ROSEBROOK

TRACERS INC.

ROSEBROOK
CRESCENT GROUND
MODEL 6000
3 DIMENSIONAL AUTOMATIC TRACER

PATENTED

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SECTION I

GENERAL INFORMATION

HYDRAULIC OIL

The Kiro-Matic Crescent Ground Tracer will operate on any good grade of Socony Mobil, or exact equivalent, hydraulic oil of from 150 SSU to 300 SSU viscosity. Mobil Type DTE 24 (formerly called DTE light) 150 SSU is the grade most generally used.

OIL TEMPERATURE

The oil temperature should not exceed 130°F. regardless of the grade used. The lower the viscosity of the oil is, the lower the temperature that should be maintained.

Before any attempt is made to adjust the 360° feed rate of the tracer, find what the average running temperature is and set the feed rate of the tracer at that temperature. Example: High 120° - Low 110°F. Adjust feed rate at 115°F.

If this procedure is followed, less out-of-rate problems will be encountered throughout the working day.

OIL COOLERS

A fan-cooled type of oil cooler should be used when one is required. Run the dump line from the pressure relief valve to the "In" side of the cooler.

Do not choose a cooler for its volumetric capacity only. The larger a cooler is in relation to the pump GPM, the more effective the results will be.

POWER UNITS

The requirements of a power unit are:

1. Adequate horsepower to handle the volume and pressure required for the machine.

2. A 2-micron filter large enough to handle the full volume of the pump (or pumps, if used with depth control and rapid traverse). This can be either on the intake side or pressure side.

3. A cooler, preferably temperature controlled.

4. A two-pump system is required; however, variable volume pumps of certain types used with flow dividers have in some cases proven satisfactory.

5. A vacuum device of some type, which does not aerate the reservoir (such as Gast Mfg. Co. Vacuum Pump Model 0211-V36-G10, to scavenge the seepage oil from the tracer).

PRESSURE SETTING

The Kiro-Matic Crescent Ground Tracer will operate at any pressure from 150 psi to 1500 psi; however, 400 to 600 psi meets most requirements for small to medium machines, 1000 psi for large heavy machines. The lower pressures are conducive to lower minimum feed rates, but higher pressures compress the entrained air in a system and give better control, particularly when climb cutting.

CYLINDERS

Crescent Ground Tracers have been found to be compatible with any well designed standard type hydraulic cylinder. Cylinder should not have internal leakage. For trouble-free service, the ID of the cylinder and the rod surface should have a 10-micro or better surface. Chevron type rod seals are most desirable. Cylinders must be equipped with bleeders on each end. Cylinder sizes should be chosen for compatibility with the size of the machine and the work to be done. Reference Rosebrook conversion recommendations Spec. No. 40020.

The most effective and efficient method of removing metal when milling is climb cutting. When climb cutting, the cutter biting into the work piece is like a rack and pinion, the cutter being the pinion and the work piece the rack. Here the cutter torque, which is sometimes multiplied many times, tends to pull the work along rather than allowing the cylinder to push. Under these conditions, a cylinder must be large enough to hold the work in check; therefore, a large area cylinder is required. Reference Rosebrook Spec. No. 40020.

In choosing a cylinder for any tracer controlled machine, remember that the cylinder's first function is to minutely control very sudden changes of movement in any direction. The second consideration is to move the load. A small cylinder at high pressure will move the load but cannot control it.

FLUID MOTORS

Fluid motors with anti-backlash ball screws have proven very satisfactory under certain conditions.

If gearing is required between the fluid motor and the screw, be sure there is no lost motion in the gearing as this will show up in bad tolerances and surface finish.

NOTE

Tracers used with fluid motors require a special grind and are not compatible with cylinder equipped machines.

GENERAL TROUBLE

Although the Kiro-Matic Crescent Ground Tracer is built to very close tolerances, it is really quite rugged. Heavy service will not harm it but abuse can.

Unless the tracer has been abused, most malfunctions are found by service personnel to be from conditions beyond the tracer's control.

Listed below are general difficulties encountered in the approximate order of most frequent occurrences.

A. 360 feed rate not uniform (see 360 Feed Rate Setting, page 20).

B. Rod or cylinder brackets loose or weak.

C. Tracer mounting brackets loose or weak.

D. Tracer spool bind because of fittings being installed too tightly or lack of proper filter.

E. Gibs too loose on the machine.

F. Gibs too tight on the machine.

G. Ways not properly lubricated.

H. Machine not level.

I. Bad foundation.

J. Blow-by in the cylinders.

K. Improper setup.

L. Cutter and stylus not 1 to 1 ratio.

M. Stylus eccentric or bent.

N. Tracer spindle bent.

O. Oil Leakage or blow-by in the system.

P. Worn ways causing fish tail.

Q. Bad machining technique.

R. Inadequate operator training.

S. Improper hydraulic hookup.

T. Cutter spindle runout.

U. Cutter spindle defective.

V. Cutter runout.

W. Contaminated or improper oil.

X. Bad tooling.

TRAINING PROGRAM

A training session, at the Schneebeck plant, is offered to anyone authorized by the original purchaser of a Rosebrook Tracer. There is no charge for this training. If, after reading this manual, it is felt that such a session would be in order, contact Schneebeck Sales Department for further details.

REPAIR PARTS

When ordering repair parts, please state the Serial No. of the tracer, and the part numbers of the parts desired. The parts list drawing identifies each part with an index number which is the same on the parts list.

SECTION II

OPERATION

The Kiro-Matic 3D AUTOMATIC TRACER is designed to give you the best control over any condition that may be encountered when duplicating parts from a template or master.

The CRESCENT GROUND FLOW BALANCE of the servo valves provides infinitely variable feed rates. The area of the cylinders or displacement per revolution of fluid motors, however, will determine the maximum and the minimum feed rate of any given machine.

The function of the tracer is to infinitely meter the volume of oil and regulate the pressure balance simultaneously to either side of any one of three coordinated hydraulic actuators, which in turn control the X, Y, and Z (360 - 3D) movements of a machine tool.

The pencil type "Joy Stick" stylus spindle, when manually or automatically urged toward and along a pattern, induces definite coordinated micrometer controlled movements of the three servo spools.

The horizontal spools (360) are absolutely coordinated in their movements by the yoke assembly, which is in turn controlled by manipulation of the stylus movements.

The yoke assembly permits a completely free 360° movement of the horizontal spools as well as allowing the stylus spindle to be moved vertically for control of the 3D movement.

The 360 rate control on the top of the tracing valve controls longitudinal and transverse feed rates.

Hand shut-off valves are provided for each servo valve in the 360 section of the tracer. These shut-off valves are not intended for metering feed rates. They are to be used to lock out movement of either horizontal slide, to facilitate indicating a fixture alignment, or to stop and hold movement when pick feeding to remove metal in a straight line over a 3D template.

A hand valve is also provided to shut off pump pressure to the tracer to stop all movement.

BIAS CONTROL

The bias control has a simple trigger actuated mechanism to enable the operator to engage or disengage the bias pressure with the thumb or finger of the guiding hand.

When the bias control is automatically directed at approximately 45 degrees toward the template, and in the direction of desired travel around the template, it leaves the operator free to do other work until a bias correction is required.

The 3D rate control dial should always be set at between "0" and "5" graduation when tracing 360 only.

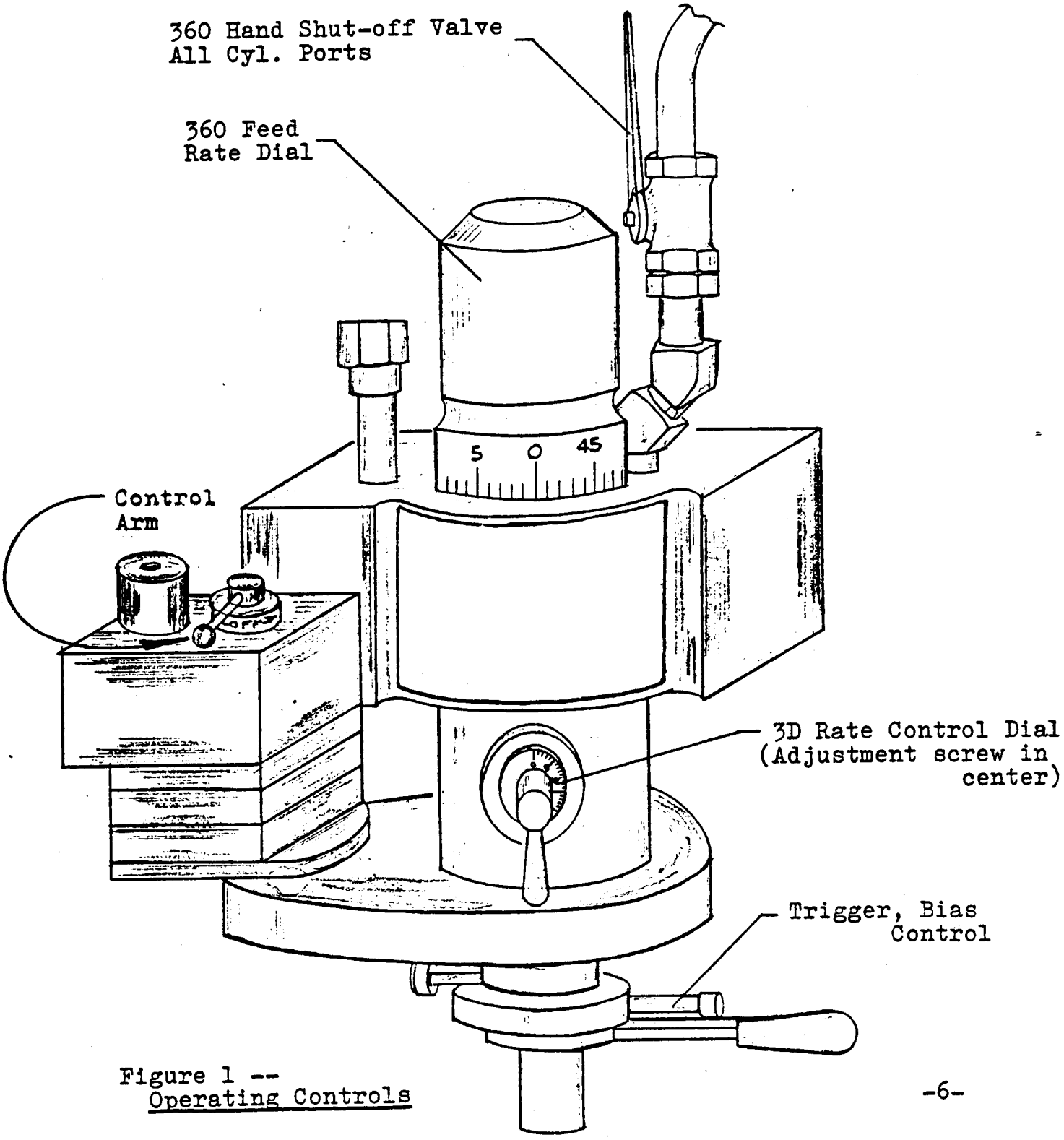


Figure 1 --
Operating Controls

The 3D rate control serves two purposes:

1. To control the rate of feed when plunge cutting.
2. To retract and hold the cutter out of the part for reloading, etc.

When the 3D rate control dial is set at "0", the vertical slide should remain practically stationary. As the dial is rotated to the left, the rate of plunge is increased, and as the dial is rotated to the right (no graduations), the speed of retract is increased.

NOTE

Do not try to trace on a flat plane with the 3D dial set at "0"; the cutter may drift up.

To trace a flat plane, set the 3D rate control dial at a pre-selected graduation which corresponds to the desired rate of plunge. After the stylus has touched the floor of the template, rotate the dial to about graduation "5".

If you do not wish to make a full depth cut, close the 3D hold shut-off valve when the desired depth is reached, but leave the dial set at the plunge rate feed setting until full depth is reached, then set at "5" graduation for finishing.

The stylus weight counter balance adjustment, which is located at the lower end of the tracer just above the bias control, enables the operator to compensate for the weight of a heavy stylus. Rotation to the right increases the lift, and rotation to the left decreases the lift.

CAUTION

Always be sure that the counter balance adjustment screw NEVER HAS LESS THAN 1/8 INCH space between its lower surface and the top of the bias control body. If this clearance is not present, the tracer spindle cannot be lifted for retracting.

Some machines are equipped with both 3D tracers and 180 solenoid activated depth control servo valves. This type of installation has changeover valves incorporated into the hydraulic circuit controlling the vertical slide. This system enables the operator to use the 3D servo valve which is operated by stylus manipulation for tracing up and down over a pattern, or to shift to 180 control for holding depth of cut in various planes on the part being produced.

CAUTION

It must be remembered that the 3D tracer has no control over the vertical slide movement when the hydraulic circuit is directed or shifted to the 180 depth control servo system. In the event the operator energizes the 180 circuit to plunge toward the work, and the end of the 3D tracer stylus contacts an obstruction, the tracer or machine could be badly damaged.

SAFETY SWITCH

If the tracer is equipped with an electronic safety switch accessory, the tracer spindle will move upward into the body of the tracer and cause the 3D servo spool to move to the extreme limit of its travel. Just before the spool reaches this limit, it trips a switch which opens the electrical circuit leading to the 180 solenoid and causes the 180 servo valve to retract the vertical slide.

After corrections have been made, the operator can press the reset button on the bottom of the switch housing to reactivate the 180 electrical circuit.

This switch can also be manually tripped, by lifting up on the stylus, for a quick retract without reaching for the 180 retract control switch. Reference Fig. 2 Safety Switch Reset Button.

ADJUSTMENT PROCEDURE

(May be required when the switch unit is removed)

1. Make sure that the hydraulic power unit is OFF.
2. Check mounting screws to insure firm location of the Safety Switch Assembly on the Tracer Head.
3. Unscrew 3D Rate Dial (left) to its extreme stop position.
4. Loosen Override Adj. Screw, set 360 Rate Dial to "49."
5. Remove cover on switch unit.
6. Unscrew Adj. Screw (7) on the Rocker (6) 3 turns.
7. Press reset pin (10) to reset switch.
8. Hold tracing head spindle at its extreme retracted position.
9. Turn in Adj. Screw (7) slowly until the trip point of the switch is heard. Continue 1/2 turn inward. Release spindle and reset switch with reset pin (10).
10. Lift Tracer Spindle to trip the safety switch which should occur just before the extreme up position is reached. Make corrective adjustments on the Adj. Screw (7) if necessary.
11. Replace cover.

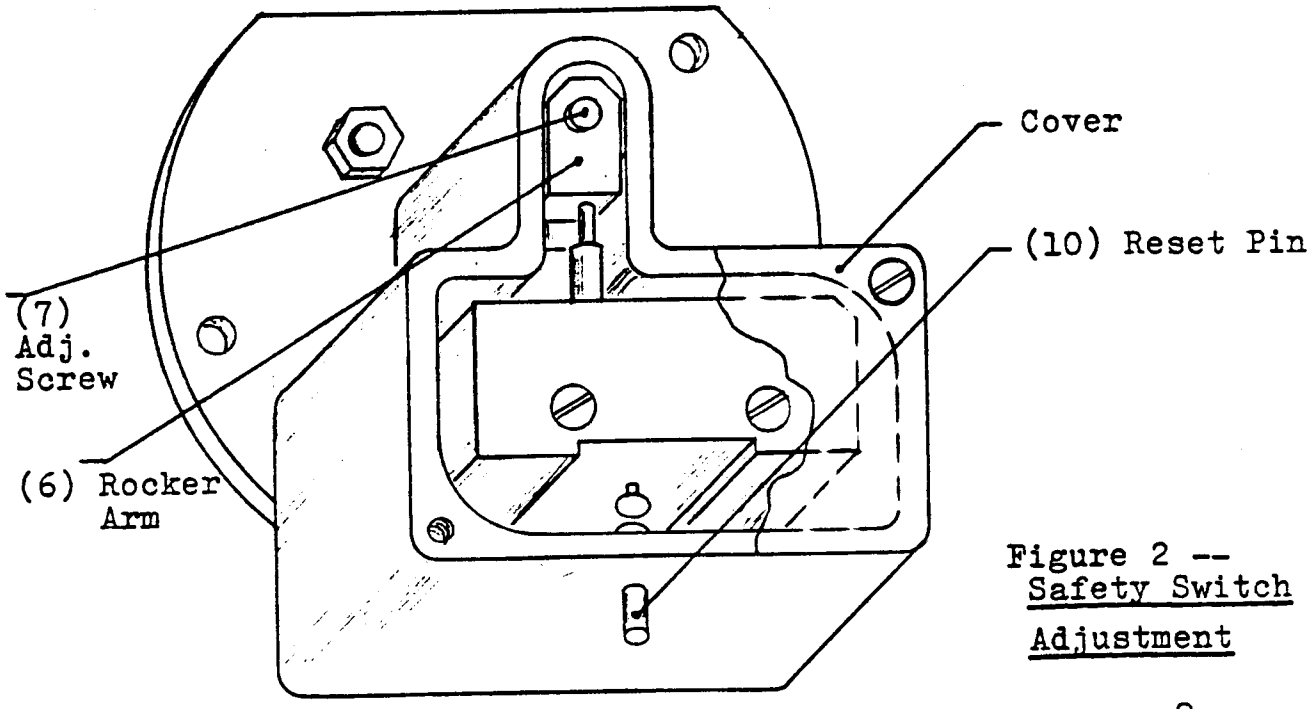


Figure 2 -- Safety Switch Adjustment

SECTION III

MAINTENANCE

YOUR NEW KIRO-MATIC AUTOMATIC CRESCENT GROUND TRACER AND HOW TO ADJUST IT

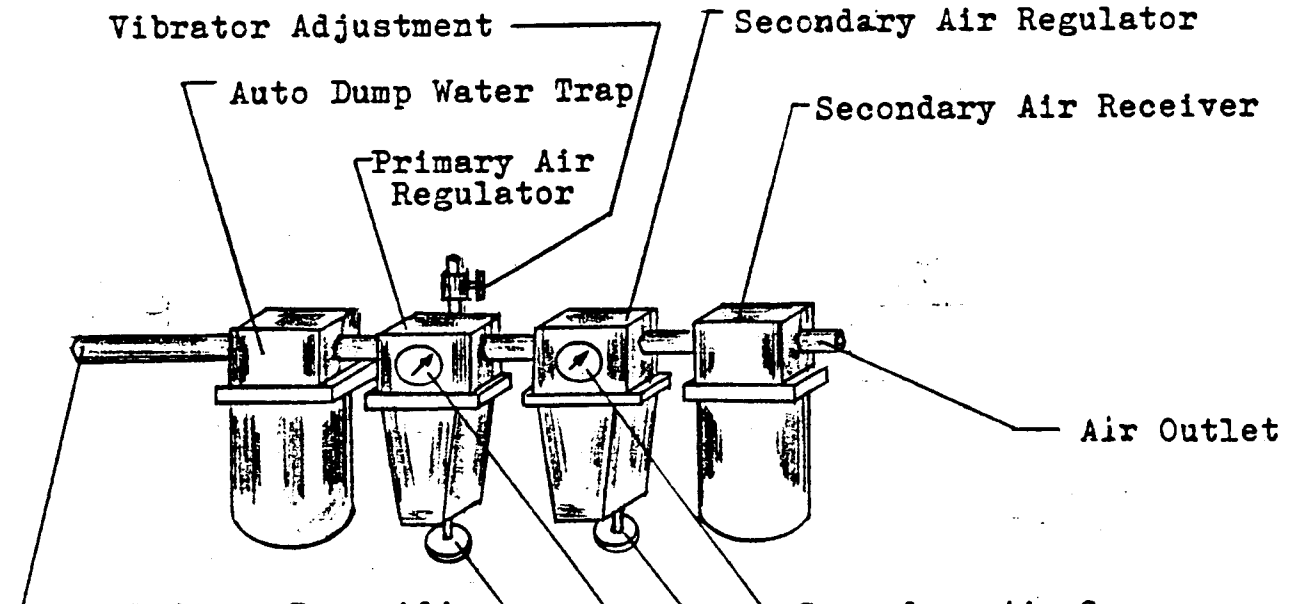
Whether you have received your Crescent Ground tracer on a new machine tool, to replace an obsolete type of tracer, or for use on a machine of your own creation, rest assured that the tracer has been adjusted and thoroughly tested on a prove-out machine at the factory. Unless it has been badly handled in transit to you, only the air supply, bias angle, and feed rates may need to be adjusted before putting the tracer into operation.

The type of hydraulic actuator used has an effect on the adjustment to balance the feed rate. A double-end cylinder with equal size rods or a hydraulic motor requires a perfect spool null setting. A cylinder with a single-end rod requires a slight spool offset to compensate for the cylinder area differential, depending upon the rod size and from which end of the cylinder the rod works.

Assuming no damage, and that you have connected the lines correctly, (see Figure 5, Pressure-Exhaust and Cylinder Ports) the following simple adjustments should get you into operation quickly.

STEERING ADJUSTMENT

Set air regulators, primary regulator air supply ass'y (12) to 45 psi, secondary regulator air supply ass'y (13) to 10 psi.



(FIG. 3 AIR SUPPLY)

1. Set steering selector to "OFF." Start hydraulic pump and adjust pressure to 500 - 600 P.S.I.

2. Check steps #1 to #9 (pages 20-22)

3. Turn steering selector clockwise to the stop (left).

4. Loosen LOCKNUT and adjust BIAS ANGLE ADJUSTING SCREW to find "null point" on spindle rotation. Then adjust to point of clockwise rotation (approx. 1/16 turn).

   Check to see if rotation reversal is possible by deflecting spindle stylus.

5. Turn steering selector to right hand stop (counter-clock wise).

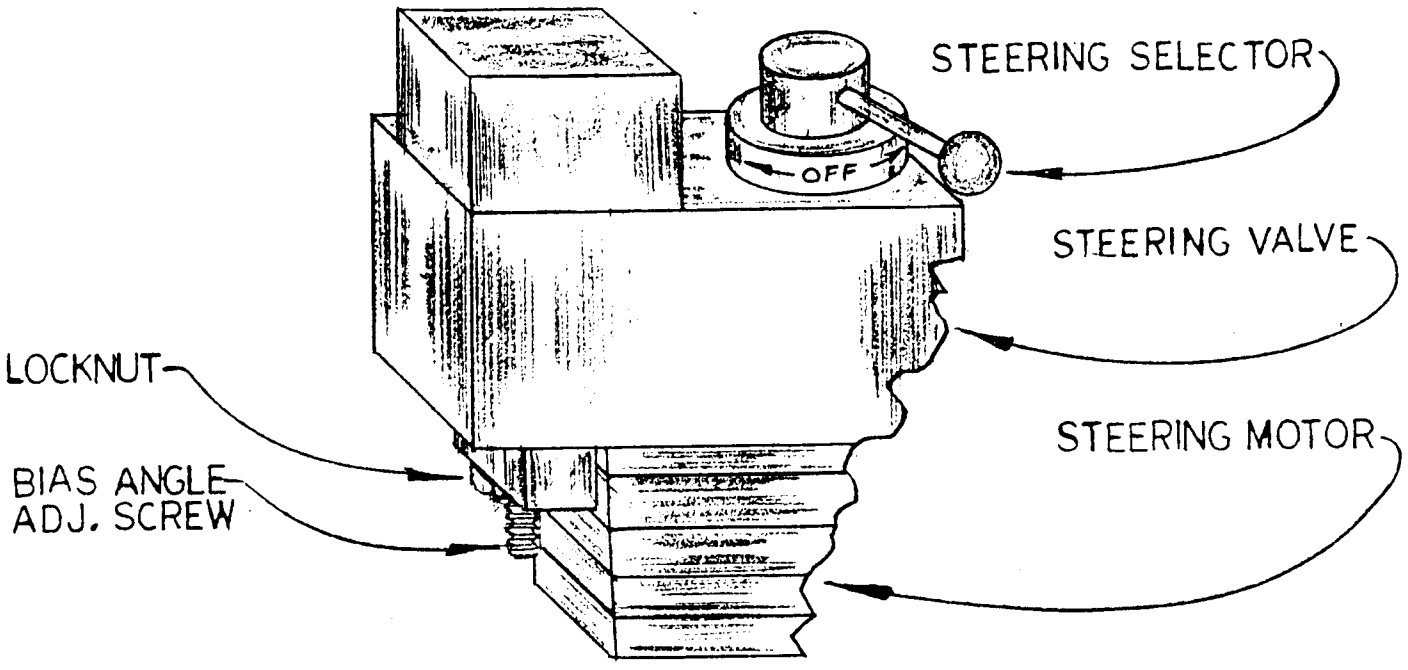
   Spindle should rotate counterclockwise and reversal should be possible with spindle stylus deflection.

6. Carefully adjust BIAS ANGLE ADJUSTING SCREW until steps 4 and 5 are met in balance in both directions.

   NOTE: The angle of the bias handle in relation to straight edge: This angle should be 45° ±10°. If not, correct angle by adjusting the set screw on steering valve.

7. Check bias angle at "0" rate on all 4 sides of template in both feed directions. To correct difference in bias angle between feed directions, check alignment of bias control with mark on spool or with air orifice hole in carrier spool. To correct difference in bias angle between two sides of template, recheck step 3 (360 feed rate setting).

   Note: This is a very critical adjustment.



SEQUENCE OF ADJUSTMENTS

In the event that it becomes necessary to completely readjust the Kiro-Matic 3D Tracer because of an accident, abuse, disassembly for inspection, or to replace worn parts, proceed in exactly the following order.

1. Spindle pivot bearing adjustment (see Spindle Reassembly Adjustment, step 5 and notes, page 14).

2. 3D adjustment screw center or mid-position setting (page 17-18, steps 1-20).

3. 360 feed rate setting (page 20-22, steps 1-9).

SPINDLE ADJUSTMENT

Adjustments of the spindle are simple but touchy; proceed with care and complete cleanliness.

Removal and Disassembly

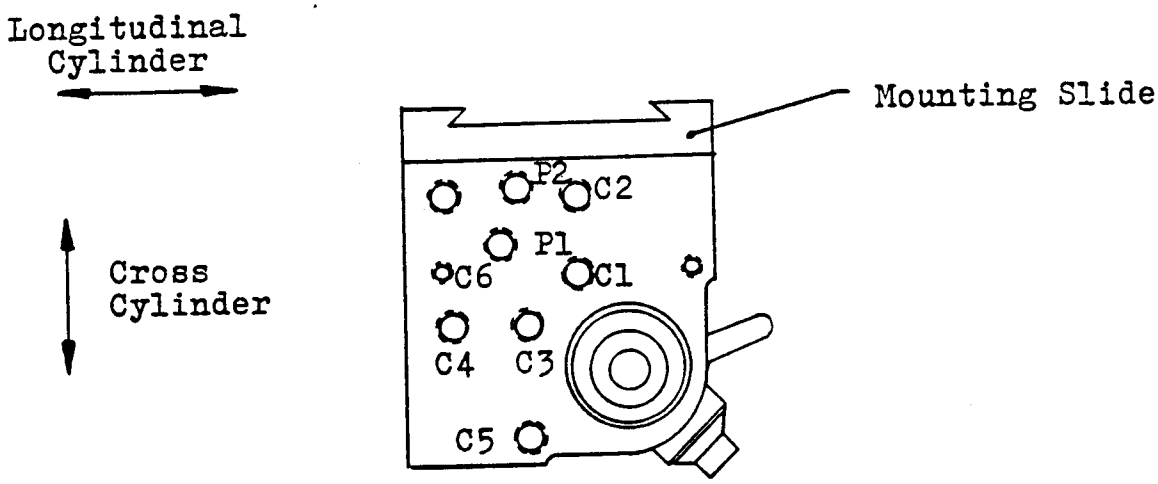
NOTE: These instructions apply to tracers with or without the safety switch (3300) accessory.

1. Remove the two 8-32 Round Head Screws (90197-6, Page 27) in the 3D Cover Plate (3076) and remove cover plate and Spring (3080). This releases pressure on Translator Ball (90004-8). Do not remove 3D spool.

2. Loosen Lock Screw (90002-3) in the bias control assembly and remove bias assembly.

3. Unscrew (left, looking up) Counterbalance Adjustment Screw (6096) and remove adjustment screw and spring (6086).

4. Loosen 8-32 Round Head Screw (90195-6) which holds 3D Dial Stop (3038), two turns.



PATTERN OF PRESSURE-EXHAUST
AND CYLINDER PORTS
(Right-Hand Mounting Shown)

LEGEND
(As Shown Above)

X = Common Exhaust

C1 = To Cross Slide Cylinder

C2 = To Cross Slide Cylinder Opposite End

C3 = To Longitudinal Cylinder

C4 = To Longitudinal Cylinder Opposite End

C5 = To Vertical Cylinder

C6 = To Vertical Cylinder Opposite End

P1 = Horizontal Pressure

P2 = Vertical Pressure

Figure 5 -- Pressure-Exhaust and Cylinder Ports

5. Hold spindle assembly as 3D Rate Control (33) is unscrewed to the left until spindle assembly drops free for removal.

6. Lock washer (17) prevents vibration from loosening the spindle assembly. The washer has a tongue protruding into its inner hold which engages the slot in the pivot bearing adjustment screw, spindle ass'y (4). The washer has been staked one direction into the notch on the bottom of spindle Carrier Spool, spindle ass'y (2), and in the opposite direction into the slot of Lock Nut, spindle Ass'y (6). Carefully, with a square punch, unstake the lock nut side.

CAUTION

Do not clamp spool in vise.

7. Rotate Lock Nut, spindle ass'y (6) to the left 1/2 turn. Unscrew (left) pivot bearing adjustment screw, spindle ass'y (4) and slide Spindle, spindle ass'y (1) our of Spool, spindle ass'y (2). (See Figure 6, Locknut Removal and Installation)

Reassembly

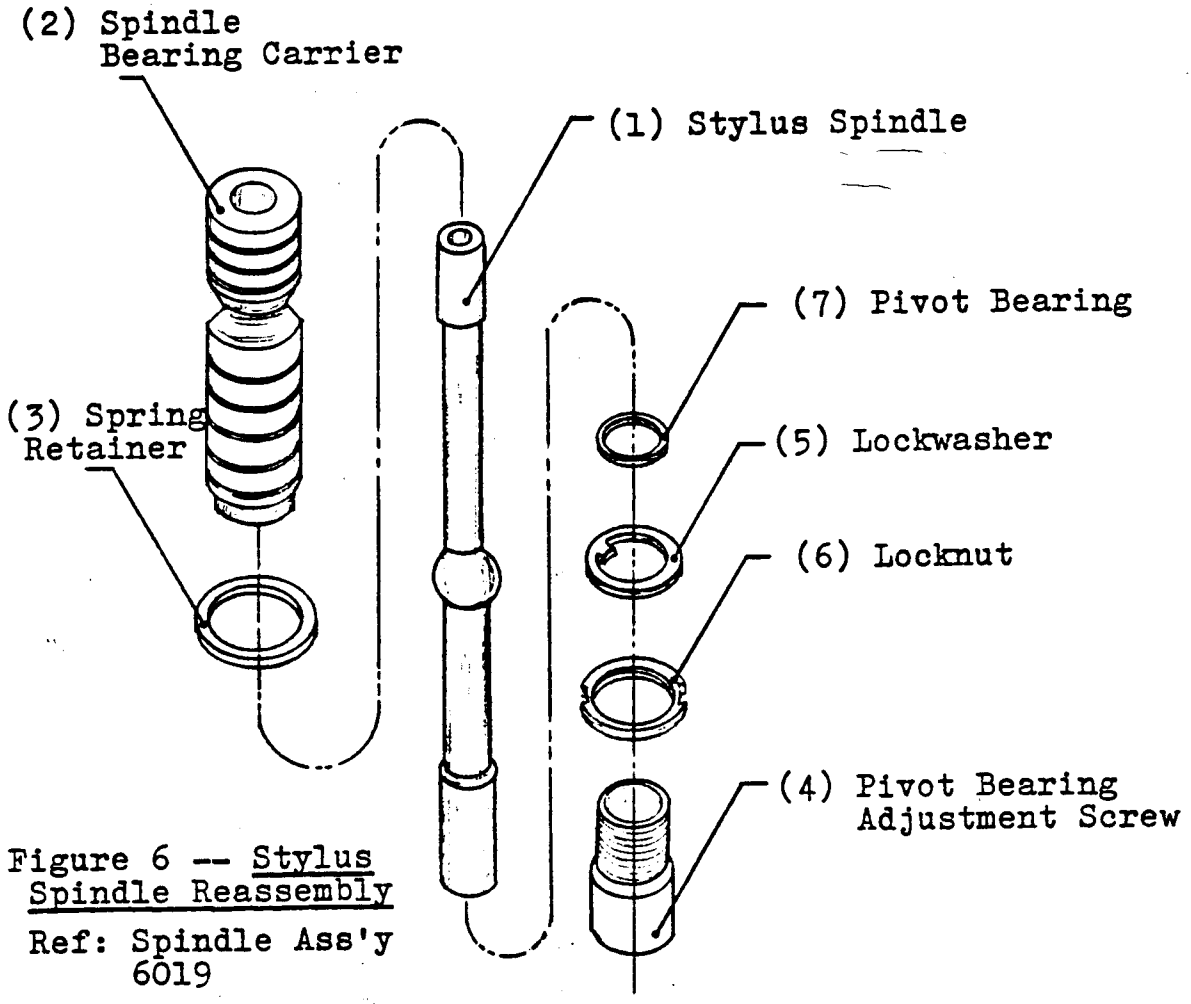


Figure 6 -- Stylus Spindle Reassembly

Ref: Spindle Ass'y 6019

Wash all parts in solvent and keep clean during assembly.

1. Lay Lockwasher, spindle ass'y (5) on flat surface and lightly hammer out the stake marks.

2. Thread Locknut, spindle ass'y (6) onto Adjustment Screw, spindle ass'y (4). (If lockwasher is placed upside down from the original assembly, the old stake marks will not affect a new lock position)

3. Slide the Pivot Bearing, spindle ass'y (7) with spherical side toward ball, onto the stylus end of the Spindle, spindle ass'y (1). Next slide pivot bearing adjustment screw, spindle ass'y (4) onto the spindle after the pivot bearing.

4. Place Spring Retainer Washer, basic valve ass'y (17) over small end of Spool, spindle ass'y (2). Insert the spindle as assembled, small end first, into threaded end of spool, and thread pivot bearing adjustment screw, spindle ass'y (4) in until the pivot bearing is seated.

NOTE

The next step requires a little patience to obtain the correct adjustment for a slight drag fit.

5. Hold the Spool, spindle ass'y (2) in your hand and with the other hand tighten the adjustment screw, spindle ass'y (4) until a very slight bind is felt when the spindle is oscillated in all directions. Hold spool, spindle ass'y (2) in hand and tighten Locknut, spindle ass'y (6) by striking spanner wrench with hammer (see Figure 7, Locknut Removal and Installation). Remember, no vise.

NOTE

As the locknut is tightened, it tends to pull the inner end of the adjustment screw away from the pivot bearing a few tenths of a thousandth (.0000), thus creating a free but close fit to the ball on the spindle. The oscillating feel must have slight drag with no lost movement in ball adjustment either in and out or sideways. If necessary, repeat the adjustment using more or less bind on the first adjustment, as stated in step 5, until adjustment is correct.

NOTE

Strike spanner wrench sharply with hammer if necessary for disassembly, and as standard practice for reassembly.

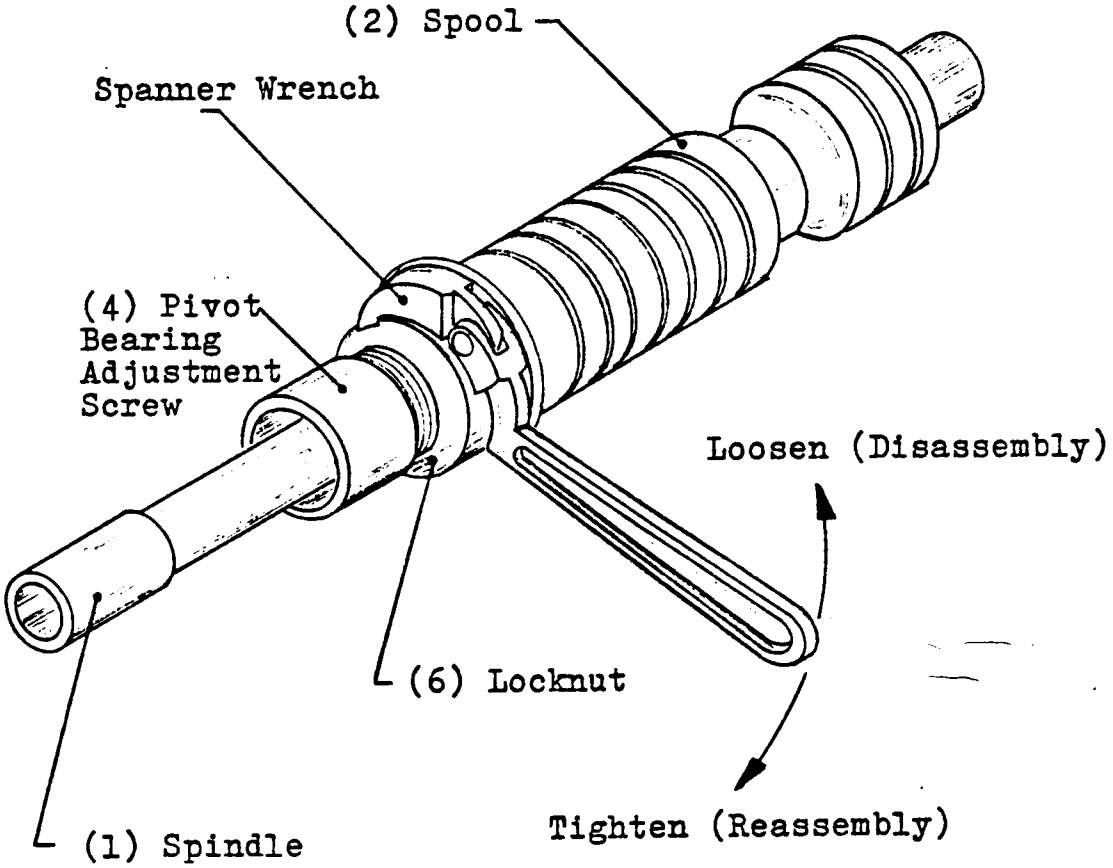


Figure 7 -- Locknut Removal and Installation
Ref: Spindle Ass'y 6019

NOTE

If the adjustment is too tight, the operator will feel a stiffness in operating the tracer and will find it difficult to hold to the template. If adjustment is too loose, it will affect tolerance and finishes on the parts produced.

6. When the adjustment is correct, place the assembly on clean rags on the bench with pivot bearing adjustment screw towards you and rotate the spool until the stake notch in the spool is up.

   With a punch, stake the lock washer into the left side of the notch in the spool (see Figure 8, Lockwasher Staking).

   Next, rotate the spool until the slot in the lock ring is up and stake the lock washer into the right side of the slot.

NOTE

Slots in spool and locknut need not be in relationship shown.

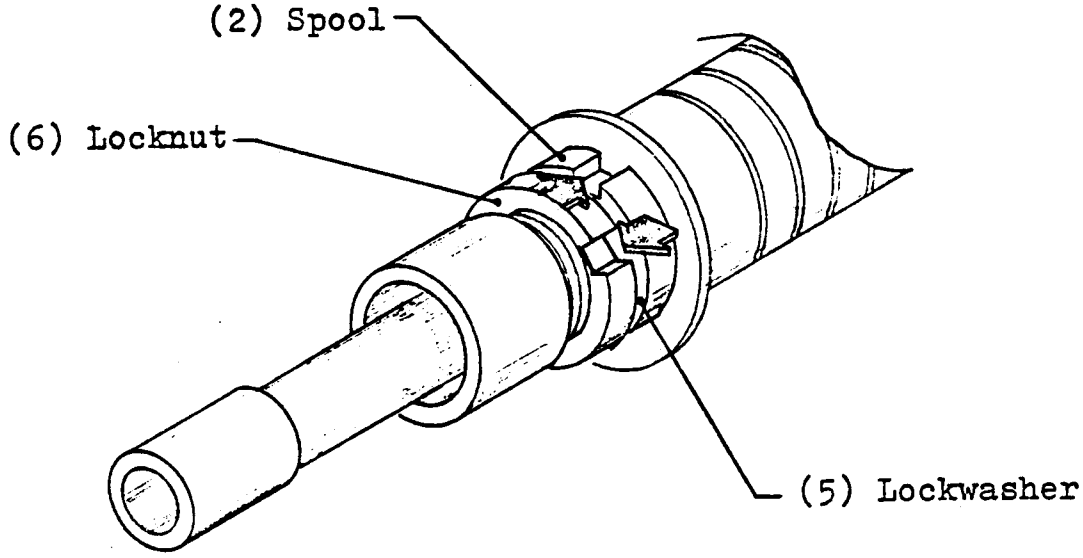


Figure 8 -- Lockwasher Staking
Ref: Spindle Ass'y 6019

7. Insert the spindle assembly carefully and clean into the tracer, guiding the spindle over the function rod and through the rate ring.

NOTE

Be sure Translator Ball, basic valve ass'y (51) is in the hole in the side of the Translator Sleeve (15).

8. Replace Rate Control Dial (33) and tighten 8-32 screw in Dial Stop (40).

9. Replace Counterbalance Spring (19) and Counterbalance Adjustment Screw (18).

10. NOTE: Replace bias control assembly, being sure to align the lock screw with mark on spool, in line with air orifice hole. Tighten Lock Screw, bias control ass'y (8) securely.

3D ADJUSTMENT SCREW CENTER OR MID-POSITION SETTING

1. Loosen 8-32 Round Head Screw, basic valve ass'y (40) two turns to let 3D Rate Control Dial (33) pass the Dial Stop (9) clip.

2. Loosen 10-32 Set Screw (56) in 3D Rate Control Dial (33) and remove the dial.

3. Screw the 3D Rate Control Adjustment Screw (11) in (right) as far as it will go (with your fingers only).

4. Replace Dial (33) on Rate Control Screw (11). Set at zero and press dial in as far as possible, overriding the Spring (12) in Friction Pin (13), and then lock Set Screw (56).

5. Turn Dial (33) to the left one full turn to zero and retighten Screw (40) on Dial Stop (9).

6. Turn on hydraulic pump and check vertical null position (3D) by rotating Dial (33) right and left approximately five graduations each way. If null point is reached within these limits, reset the dial to match zero and the index mark on the face of the 3D Rate Control Body (14).

NOTE

Face of Dial and face of Rate Control Body should be held flush with each other as Set Screw (56) is locked.

If conditions of step 6 are not satisfactory, proceed as follows.