ROSEBROOK

SERIES 180° A DYNATRACE

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MIMIK 180°A DYNATRACE SYSTEM

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OPERATING AND MAINTENANCE INSTRUCTIONS
MIMIK DYNATRACE 180°A TRACING SYSTEM

I. GENERAL DESCRIPTION

The MIMIK Dynatrace 180°A system is a hydraulic tracer control which provides movements along two machine axes through hydraulic motors attached to the feed screws. As selected by the operator, one axis provides trace movement while the other provides feed movement. Rate of feed throughout the contour path is modulated to permit tracing of parallel opposed shoulders and to provide a uniform rate of tool feed.

A schematic layout of the hydraulic system is given in Figure 1, and the major components of the system are described below. (See also Figure 1A)

HYDRAULIC MOTOR DRIVES

The two feed screws providing movement to the saddle and cross-slide on a lathe, or the saddle and the ram on a VTL, are driven by hydraulic motors controlled by the tracer system. To increase torque and permit suitable low speed operation, a reduction gearbox is usually provided between the hydraulic motor and the feed screw.

On most machines a single-ratio worm gearbox is used, and disengagement from the feed screw is provided by a clutch. On smaller lathes a dual-speed spur gearbox is used, and the shift lever can be set in neutral to disengage the feed screw. A clutch can also be provided with this type of gearbox if necessary. Where a wider range of feed rates or greater torque is required, a spur gearbox can be added to a worm gear drive. Figure 2 illustrates this arrangement along with a standard drive assembly.

Drives are mounted individually on a lathe, one at the tailstock end of the bed and one at the rear of the cross-slide. On VTL's both drives are secured to the end of the cross-rail by means of a common mounting plate, and graduated dials are provided to indicate rotation. Oldham couplings are used to connect to the machine's feed screw.

TRACER VALVE

In response to stylus deflection from the template, the tracer valve controls amount and direction of oil flow in the trace axis circuit, causing the cutting tool to describe a path identical to the template contour. Simultaneously, it varies the amount of oil flow in the feed axis circuit as the contour changes. This co-relation between trace and feed rates results in a uniform rate of tool feed over the contour and permits the tracing of parallel opposed slopes.

To ensure maximum sensitivity, a small air-operated vibrator is fitted to the stylus collet. The valve is also equipped with a limit switch which shuts-off the pump motor if stylus over-deflection occurs. A lever is provided to select either infeed or retract. Tracer valve details are shown in Figure 3. See also Figure's 5, 6 & 7.

The tracer valve is mounted to the machine slide which carries the cutting tool, both tool & tracer valve thus moving in unison. A 2-axis adjustment slide with graduated dials permits exact positioning of the stylus relative to the template, & a pivoting arm allows rough positioning.

CONTROL CONSOLE

Mounted either on the machine or on the hydraulic supply unit within reach of the operator, the control console houses a trace and feed mode selector valve, along with adjustable controls for setting the desired rates of feed, trace infeed, and trace retract.

HYDRAULIC SUPPLY UNIT

The source of hydraulic power is an 8 g.p.m. variable volume pump driven by an electric motor. Mounted to the supply tank is an electrical panel containing a fused disconnect and magnetic starter.

TEMPLATE RAIL AND BRACKETS

A rigid template rail is provided for mounting flat templates. For engine lathes, adjustable centers are available for use with round masters. Supporting brackets mount on the cross-rail of VTL's or to the rear of the bed on engine lathes.

OIL DRAIN LINE VACUUM SYSTEM

The oil drain line vacuum system is used to prevent internal bypass oil in the tracer valve &/or 180° hydraulic console from leaking.

It consists of a motor driven vacuum pump mounted to the tank lid. Drawing # 10,000-186-2A shows the connection diagram.

There are brass shut-off cocks in the lines to regulate oil flow. These are adjusted to a minimum opening needed to prevent oil dripping from the valve (or console).

For best results, oil drain-line cock opening should be set to the minimum that will prevent oil dripping, but not hang-up the tracer valve spool.

II. OPERATING THEORY AND ADJUSTMENT PROCEDURES

The 180°A tracer valve functions in the same manner as a standard MIMIK valve, the amount and direction of oil flow in the trace circuit being controlled by a grooved spool. Position of the spool relative to the valve body grooves is varied as the stylus is deflected by the template contour.

In a normal single-axis tracing system, movement along the trace axis occurs in conjunction with a uniform machine feed along the feed axis.

Tool movement is the combination of these two movements, and consequently the rate of tool feed along a changing contour can vary considerably. Furthermore, the tool cannot describe a path in which two opposing faces are parallel, because of the fixed axis movement.

By controlling, or modulating, the feed axis movement, the 180°A Dynatrace system is capable of tracing parallel opposed faces, and the rate of tool feed over the contour remains at a uniform pre-set rate.

Feed modulation is controlled through normal movement of the tracer valve spool resulting from deflection of the stylus by the contour. The spool of the 180°A tracer valve has an additional groove which meters the flow of oil through the feed axis motor, permitting maximum feed when the spool trace grooves are in the no-flow position. Feed flow is shut off completely when the trace grooves are in full infeed or full retract positions.

TRIM ADJUSTMENT

To prevent any flow of leakage through the feed motor when feed should be stopped, an opposing, slightly higher, oil pressure is fed to the feed circuit groove. This is through a "trim" line coming from the tank manifold upstream of the feed circuit pressure outlet. The correct volume of trim oil is controlled by a metering pin in the tracer valve, and is set at the factory. It does not normally require further adjustment in the field.

FEED RATE ADJUSTMENTS

Feed rates of all three movements (feed, trace infeed, trace retract) are established by two adjustment knob settings at the control console. These adjustments do not affect the groove relationships within the tracer valve, and stylus deflection therefore remains constant for all feed settings.

No adjustments are needed to establish feed axis shut-off at a 90° shoulder - this will occur regardless of the feed rate settings. However, for uniform tool feed along the contour, both adjustments must be set to the same value. This can best be done with the help of a stop-watch.

FEED AXIS SHUT-OFF ADJUSTMENTS

The tracer valve has been adjusted at the factory so that positive feed shut-off occurs when the spool is in the maximum trace infeed position, the groove dimensions ensuring that shut-off also occurs in the retract position. The setting is made by rotating the feed control pin and positioning the retainer to restrict spool movement in the infeed direction. If the spool cannot move far enough in this direction, feed axis shut-off will not occur, but if it moves farther than the position needed for shut-off, stylus deflection will increase. There is obviously one ideal location for the retainer, and a slight adjustment might be needed to establish it after initial installation. Adjustment procedure is given below:

1 - Set hydraulic pressure at 300 p.s.i.

2 - Make sure stylus pressure setting is high enough to ensure positive infeed.

3 - Open both rate valves fully (turn knobs counter clockwise).

4 - Engage both drive clutches after removing tools and workpieces.

5 - Check for correct trim valve setting by turning slotted screw on front face of tracer valve fully in, then 2½ turns out (counter clockwise).

6 - Set the retract lever to the infeed position, then loosen the lever clamping screw to allow rotation of the eccentric feed control pin. Using an allen key, rotate the feed control pin clockwise until reaching the position where retract movement stops and infeed movement just starts (If the control was correctly set before starting this procedure, slightly less than one revolution will be needed. If incorrectly set, only about half a revolution or less will be needed).

   At the above position, feed axis movement will be close to maximum. Continue rotating the feed control pin clockwise very carefully, and note that feed axis movement becomes slower, since the valve spool is being moved toward the maximum trace infeed position.

   When feed axis movement <u>just</u> stops, remove the allen key, hold the retract lever against the infeed stop pin and tighten the lever clamping screw.

7 - If feed axis movement does not stop, or if stylus deflection is excessive after above adjustments, check for kinks in the trim line for proper location of the trim line fitting on the tank manifold (must be <u>upstream</u> of the feed axis pressure line).

   If necessary, open trim adjustment screw on tracer valve slightly greater that the original 2½ turns. Repeat adjustment procedure in paragraph 6 above.

III. OPERATION OF THE TRACER SYSTEM

Operation of the Dynatrace 180°A system is greatly simplified by the fact that conventional machine functions are retained and may be used either independently or in conjunction with tracer control. The tracer system is designed primarily to control the tool path while cutting, and therefore does not require high feed rate capability. Where higher feed rates are needed for rapid traversing and rough tool positioning, the tracer drives can be quickly disengaged and normal machine feeds used.

To operate under tracer control, it is only necessary to install a stylus having the same shapes as the tool, position the template and stylus in the same relationship as the workpiece and tool, select the required trace and feed directions, and set the desired feed rates.

In most applications one or more roughing cuts must be taken prior to the finish cut, and in all cases the amount of stock removal on the finish cut should be fairly uniform throughout the contour.

Depth-of-cut adjustments are made in two ways depending on the type of contour. Shapes having opposed slopes often require a button-type tool and a round stylus, and successive cuts are taken by reducing the stylus diameter for uniform material removal over the full contour (A stepped or tapered sleeve over the stylus is sometimes helpful).

On simpler shapes without opposed slopes a standard tool is usually adequate and successive cuts are taken by changing the stylus position relative to the template by means of the valve adjustment slides.

STYLUS DEFLECTION COMPENSATION

The amount of stylus deflection needed to change from an infeed movement to a retract movement varies slightly from one installation to another, depending on machine slide forces and valve spool clearance. Measured at the normal stylus contact point 2" out from the face of the valve body, deflection is usually about .024".

To compensate for deflection error, the stylus radius should be made about .012" larger than the tool nose radius. The exact amount should be determined by making a trial tracing cut on two parallel opposed shoulders with tool and stylus identical, and comparing the workpiece with the template (If cutting an actual workpiece, make trial cut with stylus diameter about .050" larger than tool to prevent excessive material removal).

INITIAL START-UP

1. Fill the hydraulic reservoir to about half way up the oil level gauge with Sunoco Sunvis 747 or equivalent. This is a detergent-dispersant type oil of 200 SSU viscosity, containing rust, oxidation and wear inhibitors.

2. To start the pump, turn the disconnect switch on the electrical cabinet to "on", then press the start button. Set retract lever to infeed and turn feed rate and trace infeed knobs fully in to obtain a no-flow condition. Set pump to give pressure reading of 300 p.s.i.

3. Check for air supply to vibrator on tracer valve.

4. Engage drive clutches and clear the system of air by feeding the machine slides several times in both directions at all feed and trace directions of the console selector valve.

SET-UP AND OPERATION

1. Disengage tracer drives, start hydraulic supply and select required trace and feed directions with control console selector knobs. Engage drives and set feed and trace rates to suitable values based on workpiece material and size (see charts Figure 4A & 4B). Disengage tracer drives for remainder of set-up.

2. Install tool in toolpost with cutting point exactly on center. Included angle of tool point must be less than minimum contained angle of part contour, and tool point radius less than smallest contour radius. When tracing opposed shoulders either a button or fishtail type tool must be used for the finish cut (Conventional right and left hand tools may be used for roughing if preferred, feeding toward the shoulder with each tool).

3. Position machine slides so tool almost contacts a reference point at the starting end of the workpiece.

4. Insert a suitably shaped stylus in the valve collet, with oversize allowance for deflection, and for roughing cut if cut adjustments are to be made by stylus sizing.

5. Position valve arm and template so stylus bears roughly the same relation to template as tool does to workpiece. Valve adjustment slides must be parallel to machine ways (eye alignment is adequate). Clamp template to rail, and indicate and adjust for parallelism.

6. Position valve with adjustment slides so stylus contacts template, set retract lever to infeed position and engage tracer drives. Continue adjusting valve position until tool bears correct relation to workpiece.

7. Take initial tracing cut, check workpiece dimensions and adjust valve position if necessary before taking finish cut.

IV. GENERAL MAINTENANCE

Apart from the operating adjustments, reliable tracer performance depends largely on maintaining absolutely clean hydraulic oil and uniform machine slide movement.

1. Dirt entering the hydraulic system can affect the valve or the hydraulic motor performance and can cause damage to any critical components. This can be avoided by adopting the following rules;

   - Cap or plug all hose fittings and couplings immediately if disconnected and examine them for dirt before re-connecting.
   - Flush new hoses thoroughly before installing.
   - Replace the hydraulic oil every 1,000 hours of operation. Clean out the oil reservoir and replace the filter element at the same time.
   - Use Sunoco Sunvis 747 or equivalent (This is a detergent-dispersant type of hydraulic oil of 200 SSU viscosity, containing rust, oxidation, and wear inhibitors). See Appendix IV for equivalents.
   - Hydraulic circuit filter - Kralinator L-932A (See below for alternates).

2. Smooth machine slide movement requiring uniform screw torque over the full operating range must be maintained at all times. Adequate way lubrication plays an important part in this requirement. In addition, backlash in both drive trains must be kept to a minimum to avoid inaccuracies and change-over marks.

   Frequent and regular checks are recommended to ensure proper gib adjustment, adequate lubrication and minimum backlash.

3. Both the tracer valve and the template mounting bracket must be rigidly held in place. The adjustment slides should be locked after adjusting them to eliminate play and vibration.

4. Lubricate the Oldham coupling in the MIMIK drives regularly.

5. Avoid running the machine slides to the end of the travel under tracer control, as this places an undue strain on gears and keys.

ALTERNATE FILTER SPECIFICATIONS

Kralinator	AC	Baldwin	Fram	Purolator	Western	Wix
(Original Equipment) L-932A	PT-132 PT-132 X	P-20 P-20-HD	CH-33-PL CH-1652-PL	EP-78 P-130	P-157 P-232	PC-93-P CW-136-M

V. SERVICING

Apart from the adjustment procedures noted previously, no attempt should be made to service the tracer valve. It is covered by a 1-year service partial warranty which becomes invalid if the valve has been tampered with. If any part of your tracer system does not operate properly, follow these steps in the order listed;

1. Consult the Trouble-Shooting Chart for possible causes and corrective action.

2. Carry out corrective procedures.

3. Contact MIMIK Service Department if faulty operation persists:

ROSEBROOK TRACERS INC
3105 NORTH CASCADE #106
COLORADO SPRINGS, CO 80907
USA

PHONE 719.632.8894
FAX 719.32.8894 (SAME)
EMAIL rbtracer@rosebrooktracer.com

VI. MIMIK TROUBLE SHOOTING CHART

If trouble persists after trying the remedies noted, call MIMIK for service assistance.

TROUBLE	CAUSE	REMEDIES
1. VIBRATION	a) Loose gibs on machine ways:	Adjust gibs.
	b) Excessive play in feed screw nuts:	Adjust nuts or replace if not adjustable. Replace feed screw if worn.
	c) Lack of rigidity in tracer valve or template mounting components:	Stiffen mounting brackets, tighten mounting screws, snug adjustment slide gib screws.
	d) Pump pressure too high:	Check for faulty pressure gauge. Reduce pressure in 25 p.s.i. steps & check operation after each change.
	e) Pump pulsation due to wear or improper adjustment:	Re-adjust to manufacturer's instructions.
	f) Air in hydraulic circuit:	Clear system by feeding both axes several times.
	g) Stylus loose in collet:	Tighten.
	h) Trace rate too high:	Reduce.
2. POOR FINISH	a) Vibration:	See Above.
	b) Excessive stylus pressure:	Decrease to lowest setting that will ensure positive infeed.
	c) Uneven machine movement due to:	
	-Dirt or lack of lubrication in machine ways:	Clean & lubricate machine ways.
	-Gibs improperly adjusted on machine ways:	Re-adjust gibs.
	-Machine ways worn:	Re-scrape and align.
	-Nut tight on unworn portion of feed screw:	Replace screw and nut.
	-Improper machining practice:	Sharpen tools, grind correct cutting angles, use correct speeds & feeds.
	d) Excessive backlash in feed screws:	Reduce backlash.

TROUBLE	CAUSE	REMEDIES
2. POOR FINISH continued....	e) Air in hydraulic circuit:	See 1 (f) above.
	f) Play or looseness in machine slides:	Repair.
	g) Air vibrator setting incorrect (likely too high):	Reduce or change volume of air.
3. UNEVEN TOOL FEED RATE OVER WORKPIECE CONTOUR	a) Unequal setting of trace feed rates:	Set feed, trace infeed and trace retract to same rate.
	b) Change in machine way gib settings, operation on unworn portion of machine ways, change in ram counterbalance:	Correct machine fault.
4. PART-TO-PART VARIATIONS	a) Varying cutting load:	Provide uniform allowance for finish cut over entire contour.
	b) Excessive tool wear:	Use separate tool for finish cut. Check for proper speed and feed.
	c) Mechanical looseness:	Tighten all elements of tracer & machine.
	d) Air in hydraulic circuit:	Clear system by feeding both axes several times.
	e) Oil temperature variation:	Let oil warm up before tracing.
5. TEMPLATE-TO-PART VARIATIONS	a) Tool not on center:	Adjust cutting point to exact center height.
	b) Template not aligned in horizontal plane:	Adjust template rail using dial indicator.
	c) Varying cutting load:	Provide uniform allowance finish cut over entire contour.
	d) Incorrect tool-stylus relationship:	Stylus must be the same shape as tool, plus deflection allowance.
	e) Incorrect tool geometry:	Check for adequate clearance throughout contour.

TROUBLE	CAUSE	REMEDIES
6. FEED DOES NOT SHUT OFF WHEN TRACING 90° SHOULDER	a) Trim oil not adequate to oppose leakage:	See adjustment procedures on Pages 3 and 4.
	b) Incorrect tracer feed rate setting:	See adjustment procedures on Pages 3 and 4.
7. TRACE AXIS WILL NOT FEED TOWARD TEMPLATE WITH RETRACT LEVER IN INFEED POSITION	a) Clutch not engaged:	Check for blown fuses. Check to see if air is getting to clutch.
	b) Trace infeed rate too low:	Increase setting.
	c) Incorrect tracer valve feed rate setting:	See Feed Rate Adjustment on Page 3.
	d) Tracer valve spool hang-up:	See Section "8" Below.
8. VALVE HANG-UP	a) Insufficient stylus pressure:	Increase stylus pressure & actuate stylus by hand. If tracer does not begin to infeed immediately, hang-up may be due to dirt.
	b) Dirt or gummy oil deposits in valve:	Drain tank, flush complete system and replace hydraulic oil & filters. Run tank until oil warms up. Actuate stylus by hand until smooth stylus action and positive spool return are obtained.
	c) Air lock in valve:	Cycle tracer slide full stroke several times by activating stylus.
	d) Incorrect hydraulic oil:	Change to Sunvis 747.

If Tracer Valve Continues To Hang-Up, Contact MIMIK Industries Inc.

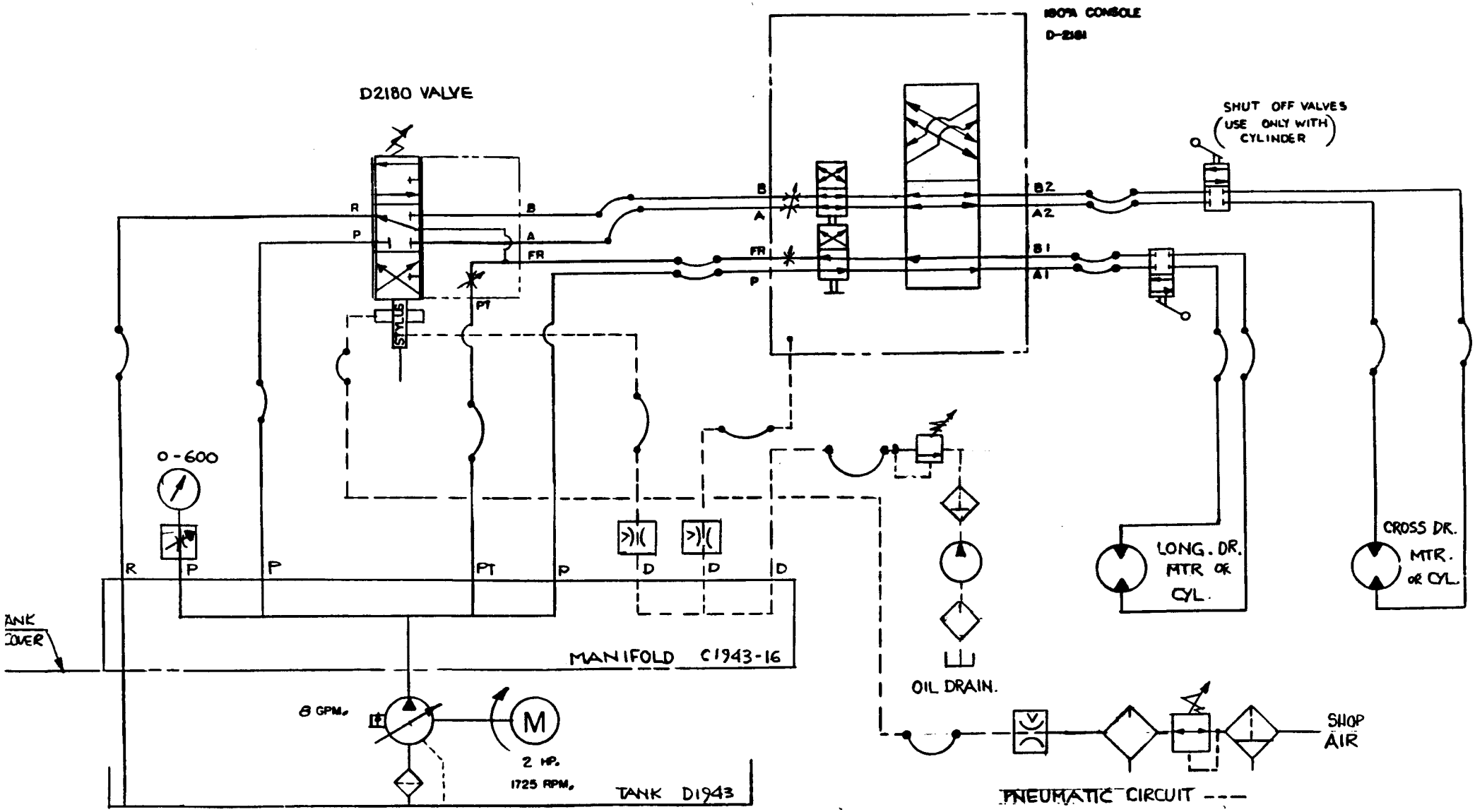
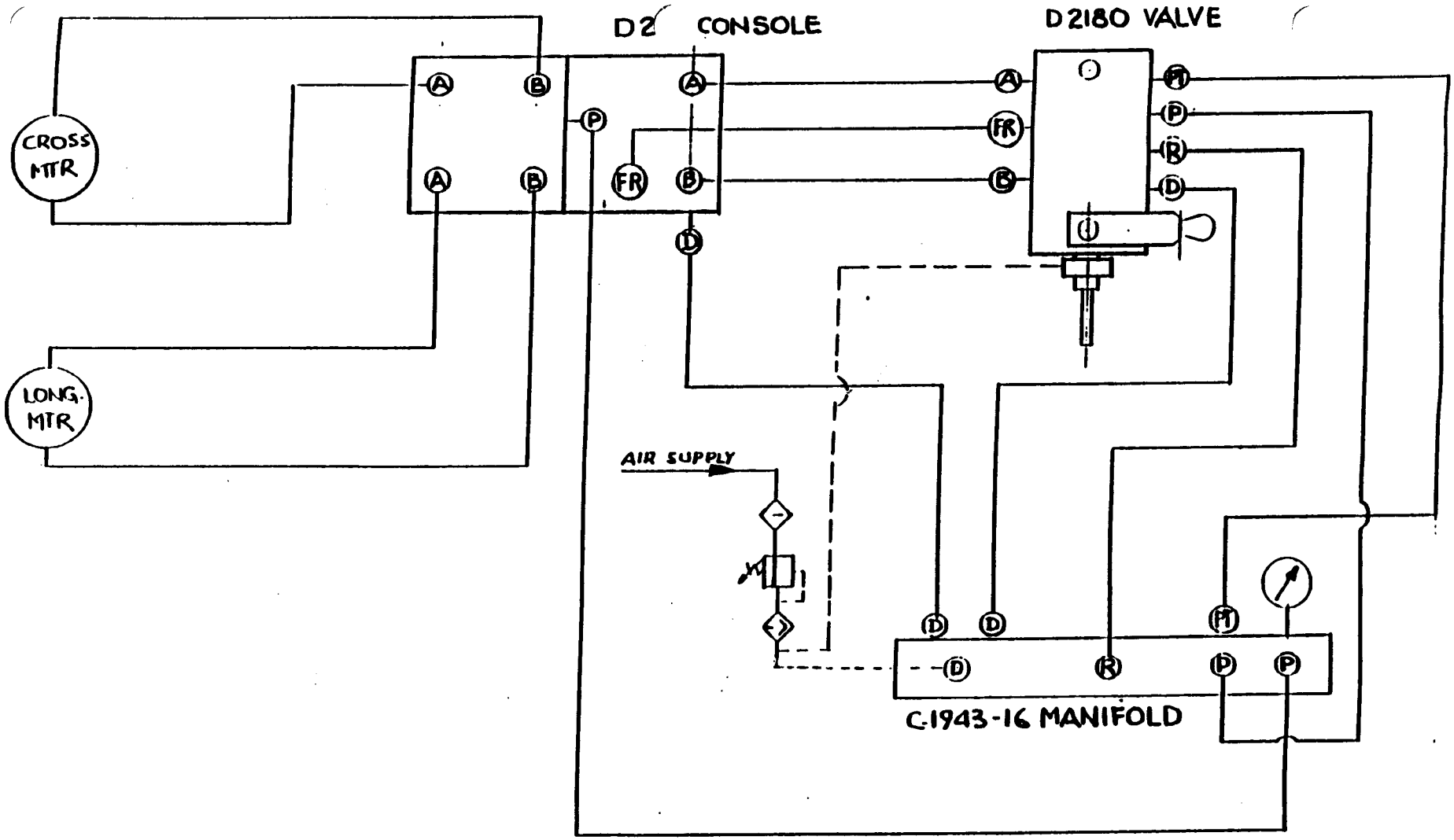

D2180 VALVE
180°A CONSOLE
D-2181
SHUT OFF VALVES
(USE ONLY WITH
CYLINDER)
R
P
B
A
FR
PT
STYLUS
B2
A2
B1
A1
0-600
R
P
P
PT
P
D
D
D
LONG. DR.
MTR OR
CYL.
CROSS DR.
MTR.
OR CYL.
TANK
COVER
MANIFOLD C1943-16
8 GPM.
M
2 HP.
1725 RPM.
TANK D1943
OIL DRAIN.
SHOP
AIR
PNEUMATIC CIRCUIT

FIG. 1



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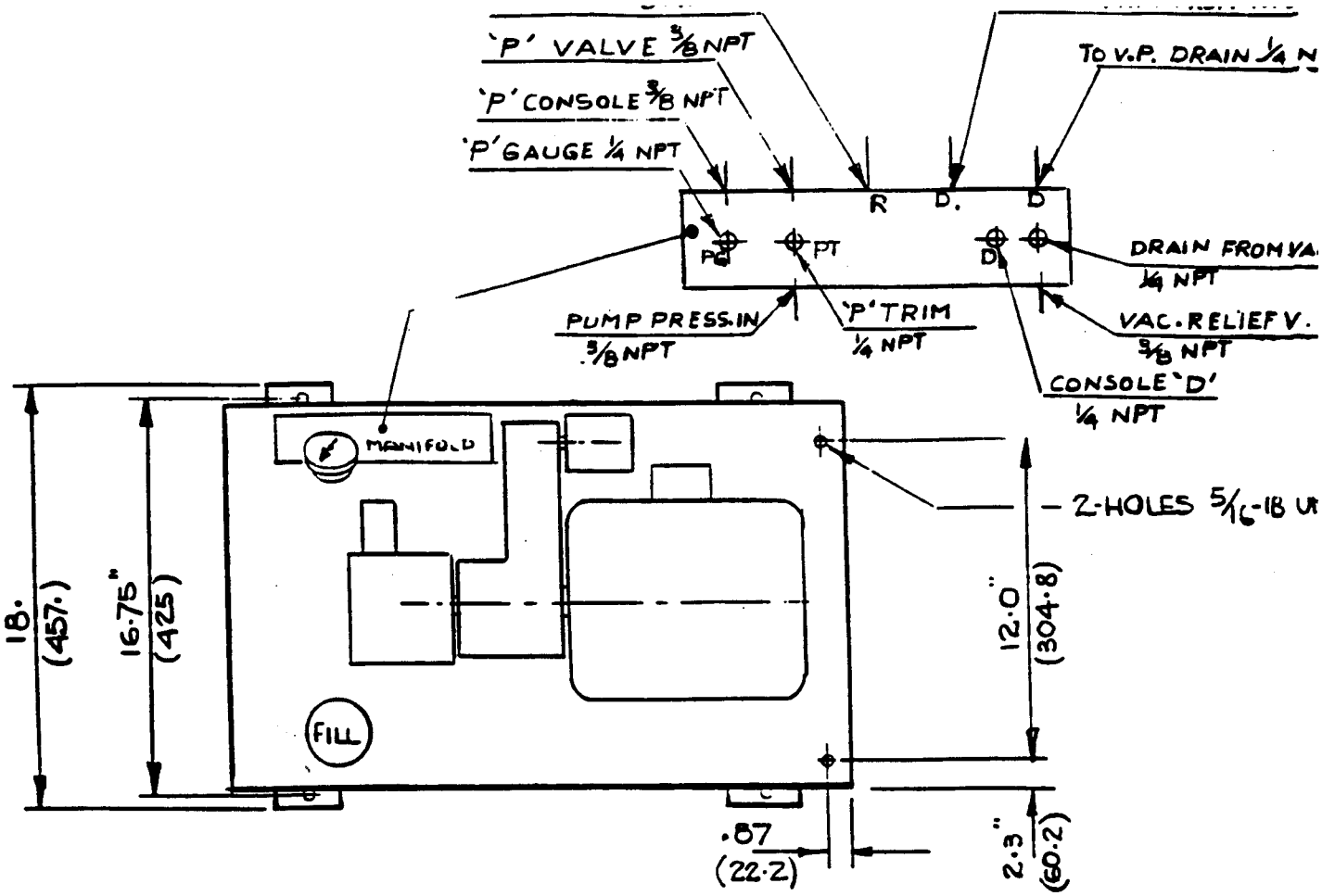
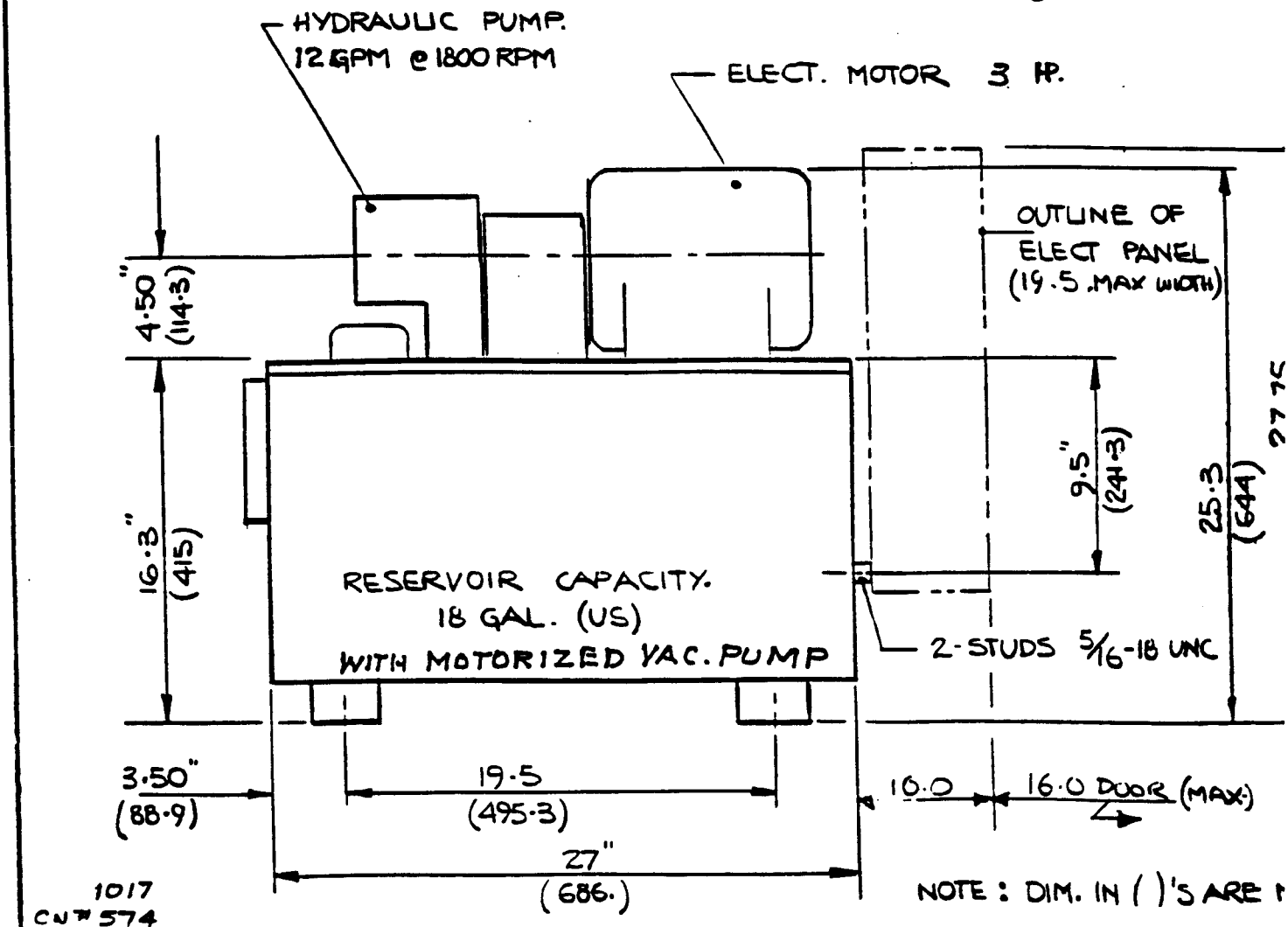
180-A HYDRAULIC/PNEUMATIC CONNECTION DIAGRAM.

FIG 1-A





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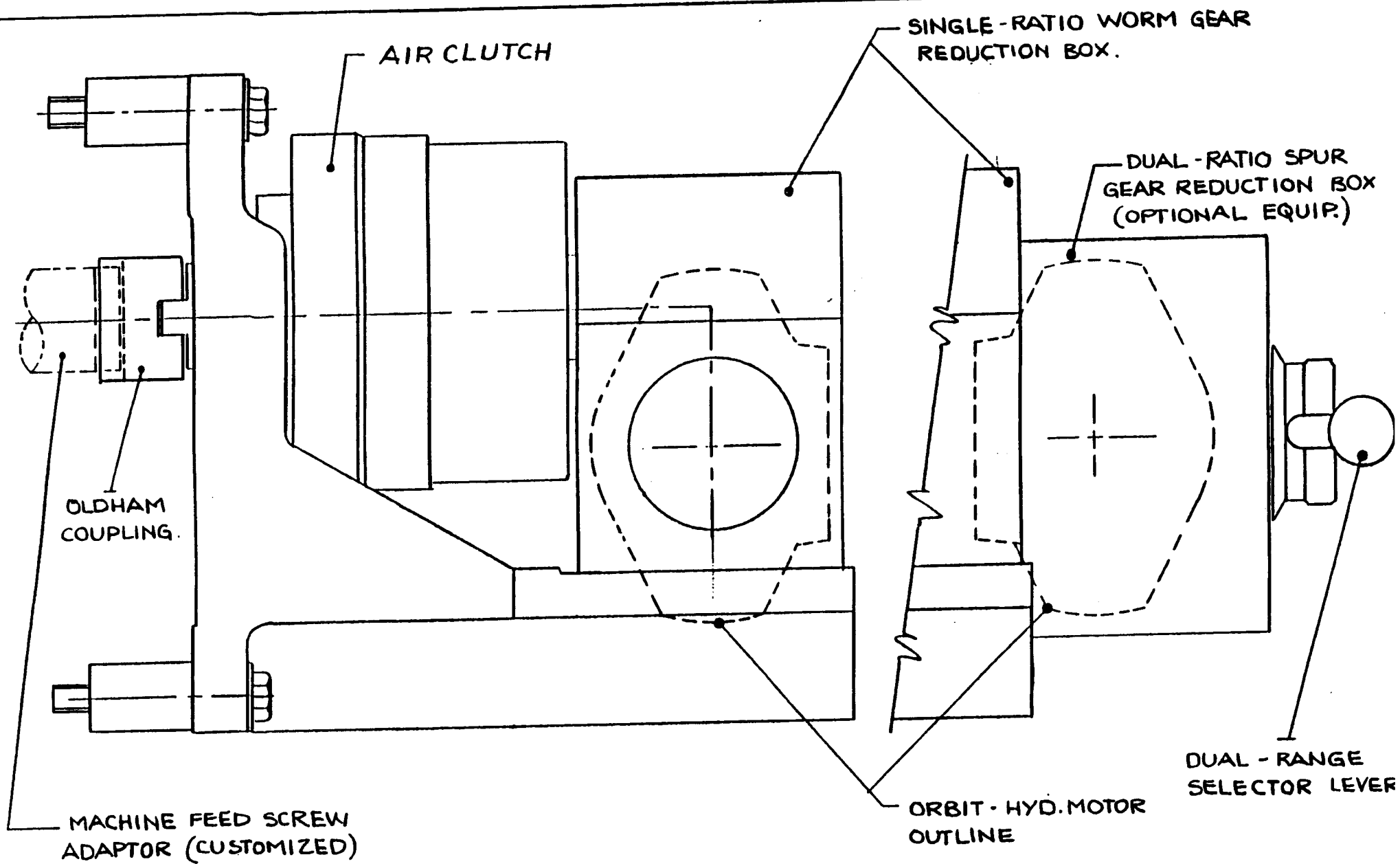

FIG 2

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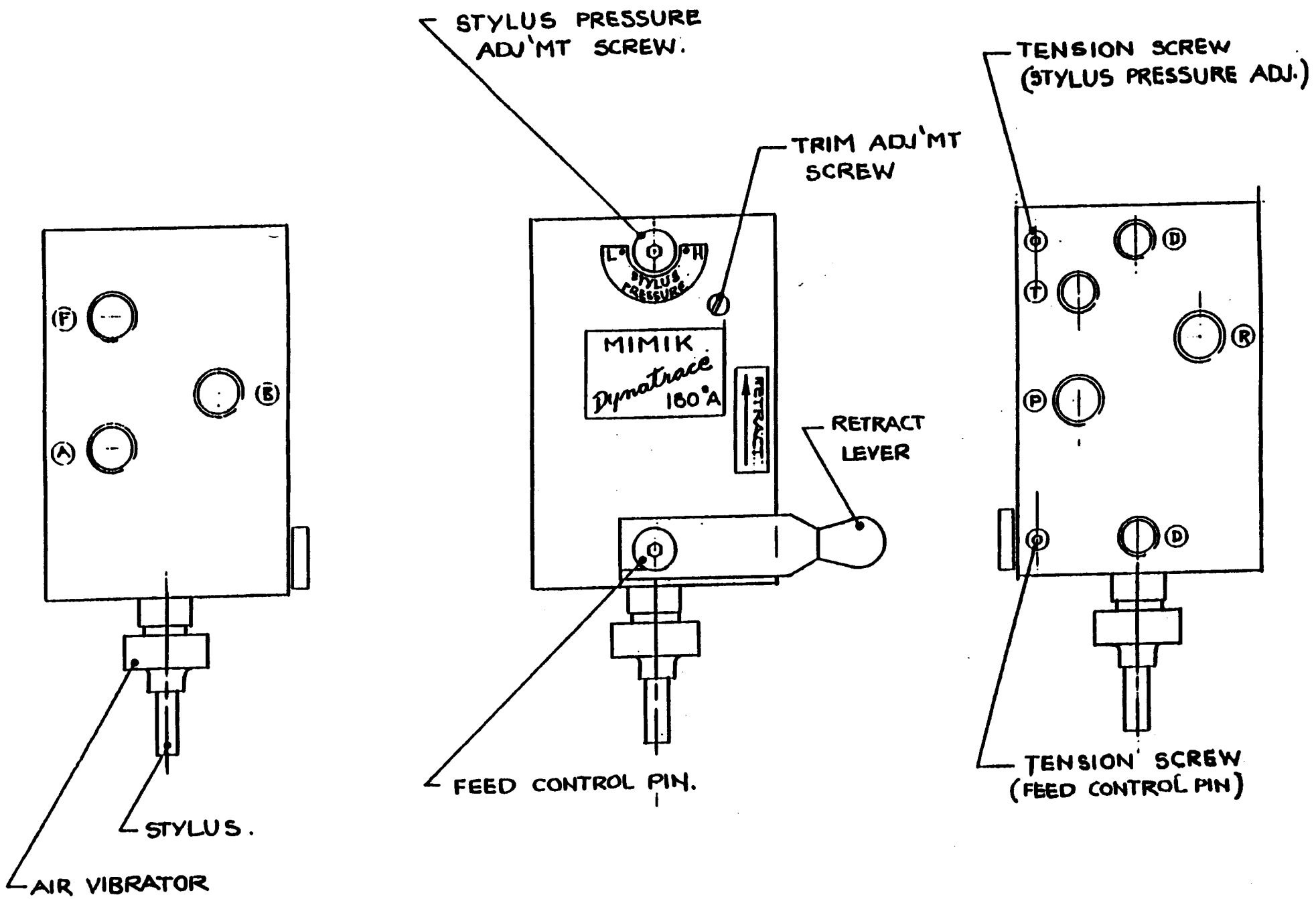
GEAR REDUCED HYDRAULIC MOTOR DRIVE ASSEMBLY.

FIG. 2

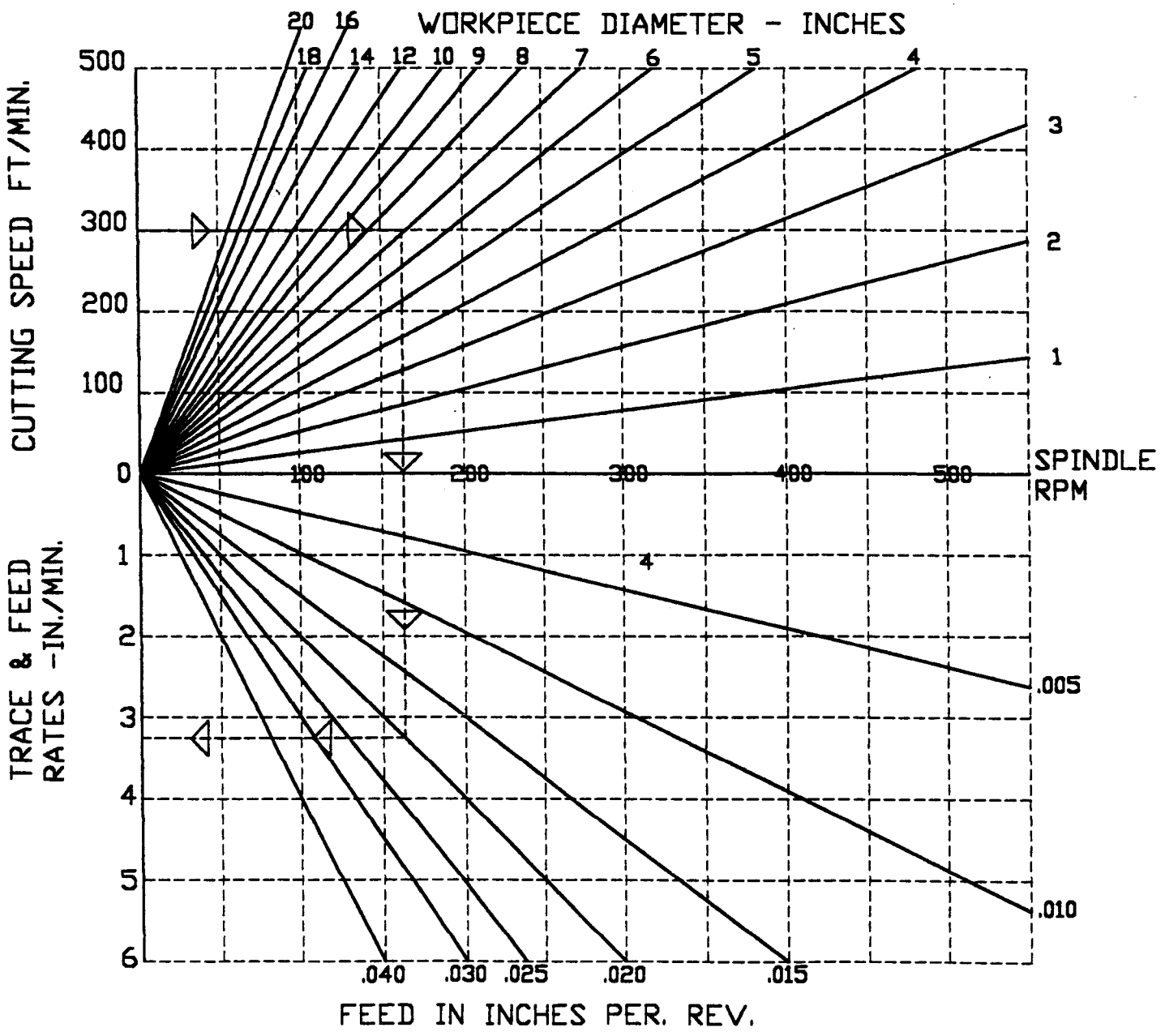


D-2180 TRACER VALVE

FIG 3

WORKPIECES UP TO 20 INCHES IN DIAMETER

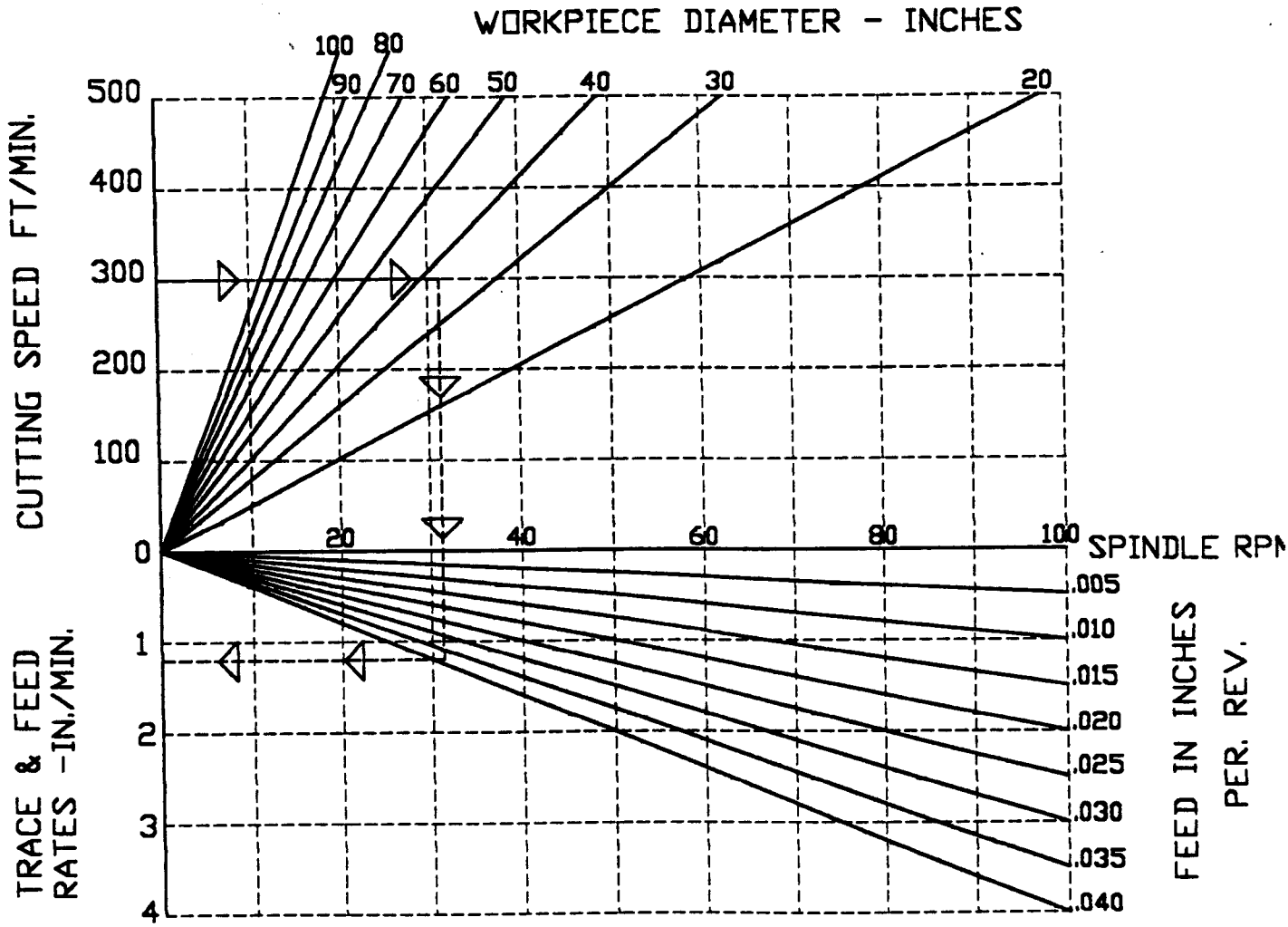
1 SELECT CUTTING SPEED TO SUIT TOOLING, MATERIAL, & FINISH REQ.
2 MOVE HORIZONTALY TO RIGHT TO WORKPIECE DIAMETER
3 DROP VERTICALY TO FIND SPINDLE R.P.M.
4 DROP VERTICALY FROM SPINDLE RPM TO FEED IN INCHES PER. REV.
5 MOVE HORIZONTALY TO LEFT TO FIND TRACE & FEED RATES.



180° A MANUAL FIG:4A

WORKPIECES FROM 20 TO 100 INCHES IN DIAMETE

1 SELECT CUTTING SPEED TO SUIT TOOLING, MATERIAL, & FINISH REQ.
2 MOVE HORIZONTALY TO RIGHT TO WORKPIECE DIAMETER
3 DROP VERTICALY TO FIND SPINDLE R.P.M.
4 DROP VERTICALY FROM SPINDLE RPM TO FEED IN INCHES PER. REV.
5 MOVE HORIZONTALY TO LEFT TO FIND TRACE & FEED RATES.



180° A MANUAL FIG:4B