

**BROWN & SHARPE**  
**No. 10 CUTTER AND TOOL**  
**GRINDING MACHINE**

# No. 10 Cutter and Tool Grinding Machine

**T**HE No. 10 Cutter and Tool Grinding Machine is designed specifically for the rapid and accurate sharpening of plain milling cutters (straight and helical), formed cutters, straddle and face mills, angular cutters of any angle, side milling cutters, end mills, straight or tapered reamers, and saws. Much other work not always required of a general cutter grinding machine can also be readily accomplished using additional equipment described in this circular.

The low fixed height of the machine gives easy visibility of wheel and work from the operating position. The controls are sensitive and easily operated, and are all right at hand from the natural position at the front of the machine; and the adjustments are likewise conveniently located. These features promote a speed and accuracy of output which appeals to manufacturer and operator alike. Simplicity of design together with the skillful use of suitable high-quality materials keeps maintenance cost at a minimum, and combines with the ease and efficiency of operation to make the No. 10 a money-saver in either toolroom or production work.

## SPECIFICATIONS

**CAPACITY** Centers swing 10" in diameter; take 20" in length. Maximum longitudinal table travel, 18", by handwheel. Table reciprocation by hand lever, 4" anywhere in the 18" travel. Maximum length of cutter that can be ground on centers, 18". Maximum length of work that can be sharpened with wheel spindle parallel to table ways, 13". Largest diameter that can be ground on centers, using cup wheel with spindle set at right angles to work, 6". Distance, center line of work to center of wheel spindle, greatest, 9 $\frac{1}{4}$ "; least, 2 $\frac{1}{4}$ ". Distance, center of wheel spindle to top of table, greatest, 10 $\frac{1}{8}$ "; least, 4 $\frac{5}{8}$ ".

**DRIVE** Wheel spindle driven by V-belt from  $\frac{3}{4}$  H.P. constant-speed dust-tight motor mounted on wheel spindle column. Belt guard provided.

**WHEEL SPINDLE** Unit type. Spindle of special alloy steel. Ends tapered to receive grinding wheel sleeves. Bearing surfaces hardened, ground and lapped. Phosphor bronze boxes provided with spring shoes for automatic compensation for wear.

**SPEEDS** Three changes of wheel spindle speed: 3000, 4000 and 4500 R.P.M. Changes obtained by changing motor sheave.

**WHEEL GUARDS** Three guards furnished. Give adequate protection to the operator. Position adjustable for wheel wear.

**WHEEL SPINDLE COLUMN** Vertical adjustment, 5 $\frac{1}{2}$ ". Operated by handwheel graduated to read to .001". Transverse movement, 7". Operated by handwheel grad-

uated to read to .001". Swivels. Base graduated to read to 90° each side of zero by degrees. Spring shoes maintain column alignment. Vertical setting clamp provided. Column and transverse ways well guarded against grit and dirt.

**SWIVEL TABLE** Working surface, 29" x 5 $\frac{1}{4}$ ". T-slot 1 $\frac{1}{2}$ " wide. Table turns on stud, permitting angular settings to 90° in either direction. Clamped by two bolts near center. Setting indicated in degrees from either of two zero marks, by graduated arc at front reading in each direction from zero to 90°. Fine screw adjustment, with scale at end of table, provides for accurate setting of table for tapers up to 3 $\frac{1}{2}$ " per foot. Height, floor to top of table, 37".

**SLIDING TABLE** Traversed by handwheel. Two rates provided:  $\frac{1}{16}$ " and 6 $\frac{1}{2}$ " per revolution of handwheel. Table also has a 4" reciprocative movement obtained by hand lever; movement available anywhere within the 18" table travel. Selective lever prevents simultaneous engagement of handwheel and reciprocative lever. Length of table movement controlled by positive stop and adjustable table dogs. Dogs have fine adjustment. Table slides on one V and one flat way, scraped and adequately guarded.

**UNIVERSAL HEAD** Can be set to an angle in both the horizontal and vertical planes. Vertical scale is graduated in degrees to 90° each side of zero. Horizontal scale is graduated in degrees to 180° each side of zero. Head has vertical adjustment of 4". Work up to 16" in diameter will swing over the table and, by placing



Above—Standard equipment regularly furnished with machine.

head at right angles to table, light work up to 24" in diameter can be taken. Carries cutter bars, taper shank mill bushings, and straddle and face mill arbor.

**CENTER HEAD** Adjustable along table. Clamped in position by T-bolt in angular slot, which draws tongue on base against side of straight T-slot for accurate alignment. Has No. 6 B & S taper hole. Height, floor to work center, 42".

**FOOTSTOCK** Adjustable along table. Clamped in position by T-bolt in angular slot, which draws tongue on base against side of straight T-slot for accurate alignment. Spindle has No. 6 B & S taper hole, is operated by spring lever, and is protected from grit and dirt. Clamp lever provided for locking spindle.

**CLEARANCE SETTING GAGE** Can be used either on center head or on footstock. Consists of gage, indicator and work dog. Gage graduated in degrees to 15° each side of zero mark.

**FLOOR SPACE** At right angles to spindle, 41½". Parallel to spindle, 65".

**STANDARD EQUIPMENT** Wheel spindle motor, electrical controls and wiring complete; V-belt for wheel spindle drive; and 3 motor sheaves for obtaining speed changes of wheel spindle.

Universal head — ⅜" cutter bar, bushing and ½" sliding shell with set of collars, including 2 stepped collars; ¾" cutter bar and ⅞" sliding shell with set of collars, including 4 stepped collars; arbor and 3 collars for straddle and face mills; taper shank mill bushing sleeve, holder and 2 bushings for Nos. 7 and 9 B & S tapers.

4 wheel sleeves, 1¼" diameter; wheel sleeve puller; wheel spindle guard; 3 wheel guards.

4 grinding wheels — sizes given in inches, diameter x thickness x hole.—1 straight, 6 x ¼ x 1¼; 1 straight, 6 x ½ x 1¼; 1 flaring cup, 4 x 1½ x 1¼; 1 dish, 6 x ½ x 1¼.

Wheel truing fixture; spindle height gage; tool rest; 4 tooth rests and 2 holders; clearance setting gage; 3 centers, including reamer grinding center; and set of wrenches.

<b>WEIGHTS AND SHIPPING DATA</b>	Net Weight, Lbs. (Approx.)	Domestic Shipping Weight, Lbs. (Approx.)	Foreign Shipping Weight, Lbs. (Approx.)	Dimensions for Shipment, Inches	Space Occupied, Cu. Ft.
Machine fitted with motor*	1045	1350	1450	50 x 38 x 54	59

\* Because of its motor requirements, this machine is only furnished equipped with motor and controlling equipment complete.

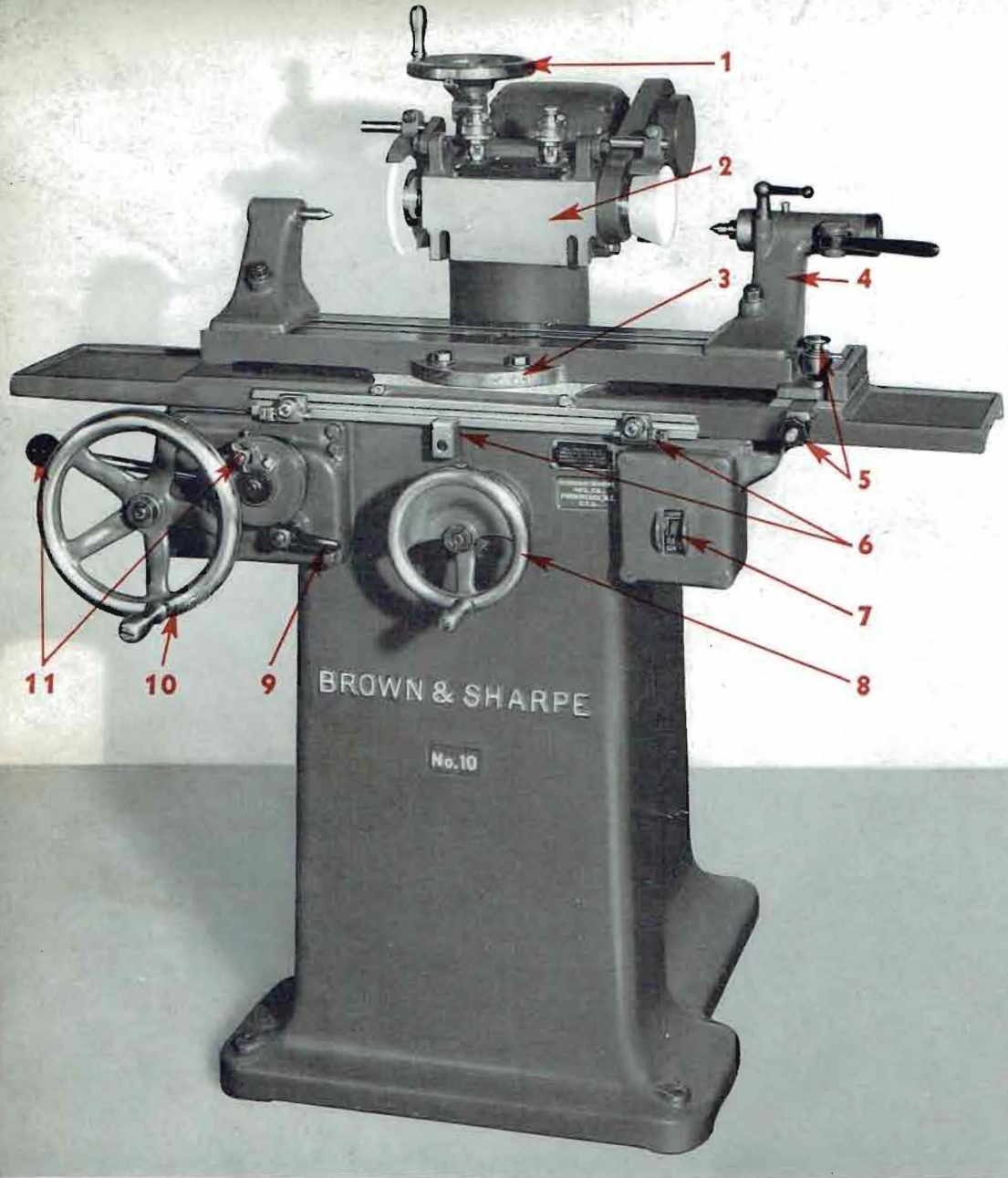
## Additional Equipment

The following additional equipment, described in pages 8 to 15 of this circular, is available at extra cost for use on this machine.—

Revolving Spindle Headstock  
 Internal Grinding Attachment  
 No. 10 Formed Cutter Sharpening Attachment (In-Feed Type)  
 No. 10 Formed Cutter Sharpening Attachment (Through-Feed Type)  
 Indexing Equipment

No. 1 Adjustable Vise  
 No. 10 End Mill Sharpening Attachment Adapters and Collets for Use with No. 10 End Mill Sharpening Attachment  
 Bushings, for Use in Universal Head  
 Taper Holding Attachment  
 No. 10 Face Mill Sharpening Attachment

# FEATURES



**1** Wheel elevating handwheel, easily reached from operating position. Graduations read to .001".

**2** Sturdy wheel spindle column carries double-end unit-type wheel spindle. Finished surface has T-slots for clamping tooth rest. Bottom shoulder finished for use with spindle height gage.

**3** Swivel table turns on stud to 90° either side of zero. Double scale, graduated to degrees, indicates setting from either of two zero marks.

**4** Footstock operated by spring lever. Both footstock and headstock clamped securely in alignment by T-bolt in angular slot.

**5** Spring latch, and knob for fine adjustments of swivel table. Latch engages knob.

**6** Adjustable dogs and positive stop control length of table movement. Dogs have fine thumbscrew adjustment.

**7** Start-stop switch for spindle motor.

**8** Handwheel for transverse movement of wheel spindle column. Graduations read to .001".

**9** Lever selects fast or slow handwheel table travel or lever-operated travel. Interlock prevents simultaneous engagement of lever and handwheel.

**11** Lever for longitudinal reciprocative hand movement of table; and wing nut for engaging or releasing the lever.

**10** Longitudinal table handwheel. Provides fast and slow rates of table travel.

**12** Dust-tight motor drives spindle by V-belt. Belt tension adjustment provided.

**13** Sturdy wheel spindle column, 5" diameter; supported on broad base. Swivels to 90° either side of zero. Scale graduated to degrees.

**14** Spring shoes hold column in vertical alignment. Clamp locks vertical adjustment for heavy grinding.

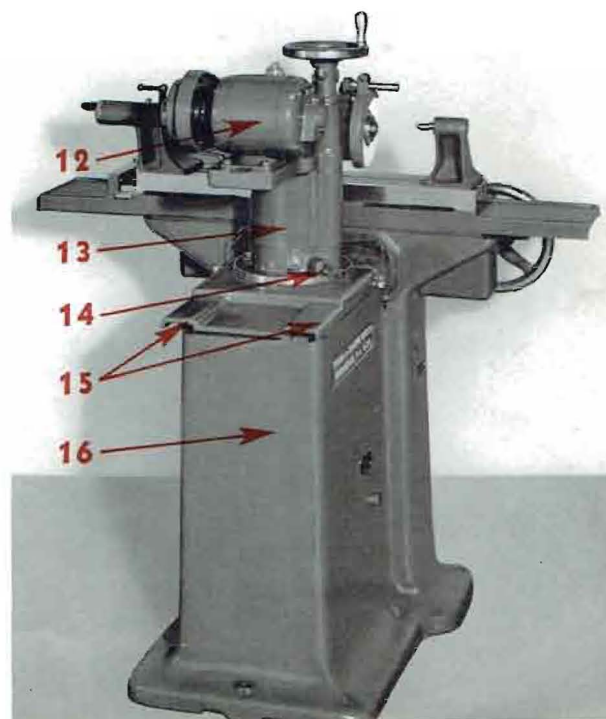
**15** Two scraped V-ways provide easy and accurate transverse movement. Transverse ways, table ways and column guarded at all points to prevent wear and assure long life.

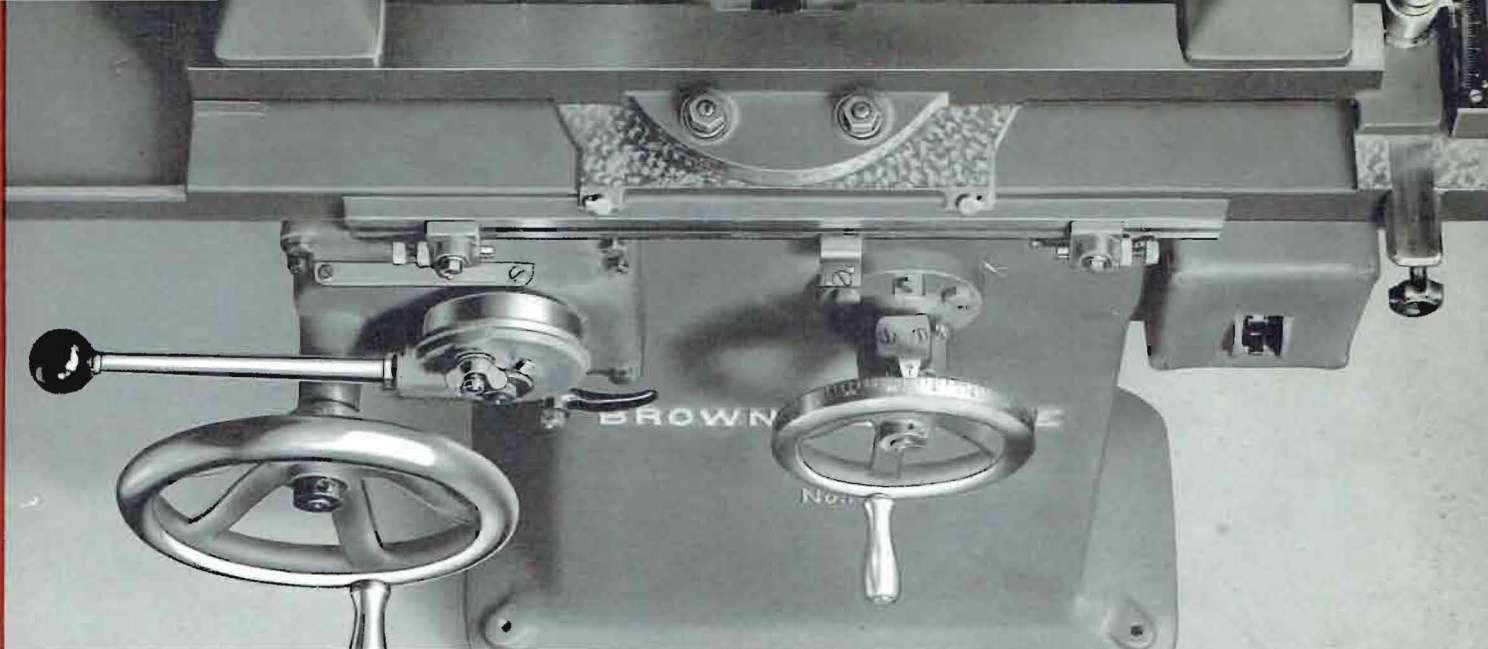
**16** Hollow one-piece base mounted on three points to preserve alignments. Provides rigid support for wheel spindle column.

● **Simplicity of Design**

● **Convenience of Operation**

● **Long-Lived Accuracy**





*Above*—Controls and adjustments as seen from near the operating position. Note convenient grouping. The vertical adjustment handwheel is also within easy reach from this position.

## Designed for Efficient Operation —Built for Enduring Precision

**S**IMPLICITY of control, flexibility of set-up and in-built accuracy enable the No. 10 to handle cutter sharpening and similar work with rapidity, ease and precision. The table and wheel controls are all easily reached without moving from the natural front-of-table position, and it is very seldom necessary to move around the machine to operate it — a time- and labor-saving feature which greatly appeals to the operator.

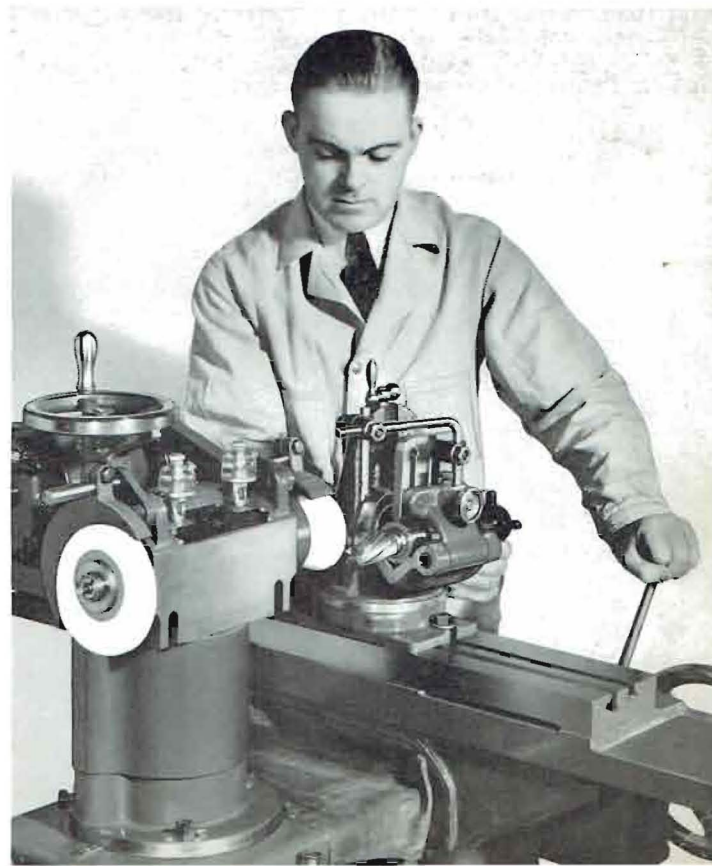
Smooth, easy and precise table movement is characteristic of this machine, whether the work is light or heavy. Fast and slow table movement ( $\frac{1}{8}$ " or  $6\frac{1}{2}$ " per revolution) is provided by the left handwheel (see illustration above); or the lever behind the handwheel can be quickly engaged to give a 4" table reciprocation at any point in the path of travel. The illustration at right shows this lever in use. A fixed central positive stop and table dogs with fine adjustment provide for the desired limitation of table travel. A fine-adjustment knob and scale at the right-hand end of the swivel table facilitate setting to grind tapers to  $3\frac{1}{2}$ " per foot; and the mechanism is quickly disengaged to permit swinging the table to any angle up to  $90^\circ$  either side of zero, by graduations in degrees on the arc at the front of the table.

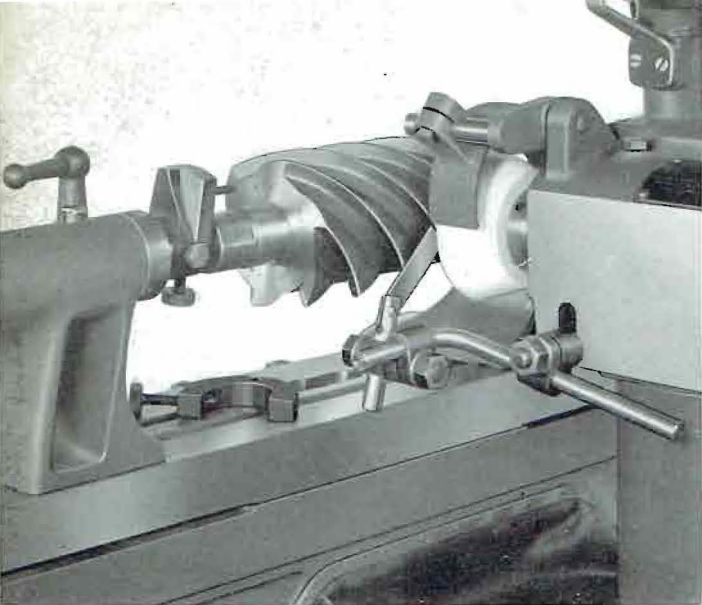
### Operations Indicate Broad Scope of Machine

**T**O give some idea of the broad capabilities of this machine, typical every-day tool and cutter grinding jobs are illustrated on the following two pages. Many other types of operation are handled equally well, using only the equipment regularly furnished with the machine. Other illustrations on pages 8 to 15 indicate some of the types of work, not always required of a general cutter grinder, that are readily done using the various attachments available as extras.

The wheel spindle column has both transverse and vertical adjustment, provided respectively by handwheels at the center front of the bed and at the top of the column. Both handwheels are handy to the operator, and are graduated to read to  $.001$ ". The column can be set to  $90^\circ$  either side of zero by a scale graduated in degrees.

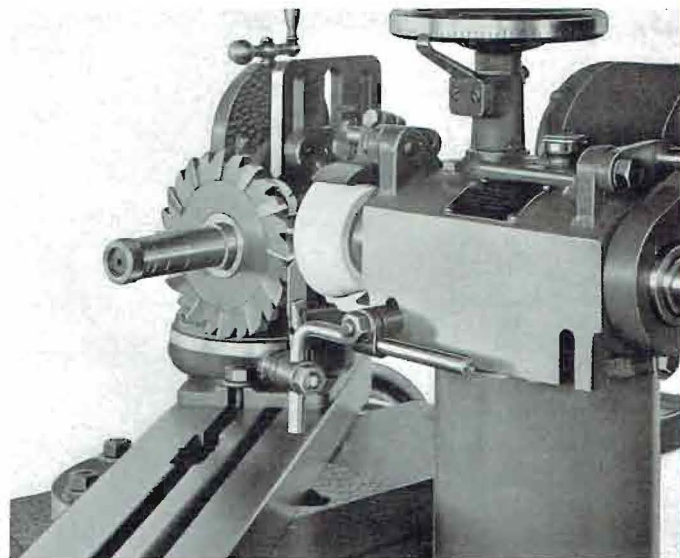
*Below*—Sensitive, easily-operated controls and convenient adjustments simplify all operations. Note easy visibility of wheel and work resulting from low fixed height of the table. Shape of base allows operator to stand close to machine.



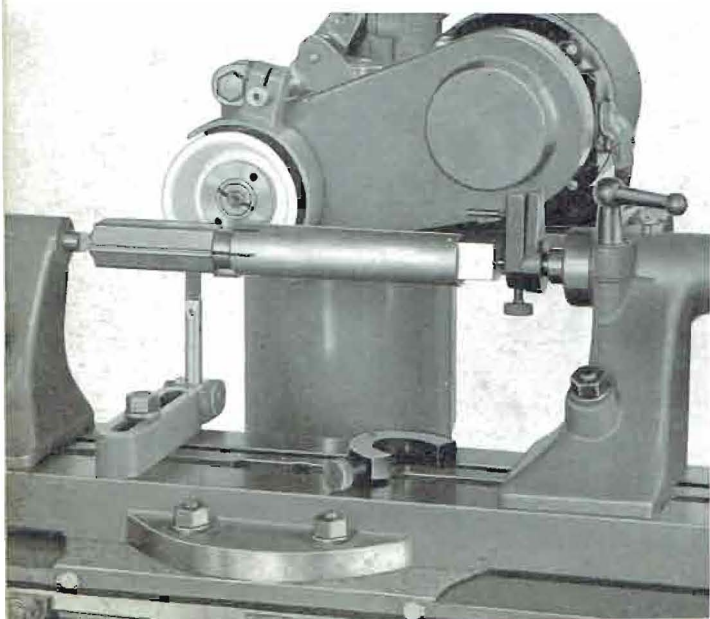
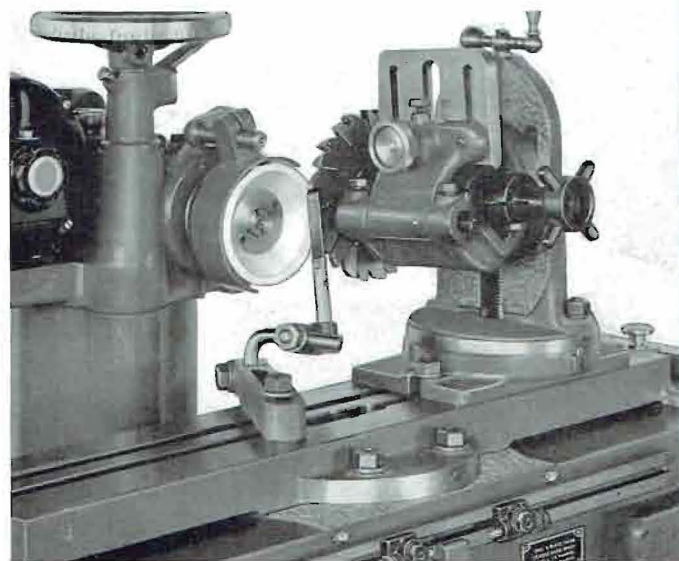


**Left — Sharpening a helical milling cutter** with steep angle of helix. The cutter is mounted between centers, and is guided by the slightly rounded end of a tooth rest clamped to the column. For clearance, the tooth rest is set below horizontal, using the clearance setting gage furnished. The cup wheel is formed so that the cut is made only by the outside (or inside) edge of the cutting surface; and the column is set so that the back edge of the wheel just clears the cutter.

**Right — Sharpening the peripheral teeth of a staggered tooth milling cutter.** The cutter is placed on a sliding shell and mounted on the cutter bar, which is held horizontal in the universal head at right angles to the spindle. The tooth rest is shaped to a double angle somewhat greater than the angles of spiral of the cutter teeth; and the teeth are ground by sliding the cutter on the cutter bar with the spiral edge of the tooth resting on the corresponding angle of the tooth rest.

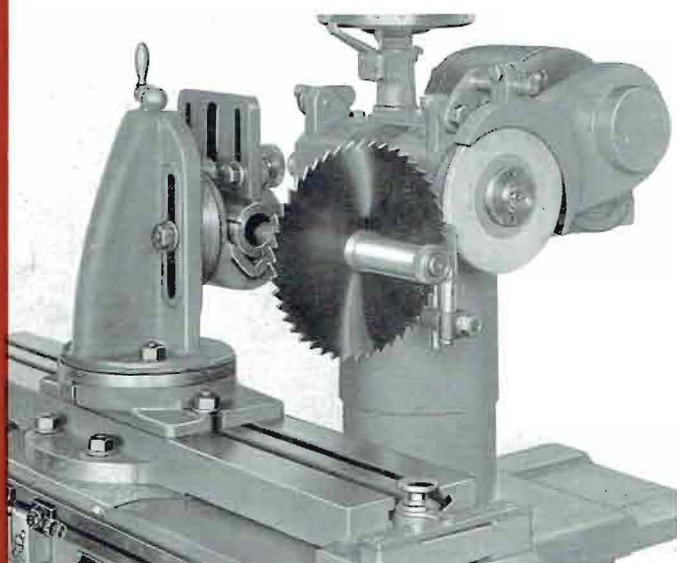
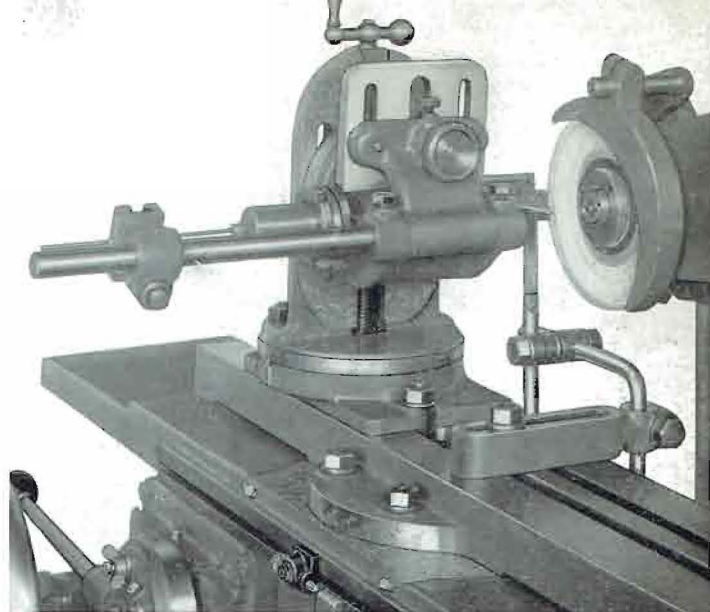


**Right — Sharpening the sides of the teeth of a staggered tooth milling cutter.** The cutter is mounted in the universal head, at  $90^\circ$  to the table ways; and the tooth rest is set so that the cutting edge of the tooth being ground will be parallel to the top of the table. Using a cup wheel, clearance is obtained by swiveling the universal head in the vertical plane to the desired clearance angle.

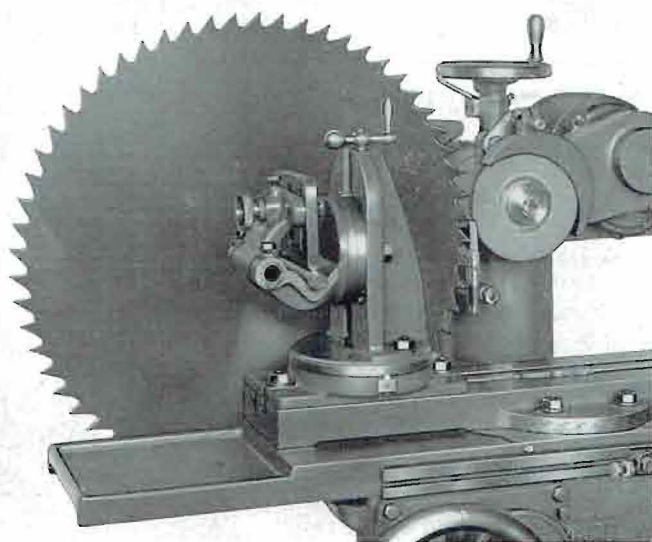


**Left — Sharpening a straight finishing reamer.** Using a cup wheel, clearance is obtained by means of the convenient clearance setting gage shown on the footstock and table, the tooth rest being set so that the tooth is rotated below center an amount equal to the clearance angle. The clearance setting gage can be used on either the footstock or the center head with equal facility.

**Right — Grinding the end teeth of a shell reamer.** The reamer is supported by its shank directly in the V-jaw of the universal head. Since the shank must be unclamped in order to index the reamer, the center (held in position by the clamp and bar) is used as a stop or locating device to keep the work in uniform position endwise. The head is swiveled vertically to the required clearance angle, and can be swiveled horizontally to grind the teeth at any desired angle to the axis of the reamer.

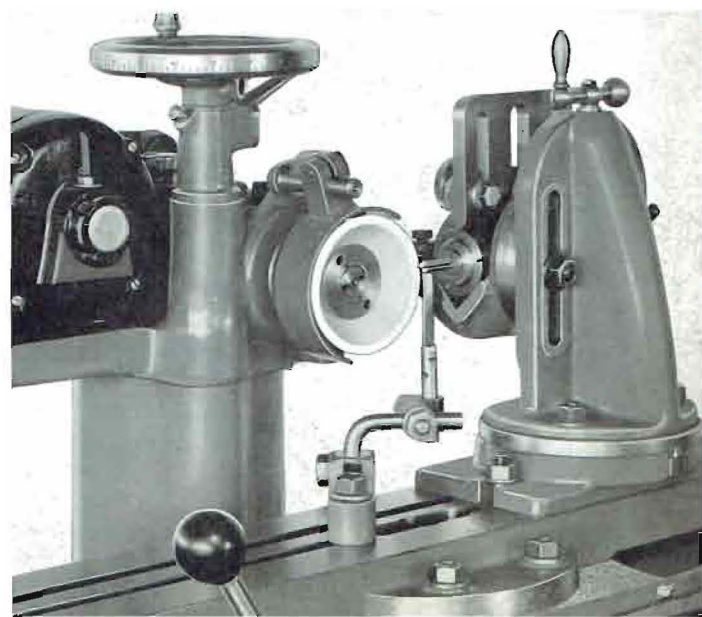


**Left — Sharpening the teeth of a small saw.** The saw is mounted on a sliding shell on the cutter bar, and is moved across the face of the wheel by sliding it along the bar. The tooth rest is wider than the saw and extends beyond the wheel; and indexing is accomplished by sliding the saw beyond the tooth rest and then engaging the next tooth.



**Left — Sharpening the teeth of a large saw.** Saws too large to be swung over the table are sharpened in this manner — another example of the multitude of possible set-ups using the regular equipment. The operator stands behind the table and moves the saw across the face of the wheel by sliding it on the cutter bar. Longitudinal table position governs depth of cut, and is maintained by clamping the table dogs in contact with the positive stop. Saws up to 24" diameter can be ground by this method.

**Right — Grinding the peripheral teeth of a two-lipped end mill.** The mill is held in a taper shank mill bushing which is mounted in a sleeve and clamped in the jaw of the universal head, and is passed across the wheel by means of the table reciprocative lever. A straight wheel can be used, if desired, with the wheel spindle column set at zero (90° from position shown).



## — ADDITIONAL EQUIPMENT —

### Items Furnished at Extra Cost

*When ordering equipment specify the size, style and serial number of machine.*

## Revolving Spindle Headstock Motor Driven

**T**HIS motor-driven headstock, furnished as an extra, provides a ready means of performing straight or taper cylindrical grinding operations on the No. 10 Cutter and Tool Grinding Machine. The centers will swing work up to 10" diameter and take 17" in length, while the maximum length of grinding stroke is 10". In addition, miscellaneous chucking operations are made possible through provision of a 4", 4-jawed independent chuck, which can be quickly mounted on the face of the spindle pulley in place of the center and work driver. When using this headstock, the swivel table of the machine must not be swung to bring the headstock more than 50° to the front or 35° to the rear of the table ways.

The spindle unit is driven by a single V-belt from a ¼ H.P. constant-speed motor mounted on the headstock. Spindle speed is 300 R.P.M. when using a 60 cycle alternating current or a direct current motor. The motor position is easily changed for proper belt tension adjustment, and a belt guard amply protects both the belt and the motor pulley.

The headstock spindle is mounted in a taper bronze bearing which is provided with means of adjustment for wear. The center turns with the spindle, and is seated in a No. 6 B & S taper hole. A ⅜" hole through the spindle permits using a rod to knock out the center.

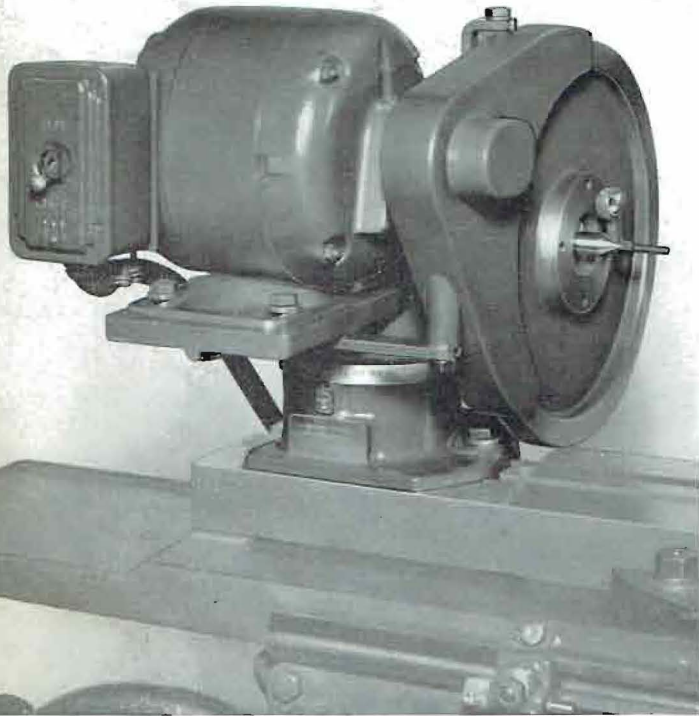
The headstock swivels on its base, and may be set at any angle in a horizontal plane, the setting being indicated by a scale graduated in degrees to 100° each side of zero. A clamp bolt maintains the adjustment. The rigid base is aligned accurately on the swivel table of the machine by means of two tongues, and is clamped in position by two T-bolts which fit the angular table slot and draw the Attachment tongues against the side of the straight T-slot.

Standard equipment includes 4", 4-jawed dust-proof reversible-jawed independent chuck complete with wrench and 4 mounting screws; work driving dog (taking work from ⅛" to 1½" in diameter); pin wrench for spindle nut; ¼ H.P. driving motor (suitable for same power supply as the wheel spindle motor of the machine); and start-stop switch, wiring, disconnect plug and receptacle in base of machine.

The Revolving Spindle Headstock is furnished only equipped with motor, switch and wiring complete, and must be fitted to the machine at our factory.

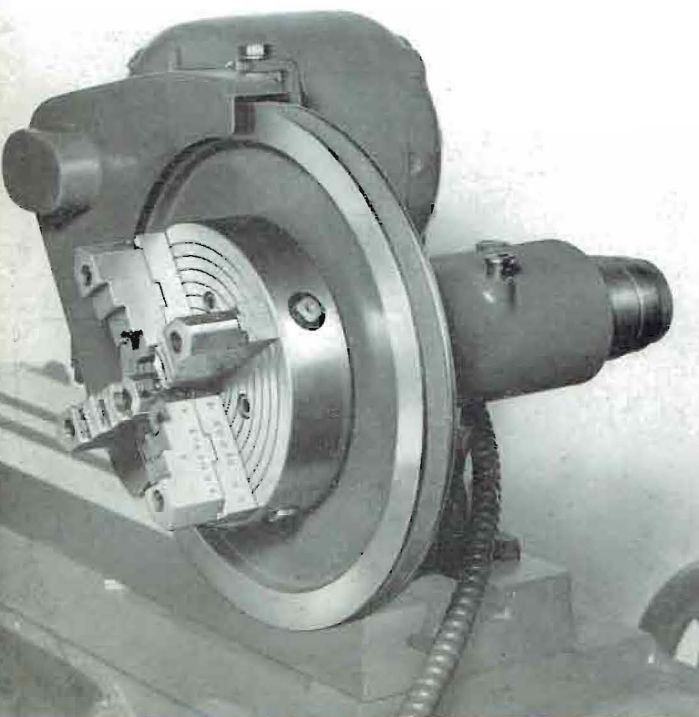
Weights\* (approx.): net, 62 lbs.; shipping, 87 lbs. Dimensions for shipment, 22" x 17" x 15".

\*With 220 volt, 60 cycle motor.



*Above*—The Revolving Spindle Headstock, showing driving motor, start-stop switch, and swivel graduated for angular settings. The light weight of the headstock makes it an easy matter to place it in position or remove it from the machine.

*Below*—This 4", 4-jawed independent chuck is furnished with the headstock, and is quickly installed in place of the driver and work center illustrated above.





## Internal Grinding Attachment

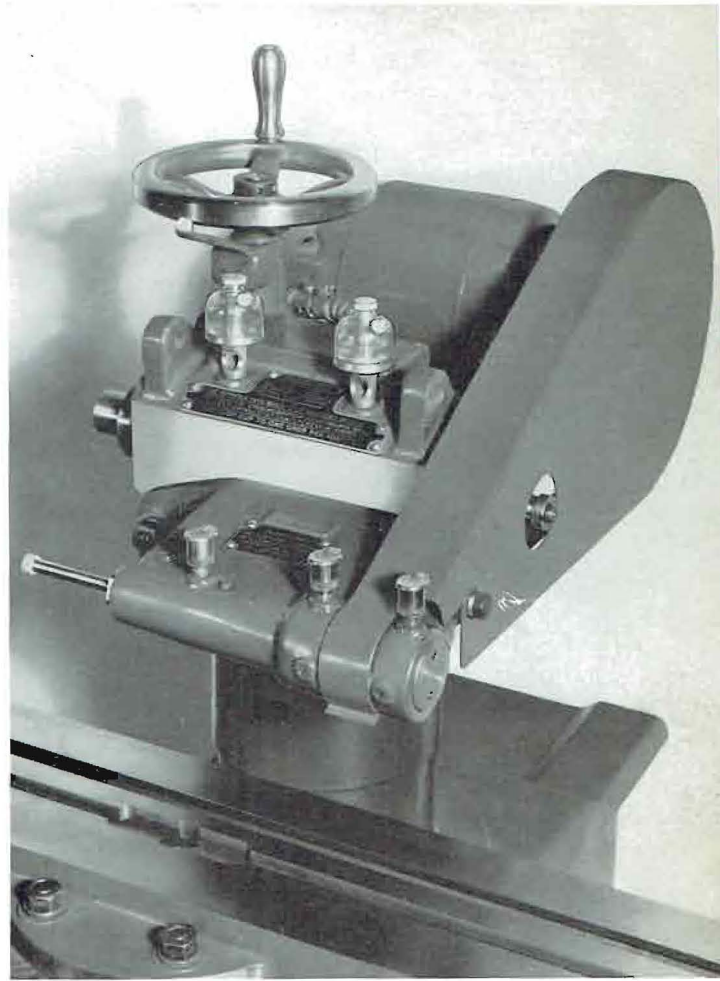
USED in conjunction with the Revolving Spindle Headstock (described on the preceding page), the Internal Grinding Attachment permits the precision-grinding of holes up to  $2\frac{1}{2}$ " in length and of  $\frac{1}{2}$ " minimum diameter in work of  $6\frac{3}{4}$ " maximum swing. The spindle runs at 22500 R.P.M., and takes wheels of  $\frac{1}{2}$ " diameter,  $\frac{1}{4}$ " thick, and  $\frac{3}{32}$ " hole.

A long, adjustable phosphor bronze bearing supports the spindle at the wheel end; and two double-row self-aligning ball bearings at the pulley end take the pull of the belt, reduce friction to a minimum and prolong the life of the Attachment. All bearings are adequately lubricated, and are protected from dust and grit.

The spindle is carried in a sturdy casting which is clamped by two T-bolts to the finished face of the machine column. Drive is by endless canvas belt from a pulley mounted on the wheel motor shaft. As illustrated at right, the driving belt and pulleys are well covered by a fabricated steel guard.

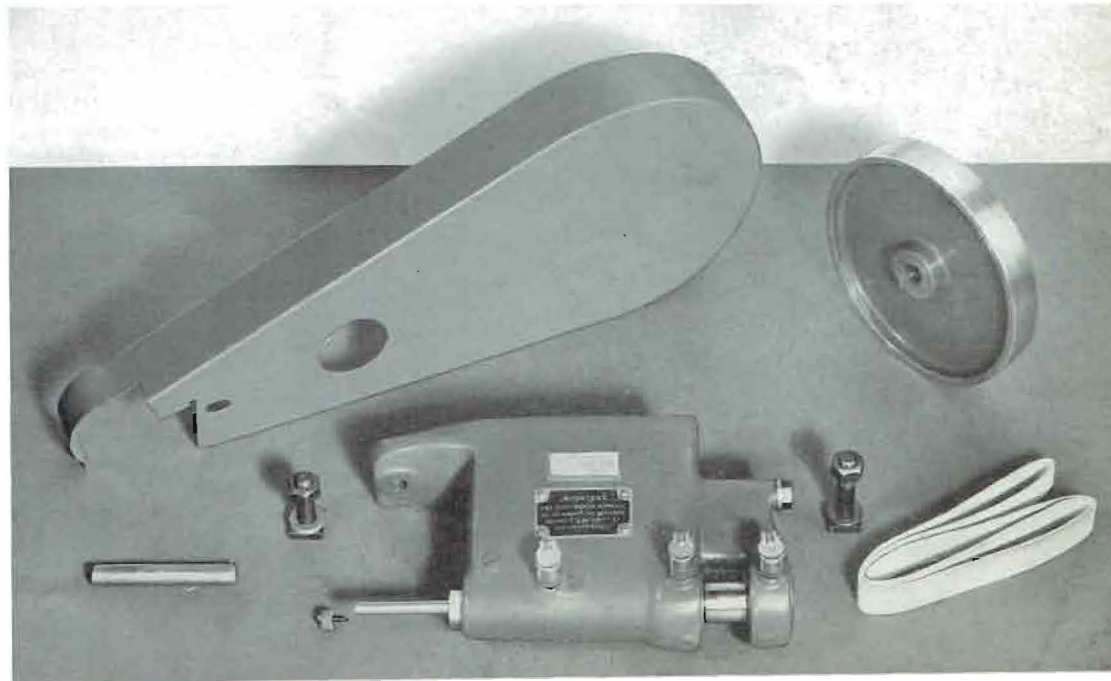
The Attachment is quickly and easily installed or removed from the machine. Positive horizontal alignment of the spindle is provided by a projection on the back of the Attachment spindle housing which is brought up against the finished bottom surface of the front of the machine column; while a height gage included with the Attachment permits setting the spindle at exact center height.

Weights (approx.): net, 15 lbs.; shipping, 20 lbs. Dimensions for shipment, 15" x 6" x 8".



Above — The Internal Grinding Attachment is quickly installed on the machine. Drive is from pulley mounted on wheel motor shaft. Belt and pulleys are well guarded.

Right — The Attachment complete. Short rod at lower left of picture is a height gage, which bears on machine table and pad on spindle housing to locate spindle at exact center height.



## No. 10 Formed Cutter Sharpening Attachment

### In-Feed Type

**F**ORMED cutters 2" to 6½" in diameter with straight teeth may be rapidly and accurately sharpened with this Attachment. A dish wheel is used, with the wheel spindle set at right angles to the table; and the cutter is supported on its side in a horizontal plane and advanced into the edge of the wheel by feeding the table (see illustration at lower left). Since the inner edge of the tooth face area thus ground has a curvature caused by the circumference of the 6" diameter wheel, this Attachment is generally recommended for sharpening cutter teeth of not more than 1½" in width.

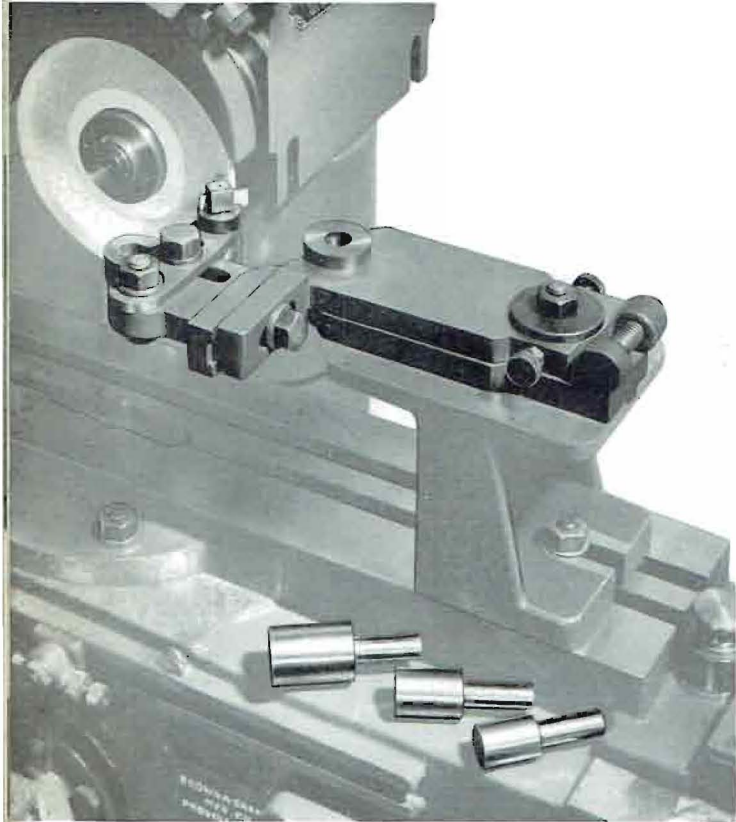
Essentially, the Attachment consists of an adjustable tooth rest assembly and a body for supporting the cutter, mounted on a base plate which is tongued for alignment and bolted to the top of the tool rest regularly furnished with the machine. The upper part or body turns on a pivot extending through the base plate; and the cutter is placed on a vertical stud or arbor which is inserted in a hole concentric with the pivot. The tooth rest assembly is carried by a bracket at the left end of the Attachment body, the tooth rest itself being adjustable vertically as well as for cutter diameter.

In operation, the tooth rest is located so as to touch the top of the cutter tooth close to the face being ground, and is clamped very rigidly in position. The bracket which carries the tooth rest assembly is adjustable transversely on the Attachment body, allowing the tooth rest to be positioned for grinding the tooth radial or with hook or drag, while at the same time maintaining rigid support for the tooth rest. The operator quickly indexes the cutter with one hand and feeds the table with the other, making for maximum speed of operation.

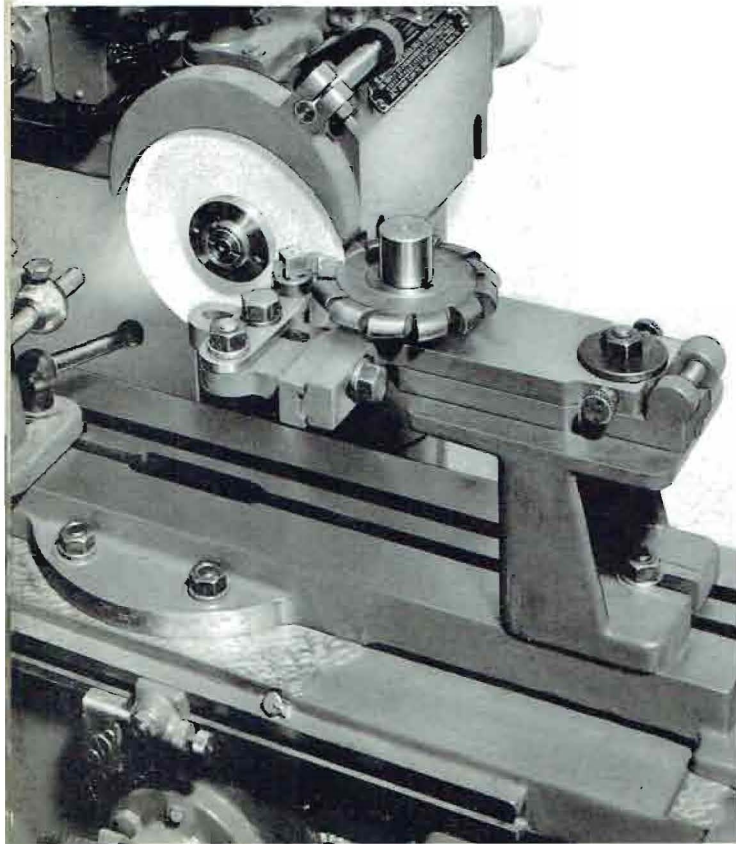
A knurled thumbscrew at the front turns the Attachment body on its pivot in order to rotate the cutter toward the grinding wheel to remove more stock. A similar thumbscrew at the rear serves as a positive stop to determine the end of this movement, facilitating the grinding of duplicate cutters to uniform size.

A wheel spindle extension for the left-hand end of the grinding machine spindle is regularly included with each Formed Cutter Sharpening Attachment. This item may be omitted when the Indexing Equipment for our No. 10 Cutter and Tool Grinding Machine is at hand (see page 12), using the spindle extension furnished with that Equipment instead. Three cutter arbors are also regularly furnished, to take cutters with ¾", 1" and 1¼" hole.

Weights (approx.), Attachment complete: net, 10 lbs.; shipping, 14 lbs.



*Above*—View of the Attachment in position on the machine. The three studs furnished take cutters with ¾", 1" and 1¼" hole, providing for most standard sizes.



*Below*—The Attachment in use. The operator quickly lifts the cutter clear of the tooth rest and indexes it with one hand, traversing the table with the other.

## No. 10 Formed Cutter Sharpening Attachment

### Through-Feed Type

**T**HIS Attachment gives a straight cut across the entire tooth face, and provides for the efficient and accurate sharpening of formed cutters up to 6" in diameter with straight teeth. A dish wheel is used, with the wheel spindle at right angles to the table; and the cutter is supported on a horizontal arbor between the centers of the machine as illustrated below at right, and is passed across the face of the wheel by traversing the table.

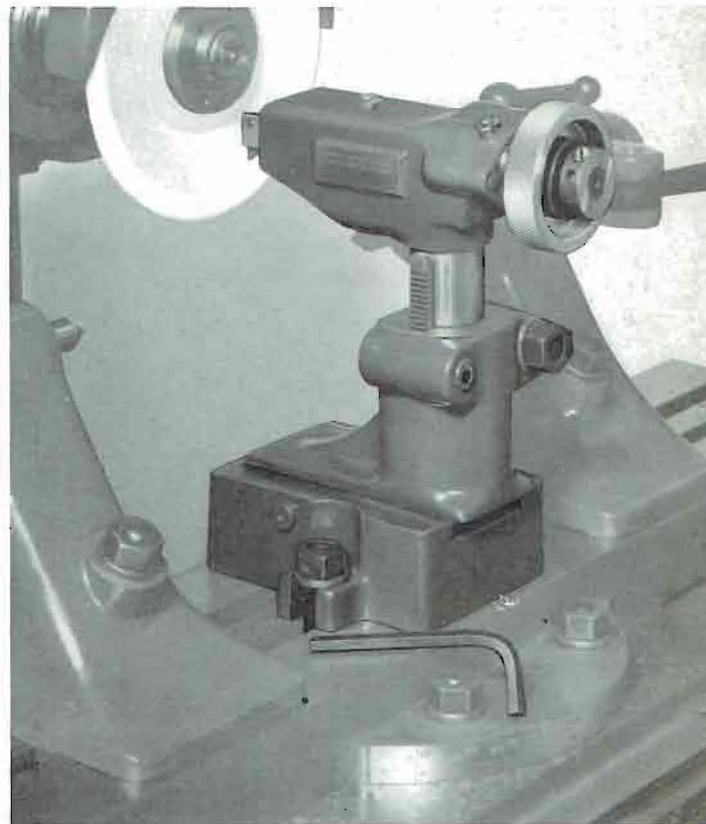
The Attachment consists of a rigid, adjustable tooth rest assembly mounted at the top of a sturdy column which is adjustable vertically to accommodate cutters up to 6" in diameter. A rack and pinion provide easy, positive adjustment, and the rack serves as a key to maintain angular alignment. The supporting bracket which carries the column is adjustable transversely along dovetail ways in a solid base; and the base, in turn, is tongued for accurate alignment, and is bolted to the machine table.

In operation, the tooth rest is located so as to touch the top of the cutter tooth close to the face being ground. The transverse adjustment of the Attachment on its base allows the tooth rest to be positioned for grinding the tooth radial or with hook or drag, while at the same time keeping the tooth rest close to its supporting body for maximum rigidity.

A knurled nut at the upper front of the Attachment advances the tooth rest slightly in order to rotate the cutter toward the grinding wheel to remove more stock. Another nut, concentric with the first one, serves as a positive stop to determine the end of this movement, facilitating the grinding of duplicate cutters to uniform size.

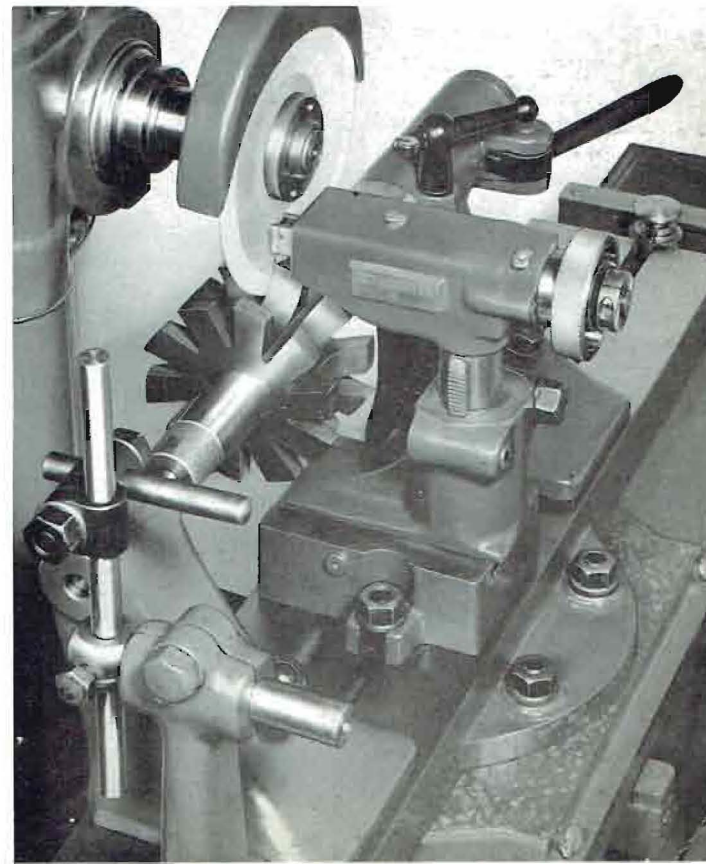
A wheel spindle extension for the left-hand end of the grinding machine spindle is regularly included with each Formed Cutter Sharpening Attachment. This item may be omitted when the Indexing Equipment for our No. 10 Cutter and Tool Grinding Machine is at hand (see page 12), using the spindle extension furnished with that Equipment instead.

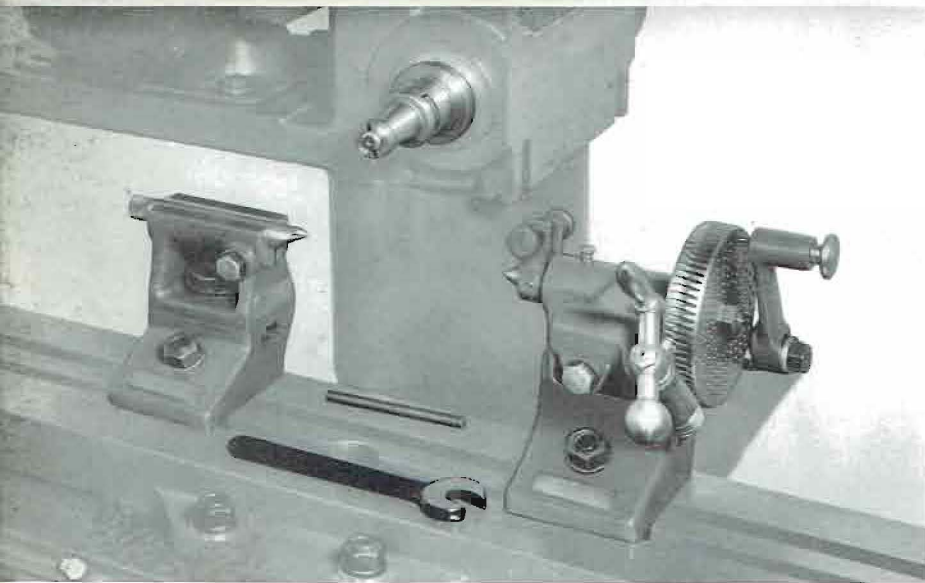
Weights (approx.), Attachment complete: net, 14 lbs.; shipping, 18 lbs.



*Above*—View of the Attachment in position on the machine. Vertical adjustment by rack and pinion (by means of the wrench shown) provides for sharpening cutters of any diameter from 1½" to 6".

*Below*— The Attachment in operation. The sturdy tooth rest is of latch construction. The operator quickly indexes the cutter with one hand and traverses the table with the other, making for maximum speed of operation.





Left—The Indexing Equipment complete. This equipment cuts costs and insures accuracy in sharpening taps, reamers, and similar work requiring accurate indexing.

## Indexing Equipment

**T**HIS Indexing Equipment consists of our regular  $4\frac{3}{4}$ " Index Centers furnished with raising blocks which adapt them for use with this machine, and a wheel spindle extension for the left-hand end of the machine spindle. It provides a simple and convenient means of grinding taps, reamers, formed cutters and similar work requiring accurate indexing.

The centers swing 8" diameter over the table. When grinding a vertical surface radial with centers, using the inside face of the wheel, work to 6" diameter clears the front of the wheel spindle column.

**Index Centers.** Indexing is rapid and accurate. A spring-loaded locking pin (see illustration) and six rows of holes in the face of the combined index plate and worm wheel provide for indexing all divisions from 2 to 14, and all even numbers from 18 to 28. The worm wheel can be

turned by worm, or the worm can be thrown out of mesh and the wheel turned by hand. Ratio of worm to worm wheel, 75:1.

**Raising Blocks\*** Each block clamped in position by T-bolt in angular slot of table, which draws tongue on bottom against side of straight T-slot for accurate alignment.

**Wheel Spindle Extension\*** Hardened and ground. Inside taper ( $3''$  per foot) fits left-hand end of wheel spindle. Secured by locking nut inserted through slot in body of extension. Outside taper ( $3''$  per foot) receives regular wheel sleeves furnished with machine.

Weights (approx.): net, 18 lbs.; shipping, 26 lbs. Dimensions for shipment,  $13'' \times 9'' \times 7''$ .

\*Raising Blocks and Wheel Spindle Extension can be furnished separately if desired.

## No. 1 Adjustable Vise

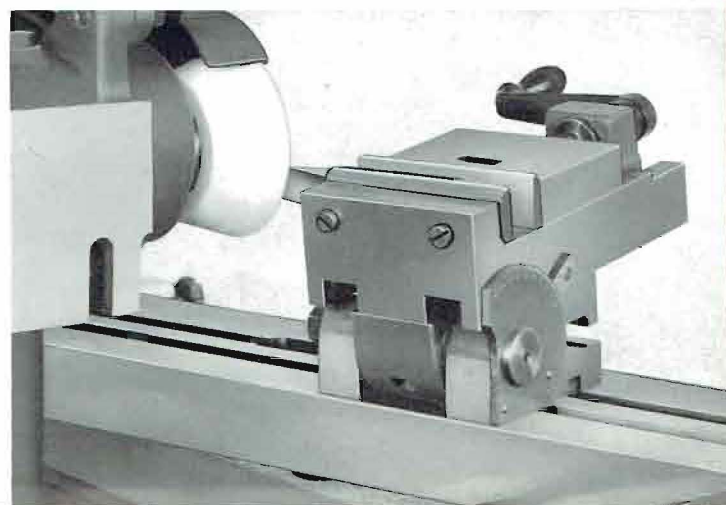
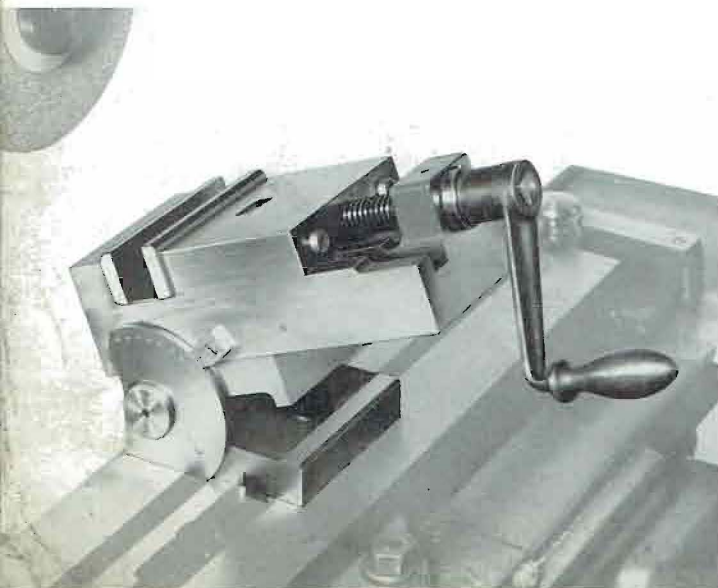
**D**ESIGNED to hold work at an angle to the grinding wheel, this vise is fastened to the table by a single bolt and is located by tongues that fit into the vertical T-slot of the table. If desired, the vise can be fastened to the top of the tool rest, and thus used in any horizontal position.

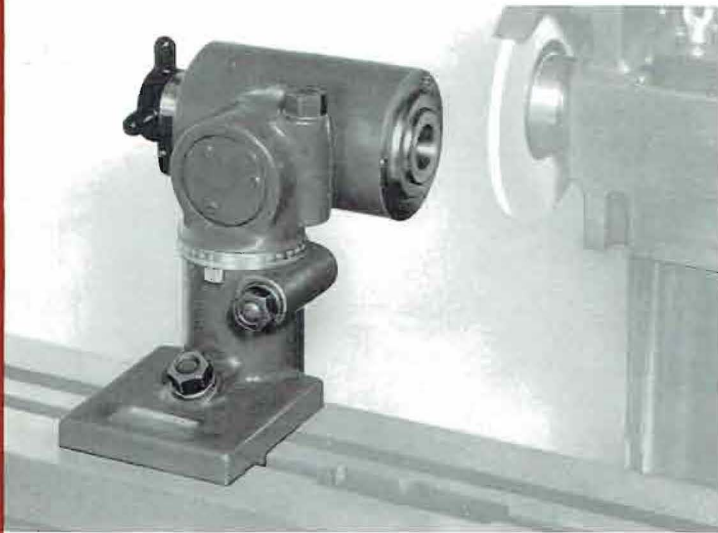
The vise proper is mounted on a hinged base and can be set at any angle in a vertical plane from 0 to  $90^\circ$ . A

fixed dial graduated to degrees indicates the setting; and the adjustment is quickly and firmly secured by tightening a single nut on the hinge pin. The removable jaws are of tool steel, hardened and ground,  $4\frac{1}{8}''$  wide,  $1\frac{1}{16}''$  deep, and open 2". Distance from bottom of base to top of jaws with vise horizontal is  $4\frac{7}{16}''$ .

Weights (approx.): net, 23 lbs.; shipping, 27 lbs. Dimensions for shipment,  $13'' \times 7'' \times 6''$ .

Below—Grinding accurate compound angle on thread chasing tool is simple with this attachment. Vise is set at clearance angle and table at thread angle.





Above—Attachment is quickly clamped in position by T-bolt in angular table slot, which draws tongues on base against side of straight T-slot for accurate alignment.



Above—Double-end end mills are quickly and easily sharpened on this Attachment. A spring collet and draw-in bolt are used to hold this type of cutter in the Attachment spindle.

## No. 10 End Mill Sharpening Attachment

**D**ESIGNED for sharpening both the peripheral and end teeth of end mills, this Attachment is of particular value in sharpening the peripheral teeth of steep spiral end mills having straight or taper shanks. For the latter work, a knob at the rear end of the Attachment spindle makes it an easy matter to hold the tooth being ground in contact with the tooth rest while feeding the cutter across the wheel by longitudinal table movement; and mounting of the spindle on antifriction bearings provides a sensitive, free-turning unit that is of especial advantage when sharpening very small end mills having a steep spiral.

The Attachment spindle is carried in a body that can be set at an angle in both a horizontal and vertical plane, with rigid clamping provided for both adjustments. Graduations to 2° provide for angular settings to 16° either side of zero in the vertical plane, and to 90° either side

of zero in the horizontal plane, the base itself being aligned by tongues which bear against the side of the table vertical T-slot. Zero marks 180° apart on the spindle body provide for sharpening both right-hand and left-hand cutters.

End mills having a No. 9 B & S taper shank will fit directly into the Attachment spindle; while cutters having shanks of other B & S tapers, as well as cutters with Milling Machine Standard taper shanks and straight shanks, are accommodated by stock collets and adapters regularly available at extra cost (see listing below). A draw-in bolt can be furnished at extra cost for use with spring collets for holding straight shank end mills.

Weights (approx.): net, 18 lbs.; shipping, 24 lbs. Dimensions for shipment, 12" x 10" x 9".

### Adapters and Collets Most Commonly Needed for use with No. 10 End Mill Sharpening Attachment

#### Cutter Adapters

- No. 9 B & S-10-2—For end mills having No. 10 M. M. Std. taper shank.
- No. 9 B & S-20-2—For end mills having No. 20 M. M. Std. taper shank.
- No. 9 B & S-30-2—For end mills having No. 30 M. M. Std. taper shank.

These Cam Lock Cutter Adapters have No. 9 B & S taper shank, fitting the Attachment spindle.

#### Spring Collets with Straight Holes

Designed to accommodate straight shank end mills, these Spring Collets have a straight hole and a No. 9 B & S outside taper fitting the Attachment spindle. Spring Collets are regularly available with holes of the following sizes (in inches):

Diam. ....	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$ *
Depth .....	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{3}{8}$	$1\frac{1}{2}$

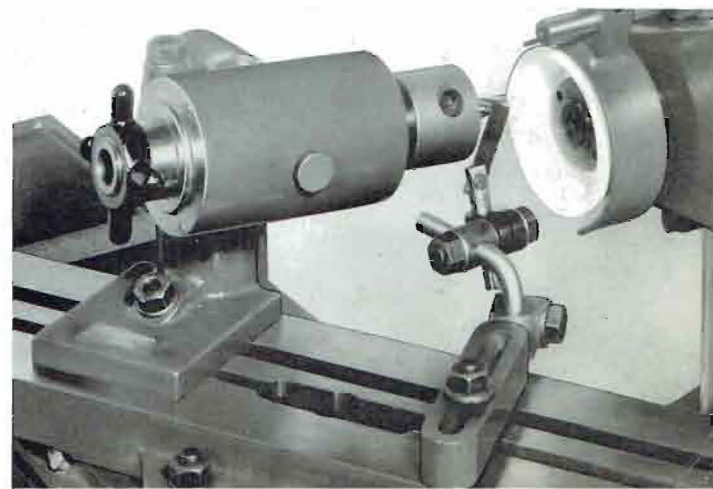
**Special draw-in bolt**, required for use with these Spring Collets, is available as an extra.

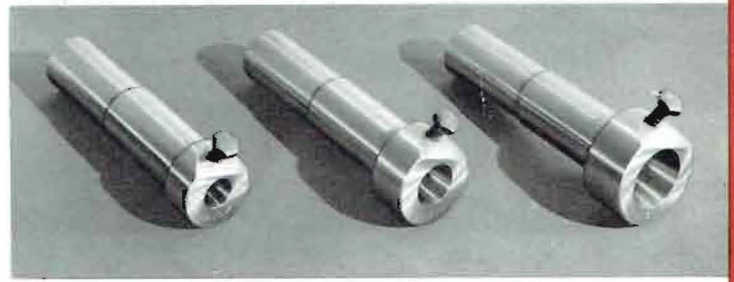
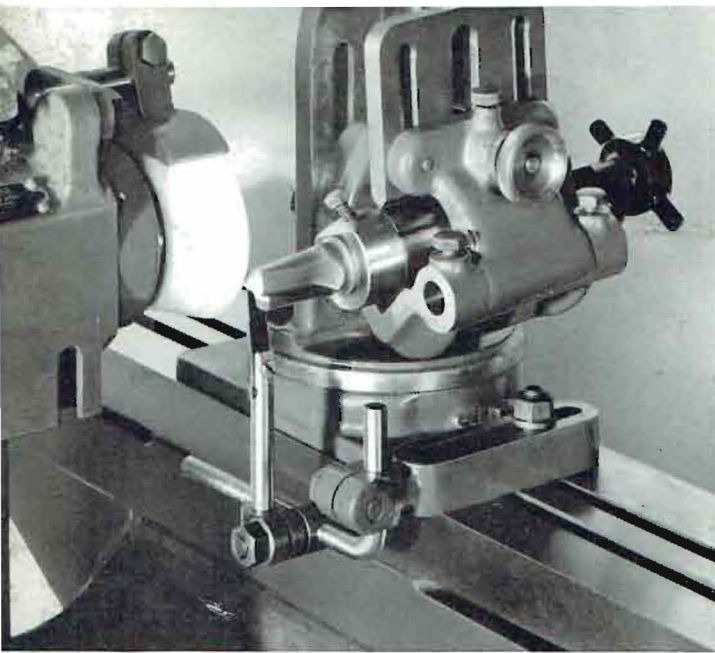
\* $\frac{3}{4}$ " size accommodates single-end end mills only.

#### Collets

- Mark K—For end mills having No. 5 B & S taper shank.
  - Mark RR—For end mills having No. 7 B & S taper shank.
- These Collets have No. 9 B & S outside taper, fitting the Attachment spindle. Hole provided for knockout key.

Below—Sharpening end teeth of a right-hand spiral Cam Lock end mill having Milling Machine Standard taper shank. Cutter is held in regular Cam Lock adapter (see listing at left).





## Bushings

**A**LL varieties of cutters having Nos. 10, 20 or 30 M. M. Std. taper shanks are conveniently held by means of these bushings for sharpening in the universal head of the machine, as illustrated at left. The precision-ground taper hole and outside diameters assure accurate alignment of the work and smooth rotation for indexing. Each bushing is available separately.

## Taper Holding Attachment

**U**SED on the universal head in place of the swivel head, the Taper Holding Attachment holds all varieties of cutters up to 8" diameter, with taper shanks or on arbors. It is particularly suited for sharpening shell end mills up to 6" diameter and face milling cutters up to 8" diameter.

To provide for clearance on end or side teeth when grinding with a cup wheel, the swivel face of the Attachment, by which it is mounted on the universal head upright, is graduated on its circumference in degrees to 30° each side of two opposed zero marks. Clearance on peripheral teeth is set by means of an integral clearance gage located at the left end of the Attachment spindle, which reads to 15°

each side of zero by degrees.

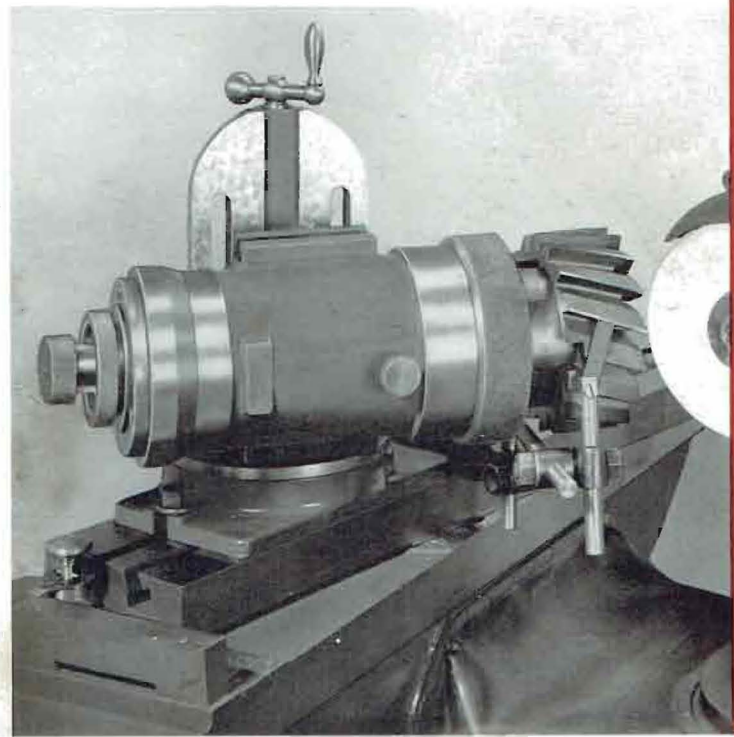
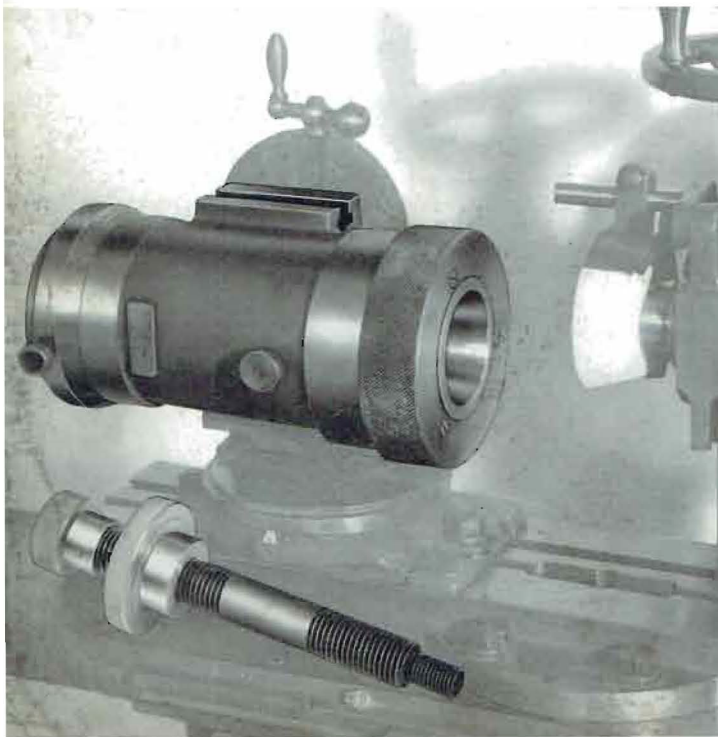
The Attachment spindle is mounted in ball bearings and can be clamped by means of a thumbscrew. It has a No. 12 B & S taper hole in one end and a No. 50 M. M. Std. taper hole in the other, and may be turned end for end, thus suiting the Attachment for a wide range of work.

A draw-in bolt is furnished; threaded, 1"-8-N.C., R.H. and  $\frac{3}{8}$ "-11-N.C., R.H. Arbors, collets and adapters listed in our catalogs are available at extra cost for handling a variety of styles and sizes of cutters.

Weights (approx.): net, 45 lbs.; shipping, 62 lbs. Dimensions for shipment, 8" x 8" x 16".

*Below*—Taper Holding Attachment and draw-in bolt. At left-hand end of Attachment is the clearance setting gage—a short outer sleeve, graduated to 15° each side of a zero mark.

*Below*—Set-up for grinding the corners of the teeth of shell end mill. If the cutter has a B & S taper shank, the opposite end of the spindle is used to support it.



## No. 10 Face Mill Sharpening Attachment

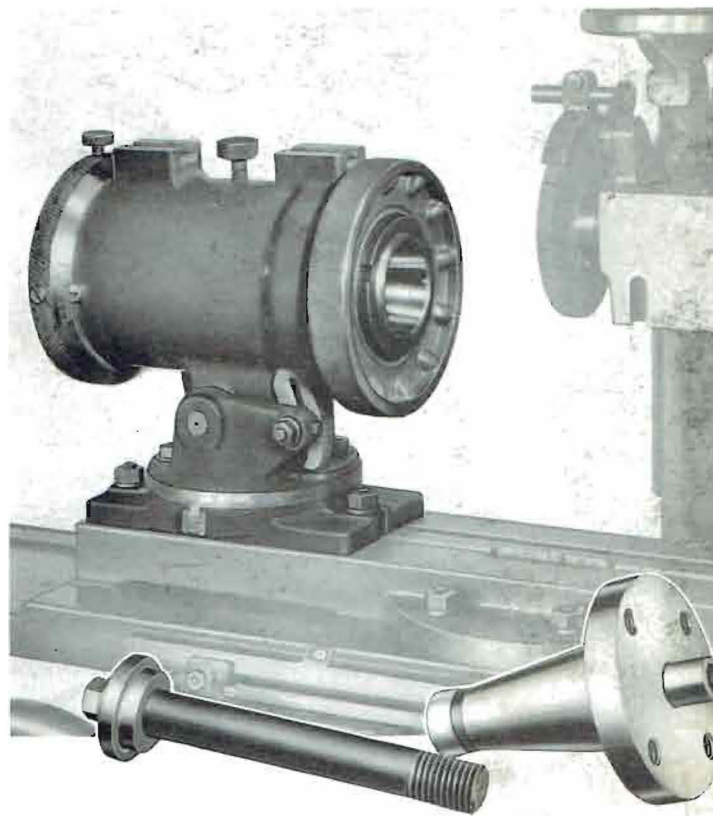
**T**HIS Attachment is designed primarily for grinding the periphery, sides and corners of teeth of face milling cutters up to 14" diameter. Its sturdy construction assures the rigidity necessary to support the heavier cutters.

The spindle, mounted in antifriction bearings, is exceptionally free-moving and accurate, and may be clamped by means of a thumbscrew. A No. 12 B & S taper hole is provided in one end and a No. 50 M. M. Std. taper hole in the other, thus suiting the Attachment for a wide range of work.

To provide for clearance on side teeth when grinding with a cup wheel, the spindle body has an angular adjustment in a vertical plane to 15° each side of zero, by scales reading to degrees. Clearance on peripheral teeth is set by means of an integral clearance gage (shown at left end of Attachment spindle), graduated in degrees to 15° each side of zero.

The spindle body and swivel bracket are mounted on a substantial base which is aligned by tongues fitting the table T-slot and clamped to the table by two T-bolts. Graduations in degrees on the circumference of the swivel bracket to 90° each side of two opposed zero marks permit setting to any angle in the horizontal plane.

Included in the equipment furnished are a work holding arbor (No. 50 M. M. Std. taper), a draw-in bolt (threaded,



1"-8-N.C., R.H.), four cutter holding screws and an arbor screw and wrench. Additional arbors, collets and adapters listed in our catalog are available at extra cost for handling a variety of styles and sizes of cutters.

Weights (approx.): net, 88 lbs.; shipping, 112 lbs. Dimensions for shipment, 19" x 17" x 11".

*Below*—Sharpening the tooth corners of a large face milling cutter. The attachment spindle body is swiveled vertically the amount desired for clearance, the setting being read to degrees; and the table is set to the required corner angle.

*Below*—Sharpening sides of teeth of a face milling cutter. The spindle body is swiveled vertically the amount desired for proper clearance, the setting being read directly from a vertical scale, graduated to degrees.

