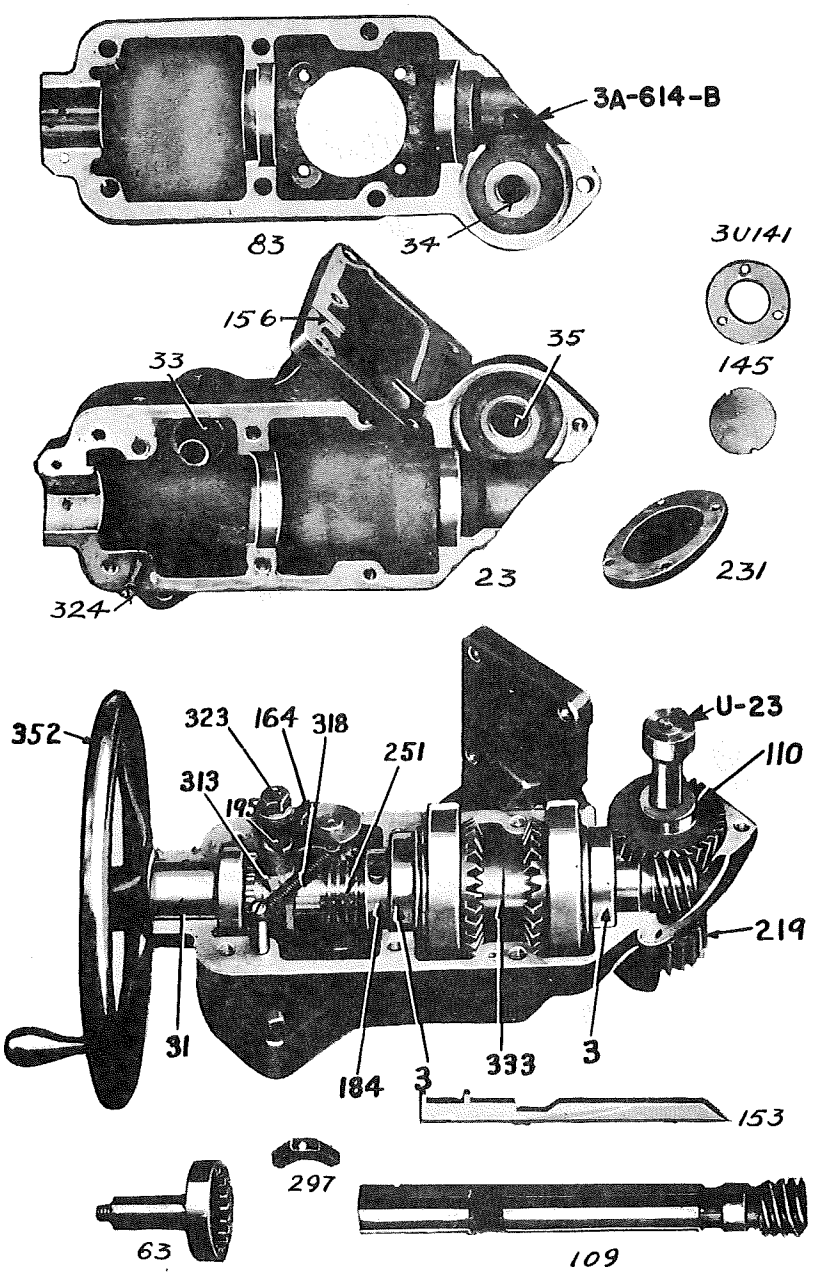
Part No.	Part Name
1	Spindle Safety Bar
2-A	Spindle Sheave Stud Bearing
#10	Spring
15-A	Spindle Upper Ball Bearing
16-A	Spindle Roller Bearing
17	Spindle Thrust Bearing
46-A	Spindle Sleeve Bush
47-A	Safety Pawl Pin Bushing
49	Spindle Chain Carrier
50	Spindle Felt Carrier
71	Spindle Spacer Collar
185	Chain Carrier Lock Nut
186	Spindle Spacer Lock Nut
187	Spindle Upper Jam Nut
188	Spindle Lower Jam Nut
192	Spindle Safety Pawl
201-	Spindle Pawl Pin
244-A	Safety Pawl Plunger
246	Sleeve Oiling Plug
271	Spindle Chain Carrier Sorew
305	Spindle Sleeve
309	Spindle Upper Bearing Spacer
4E-309-A	Large Spacer
4E-309-B	Small Spacer
310	Spindle Lower Bearing Spacer
314	Spindle
320	Spindle Sheave Stud
333-B	Sheave Stud Washer
355	Sheave Wheel

HEAD CLAMPING, SPINDLE CONTROL AND COUNTERBALANCE

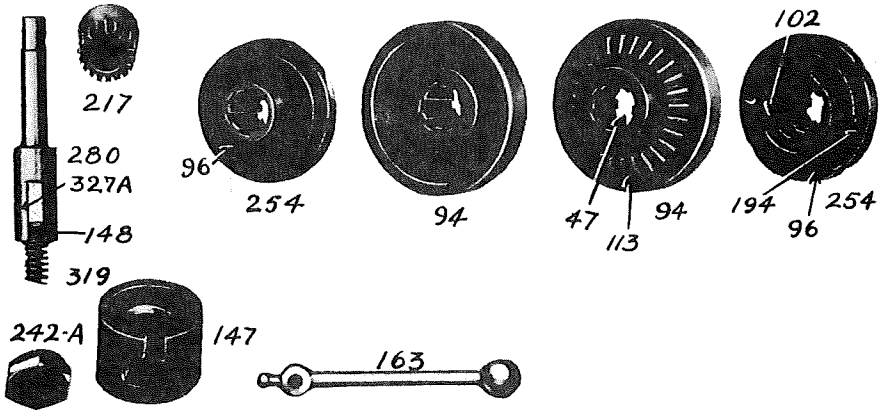


Part No.	Part Name	Part No.	Part Name	Part No.	Part Name
1E-17	Spring Case Ball Bearing (Large)	159-A	Lever Knob	286	Head Clamping Shaft
1E-18	Spring Case Ball Bearing (Small)	PS-169	Binder Lever Taper Pin	289	Reverse Shifter Lever Shaft
19-B	Head Clamping Bolt	172	Reverse Shifter Lever	290	Reverse Lever Shaft
4E-20	Chain Block	173	Reverse Lever	300-A	Upper Reverse Spool Shifter
48	Spring Cam	174	Head Binder Lever	316	Spindle Counterbalance Spring
57	Spring Case	182	Reverse Lever Link	333-A	Head Binder Lever Pin Washer
61	Head Clamp	211	Reverse Link Pin	334	Spring Stop Screw Washer
4E-63	Spring Worm Wheel Collar	234-A	Head Clamp Locking Plate (Lge.)	4E-351	Spring Adj. Worm Wheel
64	Spindle Counterbalance Chain	234-B	Head Clamp Locking Plate (Sma.)	358	Spring Adjusting Worm
84	Spring Case Cover	262	Co-Balance Spring Screw	1E-379	Spring Case Washer
103-A	Long Reverse Link Fork	270	Spring Case Stop Screw	5A-749-H	Spring Adjusting Worm Collar
104	Short Reverse Link Fork	2E-273	Head Clamping Shaft Plate		

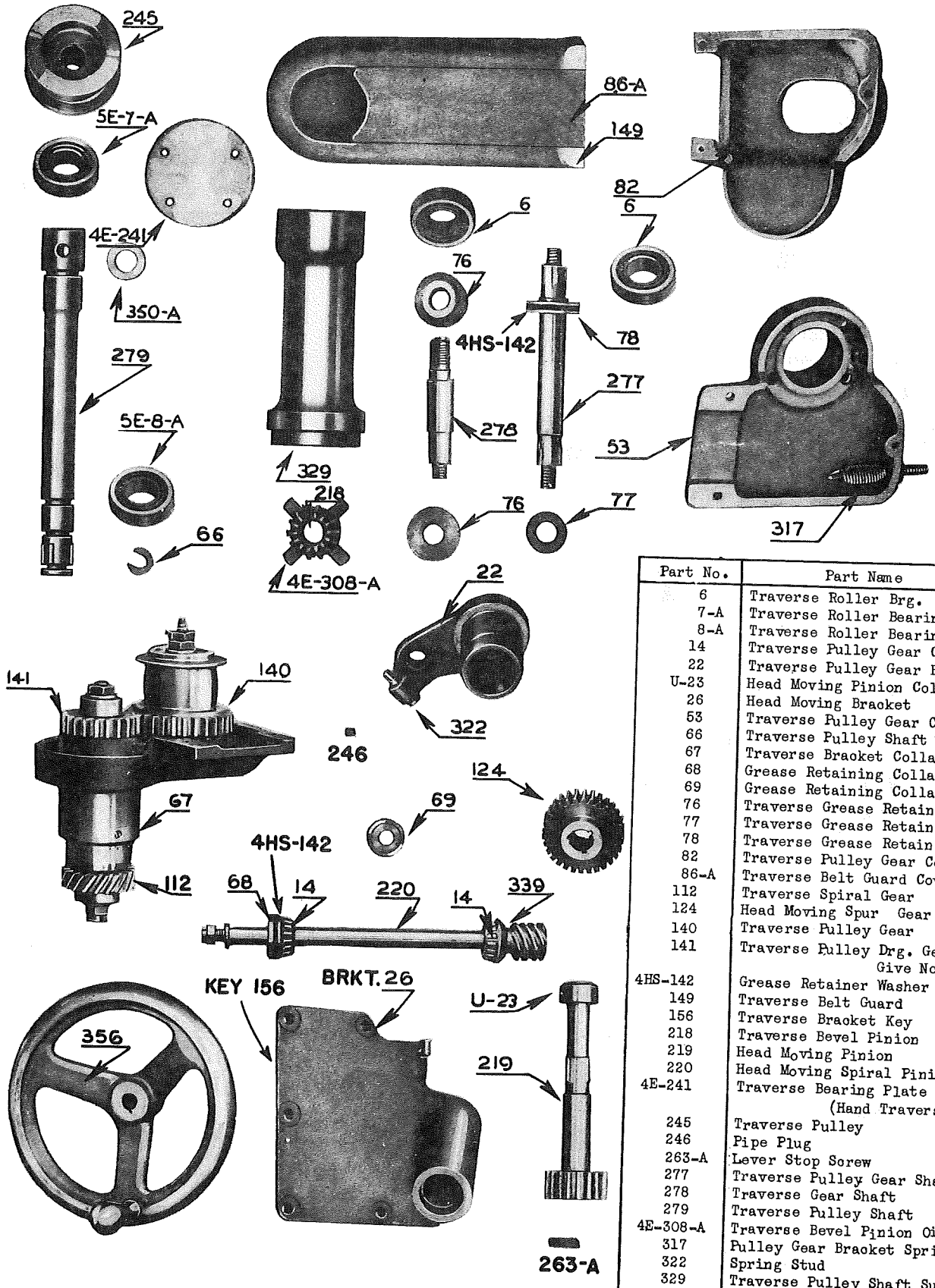
WHEN ORDERING BEARINGS GIVE MANUFACTURERS' NAME AND NUMBER



Part No.	Part Name
3	Traverse Case Thrust Bearing
23	Traverse Bracket
U-23	Head Moving Pinion Collar
31	Traverse Hand Wheel Bush
33	Traverse Lever Shaft Bush
34	Head Moving Pinion Upper Bush
35	Head Moving Pinion Lower Bush
47	Traverse Clutch Cup Bush
63	Traverse Hand Wheel Clutch
83	Traverse Bracket Cover
94	Traverse Clutch Cup
96	Traverse Clutch Disc
102	Traverse Clutch Finger
109	Traverse Spiral Gear
110	Head Moving Spiral Gear
113	Traverse Bevel Gear (28T)
3U-141	Oil Gauge Glass Washer
145	Oil Gauge Glass
147	Traverse Lever Guide
148	Traverse Spring Guide
153	Traverse Clutch Spreader Key
156	Traverse Bracket Key
163	Traverse Clutch Lever
164	Traverse Trip Lever
184	Traverse Worm Nut
194	Traverse Clutch Spreader Pin
195	Traverse Lever Pin
217	Traverse Spreader Rack Pinion
219	Head Moving Pinion
231	Traverse Bracket Plate
242-A	Lever Spring Plug
251	Traverse Clutch Spreader Rack
254	Traverse Clutch Ring
280	Traverse Lever Shaft
297	Traverse Spool Shifter
313	Traverse Clutch Spool
318	Traverse Trip Lever Spring
319	Traverse Lever Shaft Spring
323	Traverse Lever Stud
324	Traverse Spring Stud
327-A	Traverse Lever Stud
333	Traverse Clutch Washer
352	Traverse Hand Wheel
3A-614-B	Tube End



POWER RAPID TRAVERSE AND HAND TRAVERSE PARTS



Part No.	Part Name
6	Traverse Roller Brg.
7-A	Traverse Roller Bearing Upper
8-A	Traverse Roller Bearing Lower
14	Traverse Pulley Gear Cover
22	Traverse Pulley Gear Bracket
U-23	Head Moving Pinion Collar
26	Head Moving Bracket
53	Traverse Pulley Gear Case
66	Traverse Pulley Shaft Collar
67	Traverse Bracket Collar
68	Grease Retaining Collar
69	Grease Retaining Collar
76	Traverse Grease Retaining Collar
77	Traverse Grease Retaining Collar
78	Traverse Grease Retaining Collar
82	Traverse Pulley Gear Cover
86-A	Traverse Belt Guard Cover
112	Traverse Spiral Gear
124	Head Moving Spur Gear
140	Traverse Pulley Gear
141	Traverse Pulley Drg. Gear Give No. Teeth
4HS-142	Grease Retainer Washer
149	Traverse Belt Guard
156	Traverse Bracket Key
218	Traverse Bevel Pinion
219	Head Moving Pinion
220	Head Moving Spiral Pinion
4E-241	Traverse Bearing Plate (Hand Traverse Only)
245	Traverse Pulley
246	Pipe Plug
263-A	Lever Stop Screw
277	Traverse Pulley Gear Shaft
278	Traverse Gear Shaft
279	Traverse Pulley Shaft
4E-308-A	Traverse Bevel Pinion Oil Sling
317	Pulley Gear Bracket Spring
322	Spring Stud
329	Traverse Pulley Shaft Support
339	Grease Retaining Washer
350-A	Traverse Bevel Pinion Washer
356	Head Moving Hand Wheel

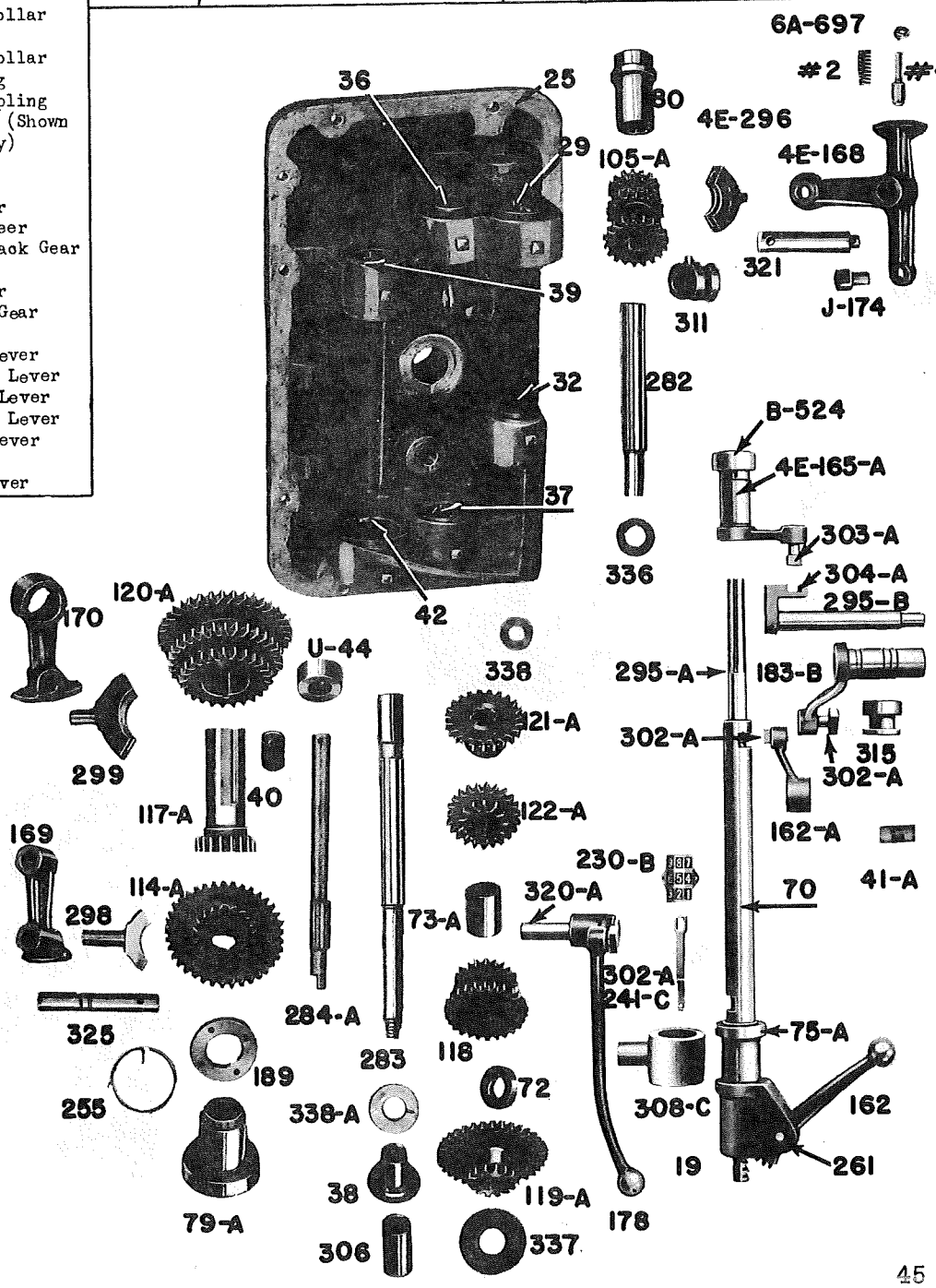
WHEN ORDERING BEARINGS GIVE MANUFACTURERS' NAME AND NUMBER
WHEN ORDERING GEARS GIVE NUMBER OF TEETH

FEED CASE PARTS

Part No.	Part Name
#2	Plunger Spring
#4	Plunger
19	Change Lever Bearing
25-	Feed Bracket
29	Dr. Shaft Center Bush
32	Dr. Shaft Lower Bush
36	Inter Sh. Upper Bush
37	Inter Sh. Lower Bush
38	Feed B. G. Bush
39	Worm Sh. Upper Bush
40	Long Back Gear Bush
41-A	Feed Change Lever Shaft Upper Bush
42	Worm Sh. Lower Bush
U-44	Worm Upper Shaft Collar
70	Feed Change Shaft Cover
72	Feed Inter Shaft Collar
73-A	Long Spacing Cover
75-A	Feed Ch. Bearing Collar
79-A	Worm Shaft Coupling
80	Feed Dr. Shaft Coupling
89-A	Feed Bracket Cover (Shown on Page 26 only)
105-A	Change Gear
114-A	Feed Back Gear
117-A	Long Feed Back Gear
118	19-26T. Int. Fd. Geer
119-A	14-34T. Int. Fd. Back Gear
120-A	Fd. Ch. Gear
121-A	23T. Int. Feed Gear
122-A	13-23T. Int. Feed Gear
162	Feed Change Lever
162-A	Feed B. G. Upper Lever
4E-165-A	Vert. Change Shaft Lever
4E-168	Rear Change Shaft Lever
169	Feed B. G. Shifter Lever
170	Feed Ch. Shifter Lever
J-174	Clutch Pin
178	Feed B. G. Long Lever

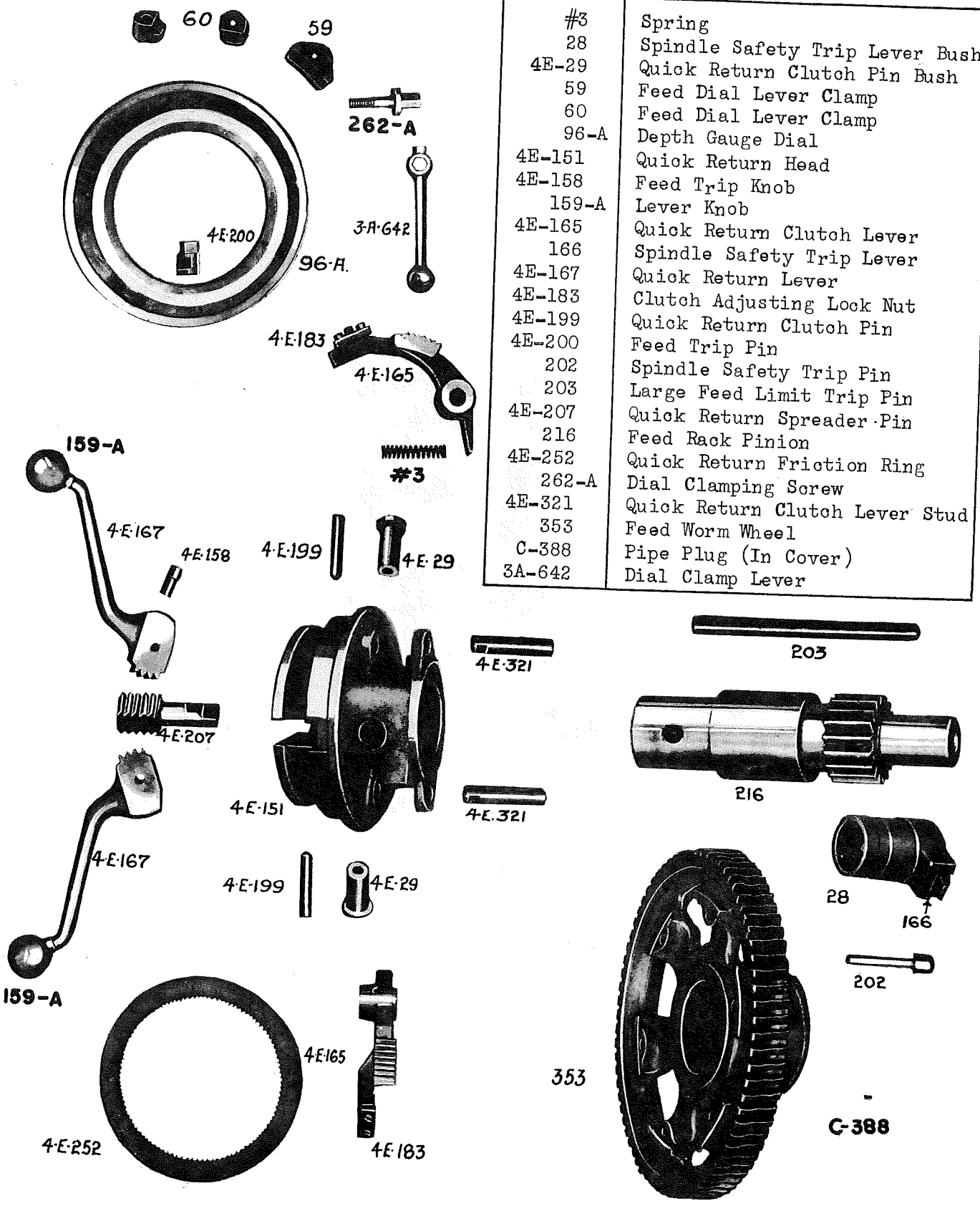
Part No.	Part Name
183-B	Short Change Sh. Lever
189	Coupling Lock Nut
230-B	Feed Index Plate
241-C	Feed Index Pointer
255	Lock Nut Retainer
261	Feed Ch. Lever Screw
282	Lower Fd. Driving Shaft
283	Feed Inter Shaft
284-A	Worm Upper Shaft
295-A	Feed Ch. Lever Shaft
295-B	Short Feed Ch. Shaft
4E-296	Rear Feed Ch. Shifter
298	Feed Back Gear Shifter
299	Front Feed Ch. Shifter
302-A	Feed Shifter Shoe
303-A	Shifter Lever Shoe

Part No.	Part Name
304-A	Angular Shifter
306	Inter Shaft Sleeve
308-C	Ch. Lever Brg. Support
311	Rear Lever Spool
315	Feed Sh. Shifter Spool
320-A	Long Feed Lever Stud
321	Rear Shifter Lever Stud
325	Feed B. G. Lever Stud
336	Feed Driving Sh. Washer
337	Inter Sh. Lower Washer
338-A	Feed Worm Shaft Upper Washer
338	Worm Sh. Upper Washer
B-524	Feed Ch. Lever Collar
6A-697	Plunger Screw



WHEN ORDERING GEARS GIVE NUMBER OF TEETH

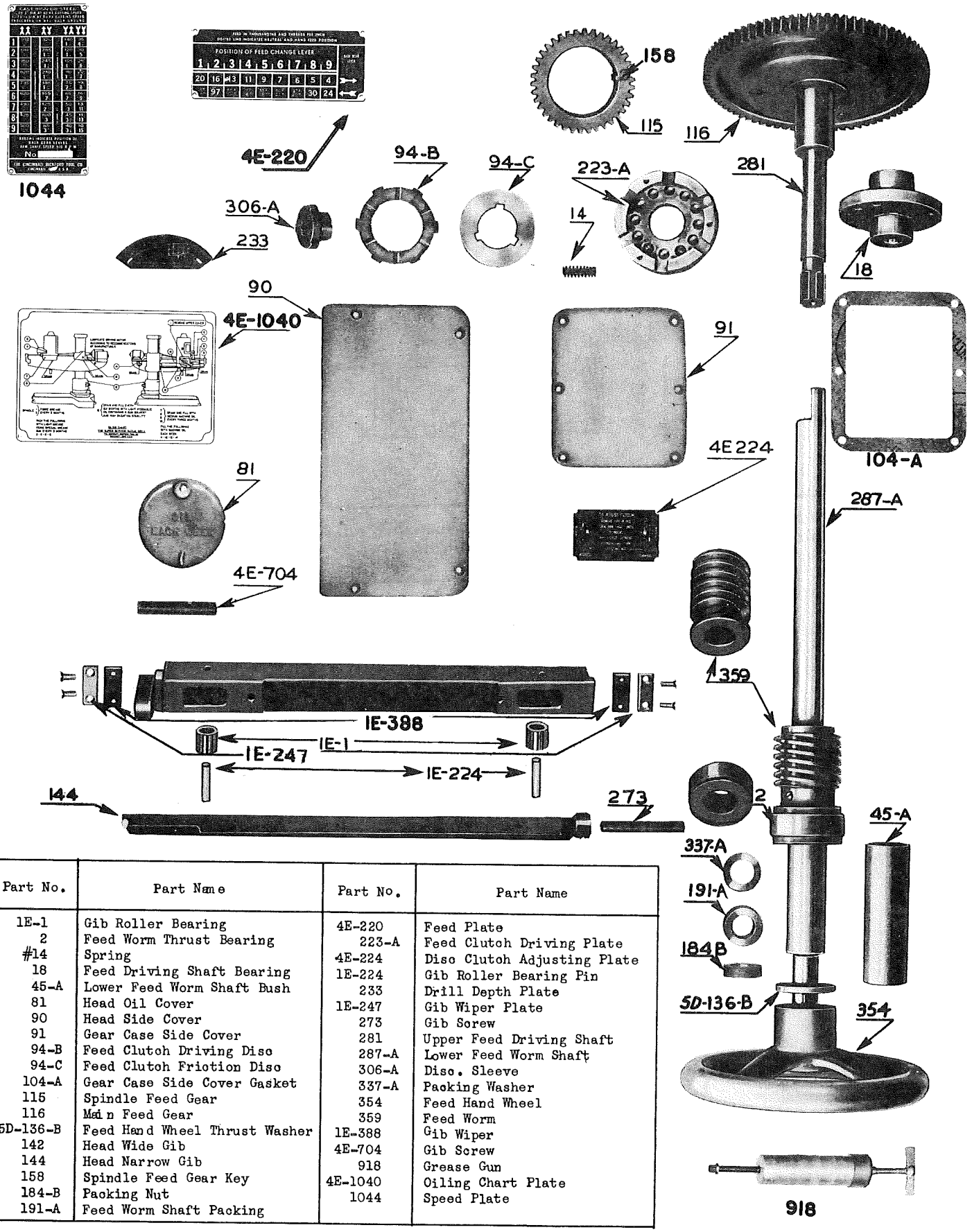
FEED ENGAGEMENT PARTS (QUICK RETURN UNIT)



Part No.	Part Name
#3	Spring
28	Spindle Safety Trip Lever Bush
4E-29	Quick Return Clutch Pin Bush
59	Feed Dial Lever Clamp
60	Feed Dial Lever Clamp
96-A	Depth Gauge Dial
4E-151	Quick Return Head
4E-158	Feed Trip Knob
159-A	Lever Knob
4E-165	Quick Return Clutch Lever
166	Spindle Safety Trip Lever
4E-167	Quick Return Lever
4E-183	Clutch Adjusting Lock Nut
4E-199	Quick Return Clutch Pin
4E-200	Feed Trip Pin
202	Spindle Safety Trip Pin
203	Large Feed Limit Trip Pin
4E-207	Quick Return Spreader Pin
216	Feed Rack Pinion
4E-252	Quick Return Friction Ring
262-A	Dial Clamping Screw
4E-321	Quick Return Clutch Lever Stud
353	Feed Worm Wheel
C-388	Pipe Plug (In Cover)
3A-642	Dial Clamp Lever

WHEN ORDERING GEARS GIVE NUMBER OF TEETH

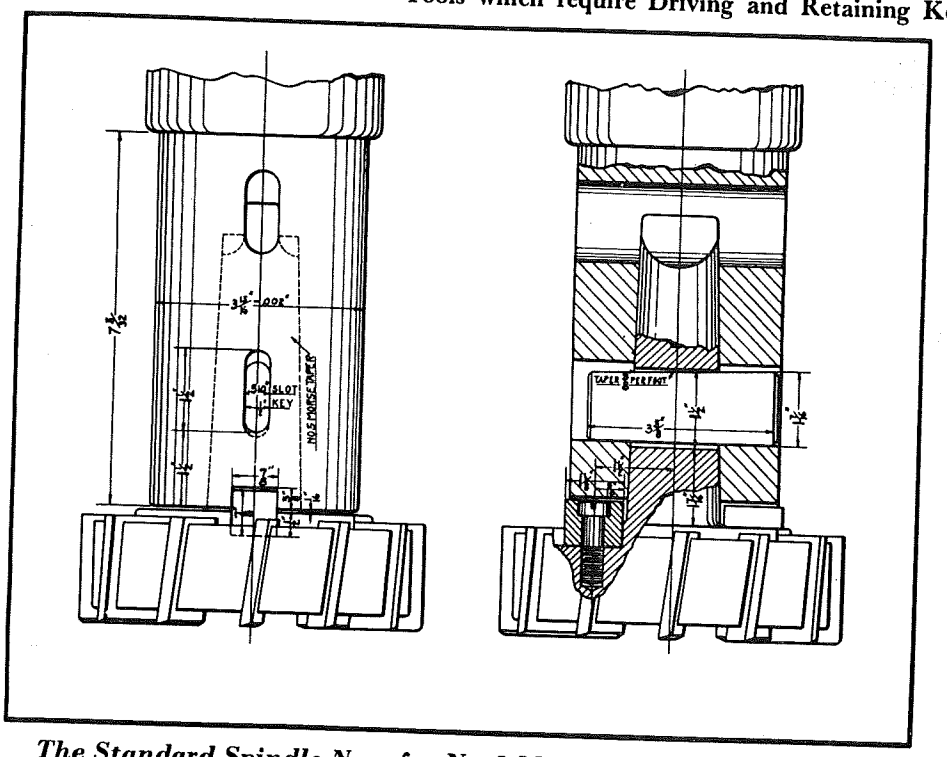
HEAD PARTS



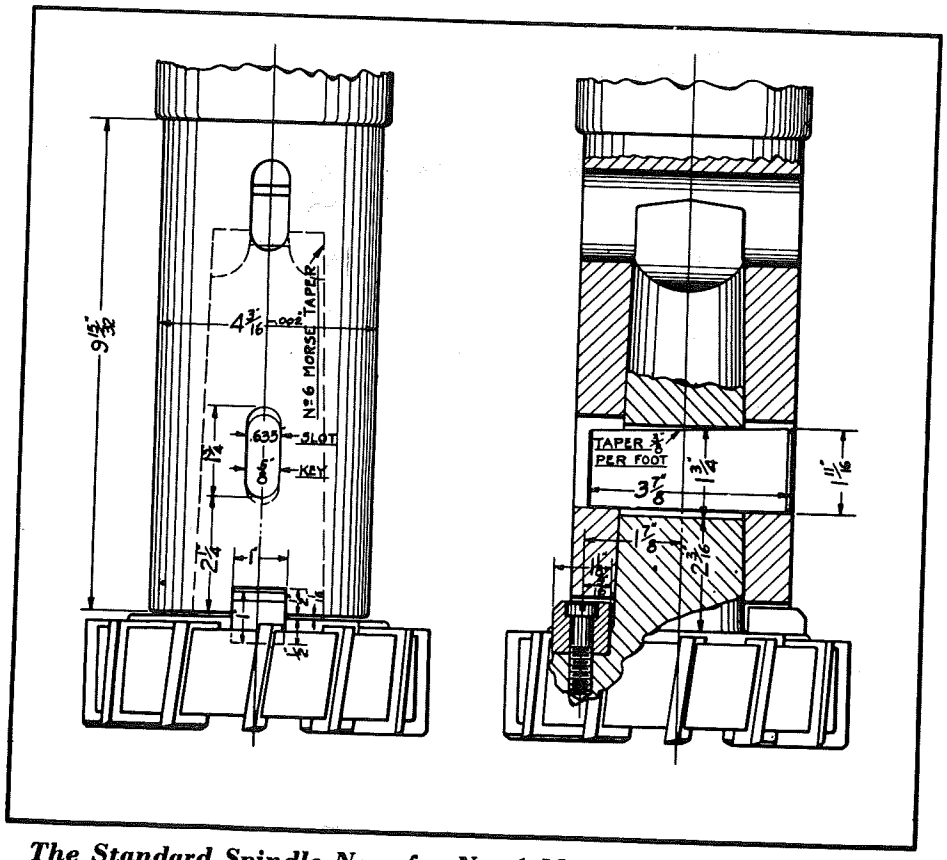
Part No.	Part Name	Part No.	Part Name
1E-1	Gib Roller Bearing	4E-220	Feed Plate
2	Feed Worm Thrust Bearing	223-A	Feed Clutch Driving Plate
#14	Spring	4E-224	Disc Clutch Adjusting Plate
18	Feed Driving Shaft Bearing	1E-224	Gib Roller Bearing Pin
45-A	Lower Feed Worm Shaft Bush	233	Drill Depth Plate
81	Head Oil Cover	1E-247	Gib Wiper Plate
90	Head Side Cover	273	Gib Screw
91	Gear Case Side Cover	281	Upper Feed Driving Shaft
94-B	Feed Clutch Driving Disc	287-A	Lower Feed Worm Shaft
94-C	Feed Clutch Friction Disc	306-A	Disc. Sleeve
104-A	Gear Case Side Cover Gasket	337-A	Packing Washer
115	Spindle Feed Gear	354	Feed Hand Wheel
116	Main Feed Gear	359	Feed Worm
5D-136-B	Feed Hand Wheel Thrust Washer	1E-388	Gib Wiper
142	Head Wide Gib	4E-704	Gib Screw
144	Head Narrow Gib	918	Grease Gun
158	Spindle Feed Gear Key	4E-1040	Oiling Chart Plate
184-B	Packing Nut	1044	Speed Plate
191-A	Feed Worm Shaft Packing		

Standard Spindle Nose Dimensions

These dimensions. should be followed in making Tools which require Driving and Retaining Keys.



The Standard Spindle Nose for No. 5 Morse Taper as furnished on Machines having 11" 13" or 15" Diameter Column.



The Standard Spindle Nose for No. 6 Morse Taper as furnished on Machines Having 17" or 19" Diameter Column.