



Con-Trol-Path

Con-Trol-Scan

AUTOMATIC TRACER CONTROL SYSTEM

Technical
Bulletin

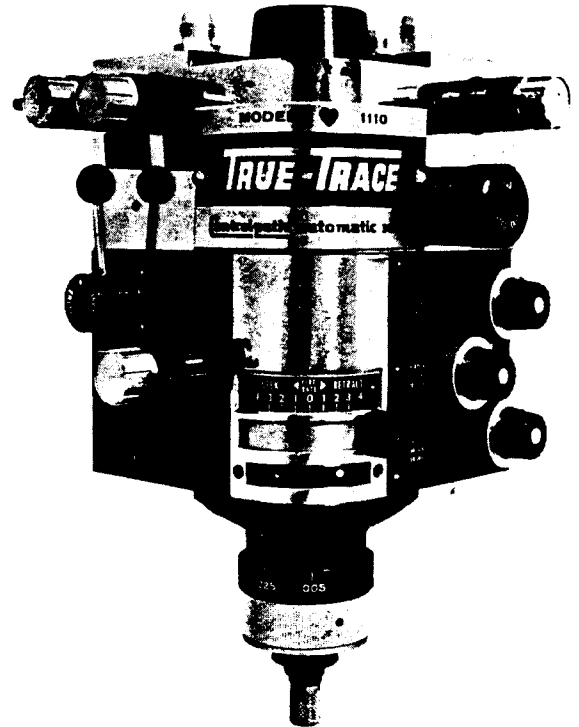
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FUNCTIONAL DESCRIPTION

The Con-Trol-Path is usually installed on vertical milling machines for contour milling of a workpiece as a one-to-one duplication of the pattern. It may be controlled either as a pencil-type tracer with the operator guiding the stylus by hand to do two or three dimensional work, or as an automatic tracer for two dimensional (360) tracing in a horizontal plane.

GENERAL

The purpose of this Bulletin is to give technical information on the product group that is more comprehensive in nature than that included in the sales literature. The theory of operation of the Controlpath Tracer Valve Series is covered in this bulletin. Summarized specifications of the various model valves in this group are given on the Model Sheets. Separate dimensional data information is available by drawing number.



This bulletin will touch on applications and construction in a general nature only. Detailed functional theory will be given on:

Servo Valve Operations.

Operation of the Tracer Valve Spindle.

Stylus to Tool Relationship.

Feed Rate Control.

Description of Action When Tracing a Contour Manually.

Description of Action When Tracing a Contour Automatically.

A basic schematic is also shown of a typical Controlpath control system in the back of this bulletin.

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Section Five

Adjustments

CONTENTS

This section is perhaps most important to the serviceman and the repairman for making adjustments in the Tracer Valve. It has detailed information on 90% of the adjustments that are made on these Tracer Valves by our field service engineers.

It is an important part of the manual in that by following these simple instructions, your Tracer Valve may be kept in peak operating condition. This will enable you to have a trouble-free running machine. This section covers the following adjustments:

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REPLACING THE DRIVE BELT

To replace the drive belt (140), the access cover (68) together with the escutcheon plate (67) has to first be removed. To do that, proceed as follows:

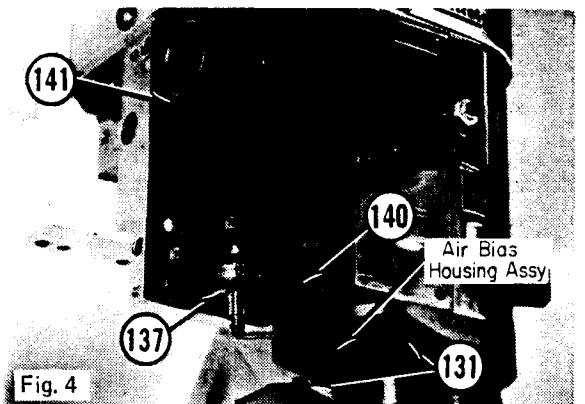
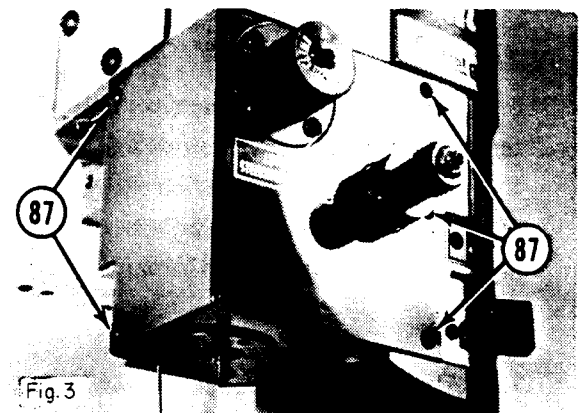
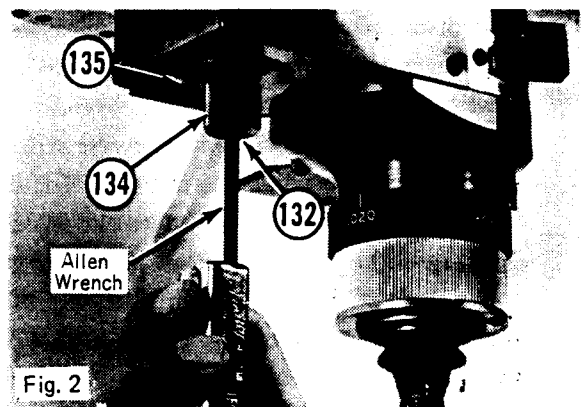
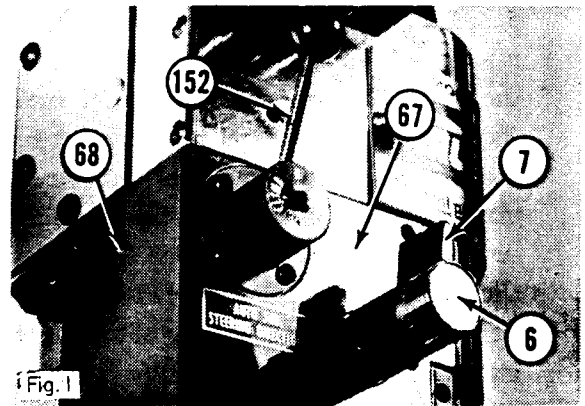
1. Unscrew the lever (152) out of the Servo-valve Assembly. Then remove the lever nut (6) and shutoff valve lever (7). Figs. 1 and 3.

2. Next, using an Allen wrench, remove the Allen nut (132) from inside the bias knob (134) as shown in Fig. 2. This will release the bias knob together with the lockwasher (133) and will allow you to remove the cover plate (135) from underneath the Servo-valve Assembly.

3. Now remove the five button-head screws (87) and the escutcheon cover. Fig. 4 shows the escutcheon cover removed exposing the Feed Direction Servo-valve Assembly (141) together with the drive belt (140) and pulley (137).

4. To get to the drive belt (140), you now have to remove the Air Bias Housing Assembly (129), which is held by three 8-32 socket head screws (131). When removing the housing assembly, care should be taken not to drop the two steel balls (155). This may be done by placing your small finger into the opening of the housing assembly as shown in Fig. 5. This action will prevent the steel balls from falling out while you are removing the housing assembly from the Tracer Valve.

NOTE: Later models have two roll pins for locating bias housing to nose assembly for close register.



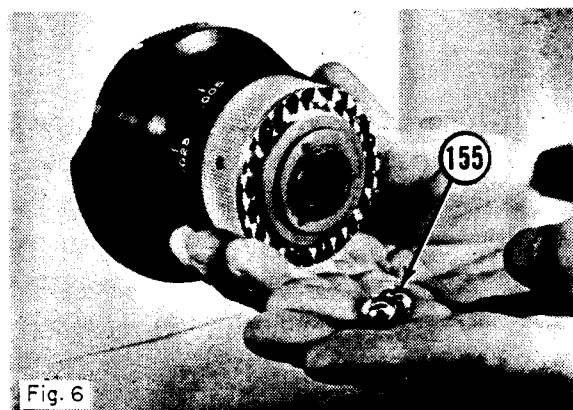
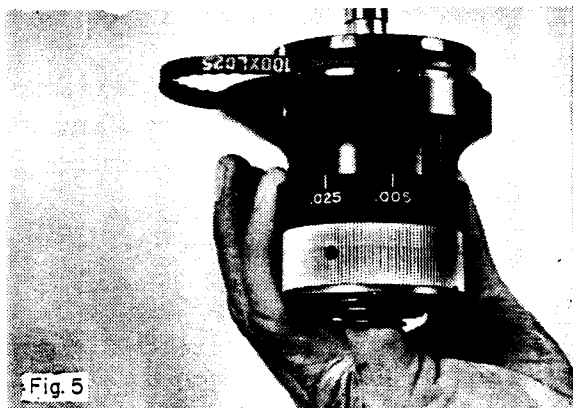
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Replacing the drive belt (cont)

5. Before replacing the new drive belt (140), it is advisable to remove the steel balls (155) from the Air Bias Housing Assembly and to inspect them for dirt or any foreign matter that might be stuck to them. The removal of these steel balls may be done by looking into the opening and turning the housing assembly in such a way as to allow the balls to fall out, one at a time. After cleaning the balls and blowing out inside the housing assembly, replace the balls by rolling them back into the opening with the ball location rotated to the bottom part of the housing assembly as you are placing them into the hole. After the new drive belt is on and in position, proceed to re-assemble the Tracer Valve in a reverse sequence as shown in the preceding illustrations. The drive belt may be placed in position on the motor pulley (137) by sliding the bias knob (134) onto the spline shaft of the motor. With the help of the thumb of one hand, push the drive belt and twist the bias knob at the same time, as shown in Fig. 7. This action will assist in getting the belt into position.

6. Before the access cover (68) is replaced, the tension of the new drive belt should be checked. It is possible that the drive belt may be too tight or too loose and may need adjustment. For adjusting the drive belt, see information in this section.

7. After the drive belt (140) is on the pulley, the bias knob (134) may be removed and the escutcheon cover replaced. Here again the reassembly of the escutcheon cover is done in reverse sequence of the disassembly as shown in the previous illustrations. For correct sequence of the assembly of parts, see exploded view in Parts Identification List section of this manual and Bulletin D-665.



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Replacing the drive belt (cont)

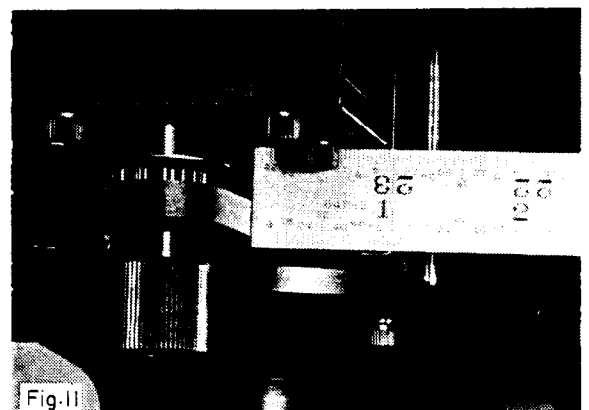
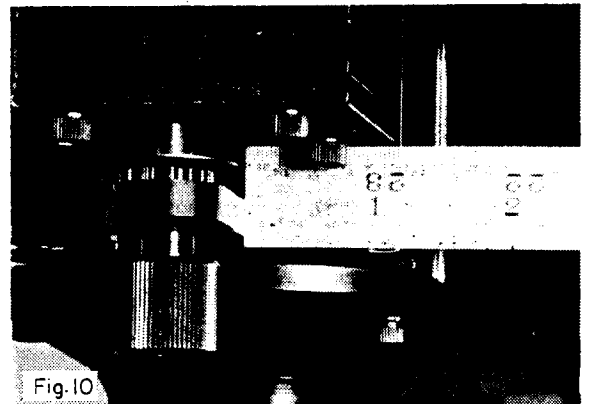
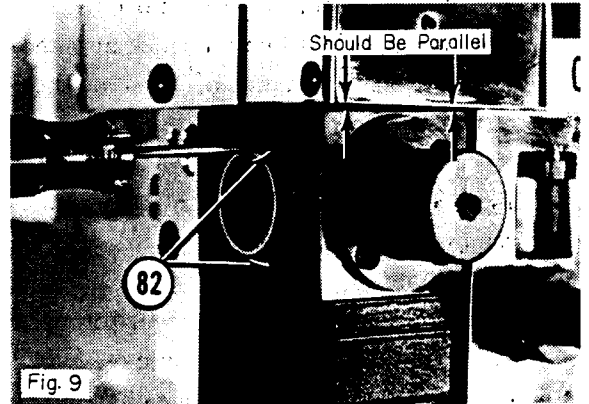
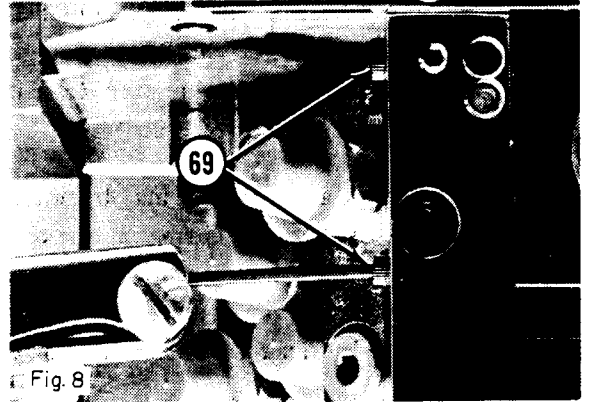
ADJUSTING THE DRIVE BELT FOR PROPER TENSION

The Feed Direction Servovalve Assembly is held in position by two 6-32 socket head screws (69) as shown in Fig. 8. These screws have to first be loosened before any belt adjustment is attempted. Loosening of these screws should be limited to moving of the assembly only. After the two holding socket head screws are loose, the whole assembly may be adjusted by inserting an Allen wrench as shown in Fig. 9 into the openings provided for this purpose. There are two 10-32 setscrews (82) for this adjustment.

A good guide to follow in adjusting the belt is the slot between the Feed Direction Servovalve Assembly and the body proper of the Tracer Valve itself. Again in Fig. 9, this slot is shown as not being parallel. To correct this condition, the setscrews (82) have to be repositioned rotationally.

In Fig. 9, the left side of the slot is wider than the right side. Consequently, the upper setscrew would have to be backed out and the lower setscrew would have to be advanced, in order to correct this condition.

The adjustment of the drive belt (140) has to be kept in mind at the same time. When the belt is in correct adjustment, there should be 1/8-inch play between the time that you touch the belt with the scale and when you depress it. The tension should be 1 to 7/8 of an inch, leaving a play of 1/8 inch as shown in Figs. 10 and 11.



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REPLACING THE SEAL IN ONE OF THE THREE REGULATORS (i.e., Stylus Pressure Regulator, 360 Auto, Vertical Stylus Pressure Regulator, or Steering Air Regulator 360 Auto)

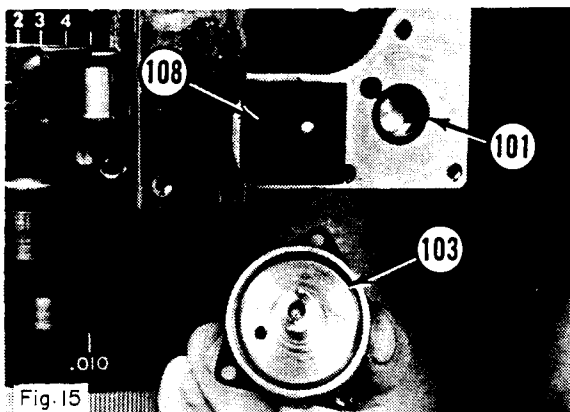
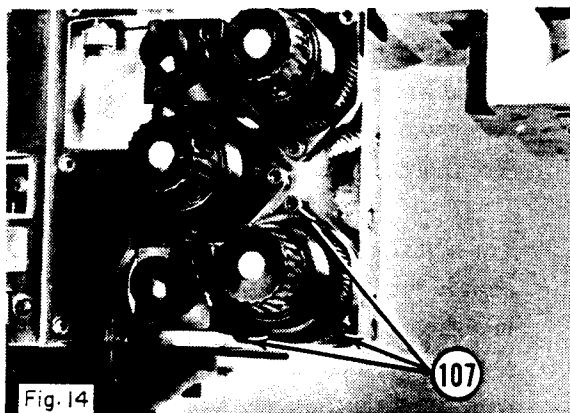
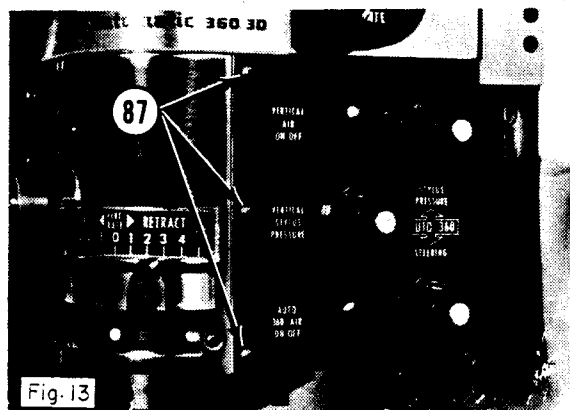
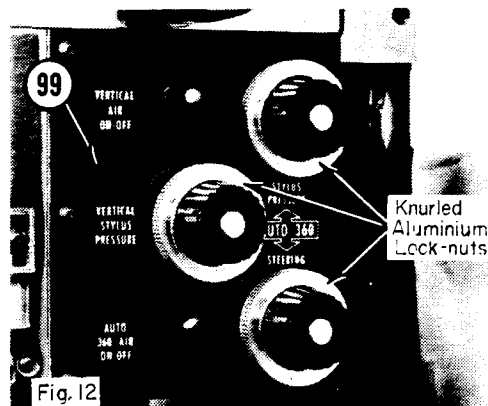
In the event of an air leak, it may be necessary to replace one of the seals (O-ring) in one of the regulators (106). To remove one of the regulators, it is necessary to first remove the cover (98) which is held down by five 6-32 button-head screws (87).

1. Before attempting to remove the cover (99), the three knurled aluminum lock nuts shown in Fig. 12 have to be taken off to allow the escutcheon plate to come off.

Fig. 13 shows the knurled aluminum lock nuts removed.

2. To remove one of the regulator assemblies (106), simply unscrew the three 6-32 socket head screws (107) holding each one of them. This will expose the two O-rings (101 and 103) as shown in Fig. 15.

To replace the regulator assembly (106), simply reverse the procedure in steps 1 and 2. In this case, as in all cases, when reassembling parts, make certain that there is no dirt or lint evident before "buttoning-up" that area. Also make certain that all bolts and screws are secure.

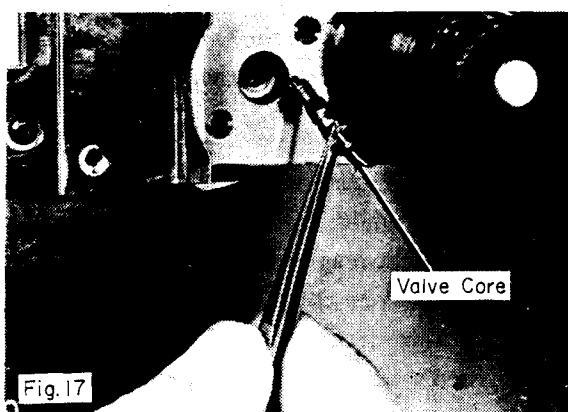
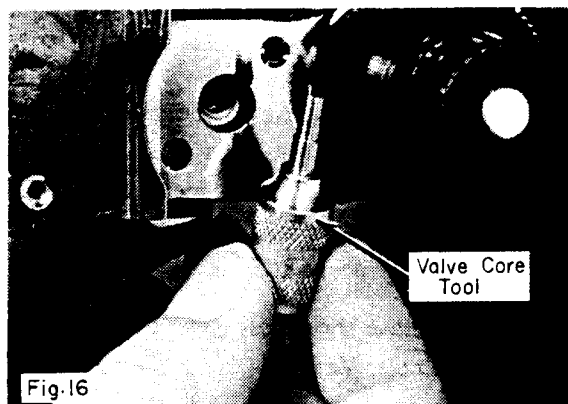


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REPLACING THE VALVE CORE IN THE
VERTICAL AIR ON-OFF VALVE OR THE
AUTO 360 AIR ON-OFF VALVE

When replacing the valve core (83), remove the air shutoff valve housing (108) by unscrewing the two 6-32 socket head screws (109). Fig. 16 shows the housing removed and the valve core exposed in the center opening.

To remove the valve core (83), a regular automobile tire valve core tool may be used as shown in Fig. 16. Simply back out the valve core and remove it with a pair of tweezers or similar tool as shown in Fig. 17. After the valve core is removed, replace with a new valve core and reverse the procedure in replacing the housing (108). Before replacing the cover (98), make certain that all the screws are secure and all housings in proper position and alignment. To replace the cover (98), simply reverse the procedure indicated in the beginning of this section. After the cover is replaced, screw the knurled aluminum lock nuts back on each regulator.



RATING IN THE SPOOLS

At certain times it may be necessary to adjust and equalize the speed of either the Cross or Longitudinal sector of the machine tool. This is called "rating in the spools." When this adjustment is necessary, proceed as follows:

- a. Remove the access cover (21) from the face of the Tracer Valve.
- b. Adjust one sector at a time. Start with either the Longitudinal or the Cross sector. When adjusting one sector, turn off the shutoff valve of the opposing section.
- c. With a screwdriver, turn adjusting screw (51) clockwise while deflecting spindle back and forth, until a slight drag is felt at the yoke. Then turn adjusting screw counterclockwise slightly until yoke moves freely without mechanical drag. Tighten setscrew (48) snugly.

Mechanical clearance at yoke may be checked with a dial indicator, as shown in Fig. 18. Holding spindle with one hand (in extreme left or right position), move control slide (50) right and left with other hand to determine clearance. Maximum desirable clearance shall be one ten-thousandth of an inch (0.0001).

- d. Repeat step c for second axis, being sure to adjust both axes equally.

NOTE: If the yoke is removed from the Tracer Valve for cleaning, be sure threaded half-nuts (49) located under setscrew (48) are installed, so as to prevent cross-threading of adjusting screw (51).

- e. Set the 360 Feed Rate Control (H) to maximum open position (Fig. 18). Loosen setscrew (48) about 1/8 of a turn, just enough to break the hold. With a small tool, screwdriver or Allen wrench for leverage, apply a gentle tapping action on the lugged adjusting washer (33) at the front of the spool, thereby rotating the lugged washer a few thousandths of an inch at one time (Fig. 19).

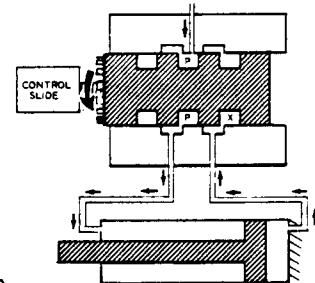
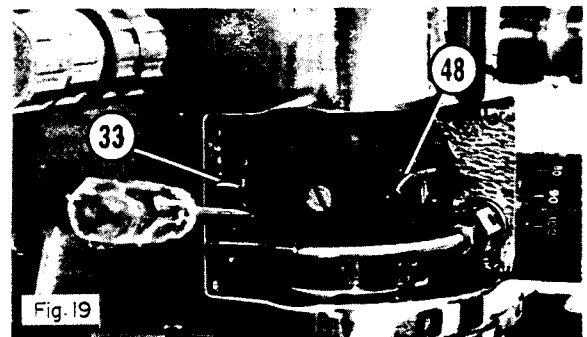
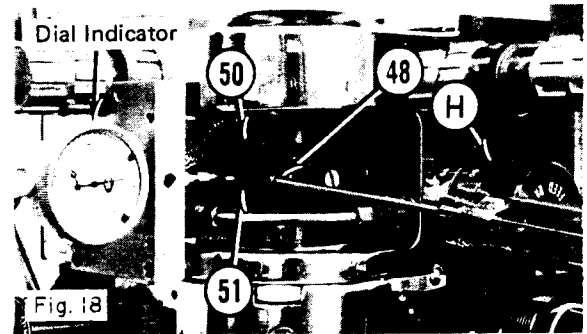


Fig. 20

CYLINDER STATIONARY

Here the Spool is off center toward the Control Slide. If the Machine Tool Slide involved is attached to the Piston Rod (the Cylinder being stationary) the Slide will move slower to the left and faster to the right. This will be more evident in the lower feed rates. To correct this condition, move the Spool away from (out of) the Control Slide as indicated by the arrow, counterclockwise.

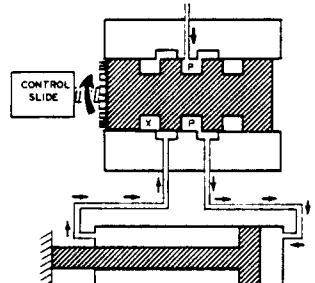


Fig. 21

ROD STATIONARY

Here the Spool is off center away from the Control Slide. If the Machine Tool Slide involved is attached to the Cylinder (the Piston Rod being stationary) the Slide will move slower to the left and faster to the right. This will be more evident in the lower feed rates. To correct this condition, move the Spool toward (into) the Control Slide as indicated by the arrow, clockwise.

Rating in the spools (cont)

This may have to be done in both directions (i.e., clockwise or counterclockwise), depending on the direction in which the Longitudinal or Cross member is moving faster. If after rotating the lugged adjusting washer (33) the Longitudinal or Cross sector becomes more out of adjustment than before, then you will have to turn the lugged washer in the opposite direction. (See illustration, Figs. 20 and 21.)

f. After an even adjustment is obtained of the same speed in both directions, the setscrew (48) should be tightened and slide speed rechecked.

g. A check should be made once more on this sector to be sure that the adjustment is correct.

The opposing sector is done in exactly the same manner. The shutoff valve should be open in the sector that is being worked on, and the shutoff valve of the opposing sector should be closed.

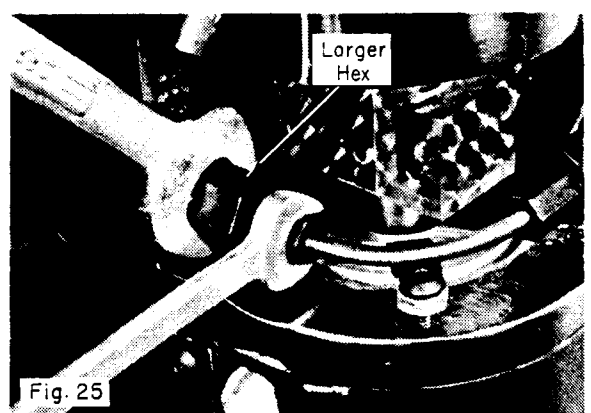
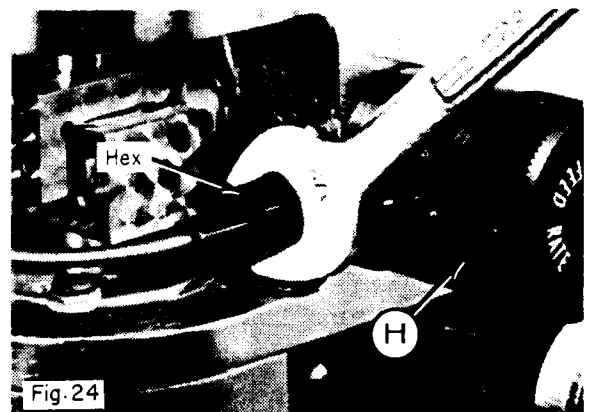
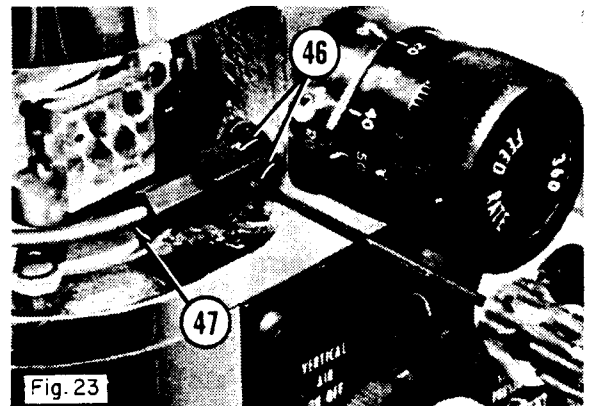
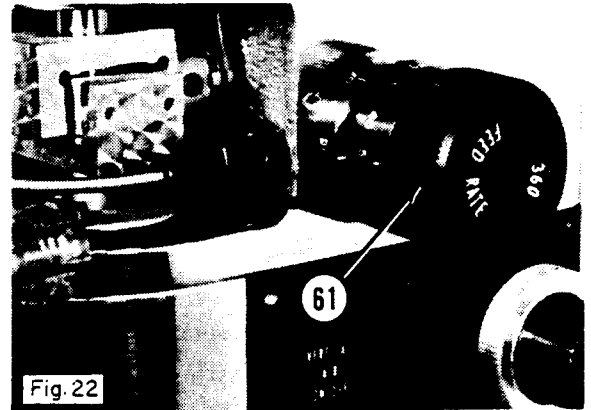
REFERENCE NOTE: A rotation of one degree of the spool moves the linear position of the spool approximately 0.0001 inch. The width of one lug on the adjusting washer is equal to 1/24 of the total circumference, or 15 degrees. Therefore, by rotating the lugged washer the distance of one lug width, the spool movement will be approximately 0.002 inch.

BALANCING THE X AND Y SECTORS

After the spools have been rated in, it will be necessary to balance the X and Y sectors so that they will be moving at the same speed in all four directions clockwise and counterclockwise, i.e., in conventional and in climb; for this purpose, a square template is necessary.

a. Loosen the 360 Feed Rate Control knob (H) by unscrewing setscrew (61) as shown in Fig. 22.

b. Remove both setscrews (46) on the flexible drive shaft (47). These setscrews are removed because they may not be in the same position after adjustment, and may not be accessible when tightening is necessary.



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