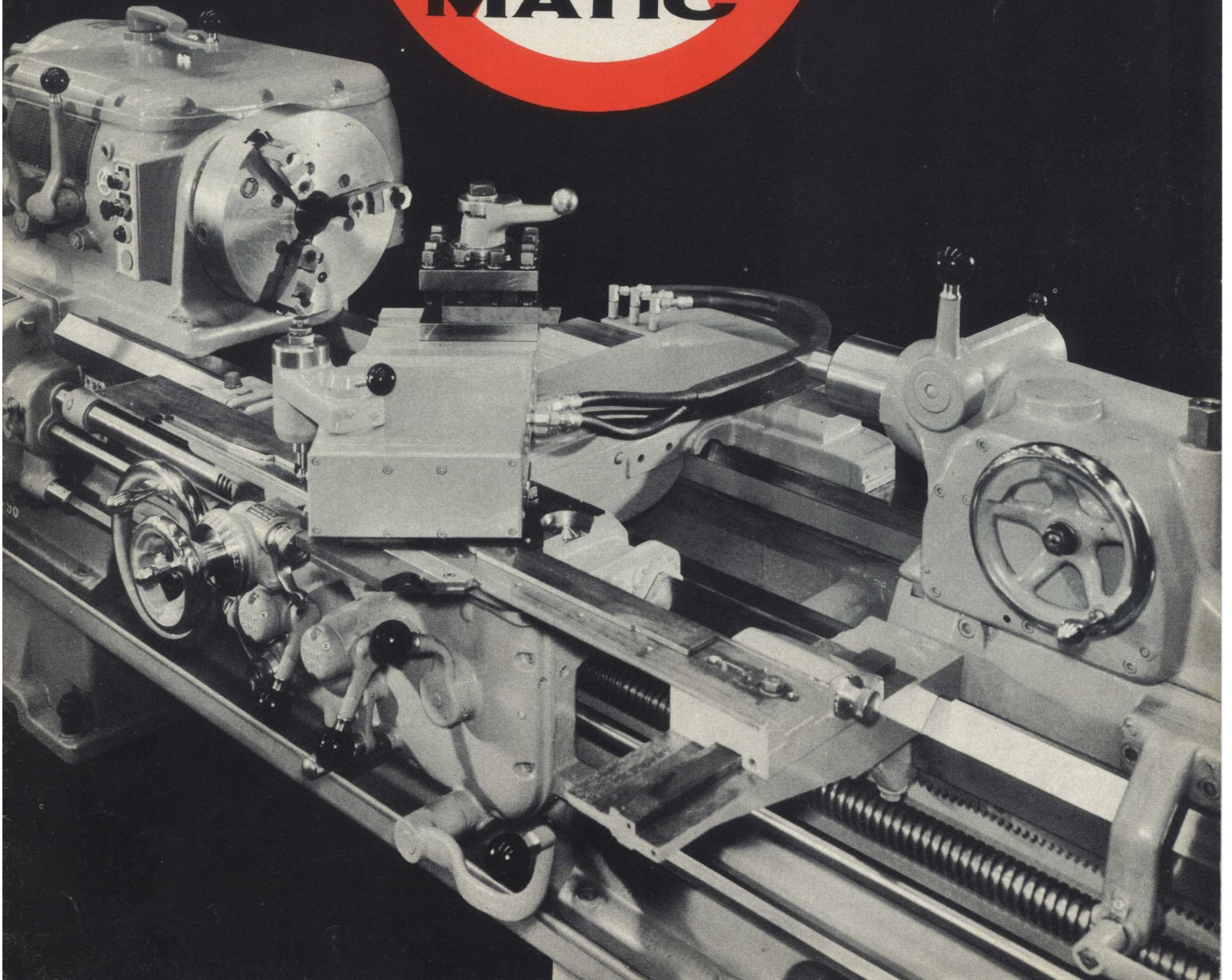
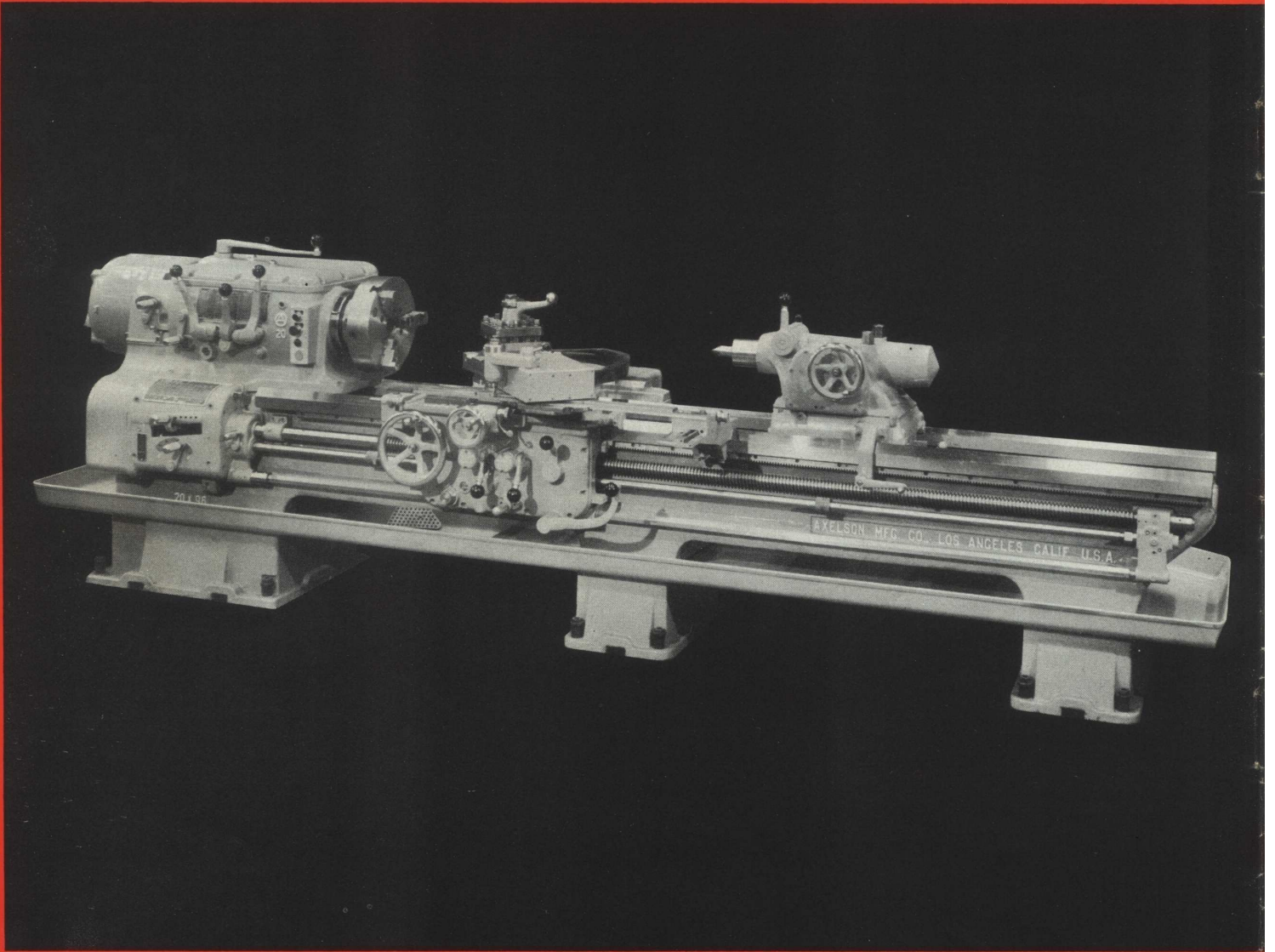


AXELSON

MANUFACTURING COMPANY DIVISION
PRESSED STEEL CAR COMPANY, INC.
LOS ANGELES 58, CALIFORNIA



AXELSON TRACE-O



**AXELSON 20" HEAVY DUTY LATHE EQUIPPED WITH
AXELSON TRACE-O-MATIC HYDRAULIC TRACING ATTACHMENT**

-MATIC

Hydraulic Tracer Attachment for Axelson Heavy Duty Lathes

THE AXELSON TRACE-O-MATIC hydraulic tracer attachment provides fast automatic precision duplicating from flat templates on Axelson heavy duty lathes. It is adaptable to all classes of work including contour turning, boring and profile facing and permits uninterrupted cuts while duplicating the exact shape of the template within very close tolerances.

HIGH PRODUCTION AND VERSATILITY with accompanying savings over former methods are realized when a Trace-o-Matic attachment is installed on your Axelson lathe. Production times and set-up times are reduced as much as 50 to 75% or more and the better finishes obtained in many cases eliminate subsequent operations. Small job lot work can be handled efficiently and economically because the Trace-o-Matic is simple to set up, templates are quickly and inexpensively produced in your own shop, and operator's time is reduced to a minimum.

ALL CLASSES OF WORK with uninterrupted cuts are handled automatically with the Trace-o-Matic, including square or tapered shoulders, flanges, radii, tapers, grinding necks, form turning, step shafts, and contour facing. The attachment does not limit the capacity of the lathe and takes full advantage of the speed and power of your Axelson lathe to take heavy roughing cuts, fast. If desired, the standard compound slide can be quickly replaced and the lathe may be operated as a standard machine on general purpose work.

THE TRACE-O-MATIC ATTACHMENT is a complete self-contained hydraulic unit requiring no extra floor space and is easily installed in a short time. The hydraulic unit including tank, pump, and motor, is installed at the rear of the carriage in the position usually occupied by the standard taper attachment and travels with carriage. The heavy hardened cast steel tracer slide mounts on the bolt ring in the same manner as the standard compound slide and is designed to support the template holder and template in a swivel slide under the compound. An anchor bracket which clamps on the front bed way secures the other end of the template carrier and is equipped with a micrometer adjustment for accurately and quickly positioning the template longitudinally. The anchor bracket is so designed that it may be used for holding the template support either parallel or at 90° to the bed ways for turning or facing operations.

THE TRACER HEAD houses the sensing valve and stylus and is mounted at the left side of the compound slide and may be quickly positioned to take advantage of the full depth of the flat template. This design utilizes the full eight-inch travel of the compound slide and permits the turning of diameter reductions up to eleven inches with the compound set at 45° angle. The contact of the stylus with the template operates the sensing valve which meters the oil directly to the cylinder in the com-

pound, which in turn controls the movement of the compound slide which supports the cutting tools. A reversing valve is installed on the hydraulic power unit to change the direction of the oil flow which reverses the action of the stylus to permit internal work and contour boring. Only standard round stylus of the same diameter as the point of the cutting tool are required. A small lever on the tracer head permits the rapid traverse of the tool slide in and out which is not only a convenience to the operator but saves time in making tool set-ups.

THE EXTREME SIMPLICITY OF TOOLING offers many advantages and at the same time handles a wide range of work. A standard quick indexing four-position tool post holds a variety of standard tools, including roughing and finishing tools, grooving tools and long tools for contour boring. Expensive form tools and the high cost of grinding and maintaining form tools are eliminated. Set-up time for the simple single point tools is only a fraction of the time required for form tools or multiple tools and finish on the work is usually superior. In operation, trial cuts are made with the finishing tool on the first work diameter until the finished dimension is obtained. Adjustment for this setting is facilitated by the micrometer dial, graduated in thousandths, on the cross slide. The machine is then automatically set to produce all diameters and contours from the template and all subsequent measuring is eliminated.

ONLY SIMPLE, INEXPENSIVE, FLAT TEMPLATES made from 3/16" soft steel are required for converting the lathe into an automatic production unit. Since the stylus exerts only a few ounces of pressure against the template, hardening and grinding is not necessary. Templates may be easily produced by turning in a standard bar holder or by any other method. It is estimated that a template can be made in the length of time required to turn two parts in the conventional manner, after which parts can be machined in a fraction of the time by use of the Trace-o-Matic attachment. The contour of the template is reproduced with a one to one ratio on the work; therefore, the accuracy built into the template is the accuracy of the finished work within very close tolerances. The templates serve for both roughing and finishing.

ANY DESIRED TAPER or length of taper within the capacity of the machine can be cut with the Trace-o-Matic attachment simply by mounting a straight template on the template holder at the proper angle and position. Set-up at the front of the machine is simple and fast and the micrometer adjustment on the template holder reduces set-up time to a minimum.

EASILY INSTALLED ON MACHINES IN THE FIELD by your own shop personnel, or the Trace-o-Matic hydraulic tracer attachment can be ordered installed on new Axelson lathes

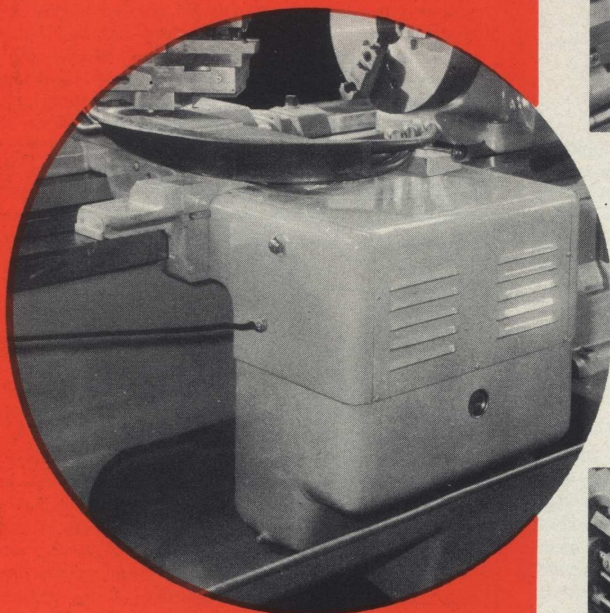
WISCONSIN TOOL & MACHINE CO.
6528 West North Avenue
Glenview 3-7170
Milwaukee 13, Wisconsin

the **TRACE-O-MATIC** is simple and easy to install

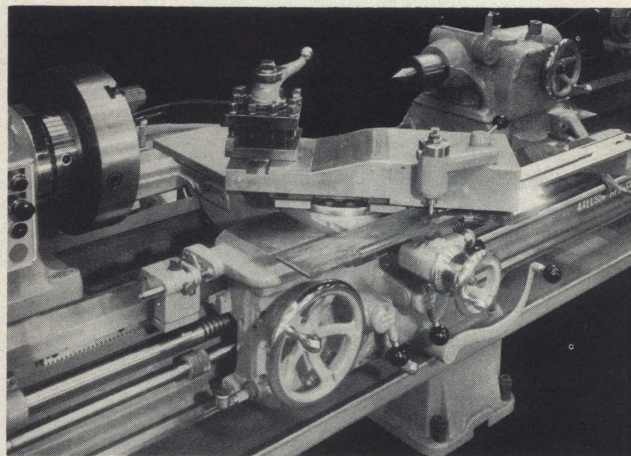
THE HYDRAULICALLY CONTROLLED COMPOUND TOOL SLIDE

The heavy hardened cast steel compound tool slide is interchangeable with the standard compound slide and is mounted on the carriage bolt circle and secured by four clamping nuts. It may be quickly positioned at any angle best suited to the work at hand. A graduated ring at the base of the slide facilitates making the desired settings. Tools are held at the front of the slide in a quick indexing four-position tool post or in a quick change tool block holder.

The tracer head houses the sensing valve and stylus and is mounted at the left side of the compound slide and may be quickly positioned by means of a cam locking lever to take advantage of the full depth of the flat template. This design utilizes the full eight-inch travel of the compound slide and permits the turning of diameter reductions

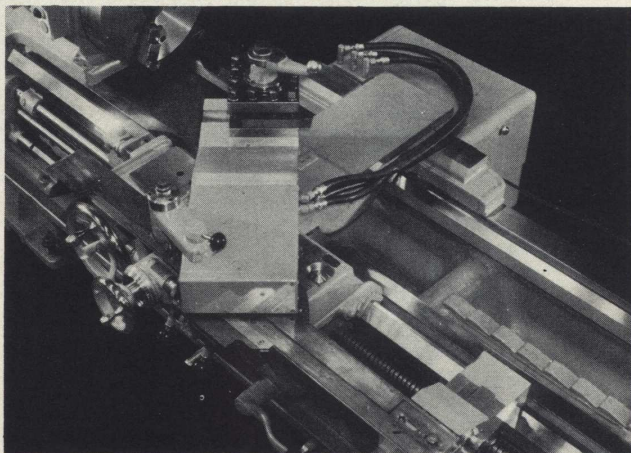


up to eleven inches with the compound at 45° angle. This will increase to sixteen inch diameter reduction as the angular setting of the slide is decreased to 0. The contact of the stylus with the template operates the sensing valve which meters the oil directly to the cylinder in the compound, which in turn controls the movement of the compound which supports the cutting tools. A reversing valve is installed on the hydraulic power unit to change the direction of the oil flow which reverses the action of the stylus to permit internal work and contour boring. The lever controlling the reversing valve is removable to guard against accidental reversing of the direction of feeding unless desired. The compound slide feeds at the rate of 45" per minute. A small lever on the tracer head permits the rapid traverse of the tool slide in and out by power. At the end of a cut or at the discretion of the operator, the tool may be retracted from the work. The slide is then held in the retracted position by hydraulic pressure until the operator, by moving the control lever in the opposite direction, advances it until the stylus point again contacts the template or until it reaches its forward travel limit. This power rapid traverse of the tool slide is not only a convenience to the operator in making tool settings but saves valuable time as well.



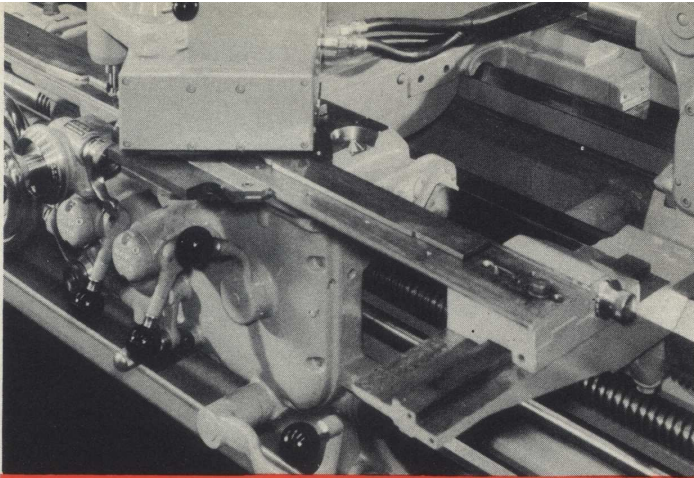
THE HYDRAULIC UNIT

The self-contained oil reservoir, motor, and hydraulic pump unit mounts on the rear of the carriage, in the position usually occupied by the standard taper attachment, and travels with the carriage. If desired the hydraulic unit may be arranged for foot mounting at the rear of the machine. No extra floor space is required for this installation. The constant hydraulic pressure is piped to and from the compound side through flexible rubber hoses which are so arranged that they do not interfere with the work or get in the operator's way. This design reduces hydraulic hoses to minimum length. A sight oil gauge is installed at the rear to indicate the oil level that should be maintained in the oil reservoir. The cover may be quickly removed for maintenance purposes.



THE TEMPLATE CARRIER

The templates are mounted on the template carrier which is mounted on a swivel under the compound. It may be positioned either parallel to the lathe for turning operations or at 90° to the lathe for profile facing. When set up for turning, the template carrier is free to travel in and out with the cross slide but is held by the bed bracket from longitudinal movement. Likewise, when set up for profile facing the template may move toward or away from the chuck with the carriage but is secured at the rear of the carriage from end movement.

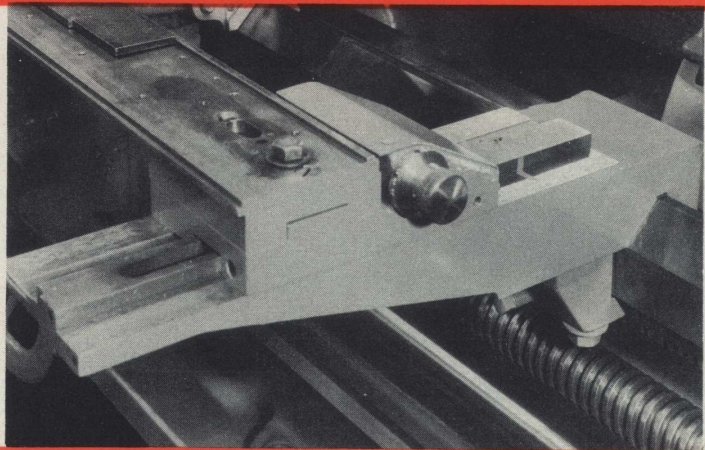


MICROMETER TEMPLATE ADJUSTMENT

Micrometer adjustment is provided for accurately positioning the template end-wise in relation to the work. The micrometer template adjustment serves for either turning operations or profile facing.

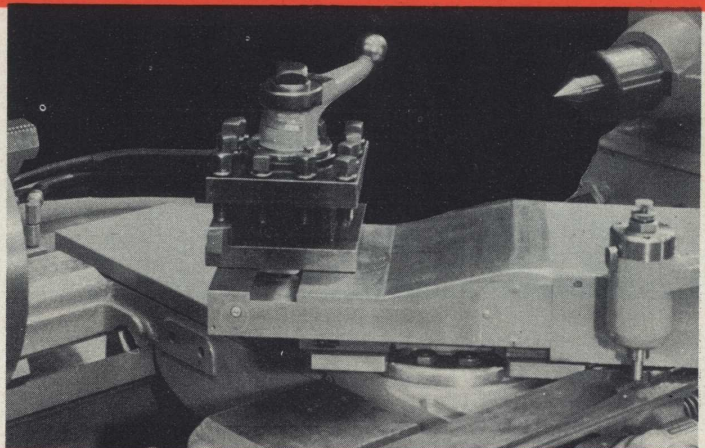
BED BRACKET TEMPLATE CARRIER SUPPORT

The bed bracket template carrier support clamps to the bed way locating on the bed "V" way. The bracket incorporates a guide strip for the micrometer adjustment holding the template carrier. The design is such that the same bracket is used also to support the template carrier for profile operations.



QUICK INDEX TOOL POST

The standard quick index four-position tool post is used on all lathes. By a single movement of the lever the tool post is unlocked, indexed, and reclamped in the next position. A hardened steel pin seating in a hardened steel bushing accurately locates the tool post in each position. A series of single point tools may be held on the tool post for carrying through a sequence of operations such as roughing, finishing, grooving, boring, etc. The quick index tool post is supplied as an extra.



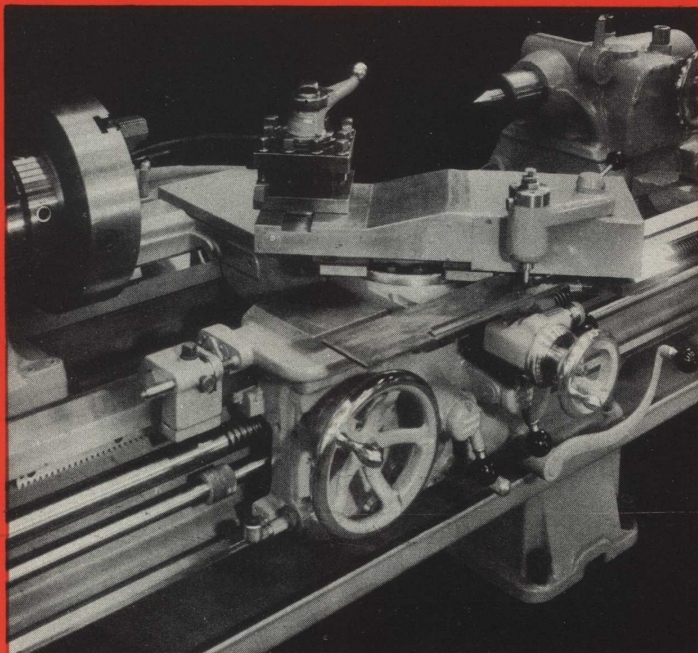
QUICK CHANGE TOOL BLOCK HOLDER

Quick change tool block holders make tool changing a fast, simple operation. A single movement of the lever releases the tool block which may then be replaced by another, as from roughing to finishing, or merely to a new sharp cutting tool. This tool holder is supplied as an extra.

Contour Turning with the AXELS

Contour Turning with the Trace-o-Matic

The Trace-o-Matic is extremely simple to use and to set up and does not require any special skill for its operation. It requires no more effort than the normal procedure of positioning, roughing and finishing tools in the quick index four-way tool post. Consideration should be taken, however, for the most suitable angle for setting the compound for the work at hand. Since the compound may be positioned at any angle as shown at right in Figure 1, the condition that should be avoided is that of having the movement of the compound slide approaching an angle parallel to the surface being machined, which results in a coarse feed. The ideal condition for best machining is to set the compound tool slide as close as possible to the angle that approximately bisects the **greatest angle of the work**, as indicated by arrow X. In the case of work having right angle shoulders or flanges this angle is 45° which is the most universal setting because it will accommodate the majority of all turning work. However, when this condition cannot exist, the result is that a coarser feed will prevail in some areas than others. The operator can then make a determination of what areas



are not critical as far as finishing is required and set the slide accordingly. That is to set the compound at the angle that will permit the work feed to be equal to or slightly less than the longitude feed as may be seen in the sketch of Figure 5. In the case of right angle shoulders or flanges the included angle between the work surface and the tool slide axis should not be less than 20° when endeavoring to make a slide setting to accommodate unusual conditions such as shown in the example.

Grooves or reliefs for snap rings cannot be generated from the template and are machined as separate hand operations. Likewise, larger grooves having two sharp angle sides can be machined only on one side with a single slide setting. Some classes of work will require two operations in which case the slide is set first at one angle to the right of center and then at an angle to left of center.

The following sketches show a variety of contour turning operations selected to illustrate the considerations that should be taken when setting the compound slide. The main object is to set the slide at an angle which permits the work feed to be equal to or slightly less than the longitudinal feed.

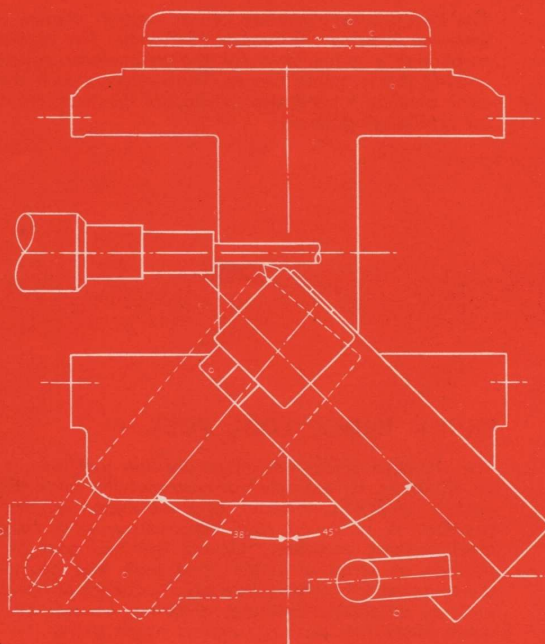
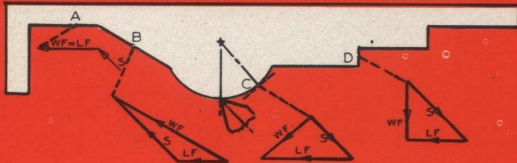
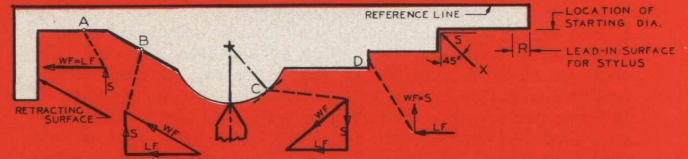


Figure 1

ON TRACE-O-MATIC

In Figure 2 the compound slide is set at 90° to the work which is ideal for turning the contour area at C, and the surfaces at A and B, but impossible to machine square shoulders at D because of tool interference.

Figure 2

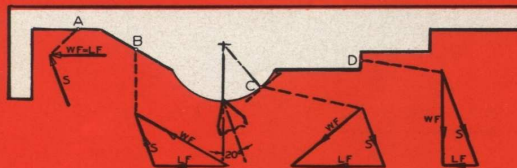
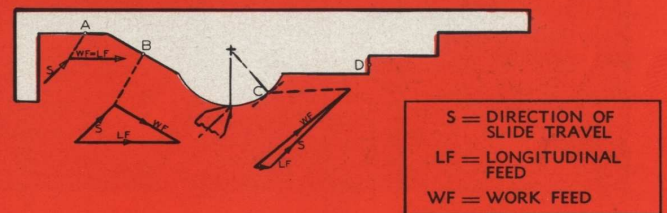


In Figure 3 the compound slide is set at a 45° angle to the right which is ideal for turning shoulders at D, diameter and taper at A and B, but is not satisfactory for the radius contour at C. This setting parallels the movement of the slide and would result in tool interference and an exceptionally coarse feed and rough finish at C.

Figure 3

In Figure 4 the compound slide is set at 45° angle to the left of center which makes it impossible to machine the shoulders at C, and the half of the round surface at C.

Figure 4



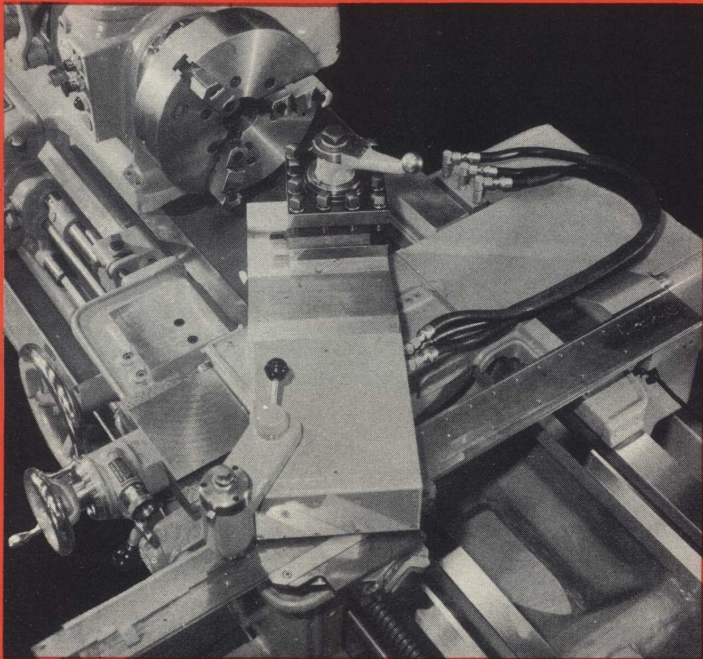
In Figure 5 the compound slide has been set at approximately 20° angle to the right of center which permits the machining of all surfaces A, B, C, and D. Here it can be seen that coarse feeds will occur only on surfaces where finishes are not critical.

Figure 5

Profile Facing with the AXELSO

Profile Facing With Axelson Trace-o-Matic

The same precautions or considerations should be taken for profile facing operations when setting the compound slide as explained in contour turning. That is to position the compound slide as close as possible to the angle that approximately bisects the greatest angle of the work. Profile facing work will fall into two divisions consisting of work that can be completely machined by feeding half way across the work that is from center to edge with one setting of the slide, and that where due to grooves, shoulders, sharp angles and contours it is necessary to feed completely across the work from edge to edge and change spindle rotation when passing center. In the latter, some of the surfaces are finish machined on the left of center and the balance of surfaces are finished on the right of center. See Figure 10.



As can be seen in the sketches certain cuts can only be taken if the slide is set at an angle to the right while other cuts should be made by setting the slide at an angle to the left. The total range of angles at which the compound slide may be set for profile facing is shown in Figure 6.

In the case of contour boring operations the slide will be set at 45° to the left and the same conditions exist as with turning.

The example that has been selected shows a variety of contour profile facing operations to illustrate the necessary considerations for setting the compound slide. Here again the object is to select a compromised slide angle that will permit the work feed WF to be equal to or directly less than the cross feed CF, or one that will permit the shortest length of feed and the shortest machining time.

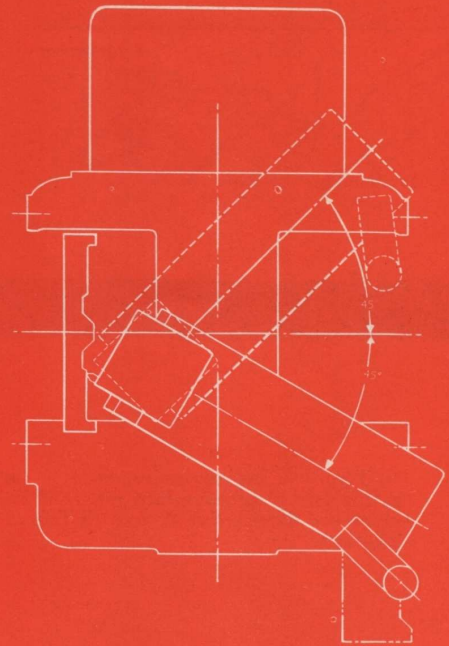
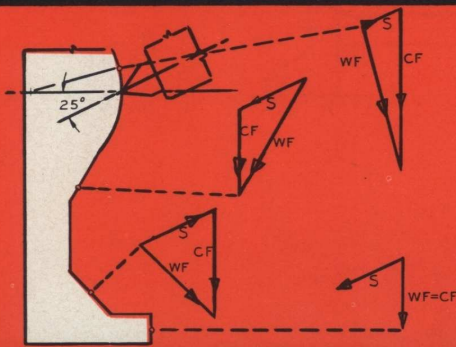
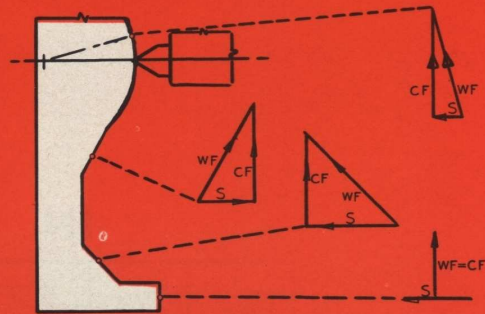


Figure 6

N TRACE-O-MATIC

In Figure 7 the compound slide is set at 90° to the work which permits turning all surfaces except the right angle shoulder at A because of tool interference.

Figure 7

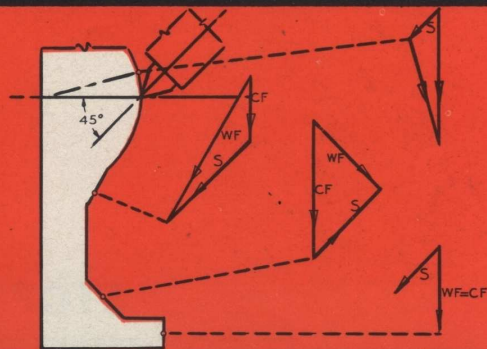


In Figure 8 the compound slide is set at 45° angle to the right which is ideal for turning the right angle shoulder at A, but it is impossible to turn the round areas at D.

Figure 8

In Figure 9 the compound is set at an angle of 25° compromising the situation so that all surfaces A, B, C, and D, can be machined with one slide setting, feeding from center toward the front of the machine.

Figure 9

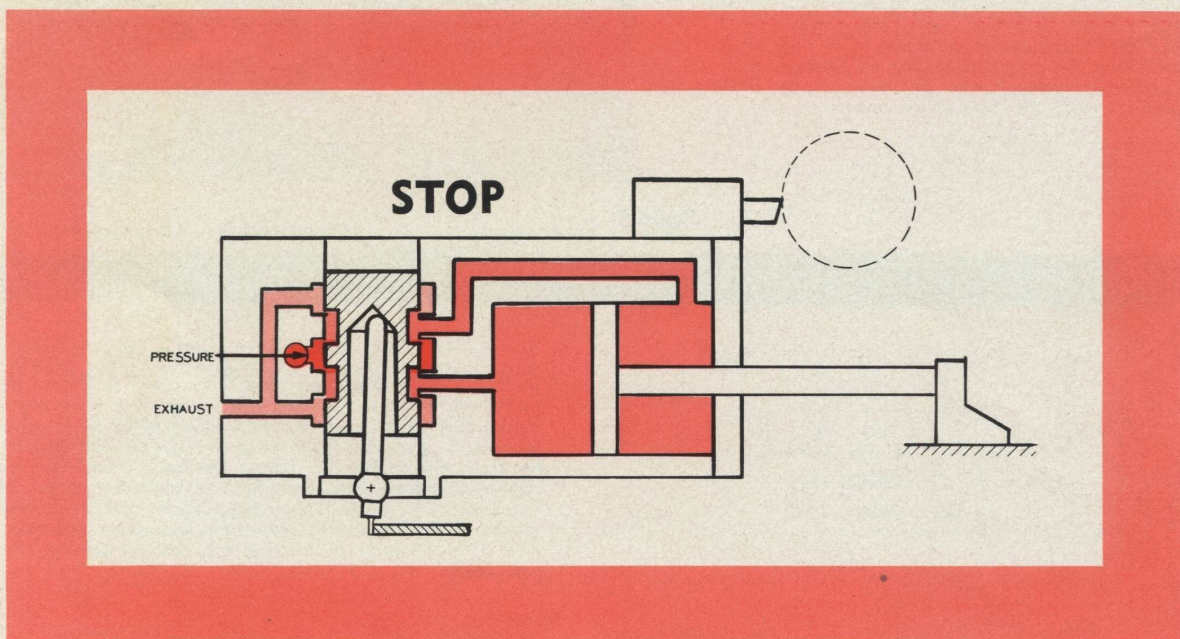
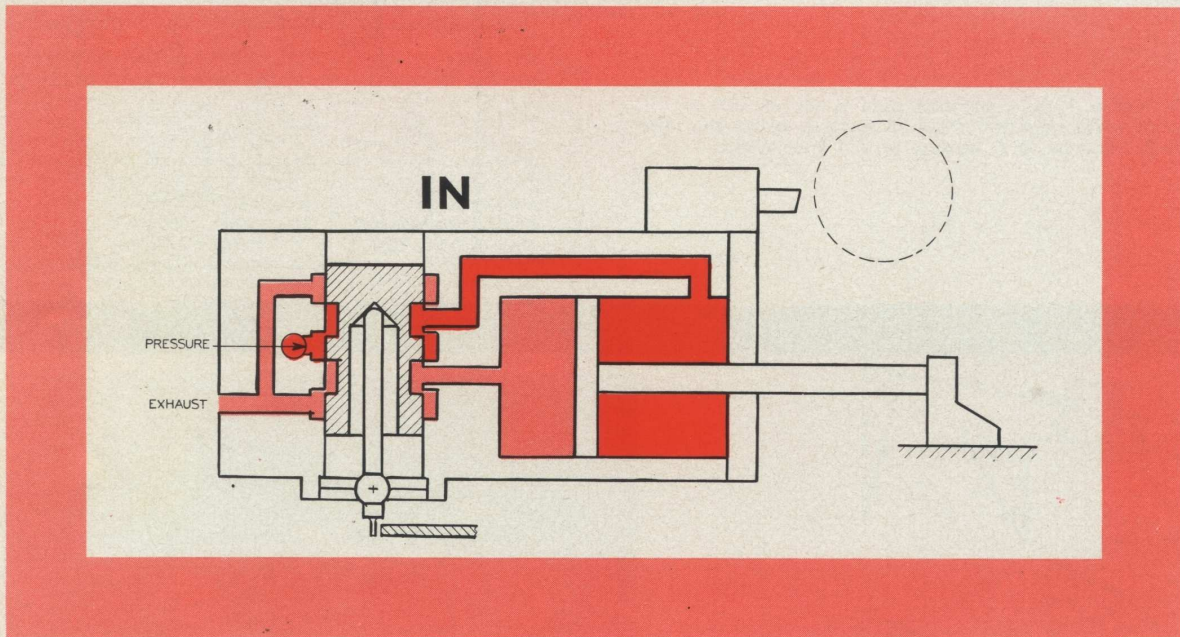


S=DIRECTION OF
SLIDE TRAVEL
CF=CROSS FEED
WF=WORK FEED

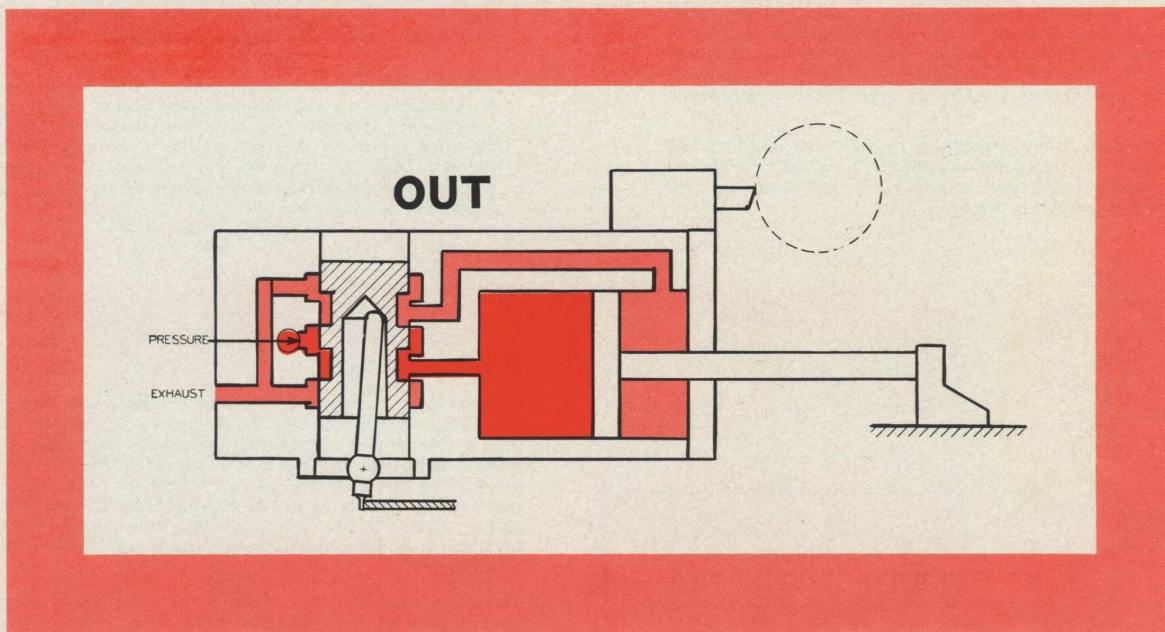
In Figure 10 it is assumed that the surface at E is to be machined. In this case the slide is set at a 45° angle to the left which permits the profile facing of all surfaces A, B, C, and D by feeding in the path as indicated by the arrow completely across the work from edge to edge and changing the direction of spindle rotation at the center. Then without changing the slide setting surface E can be turned using the longitudinal carriage feed after properly positioning the tool by use of the cross slide.

Figure 10

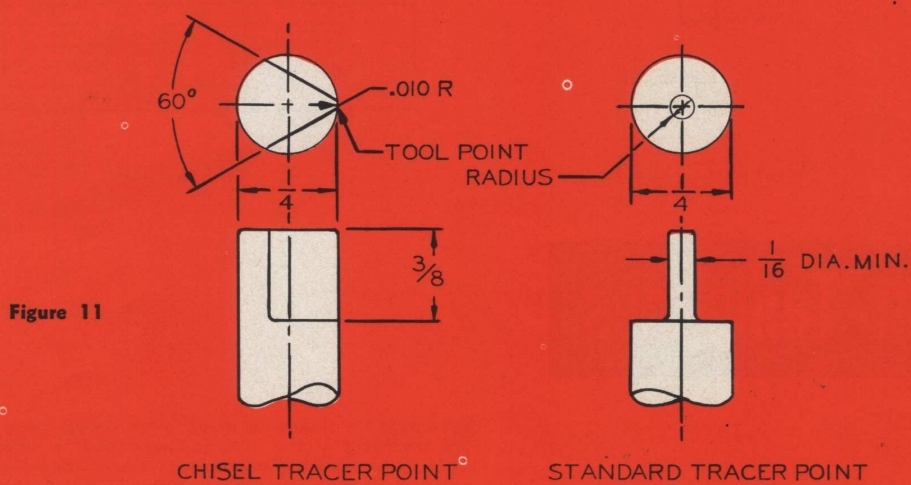
Schematic Diagram showing method of operation



of the **TRACE-O-MATIC**



Stylus Shape



Stylus and Templates

The stylus holder is designed so that tracer points may be replaced quickly with a point of the same radius of the point of the cutting tool. Only simple round tracer points are required and no special attention is therefore required for setting the point as in the case of other makes of lathe tracer attachments.

Since only a few ounces of pressure are required between the tracer point and the template, no special designed points are required nor are hardened and ground templates required.

In the sketch it can be noted that the path of the stylus is identical to that of the cutting tool. Therefore, when the diameter of the stylus is equal to the diameter of the point of the cutting tool, the contour of the template is faithfully reproduced.

When small radius cutting tools (.010") are used it is necessary to use a chisel point tracer in order to provide the strength necessary for satisfactory operation. As shown in the stylus sketch, the chisel point has the same radius as the point of the cutting tool. The minimum size tracer point recommended is 1/16" diameter. See Figure 11.

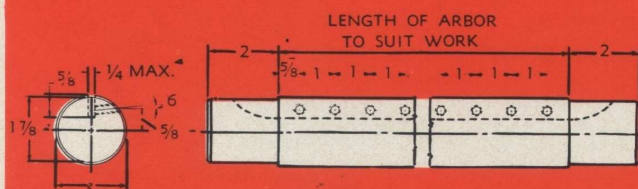


Figure 12



Figure 13

Making Templates

Only simple, inexpensive, flat templates made from 3/16" soft steel are required for the Trace-o-Matic. Since the stylus exerts only a few ounces of pressure against the template, hardened and ground templates are not necessary. It is roughly estimated that a template can be made in the length of time required to make two parts in the conventional manner. The savings in making templates alone for the Trace-o-Matic can return the cost of the attachment in a short time as compared with other makes of tracer attachments.

Templates may be laid out on 3/16" flat stock, roughed out by sawing, and finished either by hand filing, filing machine, milling machine, shaper, grinder, or by turning in a mandrel such as shown in Figure 12 which may be supplied as an extra in any desired length. Since only soft steel templates are required, corrections for deflections can be made at the machine by hand filing if desired.

ANGLE OF INCLINATION	USEABLE WIDTH OF TEMPLATE (UW)	MAX. TOOL SLIDE TRAVEL
15	7 11/16	20" LATHE W=8"
20	7 1/2	
30	6 7/8	
40	6 1/8	
45	5 5/8	
15	5 3/4	16" LATHE W=6"
20	5 5/8	
30	5 3/16	
40	5 9/16	
45	4 3/16	

Laying Out Templates

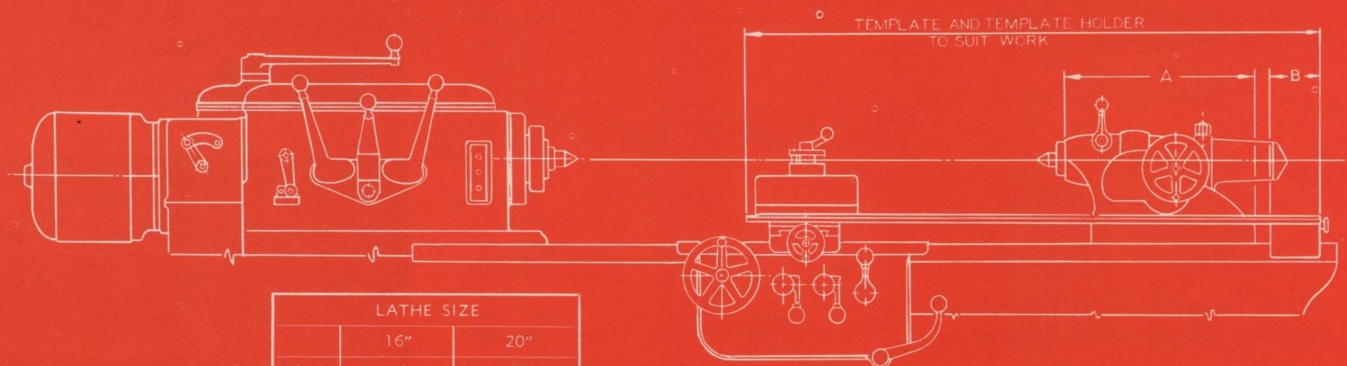
Laying out Templates

Since the Trace-o-Matic generates a contour irrespective of the diameter of the work piece, it is necessary only to maintain the distance from one surface on the template to each other surface, not the distance from the surface to the back of the template.

Consideration should be made when laying out a template so that the overhang of the Trace-o-Matic slide is held to a minimum. This is particularly advisable if heavy roughing cuts are to be taken. It is therefore advisable to use the maximum whole width of the template and refer to the template size table for maximum diameter reduction at different angular settings of the compound slide. Also provide a starting land to lead the tool into the work and a land to rapidly retract the tool from the work. See Figure 13.

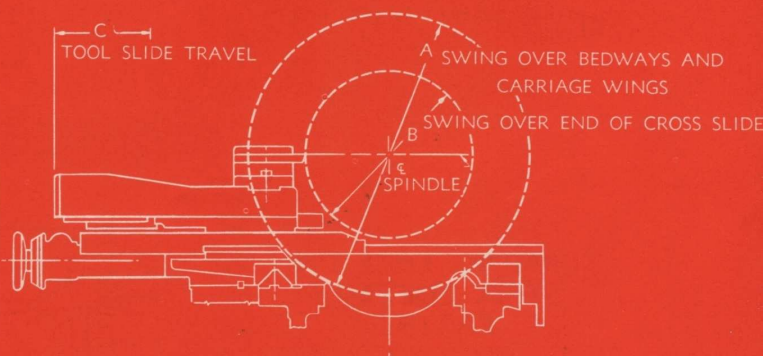
Capacity Data of the

AXELSON TRACE-O-MATIC



LATHE SIZE		
	16"	20"
A	16	22
B	5	5

CAPACITY OF AXELSON RAISED LATHES			
AXELSON 16" LATHE			
RAISED IN SAND	2"	3"	—
SWING OVER BED	22"	23 7/8"	—
SWING OVER CROSS SLIDE	15 5/8"	17 1/2"	—
TOOL SLIDE TRAVEL	6"	8"	—
AXELSON 20" LATHE			
RAISED IN SAND	—	3"	6"
SWING OVER BED	—	27 3/4"	33 1/4"
SWING OVER CROSS SLIDE	—	19 3/4"	25 3/8"
TOOL SLIDE TRAVEL	—	6"	8"



LATHE SIZE		
	16"	20"
A	18 1/2"	22 1/2"
B	11 1/2"	13 1/2"
C	6"	8"

Hydraulic Oil

recommended

It is recommended that well refined 100% mineral base, neutral pale oil be used, of the following specifications:

Viscosity approximately 150 @ 100° F.
Neutralization Number .05
Viscosity Index — 100

Capacity of the unit is 10 gallons.

Because of the exceptionally close tolerances in the operation of the four-way valve, extreme care should be taken to prevent dirt or foreign matter from entering the system.

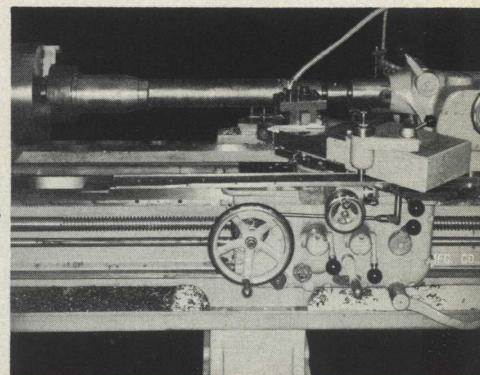
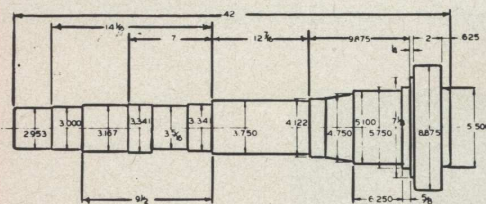
Consult your lubrication supplier for obtaining the above oil.

Reducing Costs and increasing production with

FORGED SPINDLES NOW TURNED

**200% Faster
Floor to Floor Time
64 Minutes**

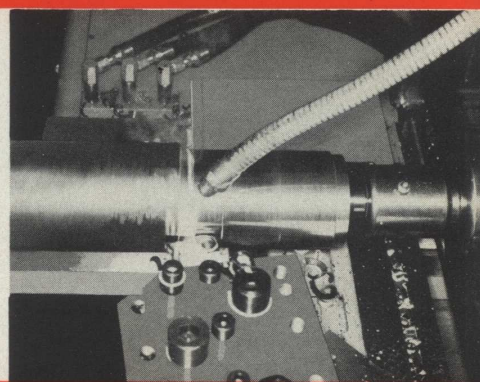
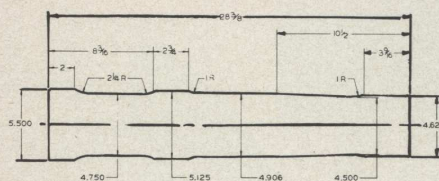
Trace-o-Matic Combines Operations—
Eliminates Extra Set-Ups.



FORGED STEEL LANDING STRUTS

**Now Turned in 40 Minutes
Former Time—328 Minutes**

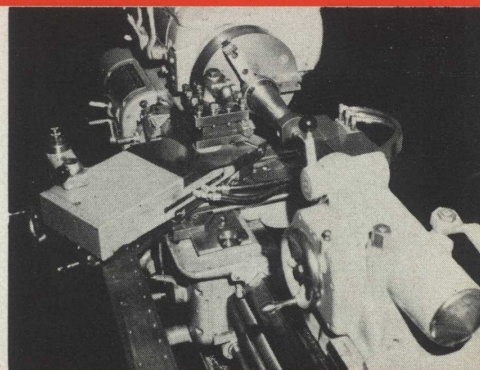
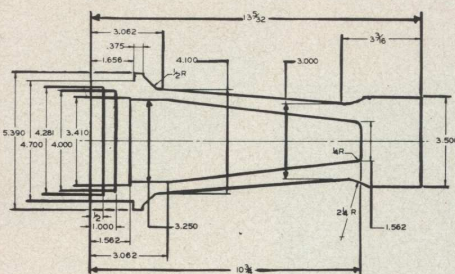
Expensive Form Tools eliminated—
Trace-o-Matic requires only single point
tools to turn all contours with uninter-
rupted cuts.



TURNING TIME ON STEEL FORGED PARTS

Reduced 37%

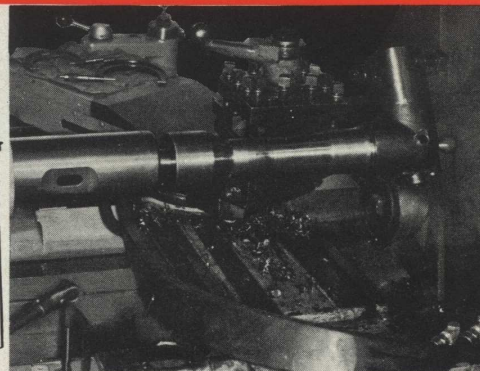
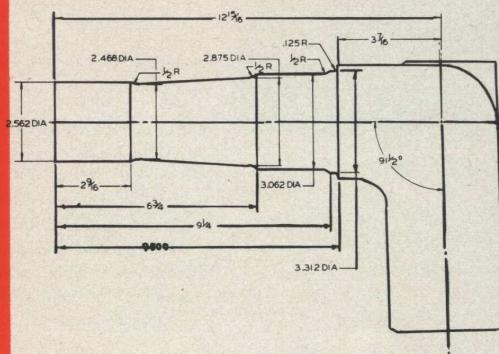
Operations include facing end, turning
diameters, radii, and tapers in one set-up
with tracer control.



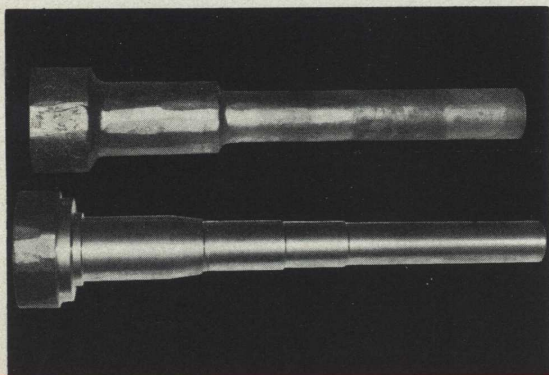
AIRCRAFT SHOCK STRUTS TURNED

362% Faster

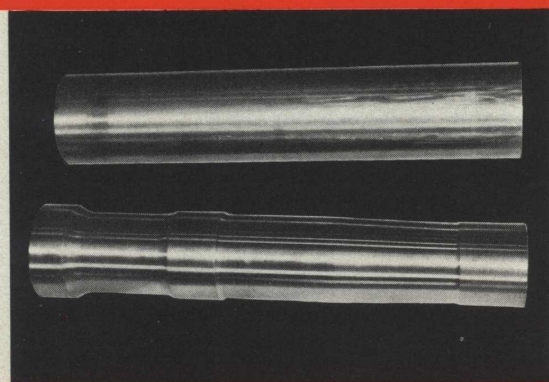
Simple single point tools turn diame-
ters, radii, and tapers in one uninter-
rupted cut controlled automatically by the
template.



AXELSON TRACE-O-MATIC

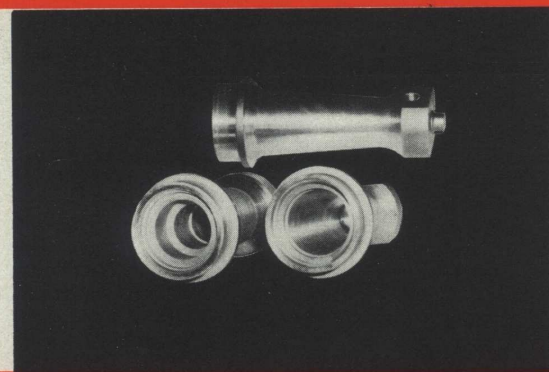


performance data

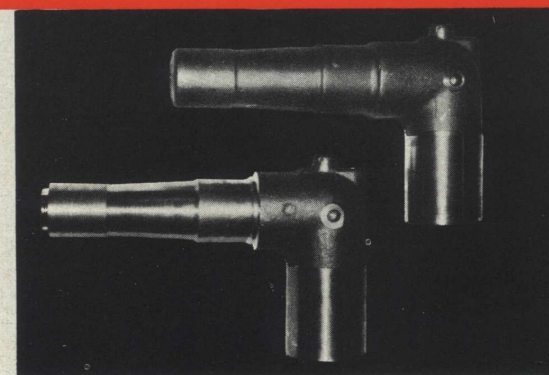
[illegible]

performance data

Part	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Shock Struts
Machine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Axelson 20" lathe with Trace-o-Matic
Number of Pieces	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50
Material	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4340 Steel Forging
Hardness	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	260 Brinnell
Max. Depth of Cut	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3/8"
Greatest Precision	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+ .003 — .000
Tool Material	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Tungsten Carbide
Floor to Floor Time with Trace-o-Matic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40 Minutes Rough and Finish
Floor to Floor Time, Former Method	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	328 Minutes Rough and Finish
Time Saved	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	288 Minutes



performance data

[illegible]

performance data

[illegible]

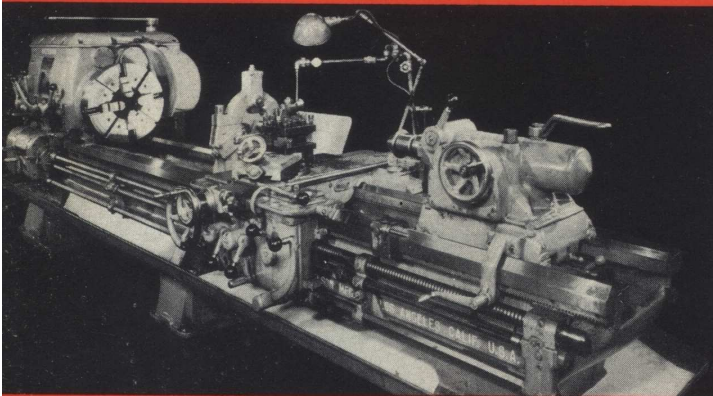
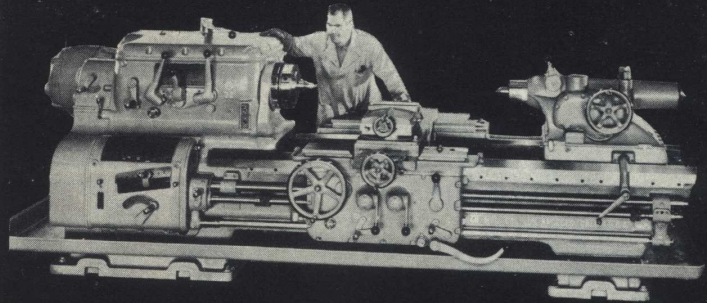
AXELSON ^{heavy duty} LATHES

AXELSON HEAVY DUTY LATHES

Model B-16"	—	Swing over Ways	18½"
Model W-20"	—	" " "	22½"
Model D-20"	—	" " "	22½"
Model E-25"	—	" " "	28½"
Model F-32"	—	" " "	34½"

Axelson Precision Tool Room Lathes

Model 16	—	Swing over Ways	18½"
Model 20	—	" " "	22½"



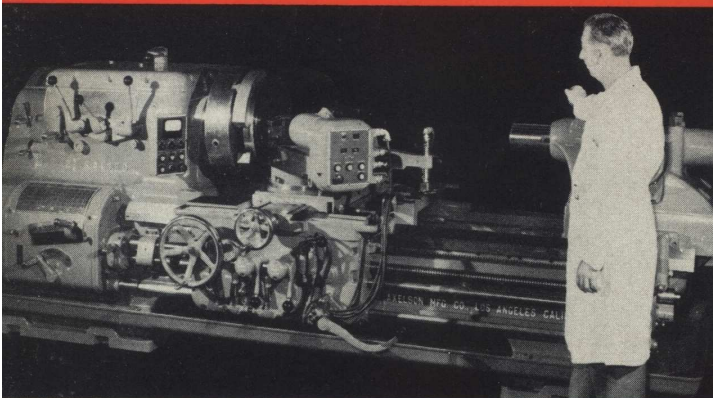
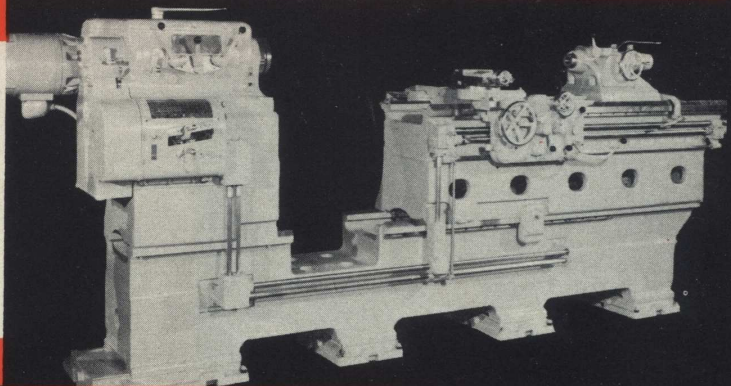
AXELSON HOLLOW SPINDLE LATHES

Model 20"	—	Swing over-Ways	22½"	Hole 8⅞"
Model 25"	—	" " "	28¾"	Hole 11"
Model 32"	—	" " "	34½"	Hole 11"
Model 32"	—	Also available with Gap Bed		

AXELSON GAP BED LATHES

Model 32x100	Swing over Ways	34½"
" "	Gap	100"
Model 32x125	Swing over Ways	34½"
" "	Gap	125"

Also available with Hollow Spindle, 11" Hole.



AXELSON SPECIAL LATHES

Special lathes designed to meet specific production requirements are equipped with special built-in features including Raytheon electronic tracer control, concave and convex radius turning attachments, automatic lathes, etc. In addition, Axelson manufactures an extensive line of standard and special accessory equipment that adapts Axelson lathes to a great variety of special work. All lathes are furnished with various length beds.



AXELSON
MANUFACTURING COMPANY DIVISION
PRESSED STEEL CAR COMPANY, INC.
LOS ANGELES 58, CALIFORNIA
AUTHORIZED DISTRIBUTORS IN ALL PRINCIPAL INDUSTRIAL CENTERS



LITHO IN U.S.A.