

# DEVLIEG SPIRAMATIC JIGMIL®



*PRECISION BORING, MILLING  
AND DRILLING MACHINES*

DEVLIEG MACHINE COMPANY FAIR STREET ROYAL OAK, MICHIGAN, U.S.A.

®Trademark Reg., U.S. Pat. Off.



CATALOG NO. SJ-108

The range of *SPIRAMATIC* JIGMIL Precision Boring and Milling Machines described in this catalog represents the outcome of many years of field analysis, research and development work carried out by the DeVlieg Machine Company to determine and meet the requirements of the metalworking industry in the field of precision boring and milling.

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## *Design Characteristics*

The DeVlieg JIGMIL is a universal precision boring and milling machine combining extreme accuracy, power, rigidity, and facility of operation that has set new standards of economy in the processing of one-piece jobs and production work. The advanced structural design of the JIGMIL provides a fixed relationship between the horizontal and vertical slides which insures precise accuracy in the full range of the machine. The rugged construction of the machine bed, column and spindlehead provides ideal conditions for the efficient application of carbide, titanium and ceramic cutting tools. In addition, the JIGMIL incorporates many important automatic functions that were pioneered by the DeVlieg Machine Company. Reliance on the "human element" to produce close tolerance work is largely eliminated by the use of these automatic machine functions which are integral features of the JIGMIL design.

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## *The Jigmil Technique*

In the process of developing the JIGMIL with its unique design and functions, DeVlieg Machine Company pioneered a new and simple technique for dealing with precision boring and milling operations. The JIGMIL Technique differs substantially from conventional boring practices, and a comprehensive training program covering all phases of the JIGMIL Technique is available without charge to all JIGMIL users. These training programs which are carried out in our own plant include the training of operators and an educational program for tool engineers, methods, time study and supervisory personnel. To insure that all JIGMIL users derive maximum benefits from their machines, we recommend that all our customers take advantage of this comprehensive training program prior to installation of their machines.

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## *Customers' Work Analysis*

We maintain a special department for making engineering analyses of precision boring and milling work submitted to us by companies who are interested in obtaining a realistic appraisal of the economies that can be obtained by the installation of our machines. This engineering service is furnished without charge and includes the recommended size and type of machine and control, method of job setup, sequence of operations, tool layouts, and time study.

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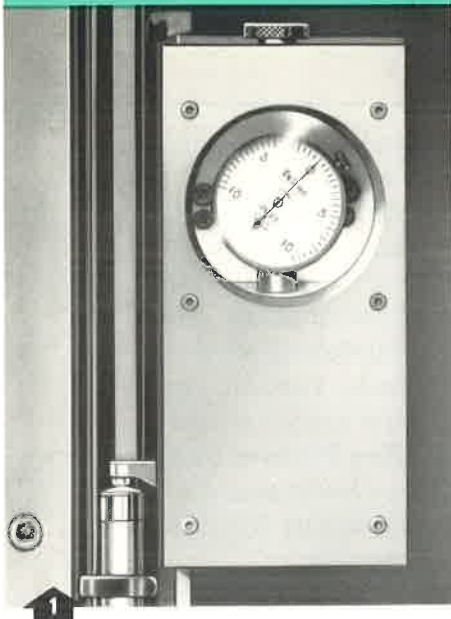
## *Field Service*

A staff of highly trained engineers is maintained to install and service machines in the field and serve customers with technical counsel relating to the operation and application of our machines so that the full potential of the JIGMIL Technique may be attained. Our modern plant is devoted exclusively to the development and manufacture of precision boring and milling machines and our experience and specialized facilities are at the disposal of the metalworking industry.

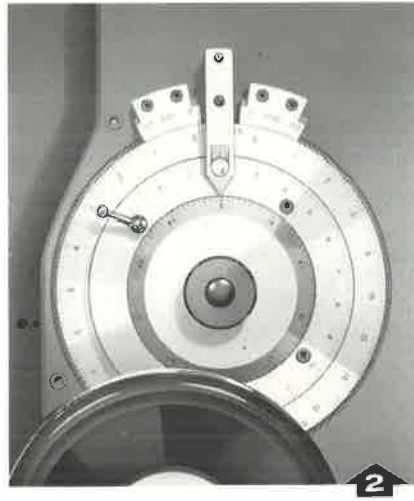
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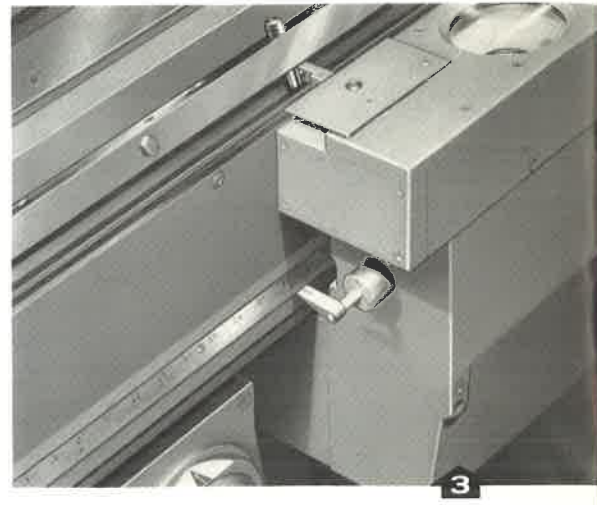
## Advanced Constructional Features included



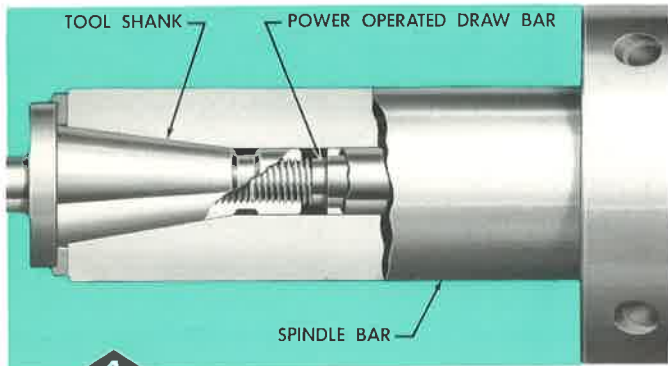
**1**  
**AUTOMATIC POSITIONING OF THE MACHINE TABLE AND SPINDLEHEAD** is performed through a sequenced electrical cycle. Hole spacing in the workpiece is controlled to precise limits of accuracy through the operation of a single push button.



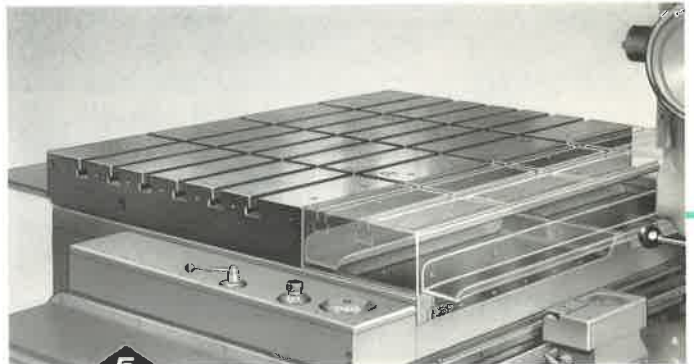
**2**  
**AUTOMATIC DEPTH CONTROL** trips spindle bar feed automatically at pre-determined points set on combination dials and vernier scales for required depth of feed.



**3**  
**DUPLITROL POSITIONING SYSTEM** provides a means of mechanical programming for "jigless boring" all types of work on a production basis, thereby eliminating expensive boring jigs.



**4**  
**POWER TOOL LOCK MECHANISM**—built into machine spindle for locking and releasing boring bars and adapters in response to a pushbutton control.

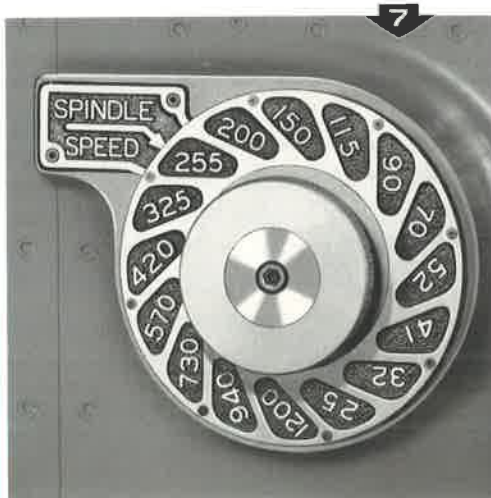


**5**  
**AUTOMATIC TABLE RETRACTION.** To facilitate tool changing and work inspection, machine table is retracted parallel to the spindle axis and repositioned automatically by pushbutton control.

**6**  
**MAIN OPERATING PUSHBUTTON CONTROLS ON SPINDLEHEAD**... provide convenience of operation for all movements of the machine.

**7**  
**PRESELECTIVE AUTOMATIC SPINDLE SPEED CHANGING MECHANISM** for Series 3H, 4H and 5H machines is operated through a single push button.

**8**  
**MACHINE SLIDES ARE OF GENEROUS DIMENSIONS** and accurate alignment is maintained through narrow vee guides. Saddle and table are fully supported on the machine bed at the maximum range of travel.



## on DeVlieg SPIRAMATIC JIGMILS as Standard Equipment...

DeVlieg JIGMILS are ruggedly constructed throughout to insure years of dependable accuracy and trouble-free operation. The bed and column slides remain in permanent fixed relationship for the life of the machine. The bed is at cross axis to the spindle center line and is dimensioned to provide full support to the saddle, table and workpiece for the full horizontal travel of the table with no deflection or distortion effect in the true plane of travel.

The column slides serve the vertical movement of the spindlehead which is fully counterbalanced to insure a true plane of vertical travel. All way surfaces are precision machined and hand-scraped to insure an accuracy of .0001" per foot in all alignments and path of travel.

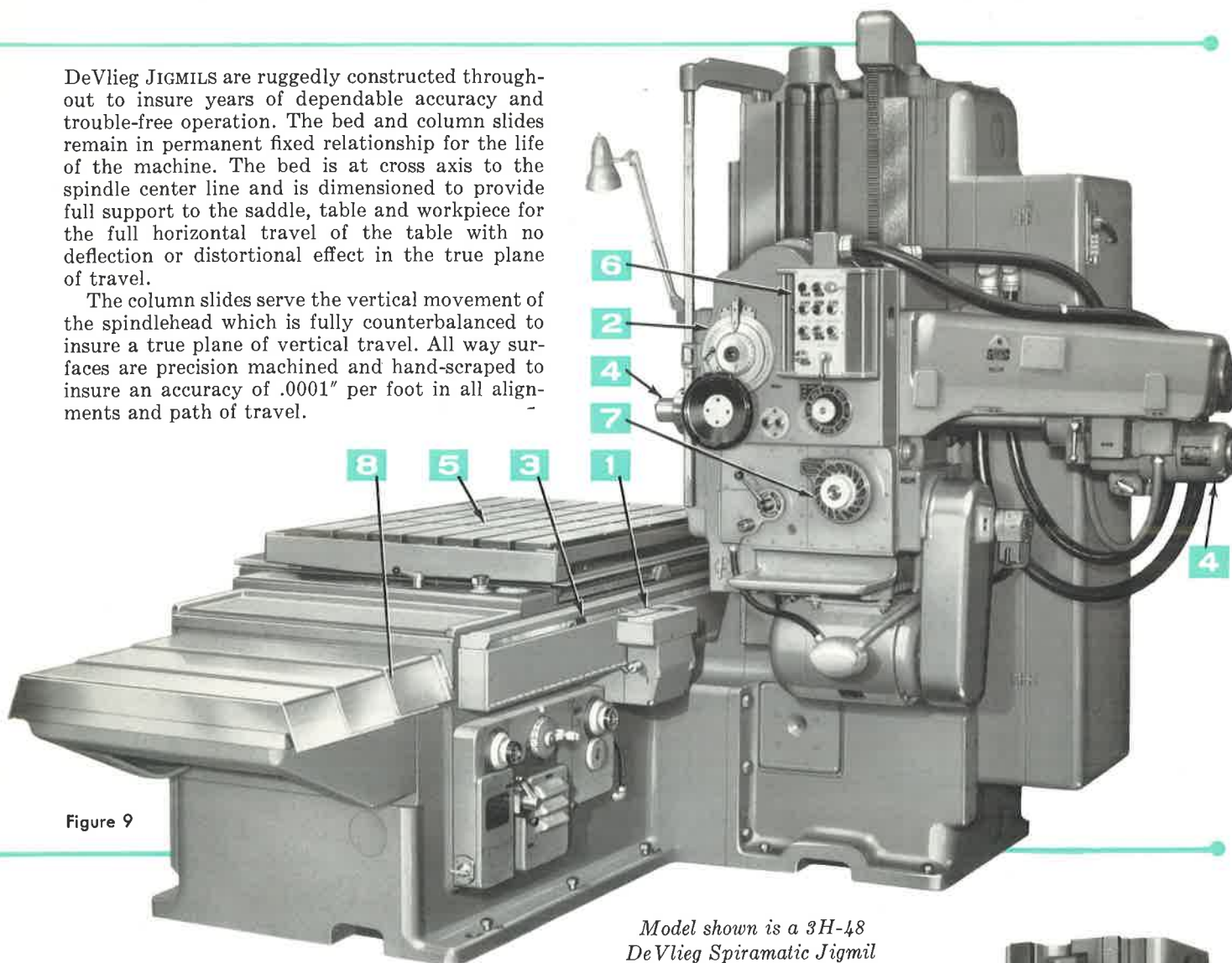


Figure 9

Model shown is a 3H-48  
DeVlieg Spiramic Jigmil

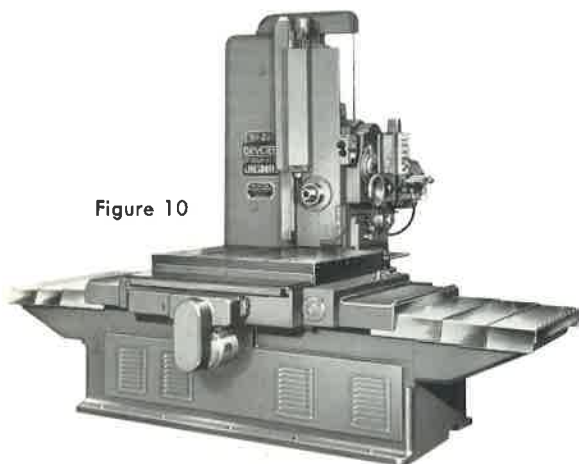


Figure 10

**EXTENDED COLUMNS** are available on machines where additional vertical travel is required for machining larger workpieces. Model shown is a 3H-48 JIGMIL with 12" extended column.

**RUGGED CONSTRUCTION** of machine bed and column affords a fixed horizontal and vertical relationship between the basic slides. The column and bed castings are joined at the hand-scraped mating surfaces and are secured by heavy bolts and tapered dowel pins.

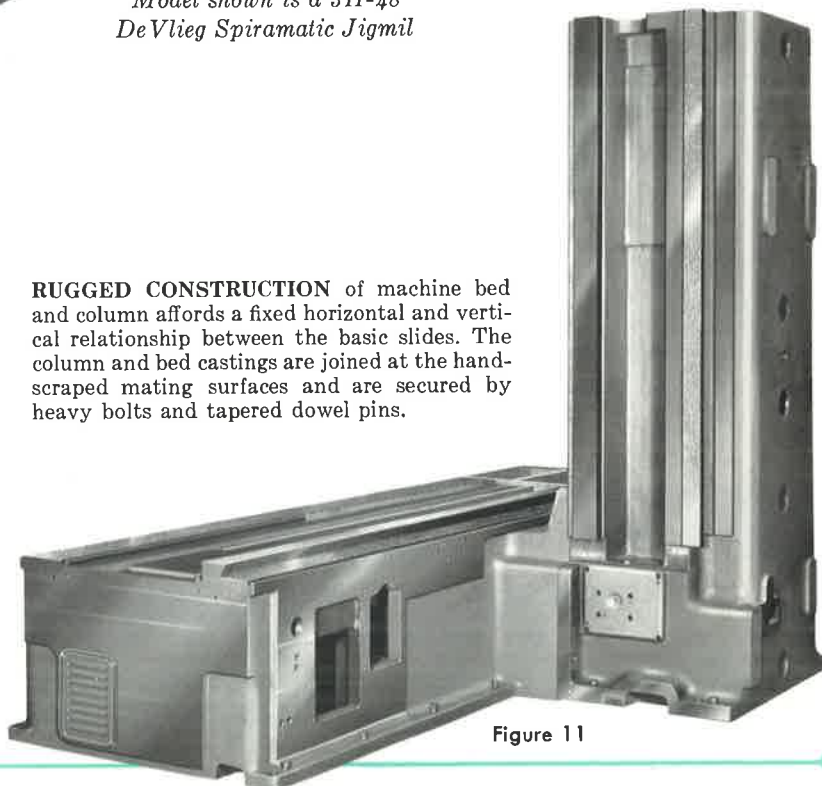


Figure 11



# A COMPREHENSIVE RANGE OF BASIC MACHINES

DeVlieg *SPIRAMATIC* JIGMILS are available in a wide range of sizes for machining all types and sizes of workpieces ranging from small instrument parts, jigs and fixtures, etc., to large workpieces such as side frames for printing and paper machinery, aircraft and missile components, large gear boxes, etc.

Detailed specifications for the full range of standard machines are given on pages 34 and 35.

A number of typical applications are illustrated on pages 10 through 13 showing how the JIGMIL Technique is applied to machine accurate holes and flat surfaces in precise locations on a variety of workpieces.

*SPIRAMATIC* JIGMILS incorporate as standard equipment many well-known patented automatic functions that have been pioneered and developed by DeVlieg Machine Company and which include:

- **Automatic Positioning** for the machine table and spindlehead.
- **Automatic Speed Changing Mechanism** for machine spindle.
- **Automatic Trip Mechanism** for spindle bar feed.
- **Power Operated Tool Lock Mechanism** for locking and releasing boring bars, milling cutters, adapters, etc.
- **Duplitrol Equipment**—mechanical program control for jigless boring production work.
- **Automatic Table Retraction** to facilitate tool changing and work inspection and to insure maximum rigidity during machining operations.

## MODEL 2B-36 *SPIRAMATIC* JIGMIL

This machine is designed for boring and milling small workpieces such as instrument parts, gear cases, jigs, fixtures, and experimental parts. The Model 2B-36 machine has a  $2\frac{1}{2}$ " diameter spindle bar, 24" vertical travel and 36" horizontal travel. Vertical travel can be extended by 6" or 12" when the machine is furnished with an extended column, optional at extra cost. See pages 34 and 35 for detailed specifications.

Shown at right—  
Model 2B-36 *SPIRAMATIC* JIGMIL

$2\frac{1}{2}$ " diameter spindle bar  
Vertical travel.....24"  
Horizontal travel.....36"  
Table.....36" x 24"

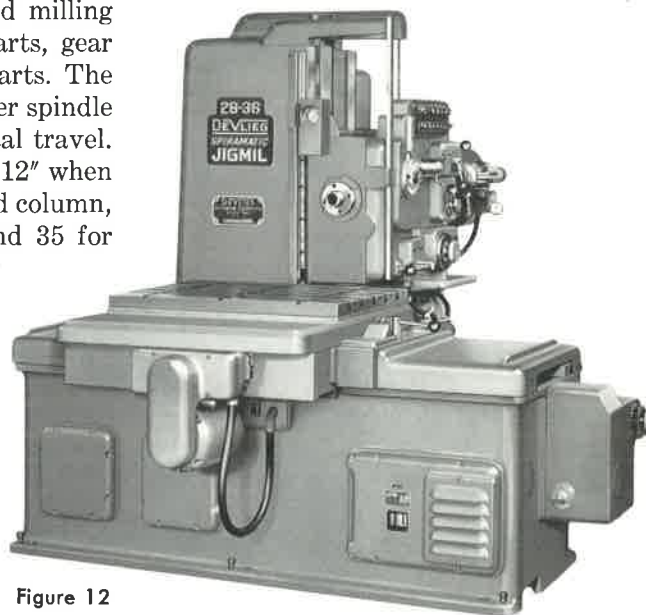


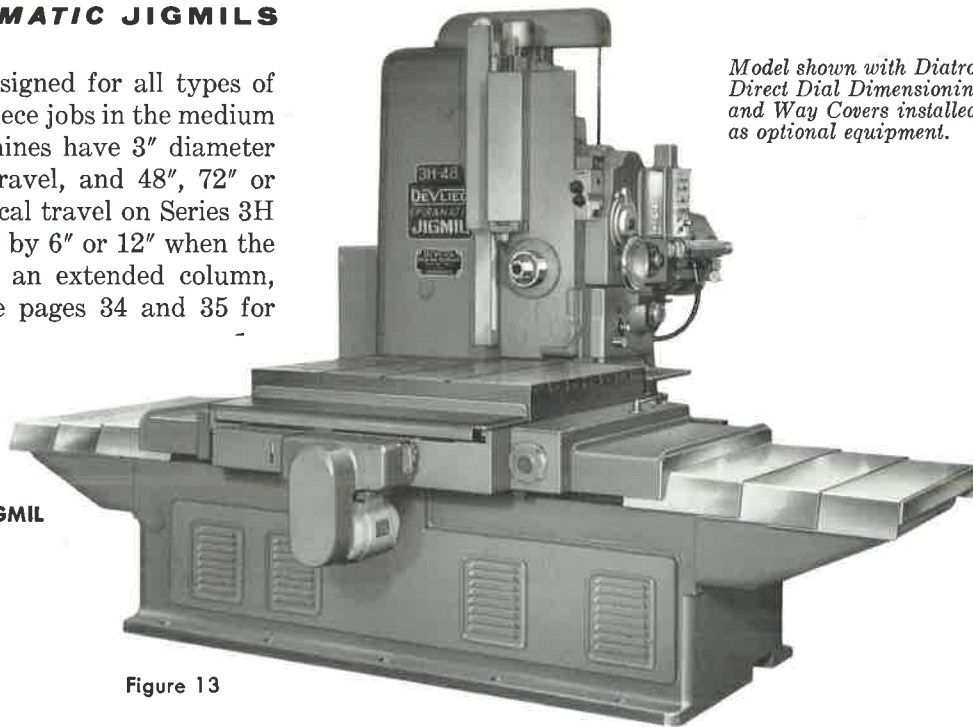
Figure 12

... for all types of Precision Boring and Milling Operations

### **SERIES 3H SPIRAMATIC JIGMILS**

Series 3H machines are designed for all types of production work and one-piece jobs in the medium size range. Series 3H machines have 3" diameter spindle bar, 36" vertical travel, and 48", 72" or 96" horizontal travel. Vertical travel on Series 3H machines may be increased by 6" or 12" when the machine is furnished with an extended column, optional at extra cost. See pages 34 and 35 for detailed specifications.

*Model shown with Diatrol Direct Dial Dimensioning and Way Covers installed as optional equipment.*



**Shown at right—  
Model 3H-48 SPIRAMATIC JIGMIL**  
3" diameter spindle bar  
Vertical travel.....36"  
Horizontal travel....48"  
Table.....48" x 35"

Figure 13

### **SERIES 4H SPIRAMATIC JIGMILS**

Series 4H machines are designed for machining all types of production work and one-piece jobs in the medium and larger size ranges. Series 4H machines have 4" diameter spindle bar, 48" vertical travel, and 60", 72", 96" or 120" horizontal travel. Vertical travel on Series 4H machines may be increased by 6", 12" or 24" by furnishing the machine with an extended column, optional at extra cost. See pages 34 and 35 for detailed specifications.

**Shown at left—  
Model 4H-72 SPIRAMATIC JIGMIL**  
4" diameter spindle bar  
Vertical travel.....60"  
Horizontal travel....72"  
Table.....72" x 40"

*Model shown with Diatrol Direct Dial Dimensioning, 12" extended column and Way Covers installed as optional equipment.*

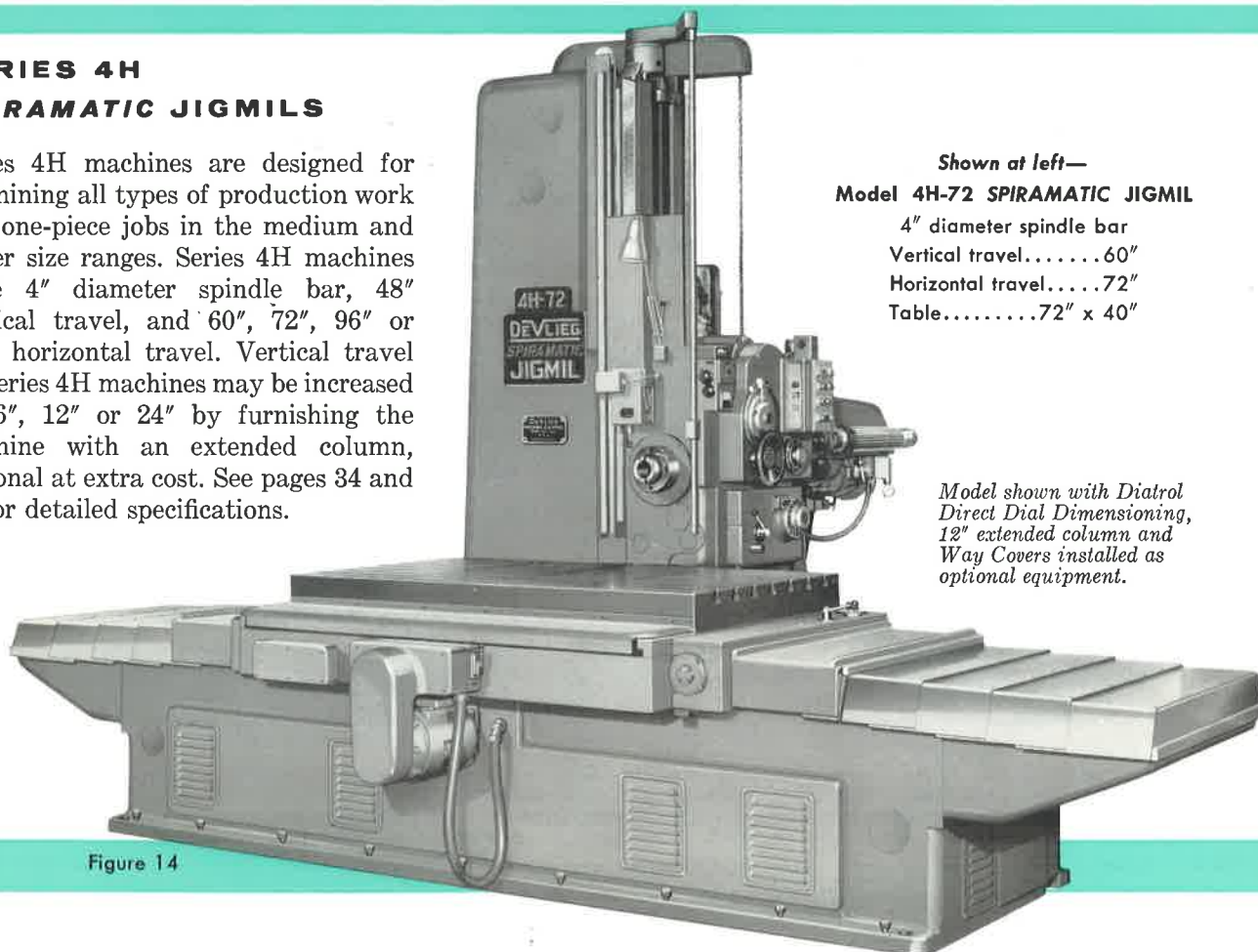


Figure 14

# Basic machines for Precision Boring and Milling larger workpieces

## Models 4H-96 and 4H-120

These machines with their greater horizontal travel are designed for machining all types of work in a larger size range. Vertical travel on both machines may be increased by 6", 12" or 24" when the machine is furnished with an extended column, optional at extra cost. See pages 34 and 35 for detailed specifications.

### Shown at left— Model 4H-96 SPIRAMATIC JIGMIL

4" diameter spindle bar  
Vertical travel.....48"  
Horizontal travel.....96"  
Table.....96" x 40"

General specifications for Model 4H-96 are shown with the accompanying illustration; Model 4H-120 has 4" diameter spindle bar, 48" vertical travel and 120" horizontal travel.

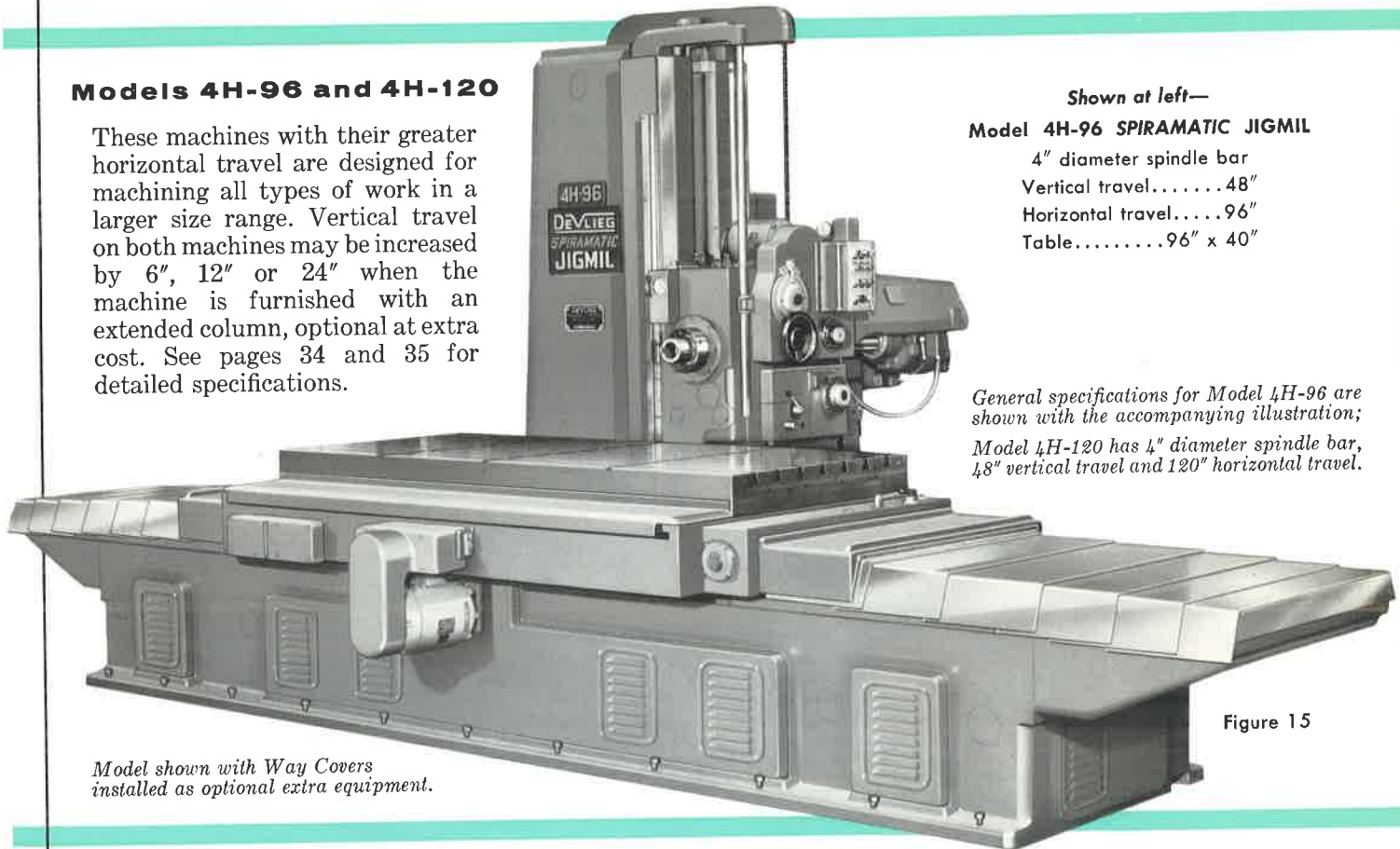


Figure 15

Model shown with Way Covers installed as optional extra equipment.

## DeVlieg Automatic Control Systems designed exclusively for Spiramatic Jigmils.

Several DeVlieg precision control systems are available to make full use of the JIGMIL's inherent accuracy and productivity. These controls are the result of extensive research and development on the part of DeVlieg engineers, and the controls become an integral part of the machine upon which they are installed. There are three basic types of DeVlieg controls avail-

able depending upon the job requirements and customer preference;

DUPLITROL—a mechanical program control.

DIATROL dial-in numerical control system.

TAPAC numerical tape control system.

These proven control systems are being widely used for jigless boring and machining operations.

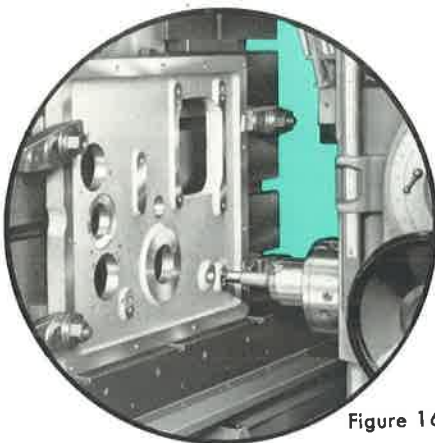


Figure 16

**DUPLITROL** . . . A system of mechanical program control that automatically positions the JIGMIL table and spindlehead for "jigless boring"; described on page 19.

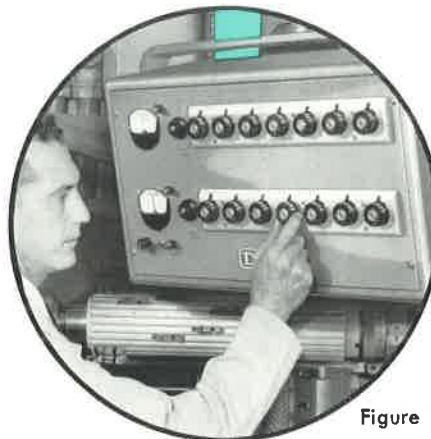


Figure 17

**DIATROL** . . . A system of direct dial point-to-point dimensioning and positioning numerical control developed exclusively for use on DeVlieg SPIRAMATIC JIGMILS. See page 10.

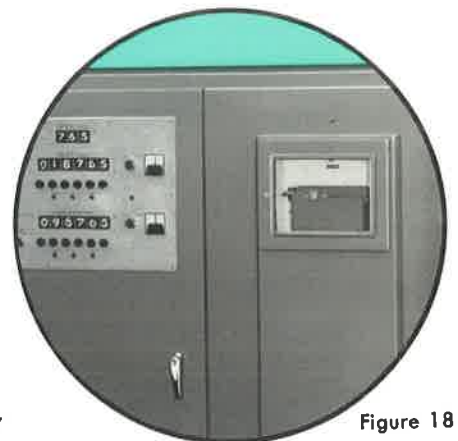


Figure 18

**TAPAC\*** . . . A system of numerical tape control developed expressly for use on DeVlieg JIGMILS makes full use of the JIGMIL's inherent accuracy and precision. See page 11.

\*Tape control systems manufactured by certain other control builders can also be adapted to the JIGMIL.

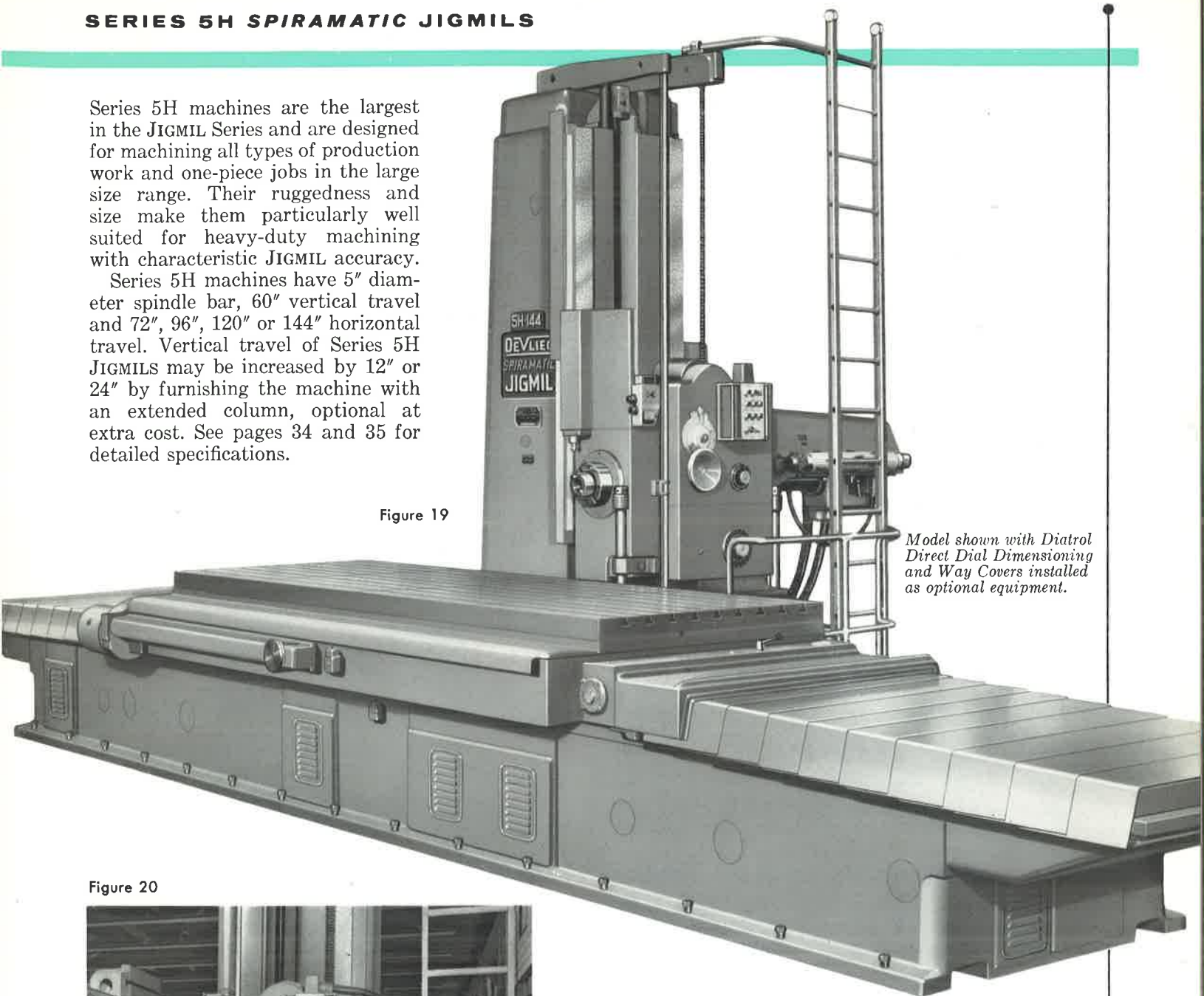


## SERIES 5H SPIRAMATIC JIGMILS

Series 5H machines are the largest in the JIGMIL Series and are designed for machining all types of production work and one-piece jobs in the large size range. Their ruggedness and size make them particularly well suited for heavy-duty machining with characteristic JIGMIL accuracy.

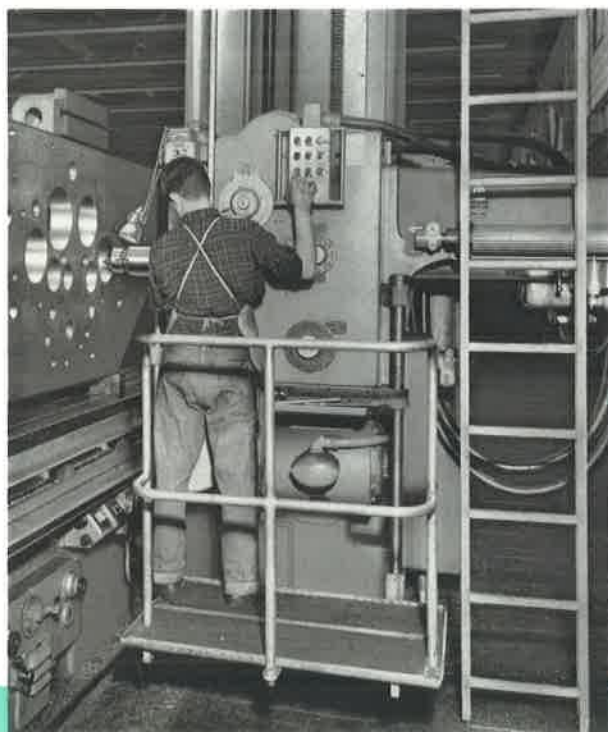
Series 5H machines have 5" diameter spindle bar, 60" vertical travel and 72", 96", 120" or 144" horizontal travel. Vertical travel of Series 5H JIGMILS may be increased by 12" or 24" by furnishing the machine with an extended column, optional at extra cost. See pages 34 and 35 for detailed specifications.

Figure 19



*Model shown with Diatrol Direct Dial Dimensioning and Way Covers installed as optional equipment.*

Figure 20



**Shown above—  
Model 5H-144 SPIRAMATIC JIGMIL**

5" diameter spindle bar  
Vertical travel.....72"  
Horizontal travel....144"  
Table.....144" x 50"

### ELEVATOR PLATFORMS for 5H JIGMILS

An elevator platform and ladder is standard equipment for Series 5H JIGMILS. The platform raises and lowers with the spindlehead so the operator has ready access to the controls throughout the full vertical travel of the machine. The stationary ladder is readily accessible to the operator regardless of the position of the platform.

# Diatrol®

## Direct Dial Dimensioning

(PATENT NO. 3,011,113)

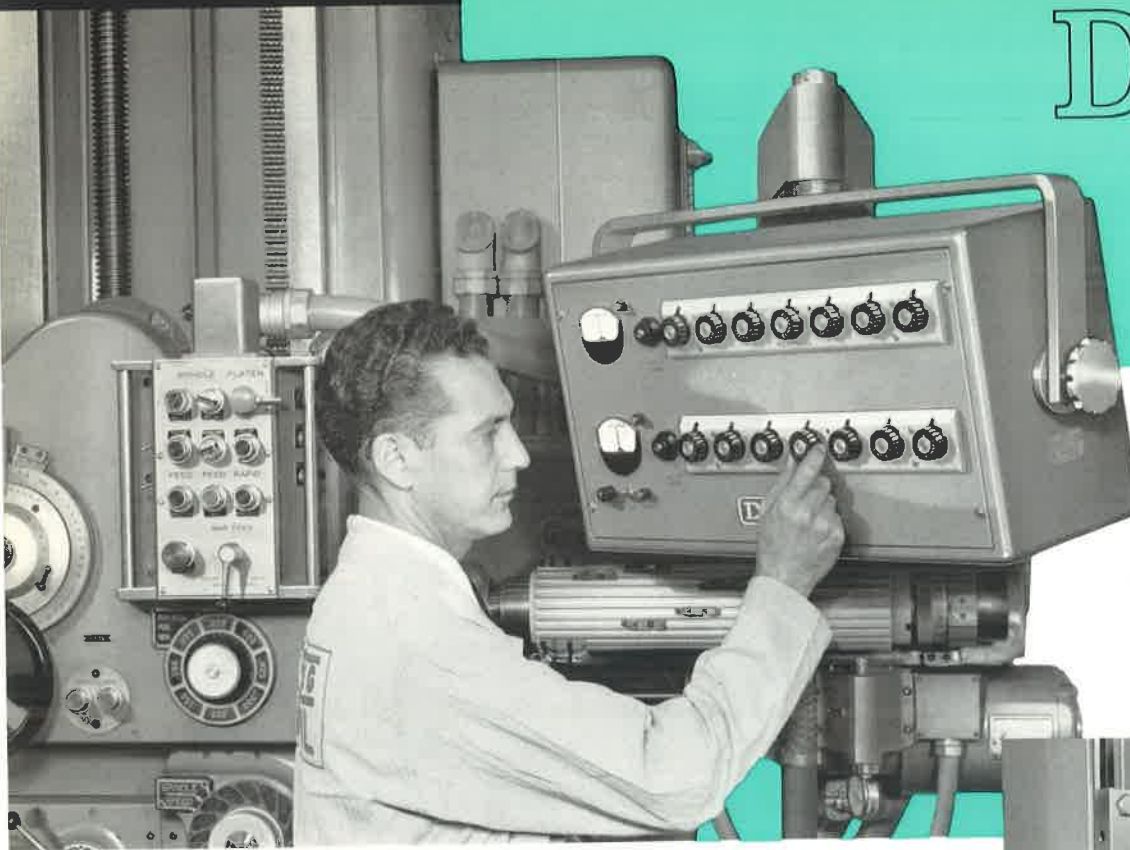


Figure 21

The DeVlieg System of accurate point-to-point dimensioning and positioning developed exclusively for use on DeVlieg JIGMILS

Figure 22

### Diatrol is a manual Numerical Control System permitting direct dial dimensioning

The Diatrol System of automatic point-to-point positioning speeds up spindle location, simplifies control, and assures accuracy. The system provides a means of preselecting coordinate dimensions for the horizontal table movement and the vertical movement of the spindlehead. Diatrol allows direct dialing of dimensions from any arbitrarily selected datum plane within the range of the control system. A pushbutton control automatically positions the table and spindlehead at the preselected hole location in seconds. All settings are made on direct reading dials; one set for horizontal and the other for vertical dimensions. Positioning is automatic from the arbitrarily selected datum or zero point.

The nature of this system makes it entirely practical for an operator to dial in coordinate dimensions directly from a blueprint with the resultant elimination of much of the mathematics normally associated with accurate boring work. While the JIGMIL is performing the machining operation, the operator can preset for the next move. The Diatrol System will measure and position well within the tolerance range of the JIGMIL. This system is ideal for tool room and experimental work as well as "jigless boring" small-lot production jobs.

The Diatrol System is a manual numerical control system developed exclusively for use on DeVlieg JIGMILS and this proven system utilizes compact plug-in units containing the latest type transistorized electronic circuitry for dependability and easy replacement. The measuring portion of the system is capable of being calibrated to the ultimate in accuracy, and the measuring, positioning and control elements are completely protected to insure continuous and trouble-free performance.

### DIATROL—DUPLITROL

For repetitive production work the Diatrol system permits the use of Duplitrol Blocks and Duplitrol Bars. This mechanical programing method eliminates expensive boring jigs and greatly reduces operator fatigue and potential error. A set of two simple Duplitrol bars is provided for each job and these bars serve as accurate and permanent masters for duplicating the particular workpiece at any time.

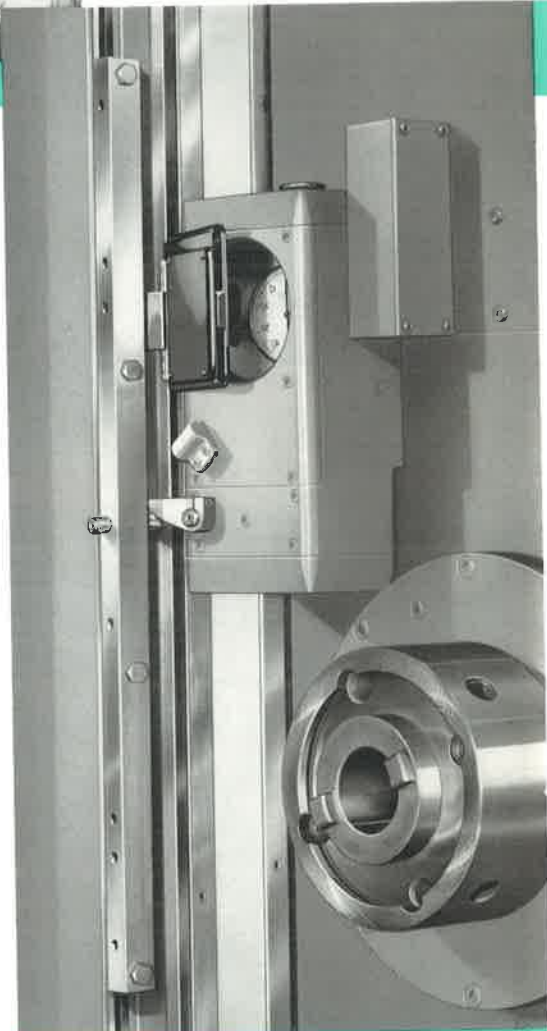


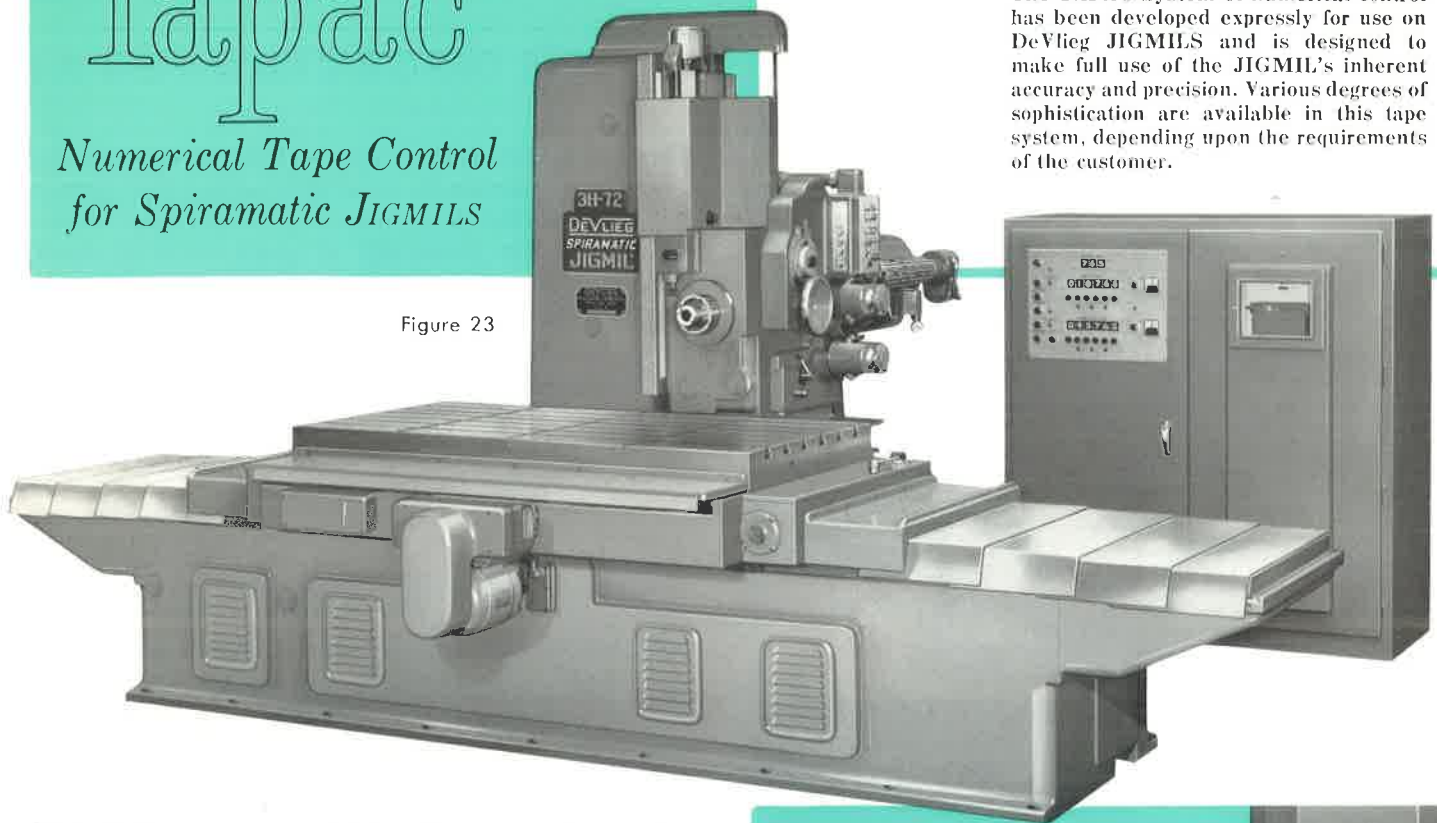
Illustration above shows the Diatrol System with a Duplitrol bar in position. The combination of Diatrol for simple dialing of dimensions in increments of .0001" plus the ability to use Duplitrol bars for production work provides a unique combination of manual numerical control plus simple mechanical programing.



# Tapac<sup>®</sup>

*Numerical Tape Control  
for Spiramatic JIGMILS*

Figure 23



The TAPAC System of numerical control has been developed expressly for use on DeVlieg JIGMILS and is designed to make full use of the JIGMIL's inherent accuracy and precision. Various degrees of sophistication are available in this tape system, depending upon the requirements of the customer.

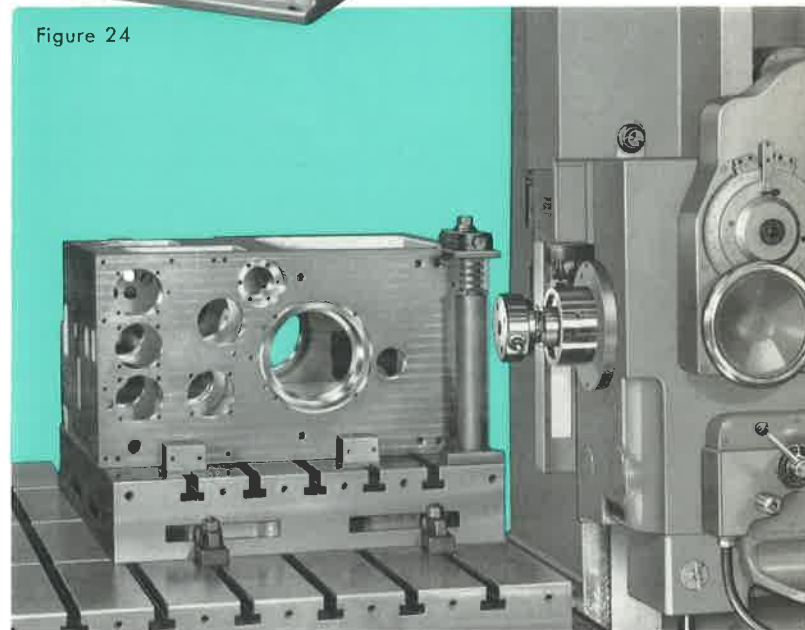
TAPAC Systems are available with numerical control of two, three and four axes of movement, depending upon the sophistication required. The basic two-axis system controls the horizontal table travel (X axis) and the vertical spindle-head movement (Y axis). Master Measuring Bars or Inductosyn scales are utilized for measurements along these axes. For the third axis requirement, the spindle travel (Z axis) is fully tape controlled and measurement is accomplished by precision lead screw and rotary resolvers. A tape controlled rotary table accurate to 2 seconds of arc is available as the fourth axis.

The TAPAC System utilizes standard 1" 8-channel binary coded punched paper or plastic tape. Machine functions such as selection of spindle speeds and spindle feeds, control of spindle depth of feed, automatic spindle rapid traverse, feed and retraction, automatic advance to new hole locations, selection of milling feed rates, point-to-point milling, can also be programmed into the tape control. In addition to this the TAPAC System provides automatic table retraction, automatic locking of slides, coolant control, tool change warning signal and operation number designation.

An important advantage of the TAPAC System is the simple programming procedure for making a tape. Many of the automatic machine movements are functions of the electrical sequences of the machine itself and do not have to be programmed into the tape. Such functions as locking and unlocking of the slides, automatic table retraction, spindle rapid traverse, feed and return, automatic tape advance, and other functions are sequenced electrically with full safety interlocks—thus greatly minimizing the programming effort and largely eliminating errors in programming.

Only the basic information need be programmed into the tape, i.e., horizontal and vertical dimensional settings, spindle speeds and feeds, depth control setting and tool change. As a result of this greatly simplified programming procedure, not only is tape programming time substantially

Figure 24



reduced, but possibilities for errors are also reduced. At the same time the simplified programming procedure for the TAPAC System results in a very short training program for the person who will do the programming. It has been determined that in just a few hours the average methods or planning engineer can become fully competent to make tapes for use on a DeVlieg JIGMIL equipped with the TAPAC System.

The DeVlieg Tape Control System has been designed with simplified maintenance in mind. The console design makes use of completely transistorized modular plug-in type units which can easily be checked and quickly replaced if necessary. There are no vacuum tubes which can cause service or heat problems. The relays are all completely sealed plug-in type, and only two types of relays are used.



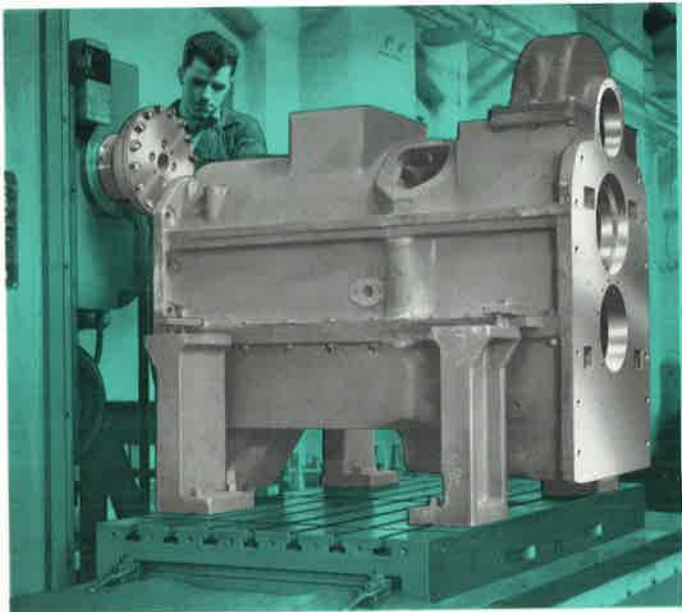


Figure 25. Milling and boring speed reducer gear box for large marine diesel engine.

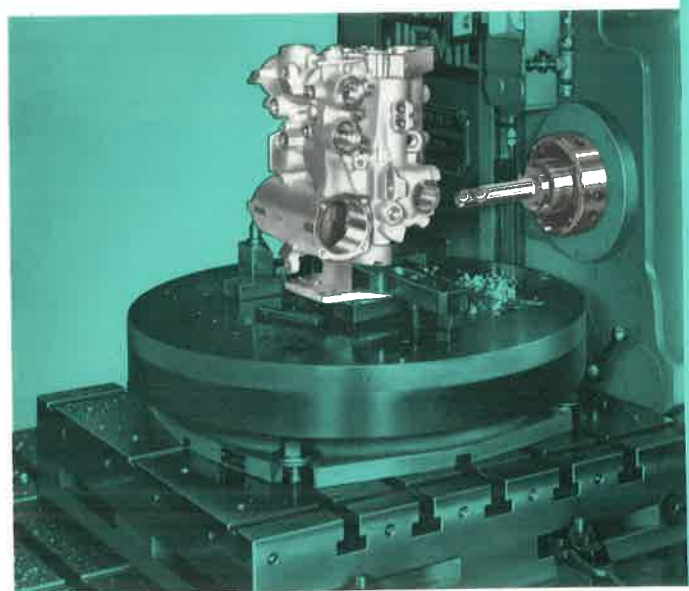


Figure 27, above. Boring, milling, drilling and tapping fuel control body for jet engine.

## *The DeVlieg JIGMIL is an unusually* for PRODUCTION WORK

**Production Applications**—The DeVlieg System of “jigless boring” eliminates expensive boring jigs, permits complete flexibility of product design, and insures interchangeable assembly of parts without hand-fitting. DeVlieg JIGMILS are used extensively for jigless boring a wide variety of production parts such as pump housings, gear cases, aerospace and instrument parts, components for machine tools, printing presses, missiles, paper machinery, textile machinery, and all types of machine parts requiring accurate holes and flat surfaces in accurately-spaced relationship.

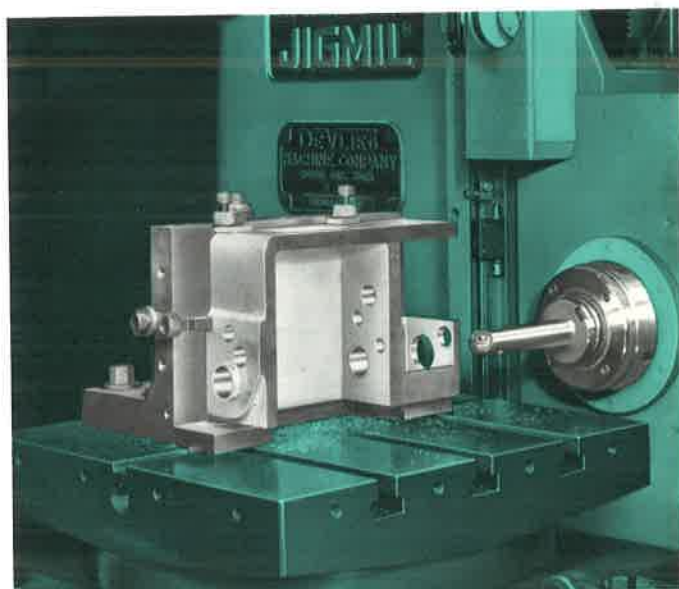


Figure 26. Precision boring aluminum instrument gear box.

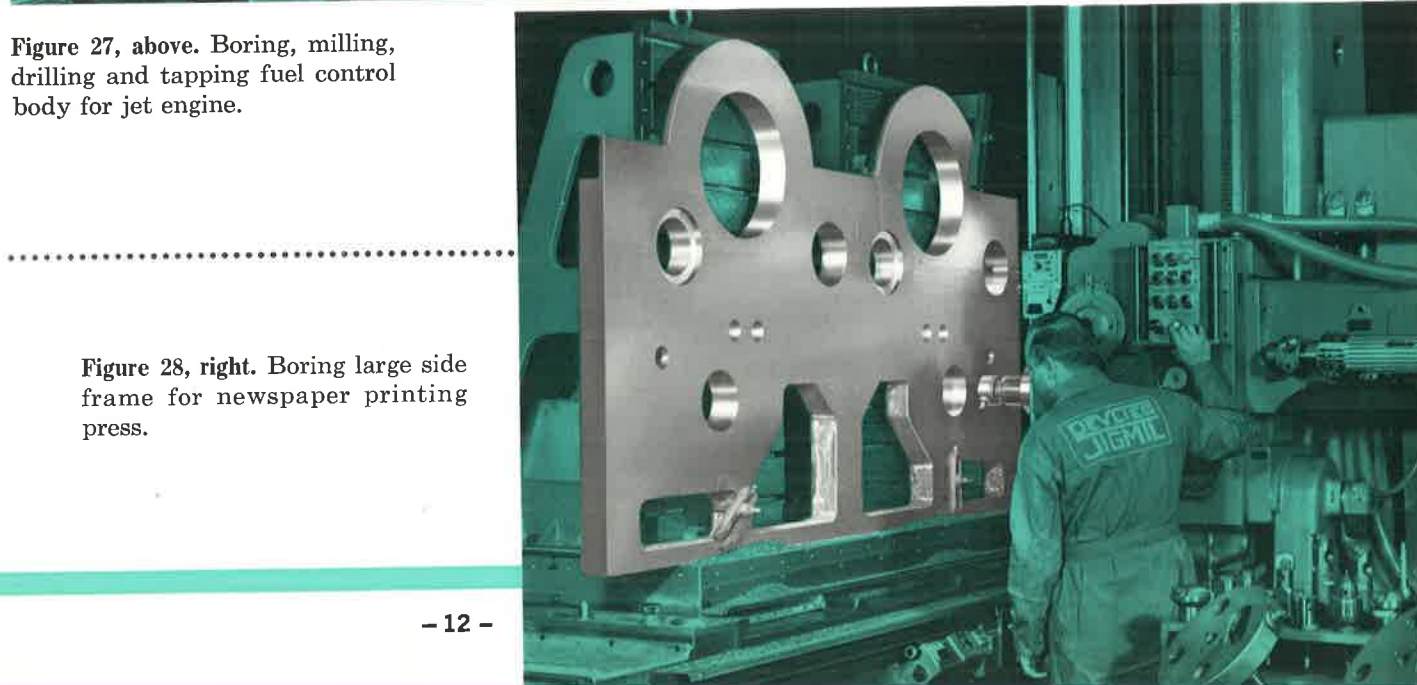


Figure 28, right. Boring large side frame for newspaper printing press.

*versatile machine which can be used effectively*

## ... or ONE-PIECE JOBS

**One-Piece Jobs**—The versatility of DeVlieg JIGMILS is exemplified by their widespread use in tool rooms, experimental shops and contract machine shops. All types of jigs, fixtures and experimental parts can be machined on the JIGMIL to precise limits of accuracy without the special operator skill which is normally required for this type of work. Reliance on the "human element" to produce close tolerance work is largely eliminated by the use of automatic machine functions which are basic principles of the JIGMIL design. The JIGMIL principle of precision boring and milling permits the machining of workpieces from several sides in one setting and actual machining times are much faster than are possible with conventional machines and methods.

*The applications illustrated are typical examples of the wide variety of work which is being machined accurately and economically on DeVlieg JIGMILS.*

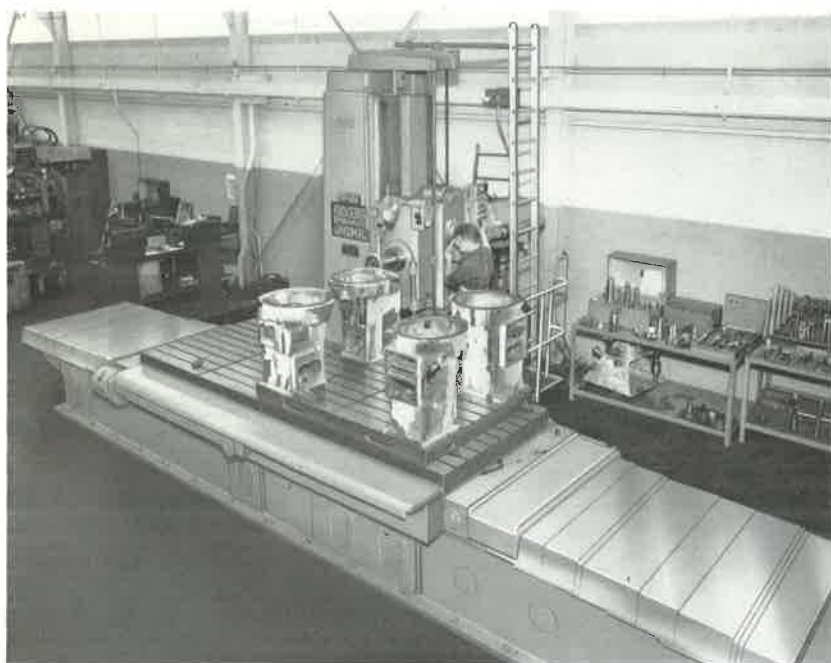


Figure 29, above. Rough and finish boring and milling of air conditioning compressor housing.

Figure 30, left. Milling and boring large tractor transmission housings on Model 5H-144 JIGMIL.

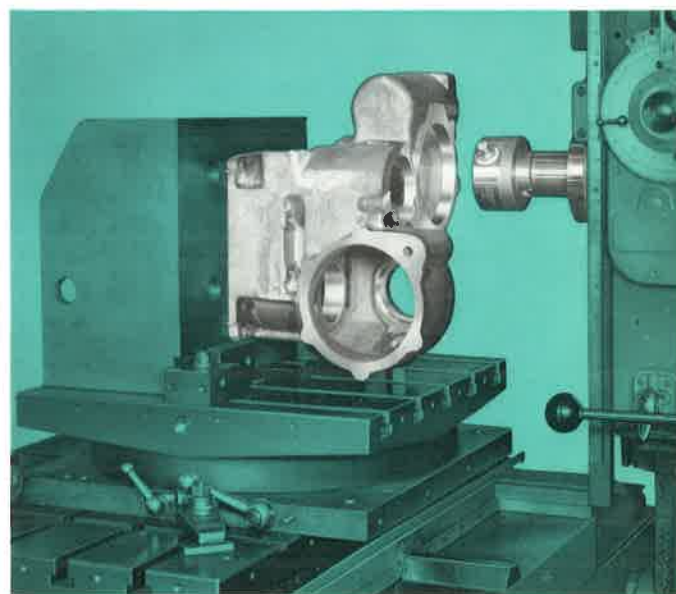
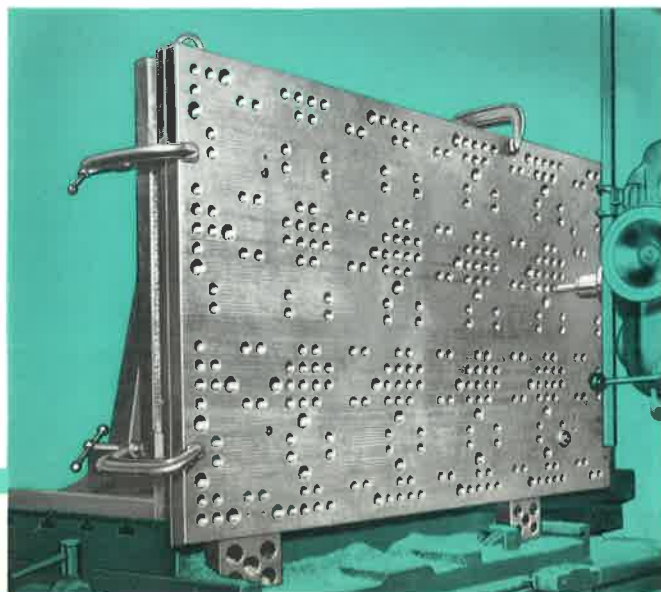


Figure 31, above. Milling and boring small transmission case from four sides on Model 2B-36 JIGMIL. Total time: 1 hour, 55 minutes.

Figure 32, left. Precision jig boring 342 holes in master locating plate.



*Additional applications shown on next pages.*



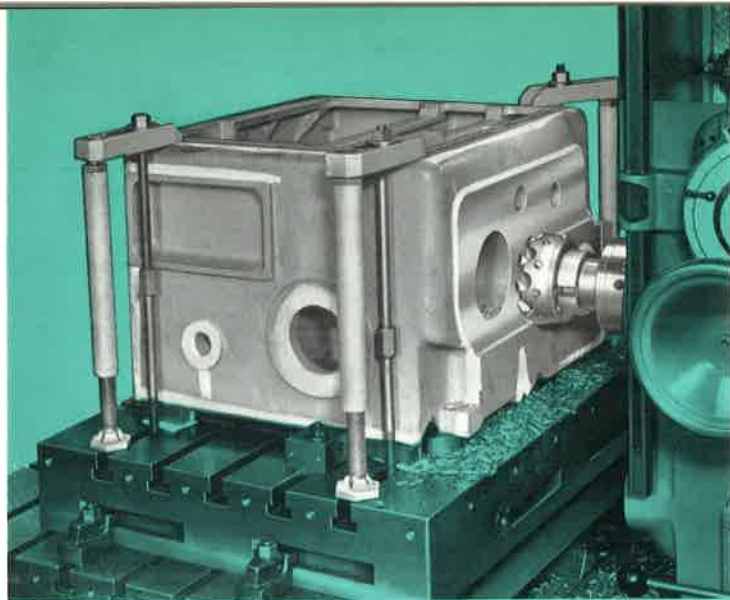


Figure 33, above. Milling and boring lathe headstock on Model 3H-48 JIGMIL.

Figure 34, right. Drilling, rough and finish boring a pair of large side frames for multicolor printing press on Model 5H-144 JIGMIL equipped with Diatrol positioning system.

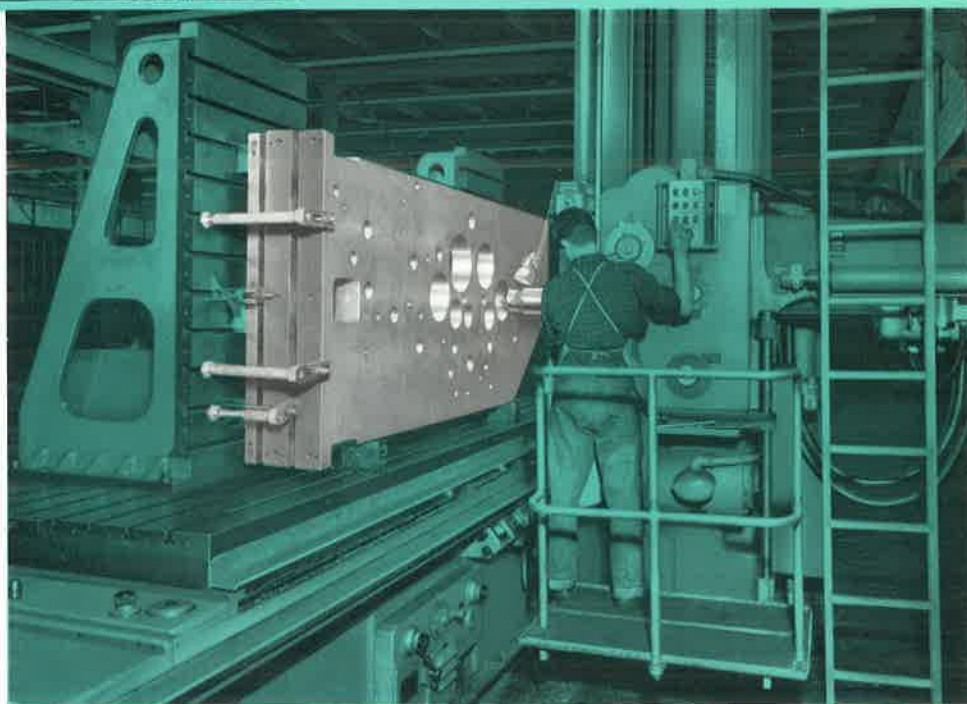


Figure 35, below. Rough and finish milling, drilling and boring large cast steel traction gear box for diesel locomotive.

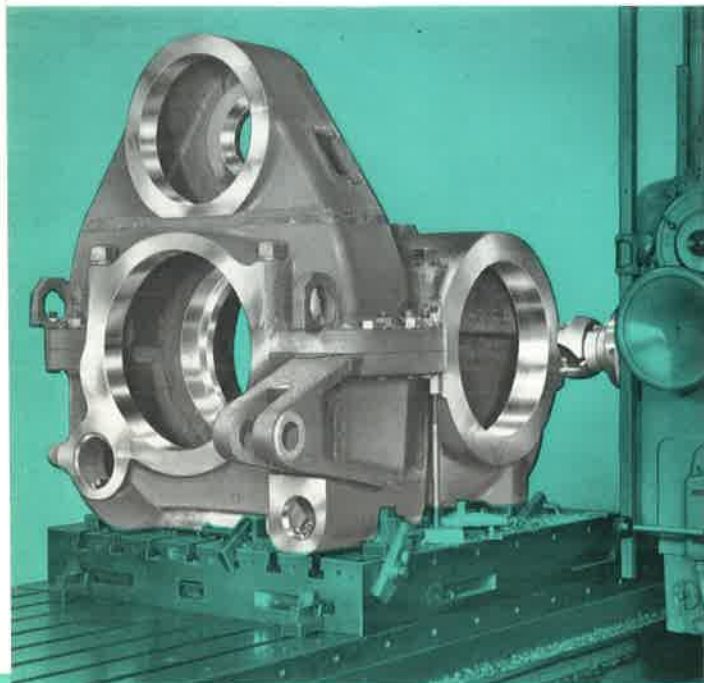
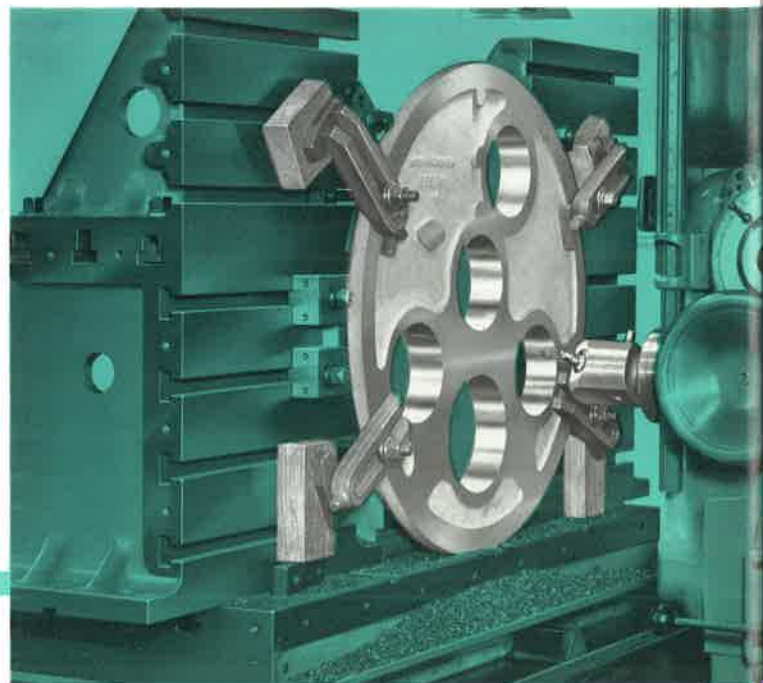
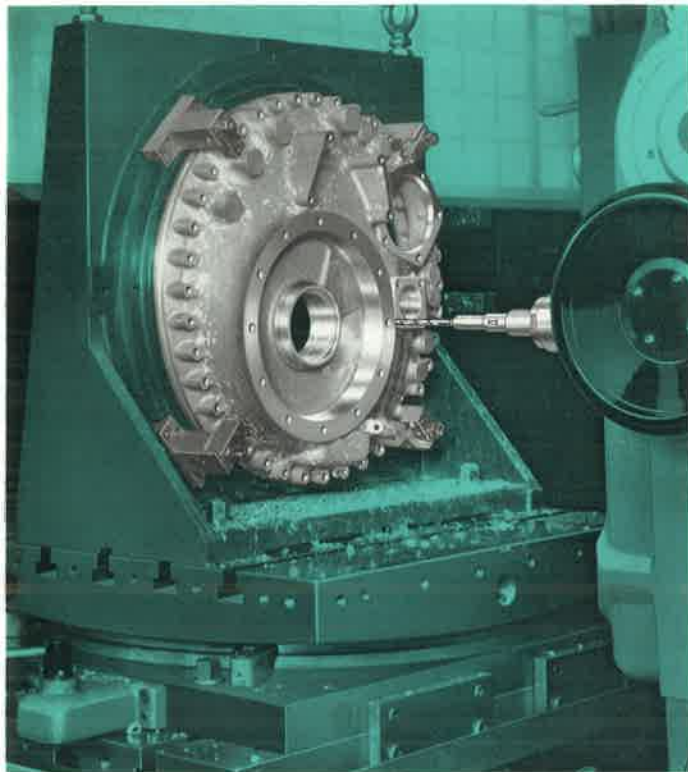


Figure 36. Rough and finish boring cast iron transmission cover plate. Total time; 11½ minutes.



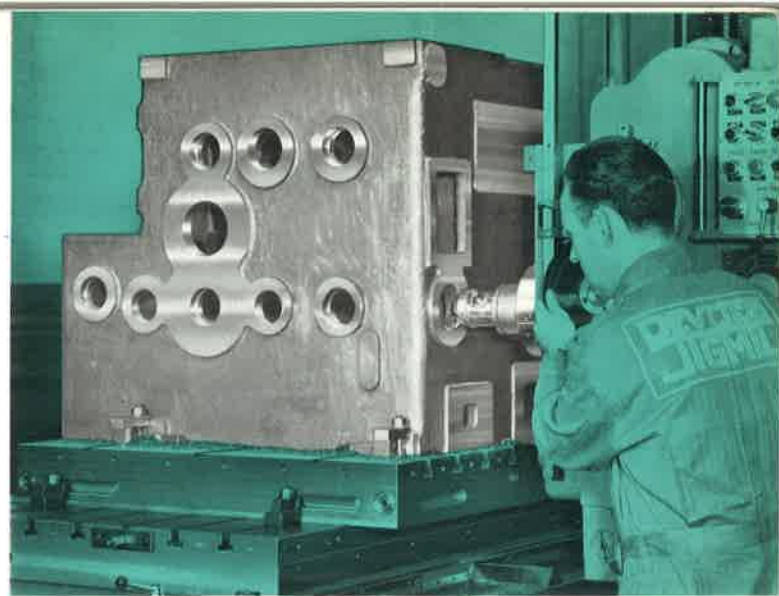




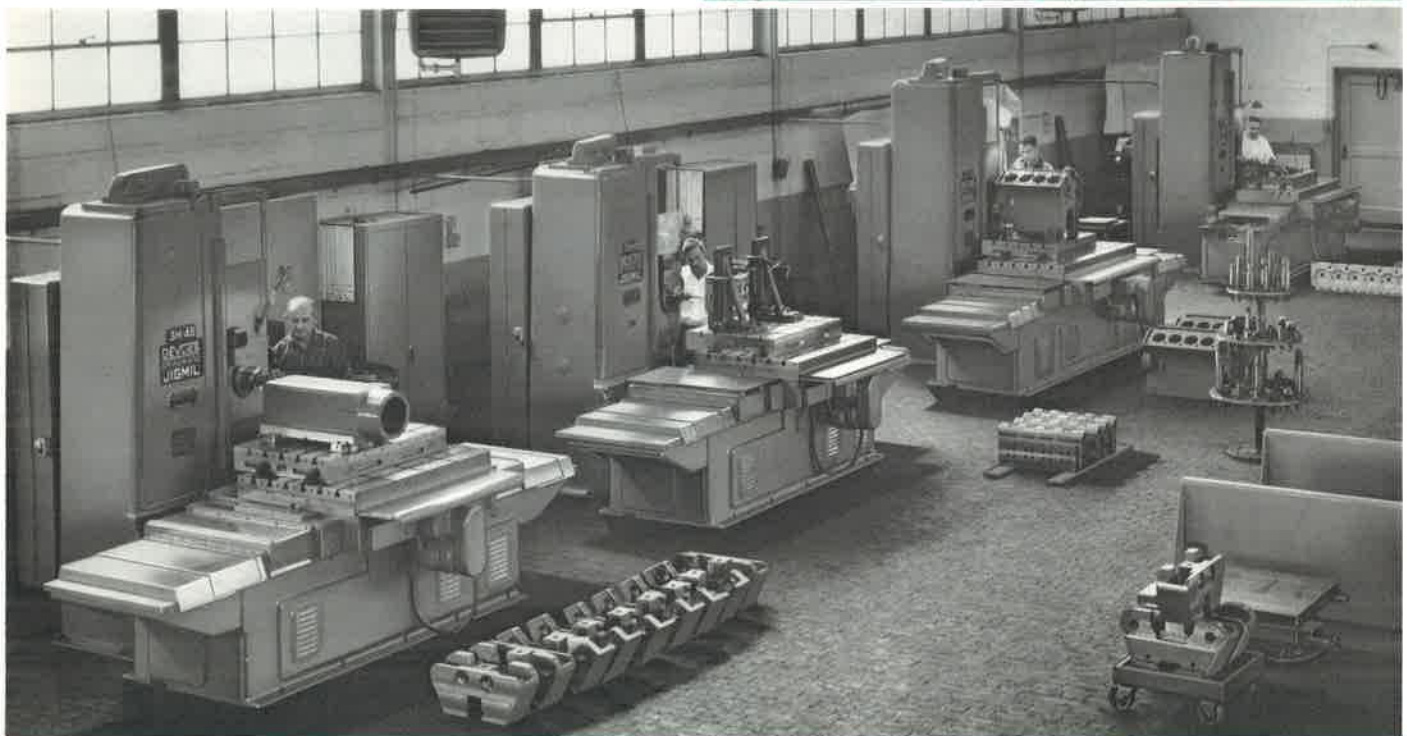
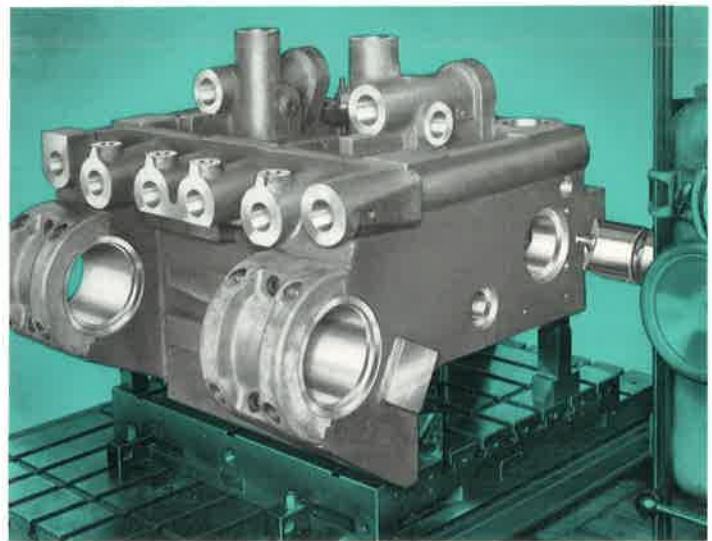
**Figure 38, above.** Drilling, tapping and boring precision aircraft part on tape controlled JIGMIL.

**Figure 39, right.** Rough and finish boring and milling precision machine tool part.

**Figure 40, below.** Overall view of JIGMIL installation in contract boring shop for precision boring and milling a variety of work.



**Figure 37, above.** Rough and finish milling and boring large gear box for wire drawing machine on Model 4H-72 JIGMIL.



## DeVlieg Spiramatic Spindlehead

(PATENT NOS. 2,728,242-2,753,725)

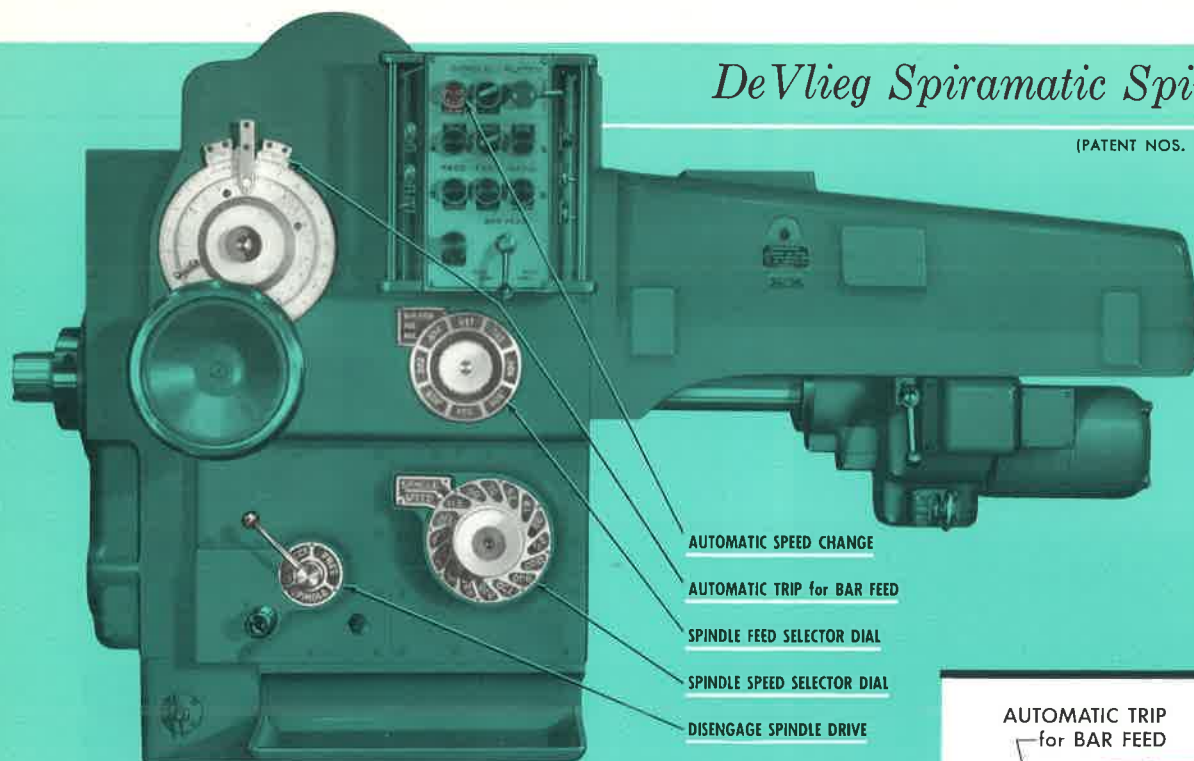


Figure 41

### AUTOMATIC SPINDLEHEAD TRANSMISSION

The *SPIRAMATIC* spindlehead incorporates helical gears operating in constant mesh. All speed changes are effected automatically through the operation of a single push button. Spindle speeds are preselected by rotating the speed selector dial, Fig. 41, to the desired speed and the actual speed change is made automatically in response to a push button. Speed changes from high to low speeds are made smoothly and without shock to the transmission. The automatic speed changing mechanism can be operated with the machine spindle running in the forward or reverse direction. For setup purposes, the spindle drive can be disengaged by moving a single lever, Fig. 41, and the spindle can then be freely rotated by hand.

### AUTOMATIC TRIP MECHANISM FOR SPINDLE BAR FEED

All *SPIRAMATIC* JIGMILS are furnished with an automatic trip mechanism for stopping the spindle bar feed at any predetermined point. This feature provides a means for accurately controlling the depth of bar feed when dealing with counter-boring, facing, and back-facing operations. The setup for the automatic trip is established by setting the combination dials and vernier scales, Fig. 41, for the required depth of feed and the power feed is automatically stopped when the tool reaches the desired depth of cut.

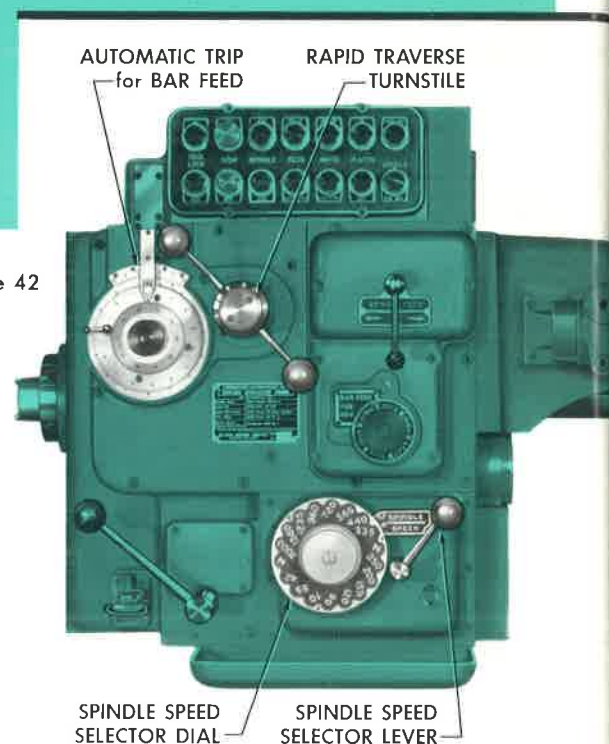


Figure 42

### *Spiramatic Spindlehead for Model 2B-36 Machine*

The spindlehead for the Model 2B-36 machine, Fig. 42, incorporates helical gears operating in constant mesh. Spindle speeds are selected in the following manner:

1. Speed selector lever is operated to neutralize the drive.
2. Selector dial is turned to desired speed.
3. Speed selector lever is operated to re-engage and start the drive.

The spindle bar Rapid Traverse is operated by a two-speed turnstile. A range of bar feeds is provided with an automatic trip and depth control mechanism.



## JIGMIL Power Tool Lock Mechanism

(PATENT NOS. 2,667,819-2,667,820-2,909,965)

### LOCKING OPERATION . . .

The tool is placed in the spindle bar to the full depth of the socket, the push button marked "IN", (Fig. 43) is depressed and the draw bar is then rotated by power in a clockwise direction, locking the tool securely in position.

### UNLOCKING OPERATION . . .

To release the tool, the push button marked "OUT", (Fig. 43) is depressed and the draw bar is rotated by power in a counterclockwise direction so that the tool is ejected and can be freely removed from the spindle bar.

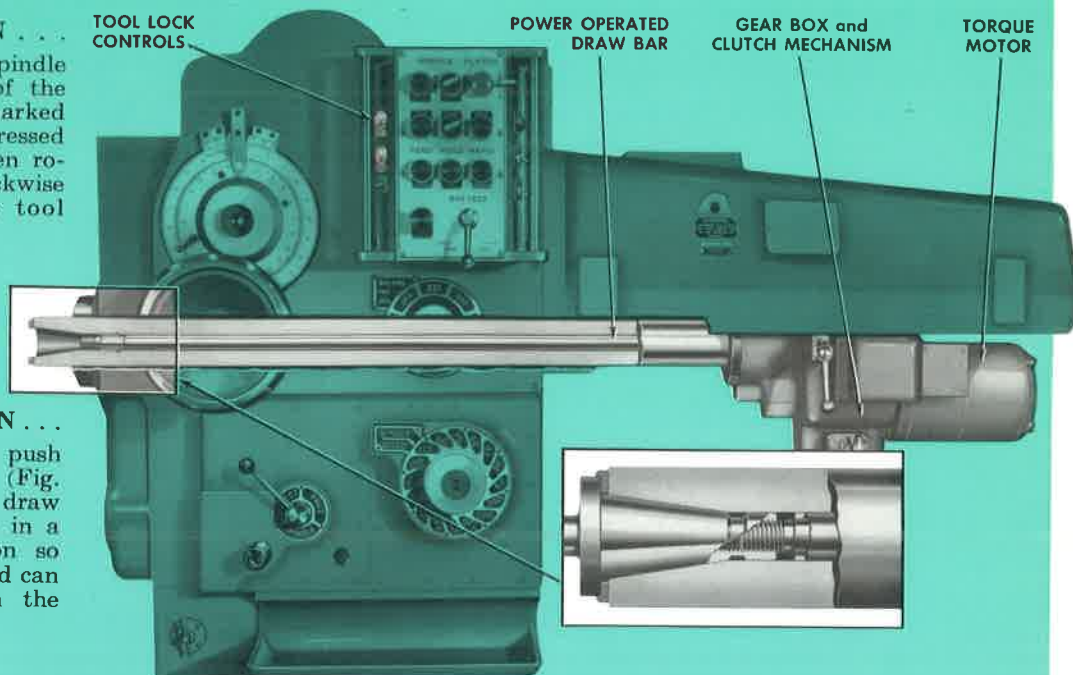


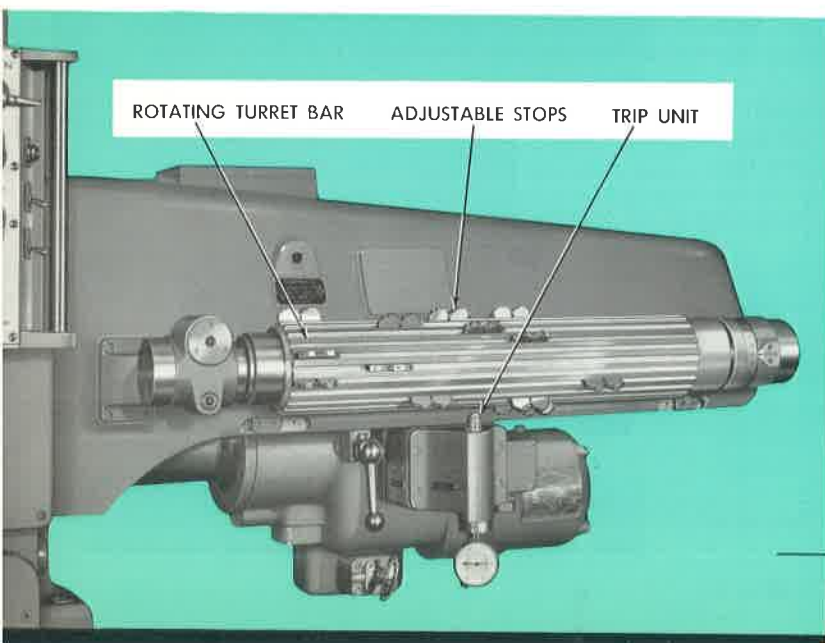
Figure 43

All *SPIRAMATIC* JIGMILS are furnished with a Power Tool Lock Mechanism which provides a means for locking and releasing boring bars and cutter adapters, etc., in response to a pushbutton control. The machine spindle bar is hollow and carries a threaded draw bar (Fig. 43) which is rotated by a fractional horsepower torque motor, driving through a simple clutch and gear box mechanism. The machine spindle bar is furnished with a standard milling machine taper socket; the Series 2B and 3H machines having No. 40 NMTB taper and the Series 4H and 5H machines having No. 50 NMTB taper. The JIGMIL Tool Lock Mechanism provides a uniform locking pressure and tools can be

locked or released in a matter of seconds. For boring operations, especially in production applications, the uniform locking pressure assures the accurate duplication of any given bore diameters. Repetitive accuracy of .0001" is entirely possible. Tool changes can be made with the spindle bar fully retracted in the spindle sleeve or at any position within its range of travel. The necessity for driving slots and drift slots in the spindle bar is eliminated and abuse of the spindle and bearings caused by hammering and wedging tools into position such as is the practice with self-holding tapers is completely eliminated.

## Bar Feed Turret Depth Control Attachment

(PATENT NO. 2,728,248)



For production operations, a Bar Feed Depth Control Attachment can be furnished on all *SPIRAMATIC* JIGMILS at extra charge. This attachment consists of a rotating turret bar (Fig. 44), carrying 24 adjustable stops which can be set at any desired position. The trip unit carries a projecting contact arm and, when this unit comes into contact with the adjustable stops, the bar feed is tripped automatically. For production work involving multiple counterboring, facing, or back-facing operations to close limits, the appropriate number of adjustable stops are set to the required positions and the turret bar is rotated to its proper station for each individual operation.

Figure 44



# Automatic Positioning of the Machine Table and Spindlehead

(PATENT NO. 2,561,346)

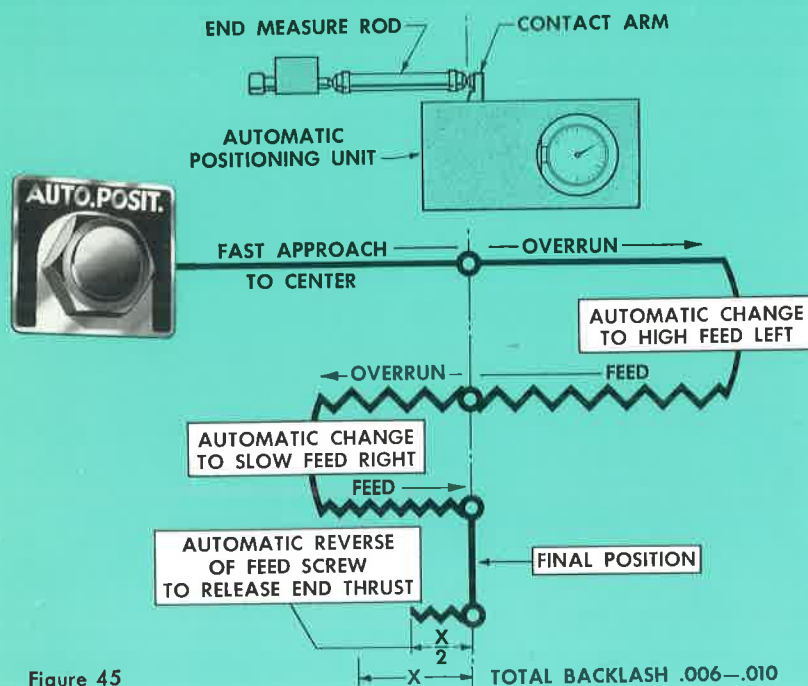


Figure 45

The DeVlieg system of positioning the machine table and spindlehead in the horizontal and vertical planes is performed automatically through a patented sequenced electrical cycle. This important feature provides a means for controlling hole spacing in the workpiece to precise limits of accuracy through the simple operation of a single push button. The diagram, Fig. 45, shows the path of travel of the machine table and spindlehead during the automatic positioning cycle. The sequence of operations is as follows:

1. Suitable end measure gages or Duplitrol bars are placed in position in the measuring troughs.
2. The push button, Fig. 45, marked "AUTO POSITION" is then depressed, causing the machine table or spindlehead to move by rapid traverse until the measuring element contacts the contact arm projecting from the automatic positioning unit (Fig. 46). The automatic positioning cycle is then completed by oscillating the table and spindlehead about the zero line at successively slower feeds, stopping these elements within precise limits of the position determined by the end measure gages or Duplitrol bars. At the position of final location, the machine automatically releases the end thrust of the feed screw so that the table or spindlehead can be locked securely without affecting its accurate location, and the entire cycle is completed in a few seconds.

Illustration (Fig. 46) shows the automatic positioning unit with built-in dial indicator for controlling the location of the machine's spindlehead in the vertical plane. A similar positioning unit is mounted on the front side of the machine bed for automatically positioning the table in the horizontal plane.

For general-purpose work involving one-piece jobs, a combination of end measure gage rods and micrometer heads serves as a dependably accurate means for controlling hole spacing.

A standard set of end measure gage rods is available for each size of machine and a typical set is illustrated in Fig. 47.

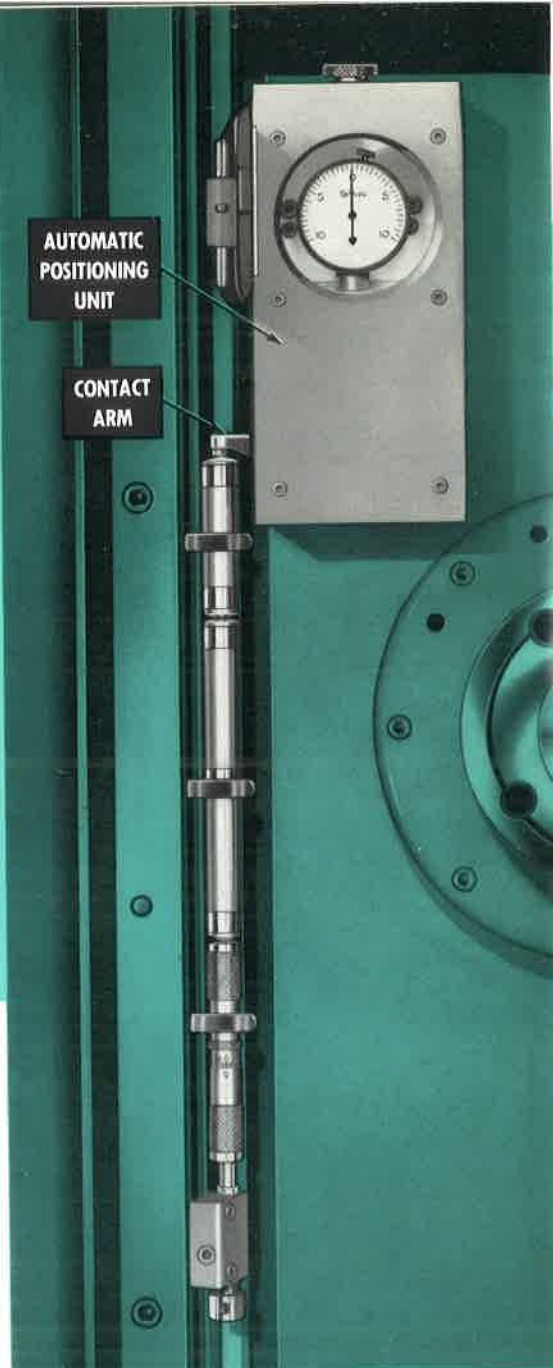


Figure 46

*Automatic positioning for machine table and spindlehead is furnished as standard equipment with all DeVlieg SPIRAMATIC JIGMILS.*



Figure 47



# The JIGMIL Duplitrol® System

(PATENT NO. 2,575,945)

All standard *SPIRAMATIC* JIGMILS are arranged to use the patented Duplitrol System as standard equipment. The JIGMIL Duplitrol System in conjunction with the automatic positioning of the machine table and spindle-head provides a mechanical programming means for "jigless boring" all types of medium and small-lot production work to precise limits of accuracy. A set of two simple Duplitrol bars is provided for each job, and

these bars serve as accurate and permanent masters for duplicating the particular workpiece at any time.

The Duplitrol System *eliminates expensive boring jigs* and permits complete flexibility in product design. When product design changes occur, it is only necessary to provide two inexpensive Duplitrol bars to suit the hole spacing in the redesigned part.

Figure 49

Illustration (Fig. 48) shows a Duplitrol bar mounted in position on the side of the JIGMIL table for controlling the positioning of the machine table in the horizontal plane. Duplitrol bars are made from suitable lengths of  $\frac{3}{4}$ " square steel, into which are bored a series of  $\frac{1}{4}$ " diameter holes accurately spaced to suit the hole spacing in the workpiece. Each Duplitrol bar is furnished with a stop pin  $\frac{1}{4}$ " diameter by  $1\frac{1}{16}$ " long. With the stop pin in correct location in the Duplitrol bar the automatic positioning cycle is engaged and when the stop pin contacts the contact arm projecting from the positioning unit (Fig. 48), the machine table is automatically positioned. As each hole in the workpiece is bored, the stop pin is moved progressively into the holes in the Duplitrol bar and the machine table is automatically positioned for each hole location. A similar Duplitrol bar is mounted in the vertical measuring trough on the machine column and this controls the automatic positioning of the spindlehead in the vertical plane.

Figure 48

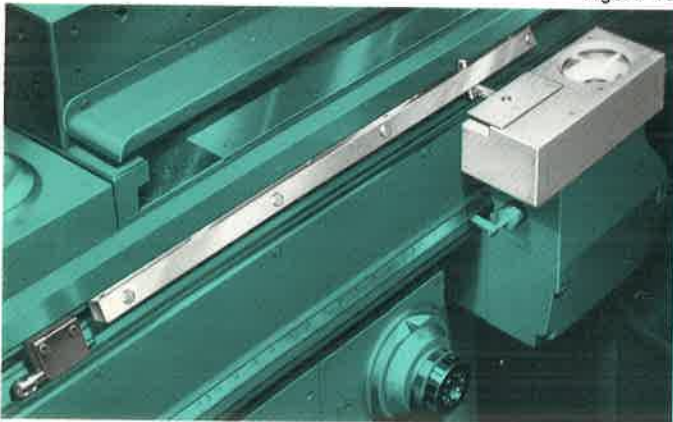


Illustration (Fig. 49) shows a typical layout of a workpiece and the necessary Duplitrol bars. The holes in the workpiece are laid out in right angle coordinates and the hole locations are identified in the horizontal plane by numerals 1, 2, 3, etc., and in the vertical plane by letters A, B, C, etc. The holes in the Duplitrol bars are identified by similar markings. This layout system provides the JIGMIL operator with a simple key for all hole locations, and by reference to the identifying numerals and letters shown on the layout, the operator simply inserts the stop pins in the appropriate holes in the Duplitrol bars, engages the automatic positioning cycle and the machine is automatically positioned for each hole location.

A special service covering the layout and manufacture of Duplitrol bars is available to all JIGMIL users and prices will be quoted upon request. Alternatively, JIGMIL users can bore their own Duplitrol bars on the JIGMIL by preparing a suitable layout as shown in Fig. 49.

Illustration (Fig. 50) shows the actual workpiece set up for boring on the JIGMIL with the Duplitrol bars in location. The same layout system and Duplitrol control is used when dealing with gear boxes, etc., where it is necessary to bore the workpiece from two, three or four sides. This type of work is completely machined at one setting on the JIGMIL index table which is described on pages 24, 25 and 26.

Standard hardened and ground Duplitrol blocks (Fig. 51) are used for production work when conditions do not warrant making special Duplitrol bars. Standard Duplitrol blocks are particularly recommended for a production run when the job is not likely to repeat.

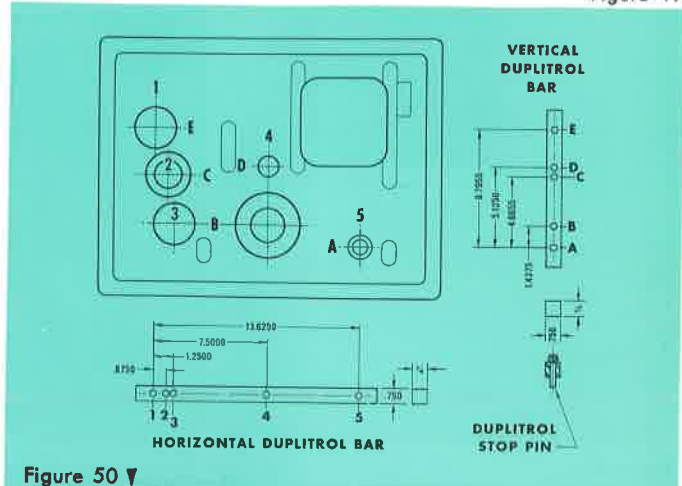


Figure 50

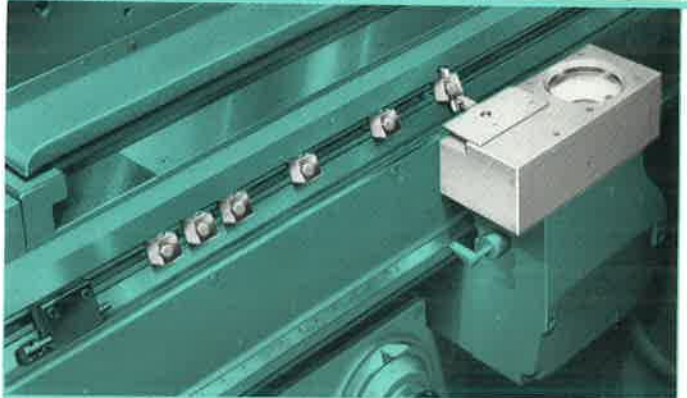
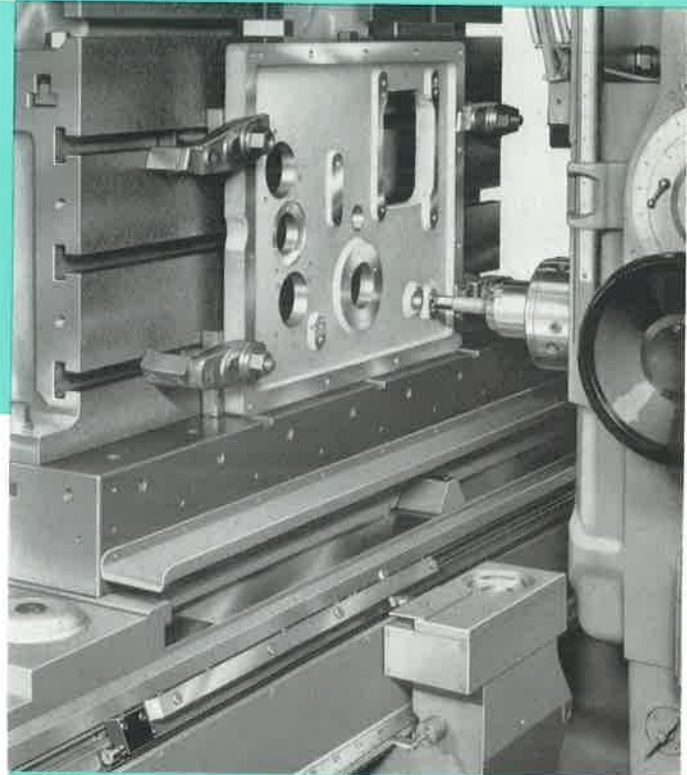


Figure 51



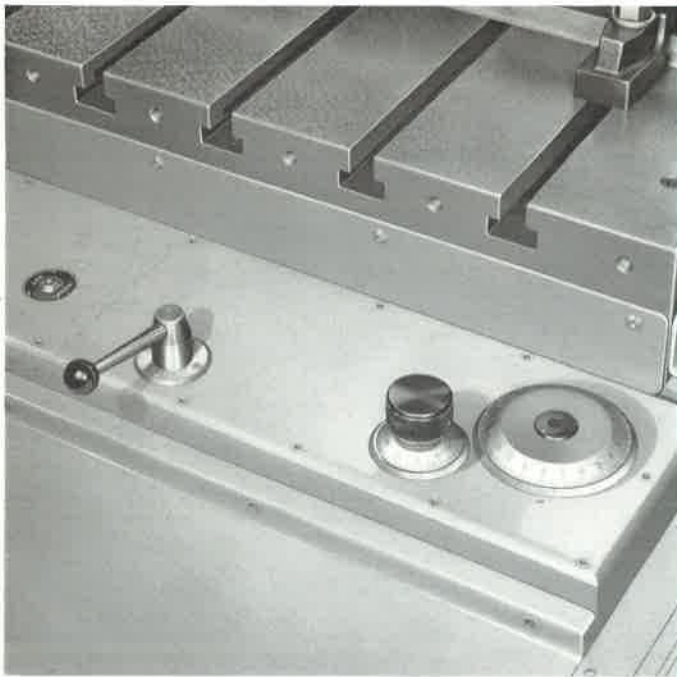


Figure 52

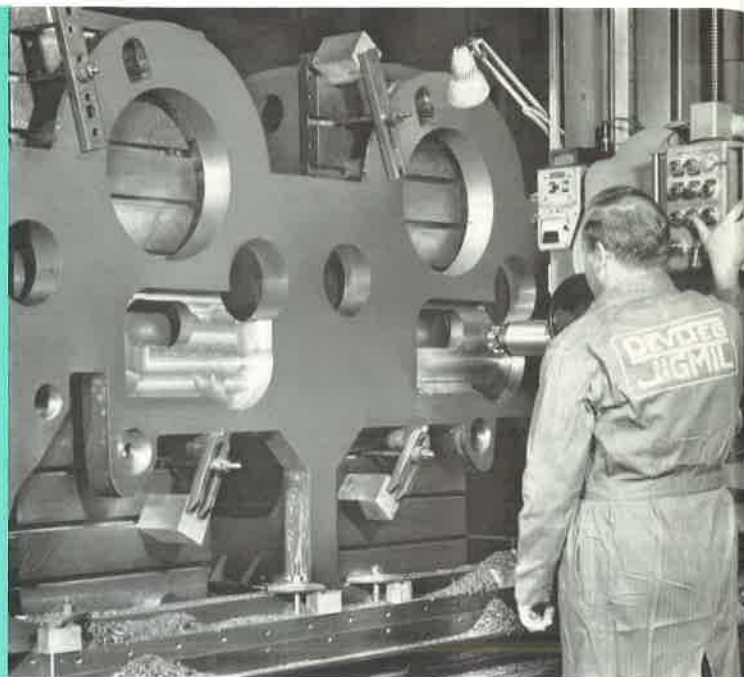


Figure 53

## Automatic Table Retraction

This important feature permits extensive use of the stub-boring principle by insuring that the distance between the cutting tool and the workpiece is held to a minimum. The JIGMIL table has a slide relationship with the saddle that is parallel to the axis of the spindle. The JIGMIL table is guided on hardened and ground vee ways to insure the ultimate in accuracy and long life. This power rapid traverse movement permits the table holding the workpiece to be readily retracted away from the cutting tool for ease of tool changing and work inspection. By a simple pushbutton control the table will reposition to the original location.

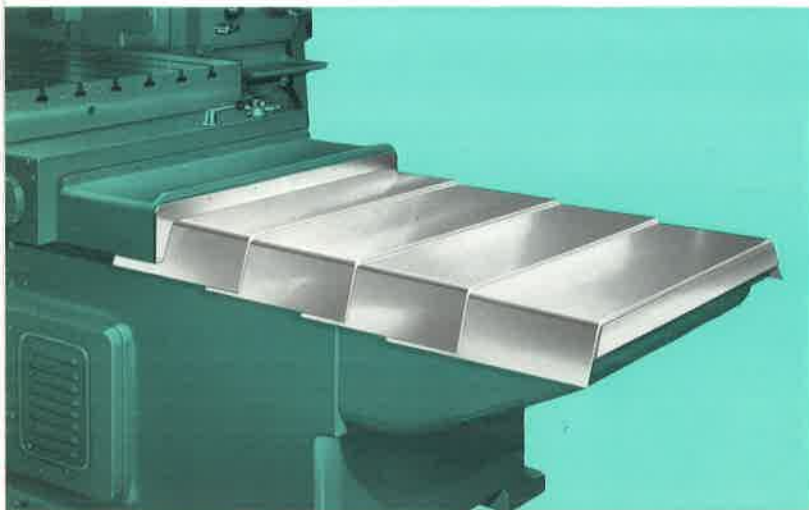
A power setting mechanism is provided to permit setting of a positive stop to any point within the full range of the table retraction. A combination of micrometer dials mounted on the saddle (Fig. 52) indicate the location of the machine table in increments of .001" within its range of travel.

This table retraction function is a particularly important feature of the JIGMIL Technique as this insures that machining operations are done in the area of highest performance.

**TOOL CHANGES** are effected quickly and easily with complete assurance that the workpiece will be accurately repositioned for subsequent machining operations. Boring bars can be locked in the spindle with the spindle actually entered through an opening in the part. This feature is especially advantageous when applied to back-boring operations or for boring large diameters through otherwise inaccessible inside walls of certain types of housings, gear cases, etc.

**WORK INSPECTION** may be accomplished frequently and conveniently by the operator. Automatic table retraction fully exposes the workpiece for utilization of various types of measuring and checking devices. Cutting tools can be readily adjusted to proper bore diameters and the accuracy of the table repositioning movement insures that the accurate tool settings are properly transferred to the workpiece.

Figure 54



## Stainless Steel Bedway Covers

(PATENT APPLIED FOR)

Accurately formed heavy gauge stainless steel bedway covers are available for all series "H" JIGMILS as optional equipment. These heavy-duty way covers provide complete protection for the bedways throughout the full range of table travel. The precision finished way surfaces are never exposed to possible damage that might be caused by excessive chips, abrasive materials or accidental dropping of heavy objects on the ways.



## Thermal Control of Main Spindle Bearings

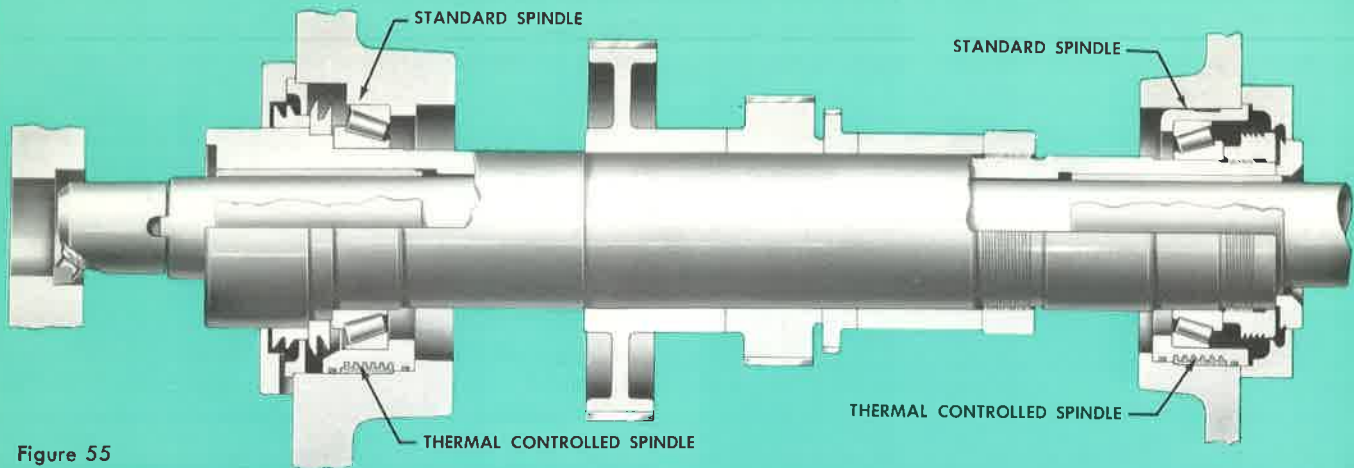


Figure 55

Thermal control of main spindle bearings assures accuracy for boring operations involving sustained high spindle speeds. Thermal control is an optional feature available for Series "H" machines at extra charge. The main spindle bearings are surrounded by sealed manifolds, as shown in the lower half of the cutaway illustration above, through which cold water is circulated. This is a self-contained unit complete with separate refrigeration system and thermostatic

control which maintains a constant temperature to within 3° of thermostat setting. Furthermore, this thermostatic control is arranged so that it can fluctuate to meet the ambient conditions in the shop. If the shop temperature should rise or fall, the temperature setting for the main bearings will rise and fall accordingly so that the temperature differential will not exceed 3° F.

Two coolant systems are available as optional equipment for all *SPIRAMATIC* JIGMILS. For certain machining operations, particularly on steel parts, the use of coolant is desirable for optimum machining efficiency. The JIGMIL can be furnished with flood and/or mist coolant systems.

**FLOOD COOLANT** systems for DeVlieg JIGMILS utilize a pump and tank unit assembly (Fig. 58) that may be installed on all machines. The coolant troughs on the machine table are accurately machined and carefully fitted to provide water-tight joints for collecting and recirculating the coolant (Fig. 56). A flexible nozzle with valve is provided to direct a suitable flow of coolant to the cutting tool. Flood coolant also provides a flushing action which removes chips during deep boring operations. This system is an integral part of the machine and should be installed at the factory.

**MIST COOLANT** systems are available installed at the factory and utilize a jet of atomized air and coolant in mist form. The mist coolant technique has become increasingly popular where coolant is required because this system largely eliminates the splashing effect ordinarily associated with flood coolant systems. The mist coolant nozzle is provided with a magnetic holder which permits mounting and positioning the nozzle in the most advantageous position for directing the mist coolant to the part piece and cutting tool. The compact mist coolant system is mounted on the JIGMIL column (Fig. 57) and contains a built-in air filter, trap, regulator, gauge and reservoir for dependable, trouble-free operation. Accurately machined and fitted troughs are provided on the main JIGMIL table to collect excess coolant which might otherwise drip on the machine.

Figure 57



## JIGMIL Coolant Systems

Figure 56

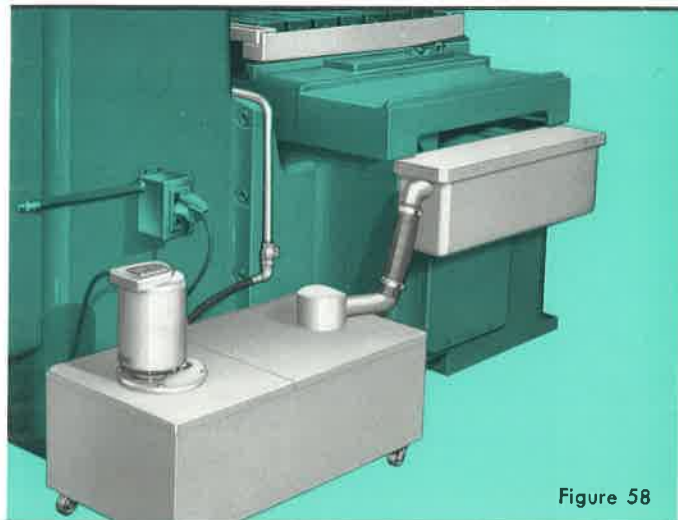
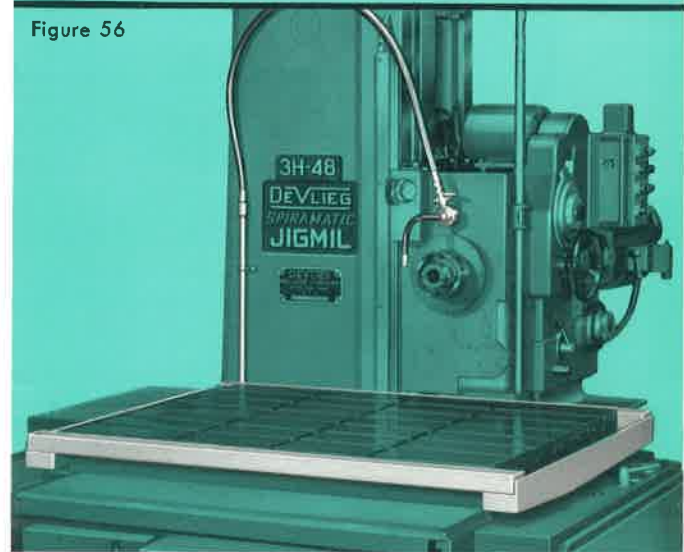


Figure 58

## *JIGMIL Precision Matched Angle Blocks*

Standard sets of precision matched angle blocks are available to provide a convenient means for mounting and clamping work for boring and milling operations. They have a wide range of use and can be applied singly or in a variety of combinations for small and large work. These blocks are machined from heavy box

section castings and all flat surfaces are finished by hand scraping. Precision machined tee slots are provided to receive the standard locating and nesting blocks so that workpieces can be quickly and accurately located.

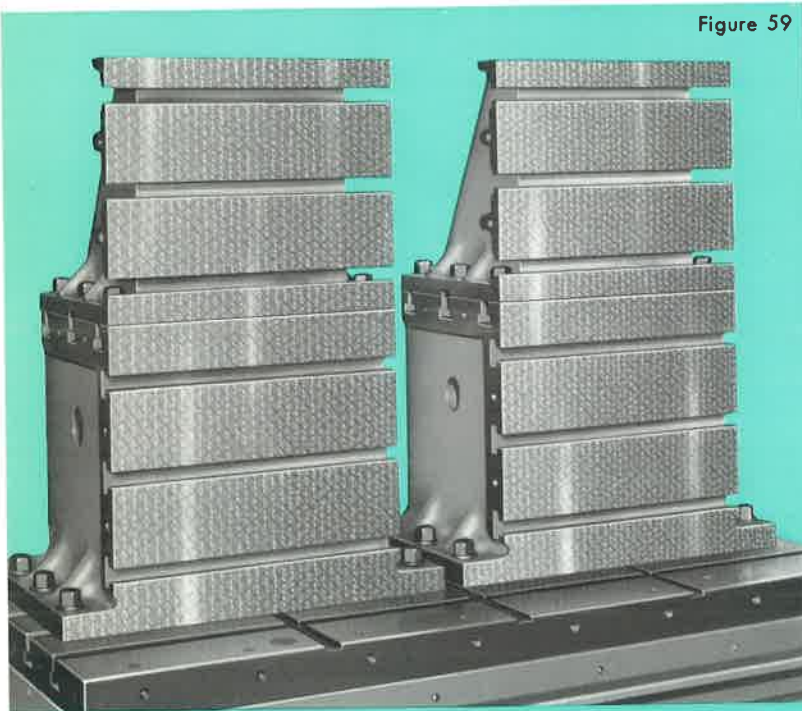


Figure 59

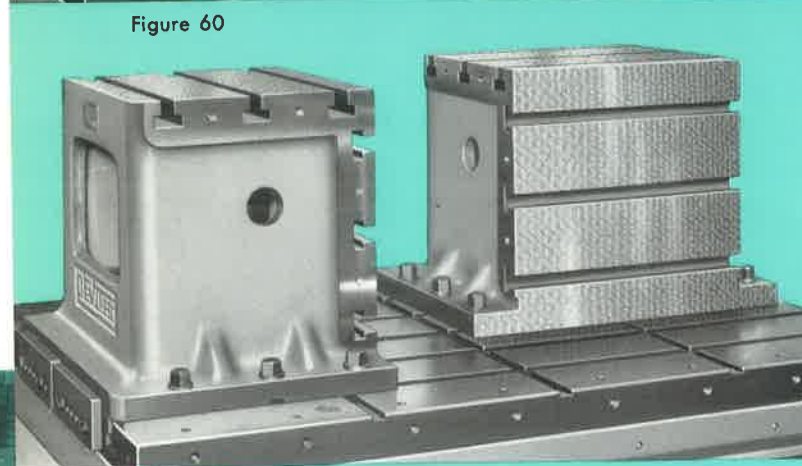


Figure 60

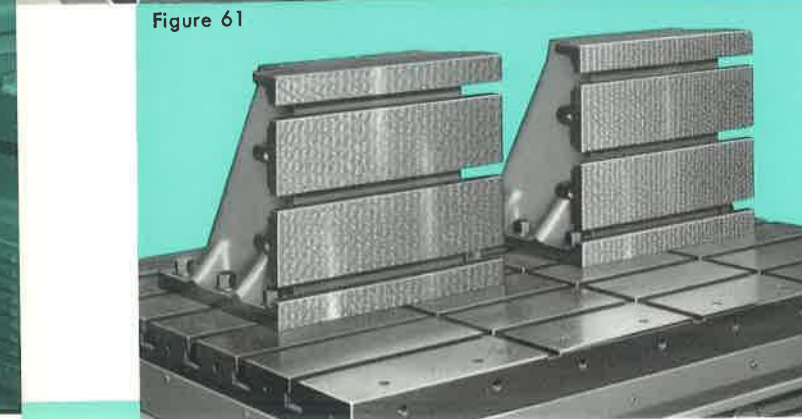


Figure 61

### FOR SERIES 3H and 4H MACHINES

A standard set of precision matched angle blocks for Series 3H and 4H machines includes two top members and two bottom members which can be applied singly or in various combinations. An assortment of hardened tee slot nuts, studs and screws is included in each set. Part numbers and dimensions are as follows:

#### Top and Bottom Blocks Assembly (Fig. 59)

	For Series 3H Machines Set RT-353	For Series 4H Machines Set RT-354
Height	30"	40"
Width	16½"	20½"
No. Tee Slots* (13/16")	6	8

#### Two Base Blocks (Fig. 60)

Vertical Face Dimensions	For Series 3H Machines Set RT-353-1	For Series 4H Machines Set RT-354-1
Height	16"	21"
Width	16½"	20½"
No. Tee Slots* (13/16")	3	4

#### Top Face Dimensions

Depth	14"	20"
Width	16½"	20½"
No. Tee Slots* (13/16")	3	4

#### Two Top Blocks (Fig. 61)

	For Series 3H Machines Set RT-353-2	For Series 4H Machines Set RT-354-2
Height	14"	19"
Width	16½"	20½"
No. Tee Slots* (13/16")	3	4

\*All tee slots spaced on 5" centers.



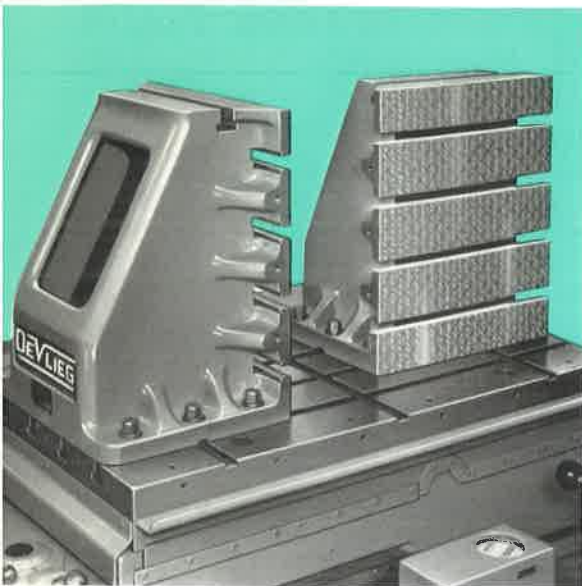


Figure 62

#### FOR MODEL 2B-36 MACHINES

The standard set of angle blocks for Model 2B-36 JIGMILS consists of two blocks, precision matched in accordance with the dimensions shown at the right, and includes an assortment of hardened tee slot nuts, studs and screws.

Vertical Face Dimensions		Set RT-2303
Height		18"
Width		15"
No. Tee slots* (1 1/16")		4
Top Face Dimensions		
Depth		6"
Width		15"
No. Tee slots* (1 1/16")		1

\*All tee slots spaced on 4" centers.

Figure 63



#### STORAGE CART for Precision Matched Angle Blocks

The Devlieg mobile storage cart is recommended as an ideal means for storing and protecting precision matched angle blocks when not in use. This storage cart is constructed of heavy steel plate welded at the seams and corners with 6" diameter ball bearing rubber covered casters, permitting ease of movement and maneuverability. A plastic dust cover is provided. The photograph shows a standard set of angle blocks mounted on the mobile storage cart.

Figure 64



#### ANGLE BLOCKS FOR SERIES 5H MACHINES

The standard set of angle blocks for Series 5H JIGMILS consists of two blocks precision matched, and the dimensions are listed below. The set of angle blocks includes an assortment of hardened tee slot nuts, studs and screws. The 5H angle blocks are primarily intended for the larger, heavier workpieces which are normally associated with the Series 5H JIGMILS.

#### For Series 5H JIGMILS (Fig. 64)

Set RT-355	
Height	57"
Width	24"
No. Tee slots* (1 3/16")	11

\*All tee slots spaced on 5" centers.

# Standard Index Tables

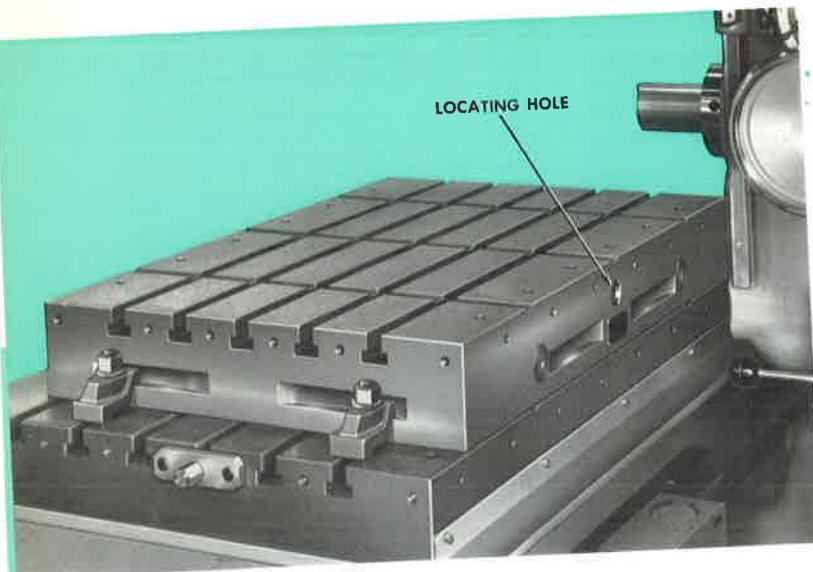


Figure 65

The general construction of Type "E" JIGMIL index tables and the principle used for controlling the angular movements is shown in the illustration below. Standard Type "E" index tables incorporate four accurately spaced index plungers in the form of a square. Each plunger is lowered or elevated individually by rack and pinion. In the main JIGMIL table two accurately spaced holes are provided at the same center distances as the plungers in the index table. These holes carry hardened and lapped bushings. The locating of the index table for each 90° index is accomplished by engaging two plungers within the two bushings in the JIGMIL table (Fig. 66). This engagement of two closely-fitting parallel plungers into the lapped bushings insures extremely accurate indexing. At the front side of the index table a locating

## TYPE "E" INDEX TABLES

Standard Type "E" Index Tables (Fig. 65) for use on Series 3H, 4H and 5H machines provide a simple and accurate means for boring gear cases, precision parts, etc., from two, three or four sides without resetting the workpiece. These standard tables provide four 90° indexing positions and the method of indexing used in the JIGMIL index table insures precise angular relationship between bores. Long "in-line" bores are held to accurate alignment by machining the workpiece from one end, indexing 180° and machining the opposite end. JIGMIL index tables are made from heavy box section castings to withstand clamping pressures without distortion.

## DESIGN FEATURES

hole (Fig. 65) is provided for setup purposes. This hole establishes the accurate center point of the index table, and relationship between the machine spindle and the center of the index table can be picked up quickly from the locating hole. For certain classes of work, particularly on small parts, the entire index table assembly can be moved forward 5" on the main JIGMIL table and the rear location plungers used for locating. This results in the index table overhanging the front edge of the main JIGMIL table by 5", but for small workpieces the workpiece itself is brought closer to the spindle, spindle overhang is thus minimized, and more accurate and productive work can be done on the smaller workpieces.

An example of this arrangement is shown in Fig. 68.

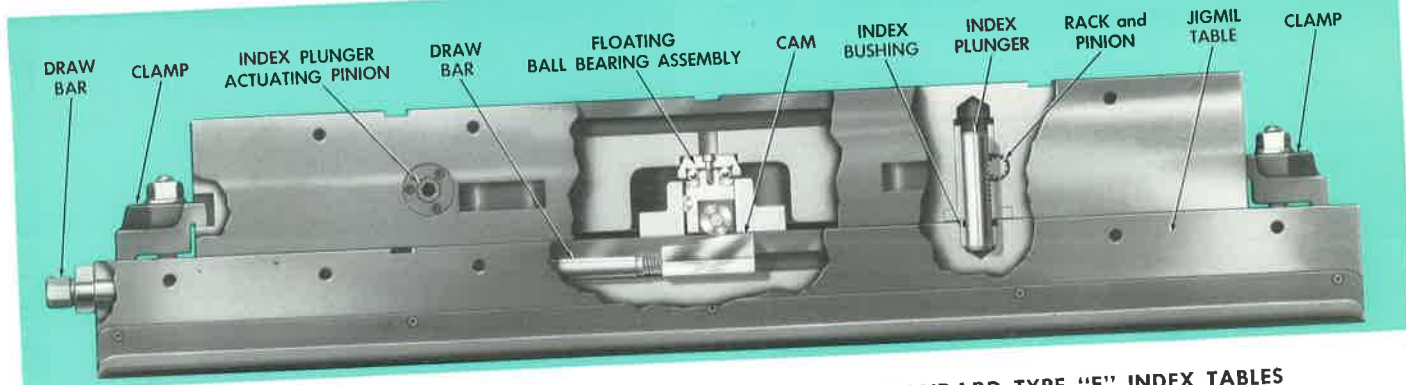


Figure 66

**THE PROCESS OF INDEXING is accomplished as follows:**

1. Clamps are released and withdrawn.
2. Two plungers are elevated and disengaged from the bushings in the main JIGMIL table.
3. Draw bar is rotated causing wedge cam to elevate a floating ball bearing assembly thereby raising the index table so that it can be freely rotated. Ball assembly allows the index table to float a limited amount and permits index plungers to freely and accurately find their locations in the bushings in the JIGMIL table. These are non-tapered index plungers and fit the respective bushed holes with a "wring" fit.
4. After rotating index table to desired position, two index plungers are lowered into the bushings, the draw bar is rotated in a counterclockwise direction, thereby lowering the index table onto the main JIGMIL table. The clamps are then moved into position and tightened.

## STANDARD TYPE "E" INDEX TABLES with Four 90° Index Positions

Tee slots and cross slots  $\frac{13}{16}$ " wide; tee slots are spaced on 5" centers.

For Series 3H Machines	For Series 4H Machines	For Series 5H Machines
30" x 30"	40" x 40"	50" x 50"
30" x 40"	40" x 50"	50" x 60"
30" x 50"	40" x 60"	50" x 70"
	40" x 70"	

## TYPE "E" INDEX TABLE with 180° Index Only

For small or narrow parts requiring machining from two sides only.

Tee slots and cross slots  $\frac{13}{16}$ " wide; tee slots are spaced on 5" centers.

For Series 3H Machines	For Series 4H Machines
20" x 30"	20" x 40"



## for DeVlieg Spiramatic JIGMILS

### TYPE "M" INDEX TABLES

Standard Type "M" air-lift index tables (Fig. 67) are designed primarily for use on Model 2B-36 JIGMILS but can be used to advantage on all sizes of machines. Type "M" index tables are built to provide four 90° index stations to serve the needs for in-line boring and to do work from four sides to precise limits with one chucking of the workpiece. The unit is self-contained having an upper platen member which rotates on a cushion of air between it and a fixed sub-base to provide friction-free indexing. The four positions are located by two precise hardened and lapped plungers that register in hardened and lapped bushings. Great accuracy results from the index plungers being widely spaced each side of center. Two simple levers operate the index plungers, actuate the locking mechanism and control the air pressure.

An external air supply is fed to the air filter and oil mist lubrication unit which provides a maximum of 50 PSI filtered pressure regulated air cushion for indexing. A normal setting of 25 PSI is all that is required for efficient performance.

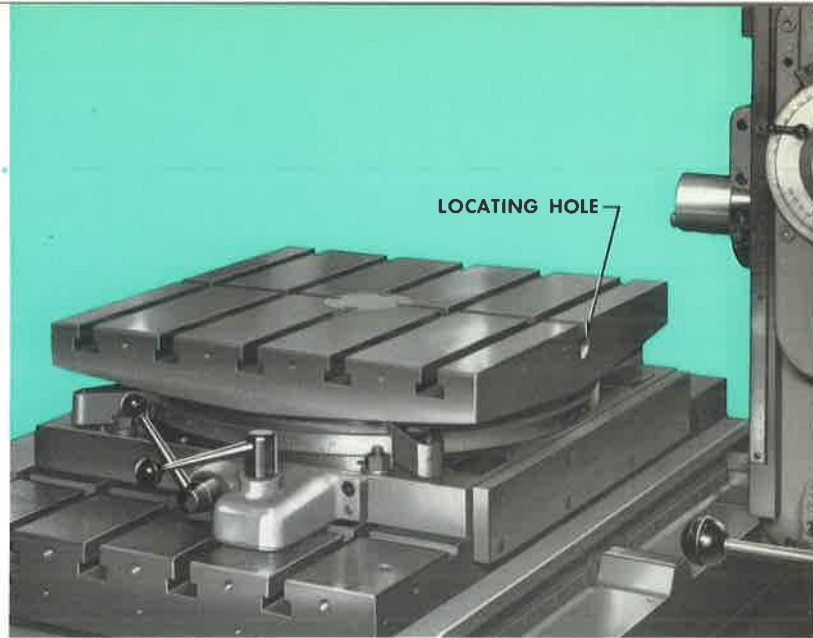


Figure 67

**STANDARD TYPE "M" INDEX TABLES**  
with Four 90° Index Positions are available  
in the following sizes:

16" x 16"      20" x 20"      \*26" x 26"

Tee slots and cross slots  $\frac{1}{16}$ " wide;  
tee slots are spaced on 4" centers.

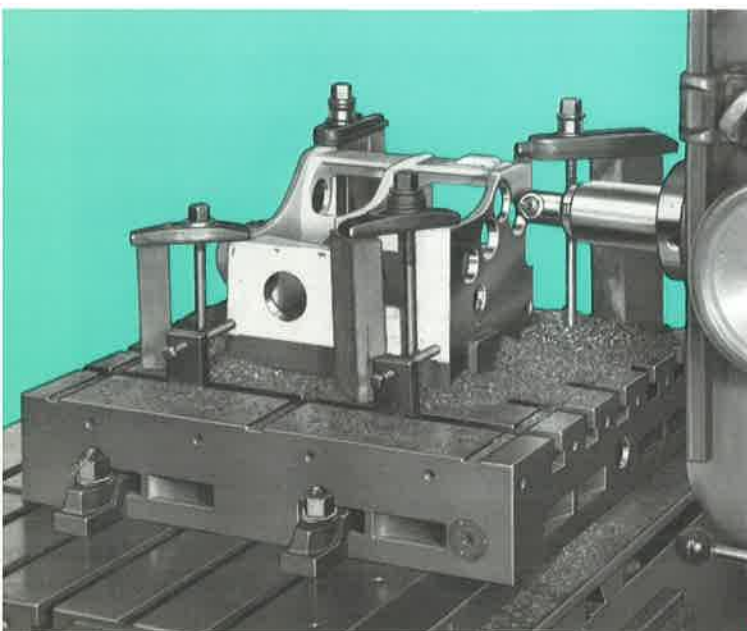
\*Can be furnished with tee slots  $\frac{1}{8}$ " wide upon  
special request.

### SEQUENCE OF OPERATION

One actuating lever lowers and disengages the two index plungers from the upper platen. The air valve and clamp actuating lever then loosens the index table clamps and supplies a cushion of air which raises the table slightly. The table is then rotated free from friction to the desired station and the lever-operated index plungers are raised to engage the upper platen. The air valve and the clamp actuating lever releases the air pressure and clamps the table accurately and firmly in position. A locating hole is provided in the table for accurate location of the machine spindle with the center of the index table. The bearing surface between

the upper platen member and the fixed sub-base is automatically lubricated and kept free from abrasive particles by the use of the pressurized oil mist and air. The Type "M" index table can, at an optional extra charge, be graduated in degrees. With this arrangement, a vernier scale is provided which permits settings to any angle with an accuracy of 5 minutes of arc. When the index table is arranged with the graduated scale and the table is set at angles other than 90°, the index plungers are not used and the clamping mechanism is sufficient to permit rigidly clamping the table at these angles.

Figure 68



### TYPICAL APPLICATION WITH 90° INDEXING

Illustration (Fig. 68) shows a typical Type "E" index table set up for machining a cast iron gear box on a Model 3H-48 JIGMIL. Machining operations include drilling, boring and counterboring 14 holes from four sides of the casting. All operations are completed at one setting of the workpiece and angular relationship and alignment of all bores are held to extremely close limits. Fast, accurate indexing eliminates the need for special jigs and fixtures and substantially reduces floor-to-floor time.

## Standard Type "AM" Air-lift Index Tables

Figure 69



Standard Type "AM" air-lift index tables are available for Series 3H, 4H and 5H JIGMILS and will accommodate a larger and heavier range of workpieces than the smaller Type "M" index tables. Four 90° index stations provide for accurate in-line boring operations and boring, milling, drilling and tapping from four sides to precise limits with one setup of the work piece.

The index table rotates freely on a 25 PSI cushion of filtered air injected between the top platen member and the fixed sub-base permitting effortless friction-free indexing of large, heavy workpieces. The four 90° index positions are located and fixed by two hardened and lapped plungers in the sub-base engaging mating hardened and lapped bushings in the upper platen. Index plungers are widely spaced on opposite sides of the center line for the greatest degree of accuracy and a locating hole is provided on the side of the index table for accurate location of the machine spindle with respect to the center line of the table.

A compact air-lift unit with a maximum output of 50 PSI serves both as a pressure regulator and a filter for the available air supply.

### STANDARD TYPE "AM" INDEX TABLES with Four 90° Index Positions

30" x 30"		30" x 40"
40" x 40"	40" x 50"	40" x 60"
50" x 50"	50" x 60"	50" x 70"

Tee slots and cross slots  $1\frac{3}{16}$ " wide;  
tee slots are spaced on 5" centers.

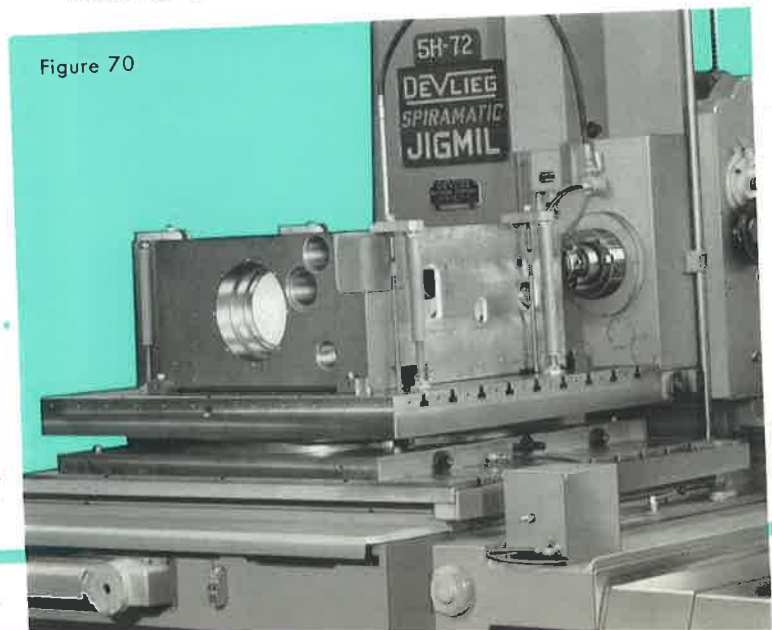
The photo at right shows a typical setup for jigless boring and milling on a Model 5H-72 JIGMIL with the part piece mounted on a 50" x 60" Type "AM" air-lift index table.

The part is a large machine tool spindle headstock that was completely drilled and bored from four sides in one setting of the workpiece and the boring operations were held to extremely fine limits.

**THE PROCESS OF INDEXING** is accomplished in the following manner:

Index plungers are disengaged from the index table by counterclockwise rotation of two index plunger actuating nuts, each of which actuates one plunger. Two clamp nuts are rotated in a counterclockwise direction to loosen four clamps and free the table. The air-lift unit is switched on and the table and part piece are suspended on a pressurized cushion of filtered air for effortless indexing to the next station. Index plunger nuts are turned clockwise to raise the plungers and align the table in precise location. The air-lift unit is switched off permitting the top platen member to properly settle on the base, and the clamp nuts are turned clockwise which tighten the four clamps and seat the index table firmly in position for the next machining operation. Type "AM" index tables can also be provided with a graduated scale reading in degrees, and through the use of a vernier scale angular settings to an accuracy of 5 minutes of arc can be set. When the index table is provided with this scale and is set at angles other than 90°, the index plungers are not used as the clamping mechanism has ample capacity to securely hold the table at these settings. This angular graduation feature is optional and can be provided at extra charge.

Figure 70





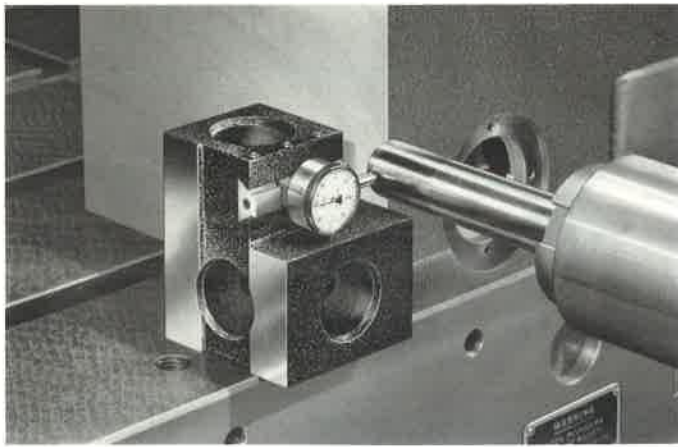


Figure 71

## DeVlieg Tri-Way<sup>®</sup> Locator

The DeVlieg Tri-Way locator set (Fig. 71) permits very accurate and rapid pickup from a machined surface to determine exact location of the machine spindle with reference to a given surface. The Tri-Way locator permits a static or moving pickup, and for most accurate requirements the best reference location can be made by picking up from a rotating machine spindle. The Tri-Way locator set can be used on any type of horizontal or vertical boring machine and it is particularly well adapted to usage on DeVlieg JIGMILS. The Tri-Way locator unit is mounted on the machine table or against a machined surface of a fixture or workpiece, and with the precision lapped test bar locked in the machine spindle it is possible to quickly and accurately establish the initial zero point for precision boring operations. The DeVlieg Tri-Way locator set consists of a Tri-Way locator and key, master setting block, dial indicator and hardened, ground and lapped 1" diameter test bar with NMTB taper shank, complete in fitted hardwood case.

## Tee Nuts, Studs and Washers

A set of standard tee nuts, studs and washers is recommended for use on JIGMILS. These products are accurately machined and hardened and are designed to provide adequate clamping of workpieces without damage to tee slots in machine tables. The complete set (Fig. 73) consists of the following items in a fitted hardwood case:

For Series 3H, 4H and 5H JIGMILS to fit  $\frac{13}{16}$ " wide tee slots, 18 tee nuts, washers and nuts; 6 coupling nuts; 6 each  $\frac{5}{8}$ " studs 4" long, 6" long, 8" long, 10" long and 12" long.

For Model 2B-36 JIGMIL to fit  $\frac{11}{16}$ " wide tee slots, set is the same as above except studs are furnished in  $\frac{1}{2}$ " size.



Figure 73

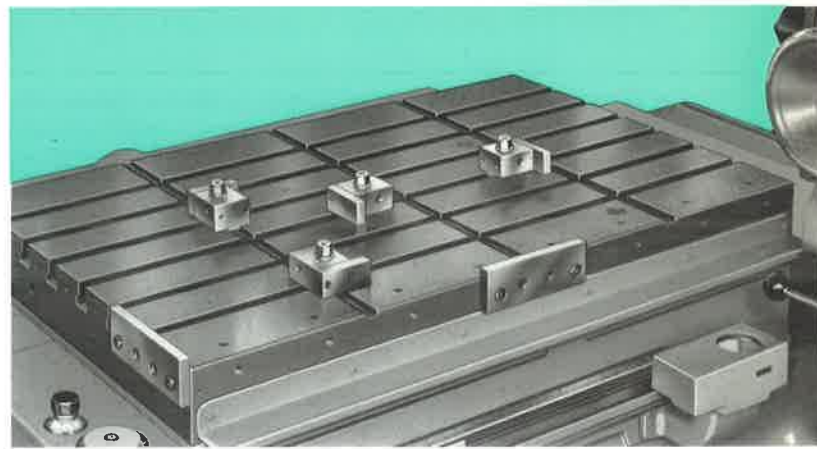


Figure 72

## Locating and Nesting Blocks

Illustration (Fig. 72) shows a standard matched set of hardened and ground steel locating and nesting blocks which are used for accurately locating workpieces on the JIGMIL table. The arrangement of these blocks indicates how tee slots, cross slots and sides of the machine table are used for mounting standard locating and nesting blocks. Provision is made on the JIGMIL index table and angle blocks for using the standard locating and nesting blocks in a similar manner. A standard matched set comprises the following pieces arranged in fitted hardwood case:

Set RT-301A for Series 3H, 4H and 5H JIGMILS consists of four locating blocks with locating tongues and end stops and two table front stops. The blocks are arranged to fit  $\frac{13}{16}$ " wide tee slots and cross slots.

Set RT-2301 for Model 2B-36 JIGMILS consists of four locating blocks with locating tongues and end stops, and two table front stops arranged to fit  $\frac{11}{16}$ " wide tee slots and cross slots.

## Work-holding and Clamping Set

The DeVlieg work-holding and clamping set is ideal for clamping workpieces to the JIGMIL table and index tables. Setups are made quickly by selecting complete clamp assemblies, adjustable without resorting to shims, to exact heights for positive holding action. Clamp assemblies consist of a series of support tubes, adjustable swivel bases and couplings which are assembled and adjusted to correct heights in a matter of a few minutes. A tee bolt through the strap provides a level, firm grip on the part piece when the nut is tightened. A complete set (Fig. 74) contains a generous supply of spacer tubes, self-leveling swivel bases, and straps in a variety of sizes, and eight tube couplings, arranged and mounted in a heavy-duty case for convenient storage and ease of selection. Tee bolts and nuts are not included.

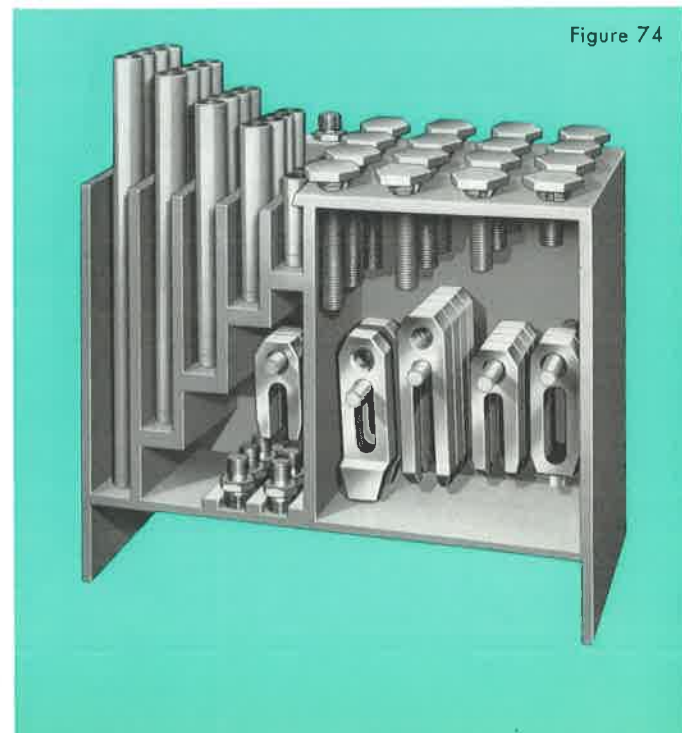


Figure 74

# Standard Milling Cutter Adapters for DeVlieg Spiramatic JIGMILS . . .

The milling cutter adapters tabulated below are available to accommodate standard Shell End Mills and Face Milling Cutters for the full range of

DeVlieg JIGMILS. Refer to Microbore Technical Manual No. 140 for complete engineering data on Standard Cutting Tool Adapters.

## SHELL END MILL ADAPTERS

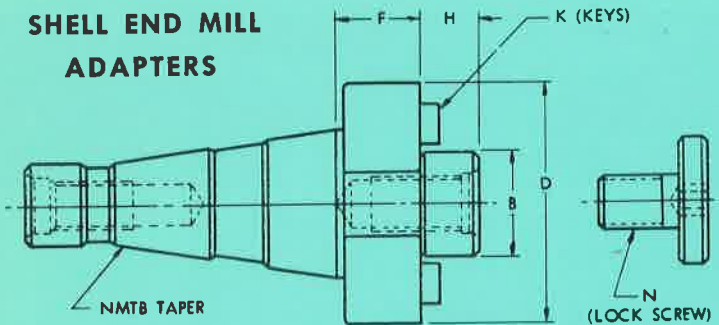


Figure 75

For Series:			Part No.	B	D	F	H	K	N
X	X		40M-S50	1/2	2 1/32	1 1/16	9/16	1/4	LS-50
X	X		40M-S75	3/4	2 1/32	1 1/16	1 1/16	5/16	LS-75
X	X		40M-S100	1	2 1/32	7/8	1 1/16	3/8	LS-100
X	X		40M-S125	1 1/4	2 7/8	1 5/16	1 1/16	1/2	LS-125
X	X		40M-S150	1 1/2	3 3/4	1 3/16	1 5/16	5/8	LS-150
	X	X	50M-S50	1/2	3 3/4	3/4	9/16	1/4	LS-50
	X	X	50M-S75	3/4	3 3/4	3/4	1 1/16	5/16	LS-75
	X	X	50M-S100	1	3 3/4	3/4	1 1/16	3/8	LS-100
	X	X	50M-S125	1 1/4	3 3/4	3/4	1 1/16	1/2	LS-125
	X	X	50M-S150	1 1/2	3 3/4	1 3/16	1 5/16	5/8	LS-150
	X	X	50M-S200	2	4 3/8	1 3/16	1 5/16	3/4	LS-200

## SLEEVE MOUNTED SHELL END MILL ADAPTERS

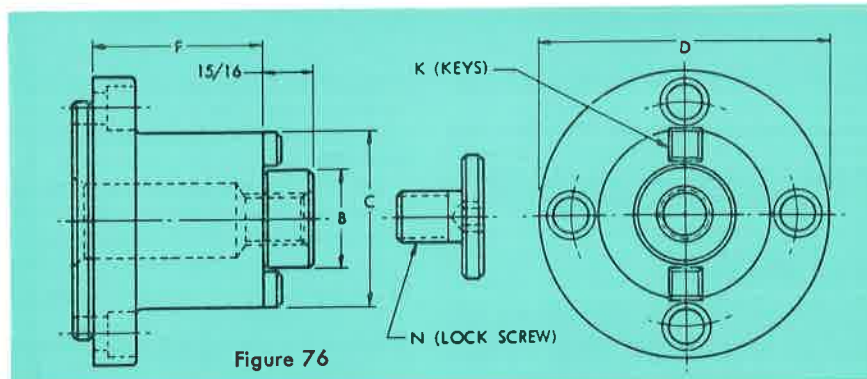
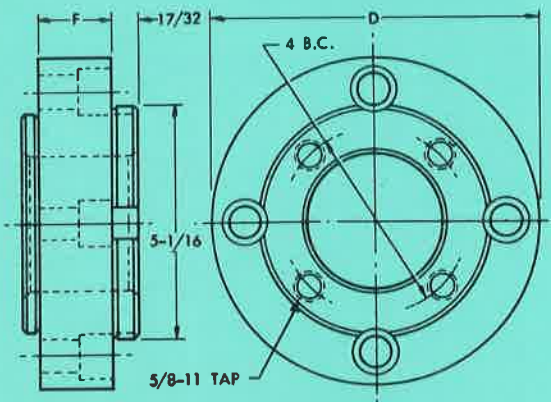


Figure 76

For Series:				Part No.	B	C	D	F	K	N
X				2SL-S150	1 1/2	3 3/8	5 5/8	2 7/8	5/8 sq.	LS-150
X				2SL-S200	2	3 5/8	5 5/8	2 7/8	3/4 sq.	LS-200
	X			3SL-S150	1 1/2	3 1/2	5 3/4	3 31/64	5/8 sq.	LS-150
	X			3SL-S200	2	3 1/2	5 3/4	3 31/64	3/4 sq.	LS-200
		X		4SL-S200	2	4 3/8	7 1/4	3 25/32	3/4 sq.	LS-200
			X	5SL-S200	2	4 3/8	8 11/16	3 25/32	3/4 sq.	LS-200

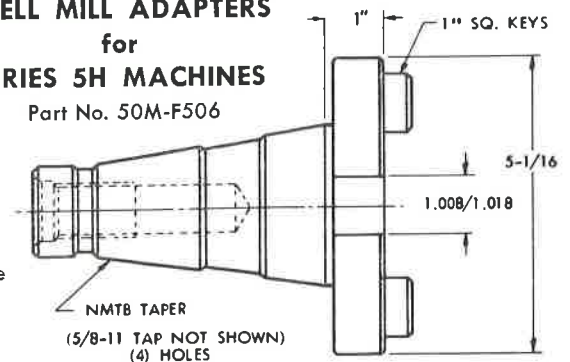
Figure 77



## SHELL MILL ADAPTERS for SERIES 5H MACHINES

Part No. 50M-F506

Figure 78



## CENTERING PLUGS with No. 50 NMTB TAPER SHANK for SERIES 5H MACHINES

Centering plugs with No. 50 NMTB taper shanks (not shown) are available with 2" diameter plug, Part No. 50M-20CP or 2 1/2" diameter plug, Part No. 50M-25CP.

## SLEEVE MOUNTED FACE MILLING CUTTER ADAPTERS

For Series:			Part No.	D	F
X			3SL-F506	5 3/4	1 41/64
	X		4SL-F506	7 1/4	1 11/16
		X	5SL-F506	8 11/16	1 11/16



## REDUCING SLEEVES

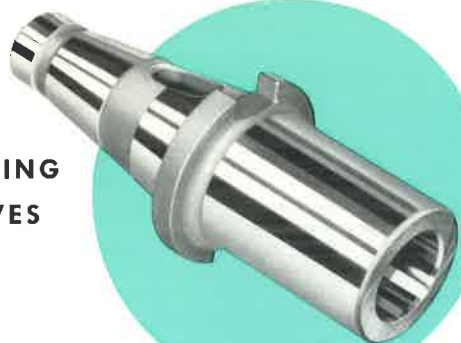


Figure 79

Standard reducing sleeves are available for the full range of DeVlieg JIGMILS. Illustration (Fig. 79) shows typical reducing sleeves. For Model 2B-36 and Series 3H JIGMILS standard sleeves reduce from No. 40 NMTB taper to Nos. 2, 3 and 4 Morse taper and Nos. 7 and 9 Brown & Sharpe taper. For Series 4H and 5H JIGMILS standard sleeves reduce from No. 50 NMTB taper to Nos. 3, 4 and 5 Morse taper and Nos. 7, 9 and 10 Brown & Sharpe taper.

## END MILL ADAPTERS



Figure 80

Standard end mill adapters are available for the full range of DeVlieg JIGMILS. Illustration (Fig. 80) shows typical adapters. For Model 2B-36 and Series 3H JIGMILS standard adapters are provided with No. 40 NMTB taper shanks to accommodate end mills with  $\frac{3}{8}$ ",  $\frac{1}{2}$ ",  $\frac{5}{8}$ ",  $\frac{3}{4}$ ",  $\frac{7}{8}$ ", 1" and  $1\frac{1}{4}$ " diameter shanks. For Series 4H and 5H JIGMILS standard adapters are provided with No. 50 NMTB taper shanks to accommodate end mills with  $\frac{3}{8}$ ",  $\frac{1}{2}$ ",  $\frac{5}{8}$ ",  $\frac{3}{4}$ ",  $\frac{7}{8}$ ", 1" and  $1\frac{1}{4}$ " diameter shanks.

## DRILL CHUCK ADAPTERS

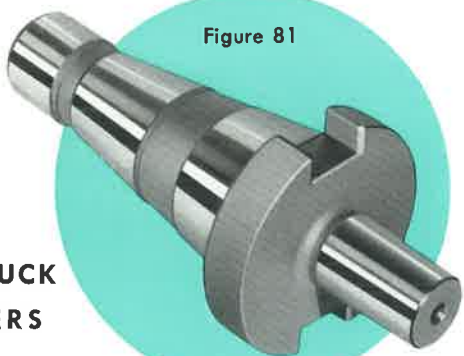


Figure 81

Standard drill chuck adapters are available for the full range of DeVlieg JIGMILS. Illustration (Fig. 81) shows typical adapter. For Model 2B-36 and Series 3H JIGMILS standard adapters are provided with No. 40 NMTB taper shank with Nos. 3 and 4 Jacobs tapers. For Series 4H and 5H JIGMILS standard adapters are provided with No. 50 NMTB taper shanks with Nos. 3, 4 and 5 Jacobs tapers.

Figure 82

## JIGMIL Tapping Equipment

JIGMIL tapping equipment includes tapping attachments made expressly for use on DeVlieg JIGMILS. The spindle in the tapping head floats endwise and permits the tap to freely follow its own lead and thus eliminate torn threads and lead errors. After the required depth of thread is reached the machine spindle is reversed and the tap spindle is retracted by the lead of the tap thread. An accurate adjustable torque control is provided which prevents tap breakage when tap becomes dull, loaded or when tap bottoms during blind-hole tapping.

A complete set (Fig. 82) includes tapping attachment and tap holders providing a range of  $\frac{1}{4}$ " to 1" diameter and fitted hardwood case.



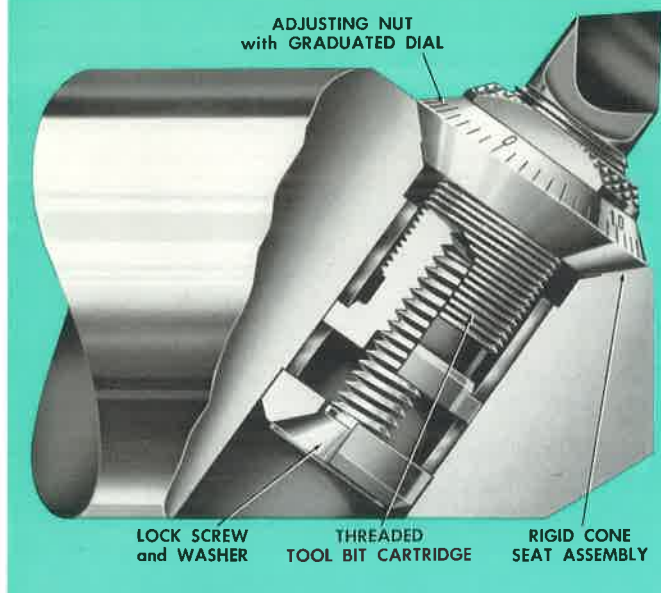


Figure 83



Figure 84

## MICROBORE-KENDEX SYSTEM OF SCREW-ON AND CLAMP-ON TOOLING

Microbore tooling with Kendex screw-on and clamp-on throw-away inserts is unsurpassed for accuracy and economy. The Microbore unit holds the Kendex insert and has the same full range of Microbore individual tool adjustment using the proven micrometer vernier principle. Inexpensive triangular inserts can be quickly indexed from tip to tip and are expended when all cutting edges have been used. The inserts can be very hard grades of carbide which cannot normally be brazed because of danger of checking or cracking. Microbore cartridges with screw-on and clamp-on tools are interchangeable with conventional Microbore units of like sizes.

**Microbore screw-on tools** are designed primarily for general purpose precision boring operations in smaller hole sizes down to and including  $1\frac{1}{16}$ " diameter.

**Microbore clamp-on tools** are made in larger sizes for performing light, medium and heavy machining operations. Clamp-on tools (Fig. 84) are particularly well suited for large bore sizes on heavy-duty machines.

## STANDARD MICROBORE BORING BAR SETS

Microbore standard bar sets for general-purpose work are available for the full range of SPIRAMATIC JIGMILS.

The No. 40M-3H set (Fig. 85) is designed for use with Series 3H SPIRAMATIC JIGMILS and covers a boring range of  $\frac{3}{4}$ " to  $9\frac{3}{4}$ " diameter. This set consists of eight boring bars with No. 40 NMTB taper shanks, two boring rings with adapter and a Jacobs chuck adapter. The set includes Microbore units for each tool station, plus an assortment of spare Microbore cartridges, necessary grinding blocks and wrenches, a spindle taper wiper, all arranged in a hardwood

Microbore Adjustable Precision Tools are recommended as essential equipment for all DeVlieg JIGMILS. Microbore tools are adjusted by proven micrometer vernier principle and tool settings are rapidly established to precise limits, thereby eliminating cut and try methods. Microbore tools can be applied singly or in clusters for all types of boring, facing and turning operations.

## PROVEN MICROMETER VERNIER ADJUSTMENT

Standard Microbore unit (Fig. 83) consists of a threaded tool bit cartridge assembled in a cone-shaped adjusting nut with graduated dial which is seated and locked firmly in the tool holder by a lock screw and washer assembly. To adjust the cutting tool, loosen the lock screw, adjust the graduated dial to the desired setting and lock by normal tightening of the lock screw. A dial movement of one graduation represents .001" on diameter, the vernier scale divides one graduation of the dial into ten parts with a resultant change of .0001" on diameter.

Microbore tooling can be applied efficiently and economically for all types of work involving one-piece jobs as well as production applications. The compactness of Microbore units makes it possible to cluster tools for machining multiple surfaces at one pass with each tool independently adjusted to specific part dimensions.

In addition to tungsten carbide tips and high-speed steel, Microbore cartridges are also available with cermets, titanium carbide, ceramic tips and throw-away inserts.

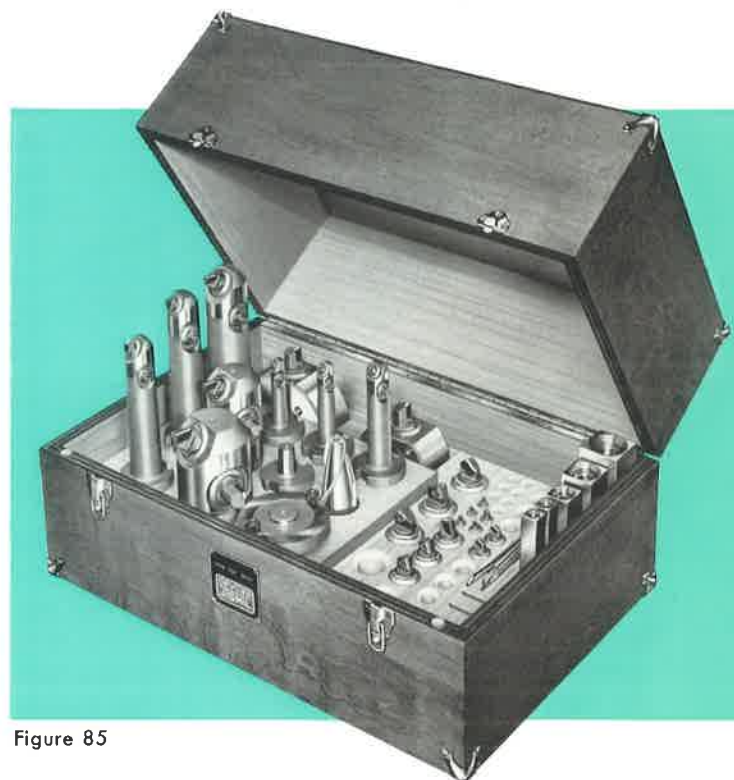


Figure 85

case. Similar Microbore standard boring bar sets are available for the Model 2B-36 and series 4H and 5H JIGMILS.

Individual standard single-tool and two-tool Microbore boring bars and boring rings and adapters are also available. Both single and two-tool boring bars are of stub design and wherever practical the bars incorporate a tapered nose section that increases rigidity. Interchangeable standard Microbore boring rings that can be mounted onto a single adapter provide an economical means for boring diameters from  $5\frac{1}{2}$ " to  $17\frac{3}{4}$ ".



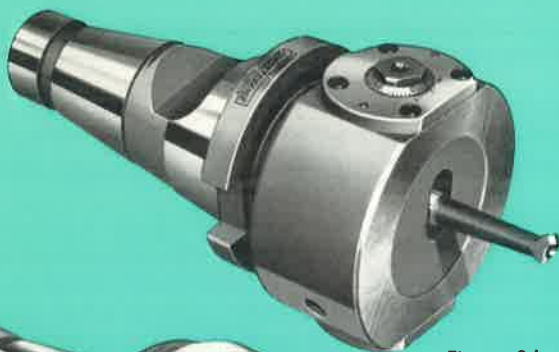


Figure 86

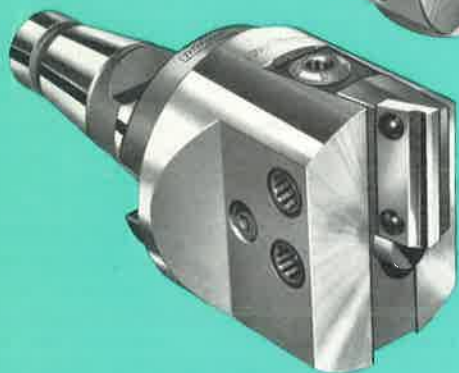


Figure 87



Figure 88



Figure 89



Figure 90

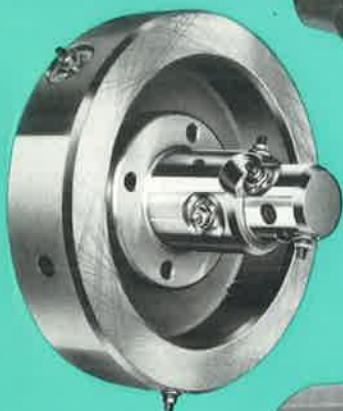


Figure 91



Figure 92

#### MICROBORE SERIES AH ADJUSTABLE BORING HEADS

Microbore Series AH Adjustable Boring Heads with proven micrometer vernier adjustment and inherent balanced design are precision tools for boring small diameter holes. Series AH Boring Heads are available in three sizes for boring from  $\frac{1}{4}$ " to  $\frac{3}{4}$ " diameter,  $\frac{1}{4}$ " to 1" diameter, and  $\frac{1}{4}$ " to  $1\frac{1}{2}$ " diameter, with fully enclosed tool holding and adjustment mechanism for dependable trouble-free service. Figure 86 illustrates a Model AH-500 Boring Head mounted on a No. 40 Flash-Change shank. Series AH Adjustable Boring Heads, shank adapters and boring tools may be ordered as separate items or as complete sets for use on all DeVlieg JIGMILS.

#### MICROFACE® ADJUSTABLE BLADE FACING HEADS

MicroFACE Facing Heads (Fig. 87) are intended for precision boring and facing, or spot-facing wide surfaces without the use of special tooling. The blade is adjusted to the required diameter by rotating a graduated dial which is calibrated in .001" increments. The cutting edge of the blade remains square to the center line throughout its range of adjustment. Precision ground high-speed steel or carbide blades in a wide range of sizes are readily interchanged or replaced as necessary. The blade only or the complete blade holder assembly can be changed while the facing head remains in the spindle, thus minimizing machine down time. Adapters are available so MicroFACE Facing Heads can be used on all DeVlieg JIGMILS to accurately plunge-face wide surfaces from  $1\frac{1}{2}$ " to 8" in diameter. In many instances this technique will eliminate the necessity of generating a face by slow cross-feed methods.

#### SPADE DRILLS AND SPADE DRILL DRIVERS

Microbore high-speed steel spade drills allow holes of a specific diameter to be drilled from the solid in one pass, thus permitting greater machining efficiency with lower costs than can be obtained by using twist drills. The rigidity and strength of the drill point, cutting edges and drill driver minimize chatter, deflection, drill drifting and breakage. Microbore spade drills are manufactured from M2 high-speed steel, uniformly hardened to R/C 62-65 and are available in a complete range of sizes from  $\frac{7}{8}$ " diameter to 5" diameter in  $\frac{1}{32}$ " increments. Standard spade drill drivers with NMTB taper shanks (Fig. 88) are available from stock for use on all DeVlieg JIGMILS. Head and stem assemblies can be furnished in any lengths required to meet specific needs; however, rigidity of the setup, material and diameter being machined, and coolant pressure available will contribute to successful results and should be carefully considered.

#### MICROBORE COUNTERBORING TOOLS

A range of standard Microbore counterboring and back-counterboring tools is available for fast, accurate counterboring and spot-facing operations. A typical counterboring tool is shown in Fig. 89.

#### SPECIAL EQUIPMENT FOR PRODUCTION APPLICATIONS

In order to exploit fully the advantages of the DeVlieg JIGMIL on production operations it is frequently necessary to provide special Microbore equipment. Production economies are effected by combining several machining operations with Microbore cluster tooling providing independent Microbore adjustment for each tool point. This so reduces the machine down time required for tool adjustment that it makes cluster tooling practical to a degree heretofore considered impossible. Figures 90, 91 and 92 show typical examples of Microbore cluster tooling and how the compactness of Microbore units makes it possible to cluster multi-diameter tools into confined areas. Concentricity between machined surfaces is held to extremely fine limits when all of the surfaces are machined in a single pass. Complete facilities for engineering and manufacturing special Microbore equipment are available and proposals will be submitted upon receipt of the necessary part drawings.

## Microbore Precision Presetting Equipment

### MICROBORE PRESETTING BLOCKS

Microbore Presetting Blocks (Fig. 93) are used to preset the tool point and lead cutting edge of Lock Type Microbore Units to predetermined tool settings. The unit is then installed in the boring bar on the machine. The addition of

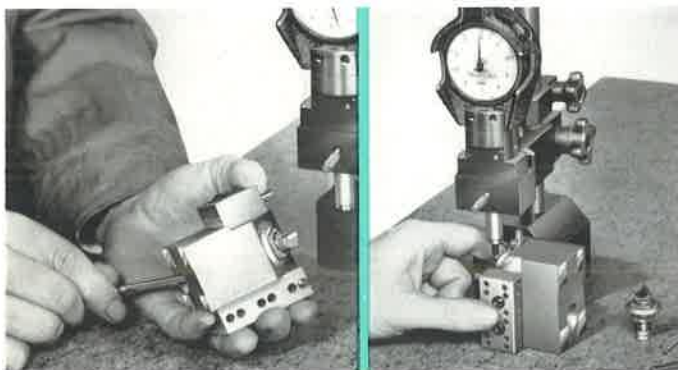


Figure 93

### PRECISION PRESETTING SPINDLE

The DeVlieg Precision Presetting Spindle has been developed to provide a method of accurately presetting boring bars to required bore diameters prior to their use in the machine tool spindle. The non-productive time required to adjust cutting tools to size through cut and try methods can be largely eliminated through the use of preset tooling. This method of presetting allows packages of preset tooling to be delivered to the machine and is of particular advantage in an area employing horizontal boring machines, jig boring machines and vertical boring machines. The standard Model CS-101 Presetting Spindle (Fig. 94) is equipped with No. 40 and No. 50 combination Flash-Change and NMTB taper sockets in a double-end design and will serve a variety of machine tools. The Presetting Spindle can also be used to inspect milling cutters and other multiple-point cutting tools.

Figure 94



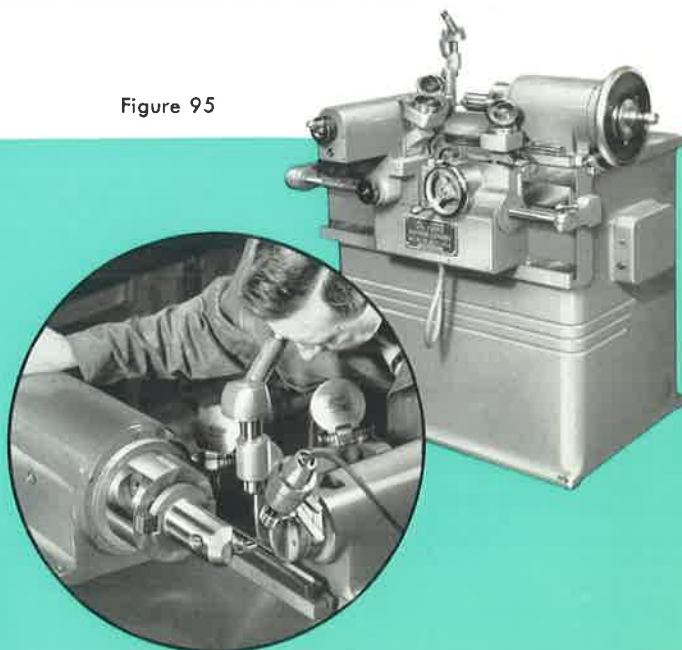
DeVlieg offers three methods of presetting tools: Presetting Blocks, Precision Presetting Spindle and Precision Presetting Machine. Each system has its own advantages for a particular class of work.

a spring washer and lock nut to a standard unit creates a "Lock Type" Microbore Unit. All Microbore tool stations, with the exception of Size 1, are counterbored to accept the lock nut and spring washer; thus standard Microbore units can be converted to lock type without modification of the boring bar. The spring washer provides a three-point bearing both on the dial and the lock nut, and light tension will hold the dial firm while it is being handled during the presetting operation and while being installed in the Microbore tool station. If necessary, fine adjustments can be made without removing the lock type unit from the boring bar. This method of presetting the cutting tool is of particular advantage in production operations on precision boring machines, transfer machines, turret lathes and special production equipment. Lock Type Microbore Units can be preset for most boring, turning, facing and chamfering operations. Presetting Blocks are available for all Microbore Lock Type Units, either brazed tip or throw-away type, in sizes 2 through 20.

### PRECISION PRESETTING MACHINE

The DeVlieg Precision Presetting Machine has been developed to efficiently preset boring bars and cutting tools to accurate diameter and depth dimensions. The presetting machine can be used efficiently to preset tooling for standard machine tools, but the ability to preset depth as well as diameter is of particular advantage when presetting tooling for numerically controlled machines. The DeVlieg Precision Presetting Machine (Fig. 95) consists of a precision presetting spindle mounted on a cast iron base and arranged with transverse and longitudinal slide movements. Precision optical scales that can be read directly to .0001" without interpolation are provided to establish diameter and length measurements. Tool point gauging is accomplished through an optical comparator principle using a 40-power microscope with precision cross-hair reticle.

Figure 95



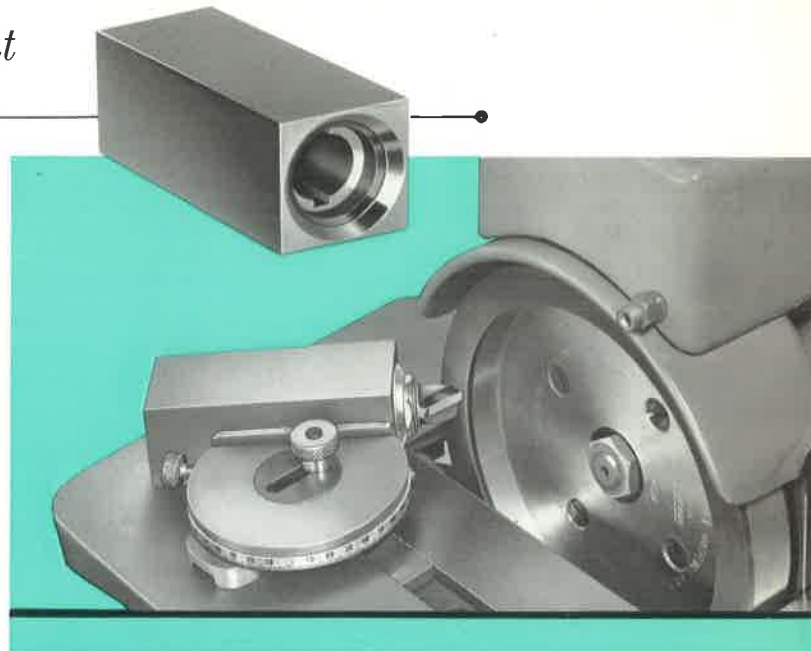


# Precision Tool Grinding Equipment

## STANDARD GRINDING BLOCKS for use on offhand grinding machines.

Figure 96

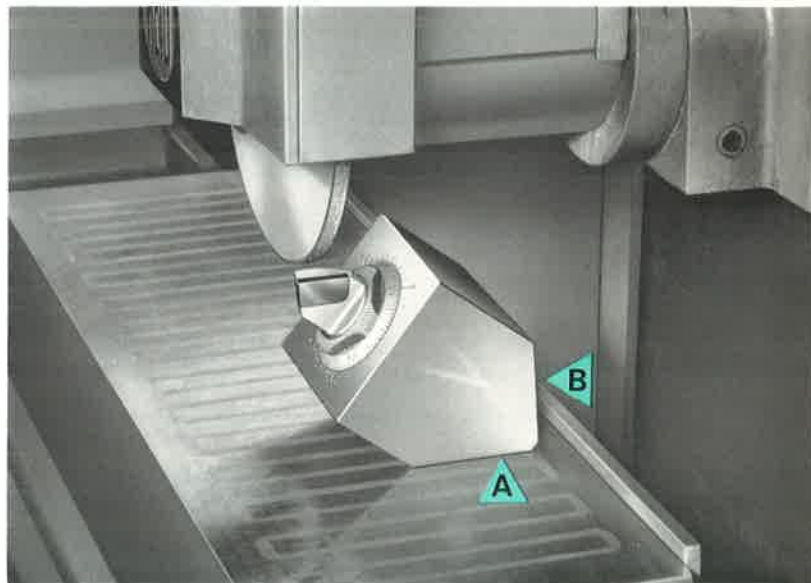
Offhand grinding is the generally accepted method of sharpening Microbore cartridges when dimensional accuracy of the tool point offset, radius, and the squareness produced by the cutting face are not of maximum importance. Style 7 rectangular grinding blocks (Fig. 96) are available for each size of Microbore unit for use on bench and pedestal grinding equipment. The Microbore unit is located and locked into the Style 7 Grinding Block in the same manner as the unit is mounted into a boring bar. The protractor and table of the offhand grinding machine are set to the desired angles and the Microbore tool is then sharpened in the conventional manner.



## TUMBLE GRINDING BLOCKS for use on surface and cutter grinders.

Figure 97

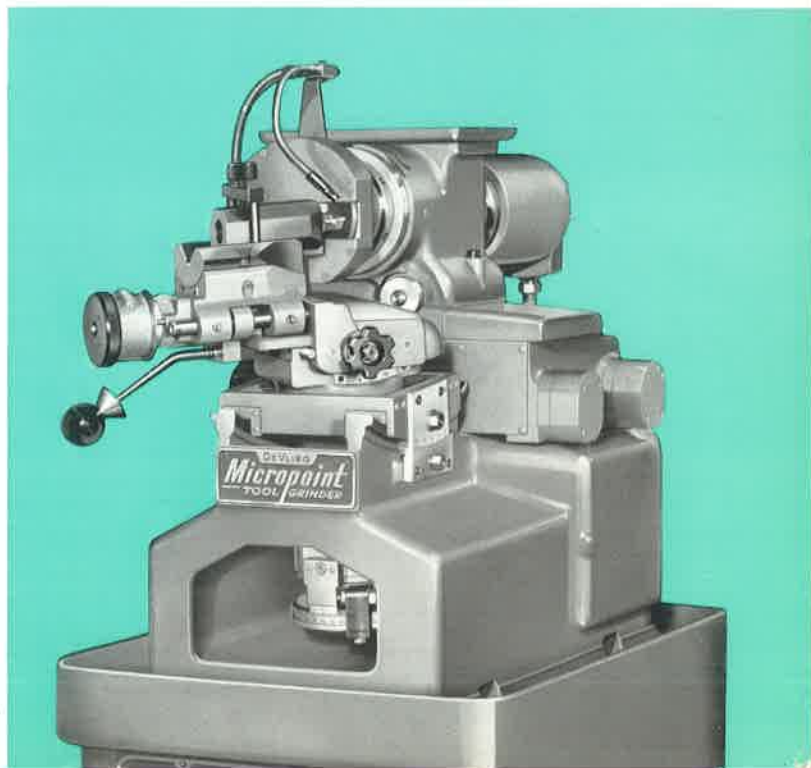
Tumble-type grinding blocks are available for all sizes and styles of Microbore units. Type 8A general-purpose tumble blocks are used for grinding angular mounted Microbore cartridges, Styles 1, 2 and 3. Type 8B Tumble Grinding Blocks are for grinding 90° mounted Microbore cartridges, Styles 4, 5, 6 and 7. The lead cutting edge angle is ground with the tumble grinding block resting on surface "A" (Fig. 97). The block is then tumbled so that it rests on surface "B"; the grinding wheel is readjusted to the correct height for the style cartridge being sharpened, and the end cutting edge is ground. Special tumble grinding blocks can be furnished for sharpening specific Microbore cartridges where the tool point offset and squareness produced by the cutting face must be held to a high degree of accuracy. The tool point radius is usually formed on an offhand grinder with the cartridge mounted in a Style 7 rectangular grinding block as illustrated in Figure 96.



## MICROPOINT® TOOL GRINDER provides absolute control of tool geometry.

Figure 98

The MICROPOINT Precision TOOL GRINDER (Fig. 98) maintains single point tool profiles geometrically correct to precise gauge accuracy, with either conical or cylindrical relief at the radius. Simple accurate octagonal tool holders fit a vee nest and clamping means on the machine which quickly set the tool in the correct position for grinding. Comparator inspection can be made without removing the tool from this holder. Tool holders and accessories are available for grinding all sizes of Microbore units, square tool bits from 1/4" to 1" and round tool bits from 1/8" to 1/2". Special holders may be ordered for other shapes.



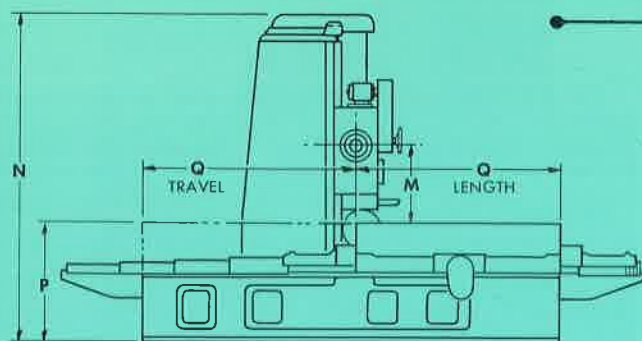


Figure 99

Series	M	N	P	Q (Table Travel and Table Length)
2B	24	81	37½	36
3H	36	102	41⅞	48 • 72 • 96
4H	48	116	41½	60 • 72 • 96 • 120
5H	60	139	42¼	72 • 96 • 120 • 144

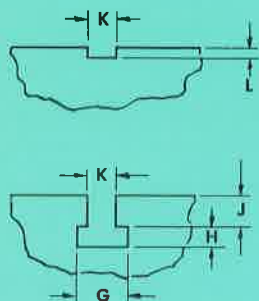
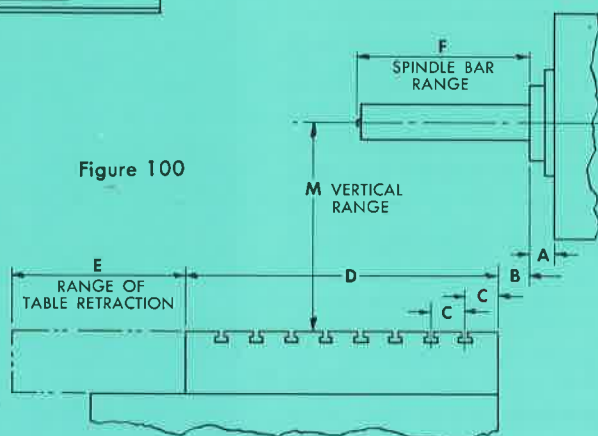


Figure 100



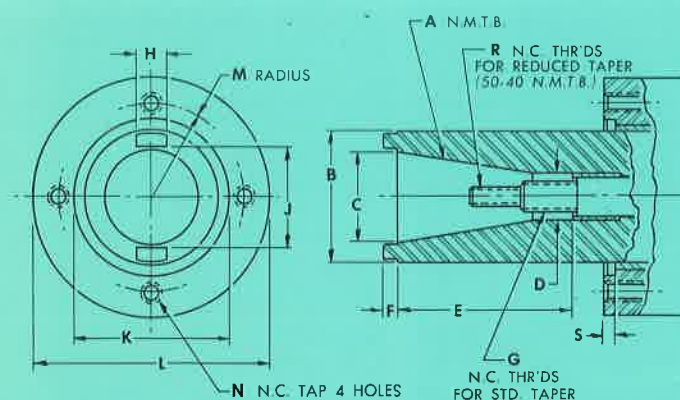
Series	A	B	C	D	E	F	G	H	J	K	L	M
2B	1¾	4⅝	4	24	12	12	1⅞	2⅞	¾	.6875	¼	24
3H	3⅝	4¼	5	35	16	16	1⅞	1⅞	⅞	.8125	¼	36
4H	3¾	4⅞	5	40	20	20	1⅞	1⅞	⅞	.8125	¼	48
5H	4	4½	5	50	24	24	1⅞	1⅞	⅞	.8125	¼	60

## TABLE AND RANGE DIMENSIONS

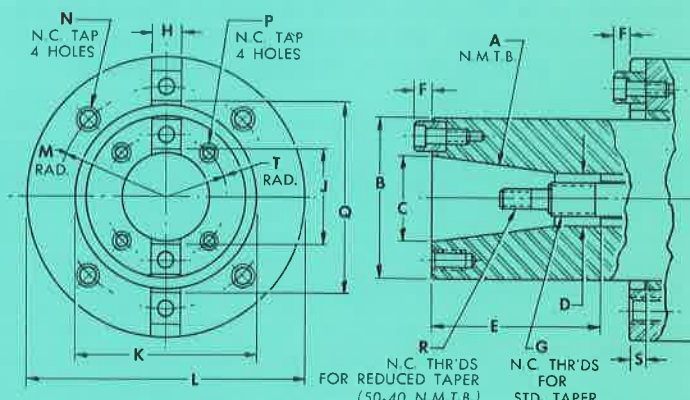
## SPINDLE BAR and FLANGE DIMENSIONS

Figure 101

Figure 102



Series 2B, 3H and 4H



Series 5H

Series	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T
2B	#40	2.500	1.750	1.062	4⅞	⅝	⅝-11	.625	1.790	—	5.0613	2	⅝-11	—	—	—	—	—
3H	#40	3.000	1.750	1.062	4⅞	⅝	⅝-11	.625	1.810	4.750	5.750	2¼	⅝-11	—	—	—	⅝	—
4H	#50	4.000	2.750	1.562	5½	½	1"-8	1.000	2.810	4.750	7.280	2⅞	¾-10	—	—	⅝-11	⅝	—
5H	#50	5.000	2.750	1.562	5½	½	1"-8	1.000	2.875	5.750	8.718	3½	¾-10	⅝-11	6	⅝-11	½	2



# DeVlieg Spiramatic Jigmils

## GENERAL SPECIFICATIONS

All Specifications listed  
apply to  
Standard Machines only.

Standard Machines only.		2B-36	3H-48	3H-72	3H-96	4H-60	4H-72	4H-96	4H-120	5H-72	5H-96	5H-120	5H-144
Diameter of Spindle Bar		2.5000"	3.0000"			4.0000"				5.0000"			
Spindle Nose Taper, NMTB		No. 40	No. 40			No. 50				No. 50			
Main Spindle Drive		5 H.P.	7½ H.P.**			10 H.P.†				20-10 H.P.‡ (2 speed)			
Spindle Bar Travel		12"	16"			20"				24"			
Horizontal Travel		36"	48"	72"	96"	60"	72"	96"	120"	72"	96"	120"	144"
Vertical Travel*		24"	36"	36"	36"	48"	48"	48"	48"	60"	60"	60"	60"
Table Dimensions	Length	36"	48"	72"	96"	60"	72"	96"	120"	72"	96"	120"	144"
	Width	24"	35"	35"	35"	40"	40"	40"	40"	50"	50"	50"	50"
Table Retraction		12"	16"	16"	16"	20"	20"	20"	20"	24"	24"	24"	24"
Standard Speed Range—R.P.M.		42-2000	25-1200			21-1000				10-1000			
Spindle Speeds		16	16			16				19			
High Speed Range—R.P.M.		50-2400	33-1600			26-1220				—			
Range—inches per revolution		.0016"-.018"	.002"-.024"			.002"-.024"				.0034"-.0365"			
Number of Bar Feeds		6	8			8				8			
Rapid Traverse rate —inches per min.		Manual	90"			100"				100"			
Range—inches per min.		.4"-32"	.5"-36"			.5"-36"				.5"-36"			
Milling Feed Rates—16													
2 Rapid Traverse rates —inches per min.		50"-150"	50"-150"			50"-150"				50"-150"			
Height, floor to table top		37½"	41⅜"			41½"				42¼"			
Height, Over-all		6' 9"	8' 6"			9' 8"				11' 7"			
Floor Space	Length	9' 6"	13' 1"	17' 1"	21' 4"	15' 3"	17' 3"	21' 6"	25' 9"	17' 4"	21' 6"	25' 9"	30'
	Width	9'	11' 4"			12' 9"				15'			
Net Weight (Lbs.)		13,000	25,200	30,000	34,500	34,200	38,400	45,000	51,000	51,600	58,900	66,200	73,400

\*Additional vertical travel on machines equipped with extended column: 2B-36, 6" or 12"—Series 3H, 4H and 5H; 6", 12" or 24".

## MOTOR SPECIFICATIONS

	Model 2B-36	Series 3H	Series 4H	Series 5H
Spindle Drive	5 HP	7½ HP**	10 HP†	20-10 HP‡ (2 speed)
Feed and Rapid Traverse	1½-½ HP (2 speed)	3¼-1¼ HP (2 speed)	4H-60 and 4H-72 : 4H-96 and 4H-120 3¼-1¼ HP (2 speed) : 5-1½ HP (2 speed)	5-1½ HP (2 speed)
Bar Rapid Traverse	None; Manual	¾ HP	¾ HP	1 HP
Table Retraction	¾-¼ HP (2 speed)	3-1 HP (2 speed)	3-1 HP	3-1 HP (2 speed)
Automatic Tool Lock	½ HP	½ HP	½ HP	½ HP
Feed Unit Hydraulic Pump	⅓ HP	½ HP	½ HP	½ HP
Table Stop Adjustment and Power Saddle Lock	None; Manual	⅙ HP	⅙ HP	⅙ HP

\*\*10 HP available at extra charge.

†15 HP available at extra charge.

‡30-15 HP available at extra charge.



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DEVLIEG MACHINE COMPANY

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*Makers of Fine Machine Tools*

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FAIR STREET • ROYAL OAK, MICHIGAN, U.S.A.

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