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**HARDINGE
CATARACT
LATHES**

**HARDINGE
BROTHERS
INCORPORATED
CHICAGO**



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HARDINGE BROTHERS, INC.
CHICAGO, ILL., U. S. A.
1919

INTRODUCTION

THIS lathe is the result of thirty-eight years of practical experience, coupled with fifteen years of observation while designing and manufacturing the well-known Cataract Bench Lathes, Milling Machines, Drill Presses, Grinders, Gear Cutters, small Tapping Machines, Patent Benches, Special Taps and Dies and Instruments of Precision.

Our lines of Bench Lathes have the greatest chuck capacity, are correctly designed and are the result of twenty-eight years of experience in making all styles and sizes of Watchmakers' Bench and Tool Room lathe chucks, embracing over one hundred styles. We are the largest manufacturers of draw-back chucks and collets in this country.

We cannot emphasize too strongly the importance of equipping a factory with a line of machinery manufactured by a firm that links interchangeability of to supply all fixtures usually required in manufacturing also special equipment.

Mr. Franklin Hardinge is the designer and patentee of the Cataract line and submits this Precision Lathe as an addition to that line, bringing it one step nearer to completion. Undoubtedly there is no one in the country who has a wider experience with this class of machinery.

The entire Cataract Line is made with jigs and gauges so that interchangeability of all parts is possible and the highest quality of workmanship is guaranteed.

HARDINGE BROTHERS, INC.

Cataract Quick Change Swing Precision Lathe Description

HEAD:

The single back-gearred Precision Lathe Head is 12" long.

Distance from bed to center of spindle, $4\frac{1}{2}$ ".

Swing over bed, 9".

Diameter of front journal, $2\frac{1}{32}$ " by 2" in length.

Diameter of rear journal, $1\frac{7}{8}$ " by 2" in length.

The journals which are adjustable, and made of cast iron, are of the same design as those used in connection with the Cataract bench lathes, of which there are over 4,000 in use, and to the present time have replaced less than one-half dozen defective journals.

We are therefore satisfied that a hardened spindle and an adjustable cast iron journal are as good a combination of materials as can be used in lathe head journal and spindle construction.

The bases of the heads and tailstocks are planed to interchange with the standard Cataract bench lathe beds, with the exception of draw bolts and tee slots, which are much heavier than those used with bench lathes. Heads and tailstocks are aligned in a special boring machine.

The spindle end shake is adjusted between housings by means of a patent end shake nut within the cone, thus making it practical to use ball-bearing thrust, which feature has been so successful in our bench lathes.

We, however, have added to this head an auxiliary sleeve upon which the cone pulley revolves when the back gear is used, which allows the cone pulley to have proper end shake, while the spindle end shake is independently adjusted.

The respective diameters of the three-step cone pulley are $3\frac{1}{2}$ ", $4\frac{3}{4}$ " and 6" for $1\frac{1}{4}$ " belt.

Provisions have been made for the proper lubrication of the spindle as may be seen by referring to sectional view of the head; pages 14 and 15.

MULTIPLE THREADS:

A sixty-hole index is drilled in the rear face of the spindle driving gear, intended for spacing spindle when cutting double, triple or quadruple threads.

To index the spindle independent of the change gears, revolve spindle in forward direction until "O" on the gear index comes opposite index pin; raise handle "E" (Fig. No. 200), thereby disconnecting gears.

The spindle may then be revolved in forward direction to desired division of index.

SPINDLE:

Length of spindle, $15\frac{1}{2}$ " ; hardened, ground and lapped.

Length of front and rear bearings, 2".

Diameter of front bearing, $2\frac{1}{8}$ ".

Diameter of rear bearing, $1\frac{7}{8}$ ".

Diameter of hole through spindle, $1\frac{1}{4}$ ".

Maximum capacity through No. 5 chuck 1" round.

Diameter of spindle nose, $2\frac{3}{16}$ ".

Pitch of thread, 10; U. S. S. F.

The end shake of the spindle is adjusted between the journal housings by a patent end shake adjusting nut within the cone pulley.

DRAW-BACK CHUCK:

The draw-back chuck is our standard Cataract No. 5 of 1" capacity for round stock and may be used on No. 5 bench lathe of 7" or 9" swing.

TAILSTOCK:

The Tailstock has a bearing surface on the bed 7" long. It has two inner and two outer 30-degree angular guiding surfaces, making 2" of wearing surface $\frac{5}{8}$ " wide, or a total wearing surface of $3\frac{1}{4}$ " by 7".

BED:

The Bed is 52" long, $8\frac{3}{4}$ " wide by $7\frac{1}{2}$ " deep and is well braced, weight of the casting being 230 pounds.

It has one large 45-degree way in front and a flat way in the rear of carriage, while the center of the bed is fitted to the Cataract bed standard. Consequently, **Turrets**, **Milling Attachments** and other bench lathe **fixtures** may be used on this machine by simply changing the draw bolts. This change is necessary because the Tee slots are much heavier than the bench lathe Tee slots.

A Tee slot is planed in the back of the bed into which the Taper Turning Attachment Bed Bracket is locked. This also provides the rear carriage gib and lock bearing, also admits Bracket "A" for extra fine feeds and the 15" swing Bracket "B". The bed and legs have a three-point bearing which prevents the bed from warping when set upon an uneven floor.

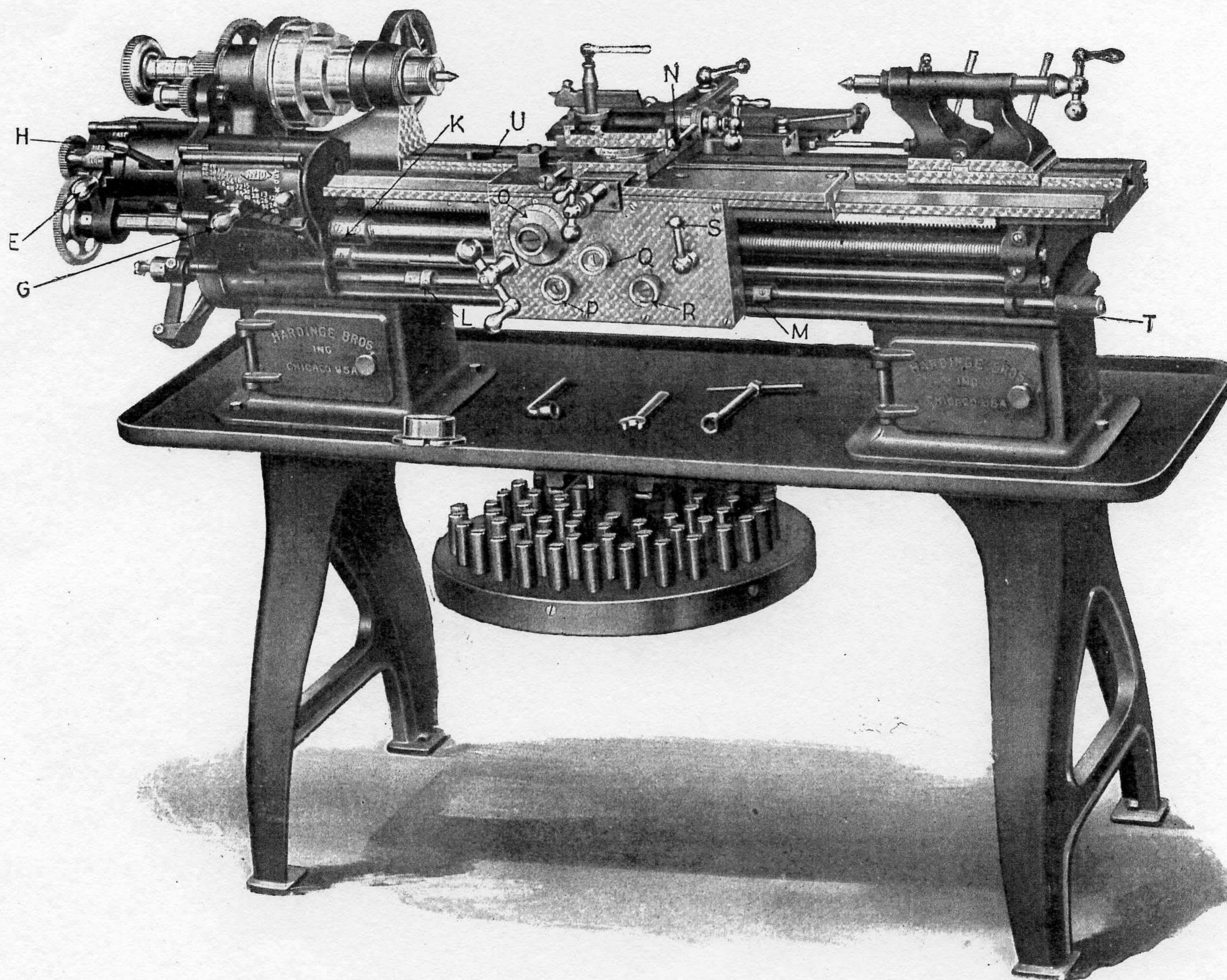


FIG. No. 200
CATARACT QUICK-CHANGE-SWING PRECISION LATHE

CARRIAGE AND APRON:

The front way of the Carriage is $19\frac{1}{2}$ " long, rear way $14\frac{1}{2}$ " long. The length of Apron is $13\frac{1}{2}$ ". The ways are protected by a wick let into each corner through recesses cut into the carriage, so that oil is constantly supplied and the ways are always wiped.

A gib with a $3\frac{1}{4}$ " by $\frac{1}{2}$ " wearing surface is placed directly over the carriage feed pinion at the front end of apron, also over the lead screw nut at the rear end, the carriage being gibbed on all four corners and at which points surfaces are free from catching dirt. These gibs are easily adjusted, keeping the carriage closely fitted to the ways; thus the carriage cannot be lifted from the bed. The feed pinion and lead screw nut being immediately underneath the guiding way, insures a direct pull from the rack or lead screw.

The travel of the carriage is controlled by adjusting stops "L" and "M" (Fig. No. 200, page 5) and fine adjustments are obtained through carriage control rod "T". The handle "R" throws out the feed and eliminates the possibility of engaging the lead screw nut and feed rod simultaneously. "P" and "Q" are power feed controls, while "O" represents a graduated friction index, each division thereon representing $\frac{1}{32}$ of an inch. This feature will be found very convenient in recessing holes or similar operations.

The Apron mechanism is entirely encased and the oiling system has been carefully carried out. In all places, both in apron and gear boxes, where wear on the shaft is greatest, there are hardened bushings or double bearings; consequently, there are two separate journals so that in case one should seize or stick, the other relieves it until it becomes lubricated.

CROSS SLIDE:

The Cross Slide surface is 11" by $4\frac{1}{2}$ " wide and the nut, which is made of phosphor bronze, is $2\frac{1}{2}$ " in length. The diameter of the Cross Slide screw is $\frac{1}{2}$ " by 10-pitch, left-hand square thread.

COMPOUND SLIDE:

The Compound Slide is equipped with a triple pitch nut, requiring one-half revolution of handle "N" to move the slide $\frac{5}{32}$ " to a stop in either direction. This will be found exceedingly convenient in cutting internal or external threads, or in turning operations. It does not interfere with the regular uses of the compound slide screw, which, on this machine, is fitted with adjustable indexes graduated in thousandths of an inch.

Through the use of this device in advancing or retarding tool in thread cutting operations, the necessity of withdrawing the tool through means of a cross slide screw is eliminated, which means a direct reading of the index on cross slide screw is always available.

The carriage is further controlled through the application of automatic stops "L" and "M" and reversing lever "H" (Fig. No. 200, page 5).

LEAD SCREW:

The Lead Screw is 6-pitch, 1" diameter, 39" long, without a spline and is constantly translated to 10-pitch through the gears in reversing gear box. The screw is detachable from the change gear shaft "K" (Fig. No. 200, page 5); consequently, it may be readily removed without interfering with the change gear mechanism.

This feature will be found very convenient in replacing worn screws or inserting screws of special accuracy, also for cleaning lead screw and lead screw nut.

The change gears, also the lead screw, revolve in roller bearings. The lead screw nut is 3½" in length.

Handle "H" (Fig. No. 200, page 5) reverses the screw, eliminating the necessity of reversing spindle for the return of the carriage.

GEARS:

Gears of the following number of teeth are furnished as regular equipment:
32, 36, 40, 44, 46, 48, 52, 54, 56, 60, 80, 84, 88, 100, 110 (20-tooth double-width pinion for Stud "J", illustration No. 5, page 8).

The above set of gears used outside of Quick-Change Nest and including Quick-Change will produce threads as follows, without compounding:

4, 4½, 5, 5½, 6, 6½, 7, 7½, 8, 9, 10, 11, 11½, 12, 13, 13½, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 60, 64, 68, 72, 76, 80, 84, 88, 100, 110.

EXAMPLE:

Using a 20-tooth gear on Stud "J" and 32 on Screw "I" (Illustration No. 5, page 8), cuts threads 32 in "Slow", 16 in "Medium" and 8 in "Fast".

By using 40 on Stud "J" and 32 on Screw "I" cuts threads 16 in "Slow", 8 in "Medium" and 4 in "Fast".

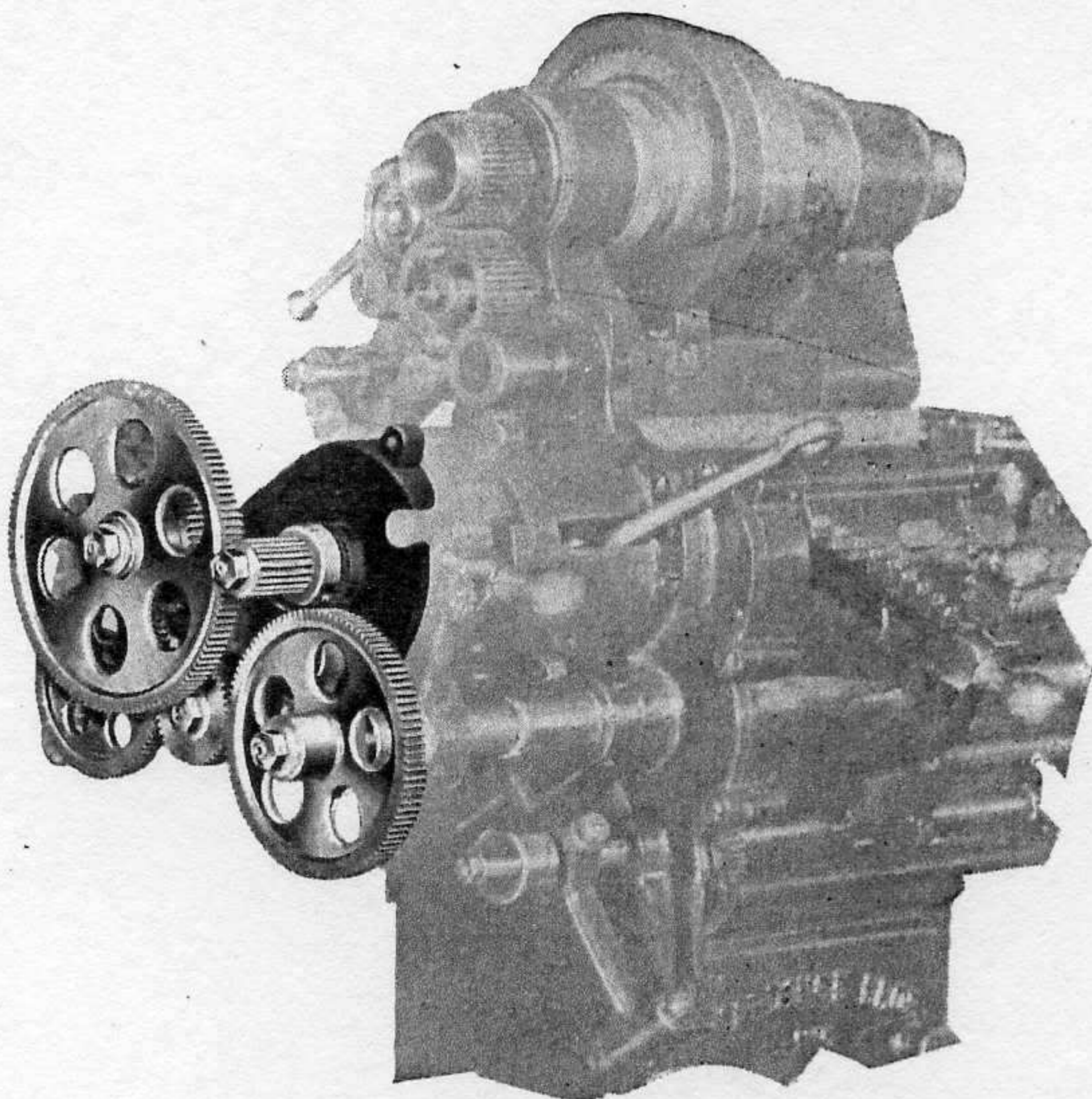
NOTE:

For price of extra gears refer to price list.

CHANGE GEAR BOX:

The Change Gear Box consists of a nest of nine gears, 40 to 80, and through the manipulation of levers "H" and "G" (Fig. 200 page 5), 27 changes of threads are obtainable. Other threads may be cut through different combinations of gears on stud "J" and screw "I" with lever "G" in lock-out position (Fig. 200, page 5).

All gears of 80 pitch or under are made of steel, both in gear box and apron.



ILL. No. 6—METRIC BRACKET

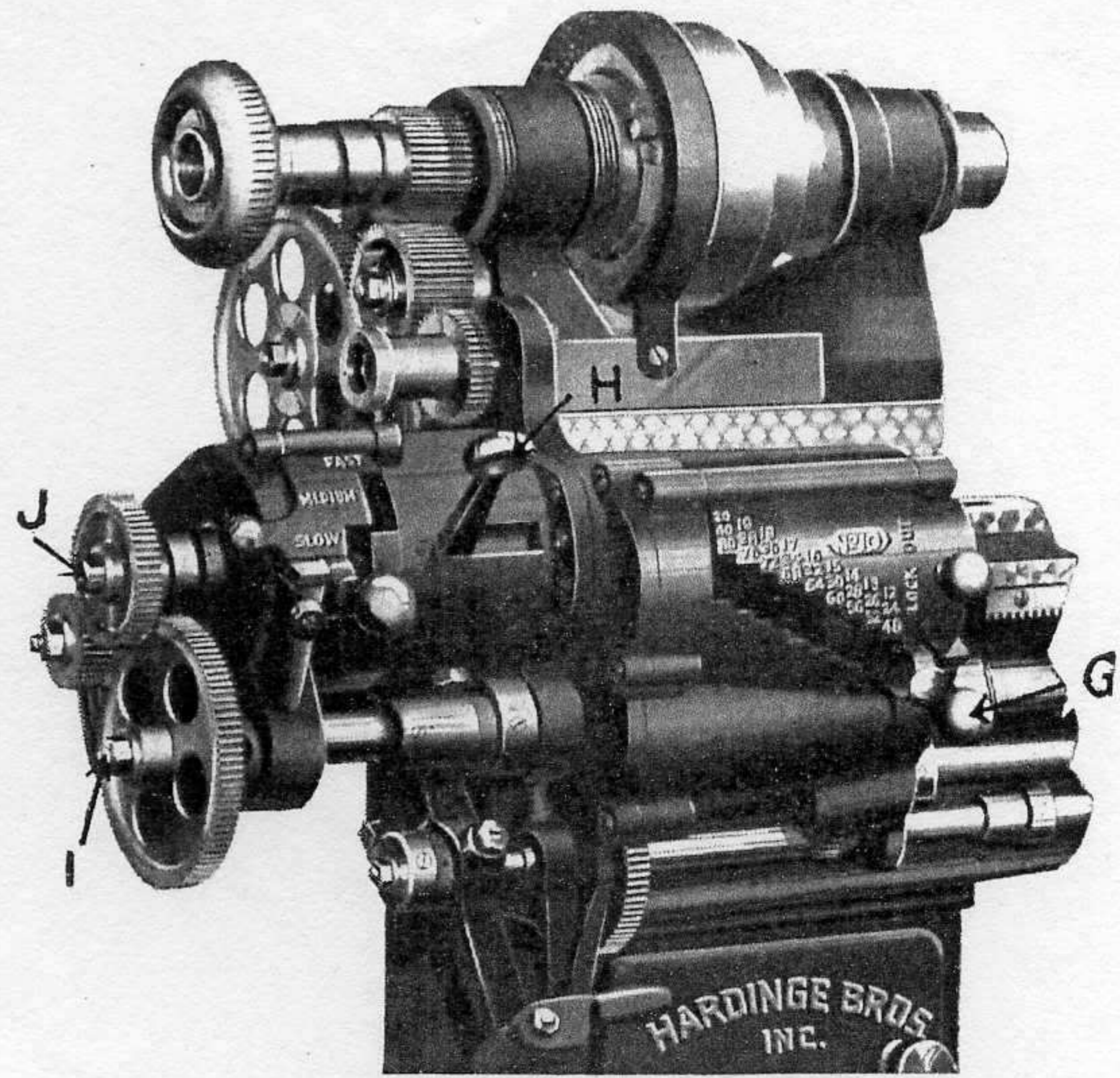
BRACKET "B":

Bracket "B", which is attached to Bracket "A" (illustration), is for connecting spindle gear with change gear mechanism when head is raised to 15" swing.

BRACKET "C":

Bracket "C" (illustration), which is also attached to Bracket "A", carries one intermediate gear for connecting two or three to one reduction feed gear, though gear "F" (illustration) must be disengaged.

For each inch travel of the carriage when using slowest feed through change gear box, the spindle revolves 210 R. P. M., and for each inch travel of the cross slide the spindle revolves 350 R. P. M.

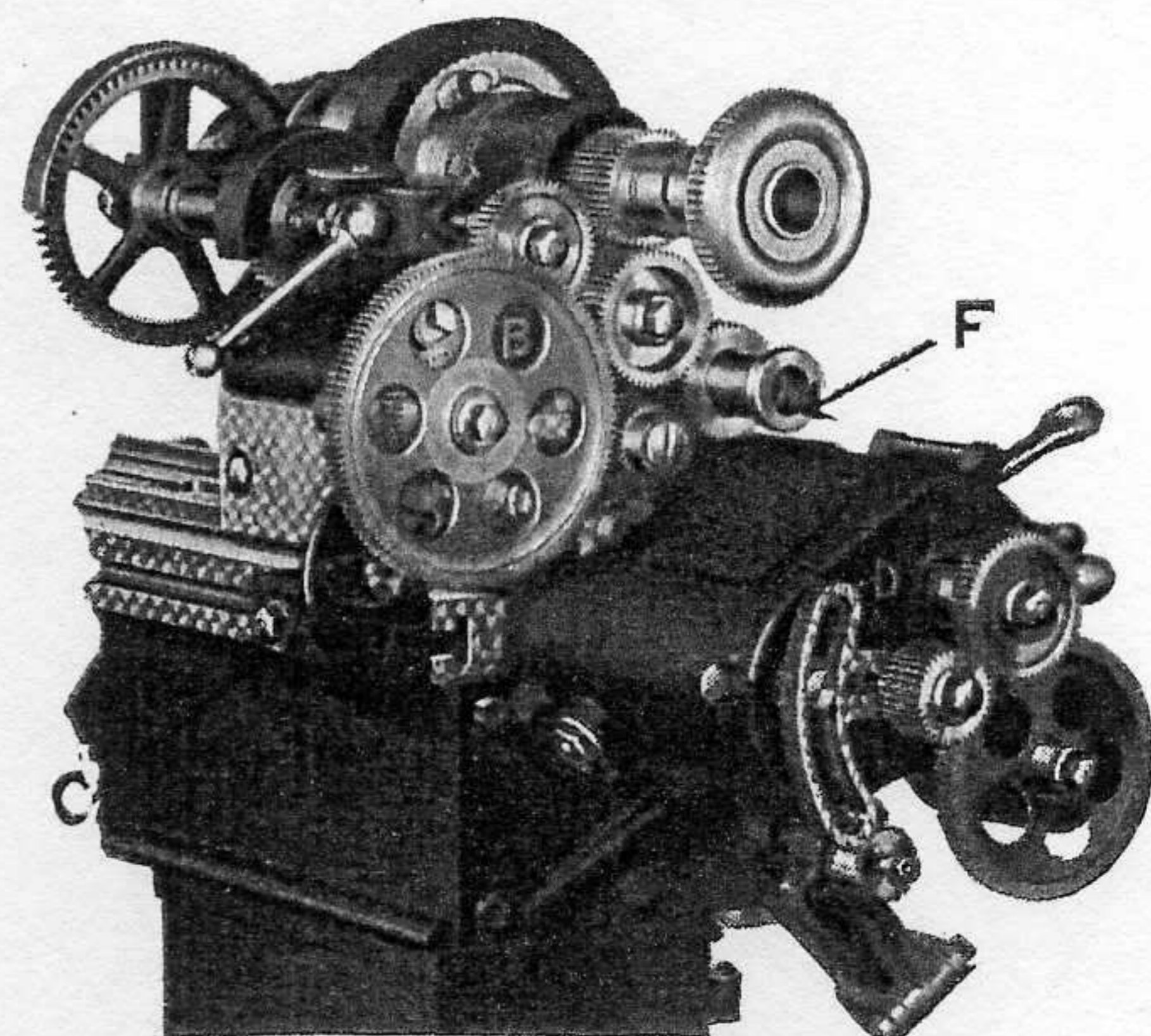


ILL. No. 5—CHANGE GEAR BOX

METRIC BRACKET:

The Metric Bracket as shown in illustration is set for .10 M/M pitch with handle "E" in slow and handle "G" in lock-out position.

When handle "E" (illustration) is set in medium position the pitch of thread will be .20 M/M and when set in fast the pitch of thread will be .40 M/M. Thus it will be seen that each tooth of gear on stud "J" represents .01 M/M when handle "E" is in medium position and when a 100-tooth gear is on screw "I".



ILL. No. 4—SHOWING BRACKET "B"

FOLLOW REST:

The application of the Follow Rest to the carriage is quickly accomplished and because of the fact that it is of rigid construction and bolted to carriage at three points, the spring under heavy cuts is practically eliminated.

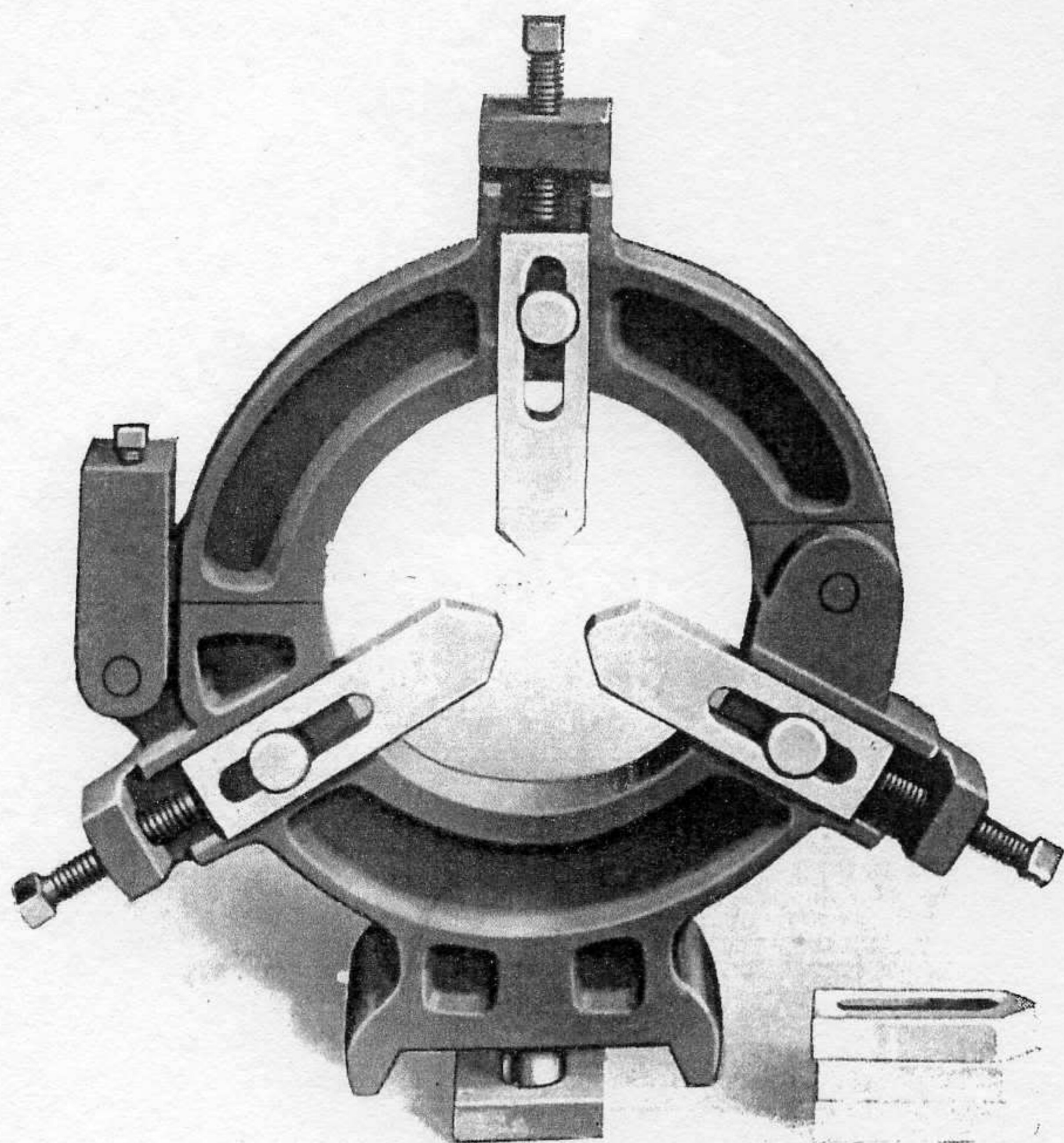


FIG. No. 204

CENTER REST:

The capacity of the Center Rest illustrated is $4\frac{1}{2}$ " and is regularly furnished with two sets of cast iron jaws which may be independently adjusted.

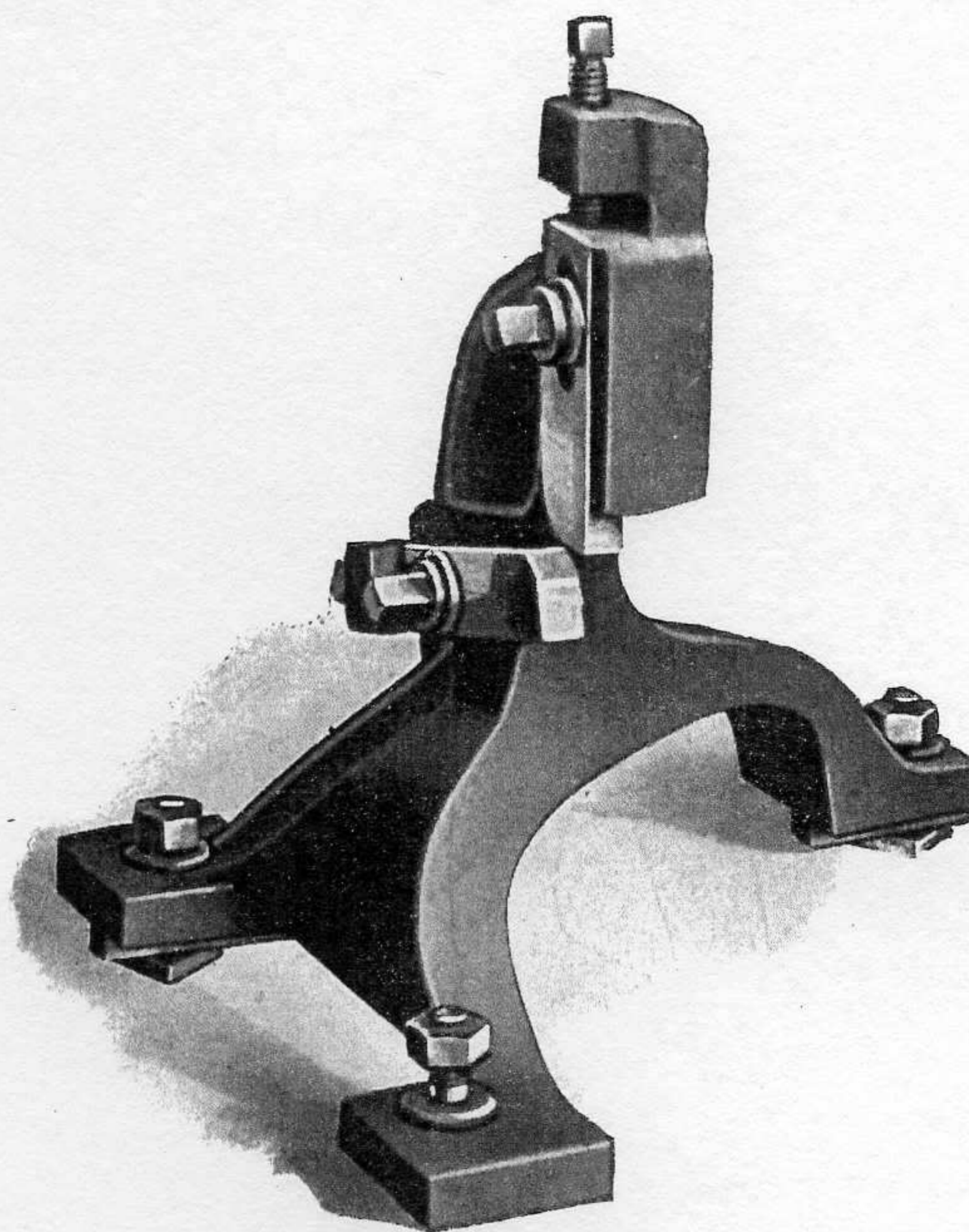


FIG. No. 203

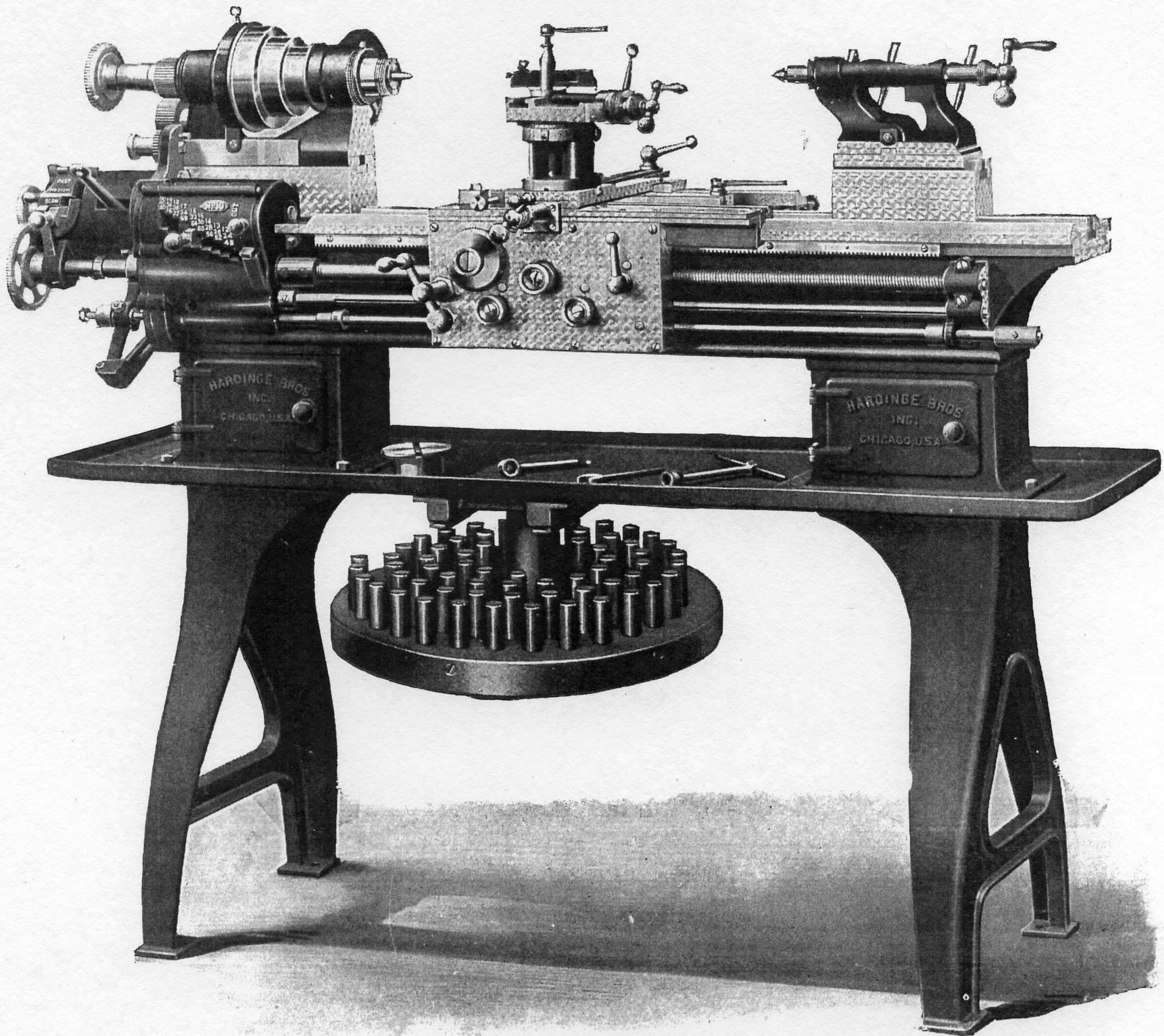


ILLUSTRATION SHOWING RAISING BLOCKS
CATARACT QUICK-CHANGE-SWING PRECISION LATHE

GEAR BOX BRACKET:

The Gear Box Bracket is attached to the end of the bed and contains all gears, excepting the one on the spindle. Therefore the swing of the lathe may be changed from 9" to 15" without interfering with the arrangement of gears, by simply adding brackets "A" and "B" (illustration 3, page 17), containing two connecting gears.

In removing head, when changing from 9" to 15" swing, the head and raising block binding bolts pass through two oblong slots "U" (illustration 3, page 17).

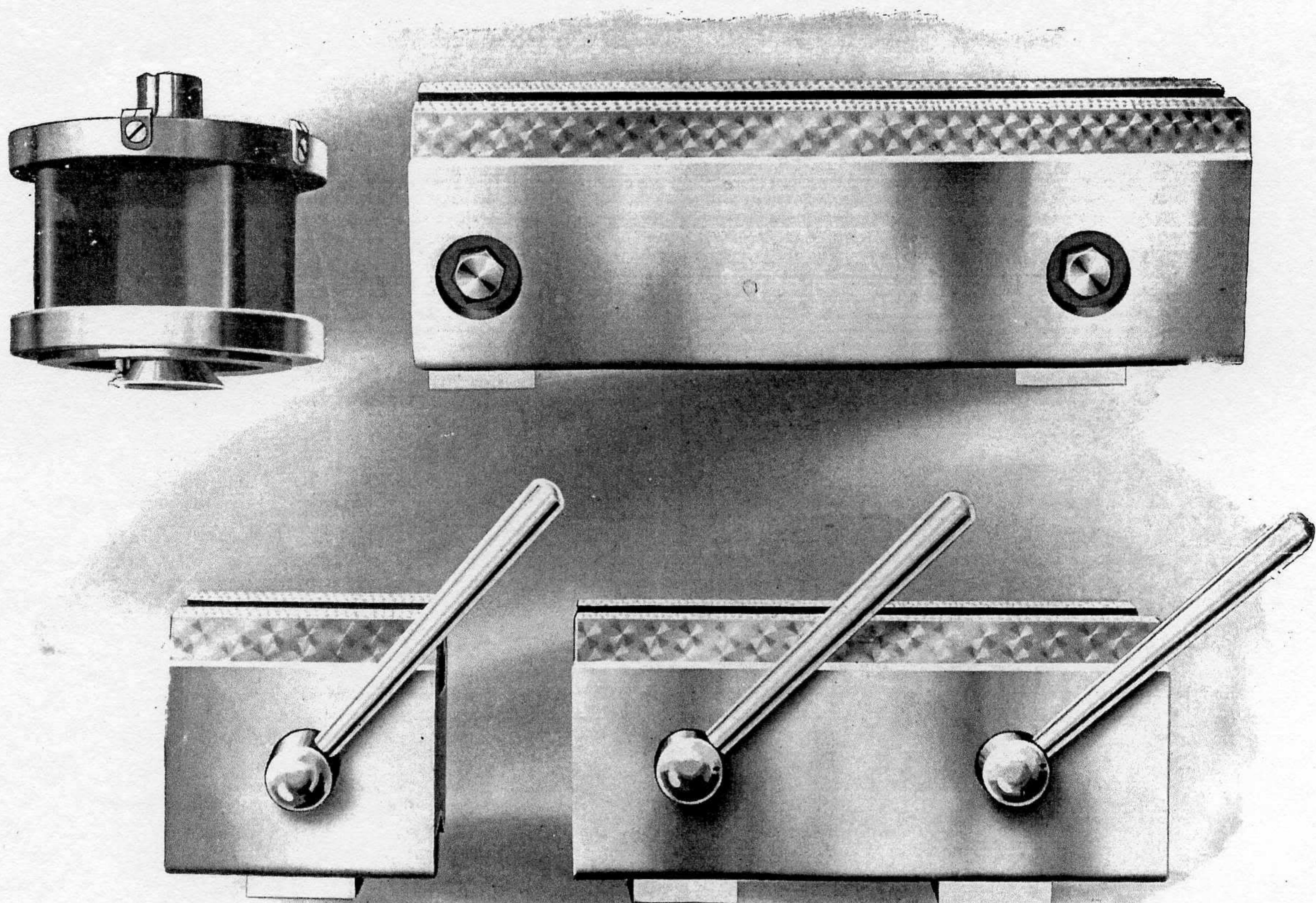


FIG. No. 211

RAISING BLOCKS FOR HEAD, TAIL STOCK, COMPOUND SLIDE AND CENTER REST
HEIGHT OF BLOCKS, THREE INCHES

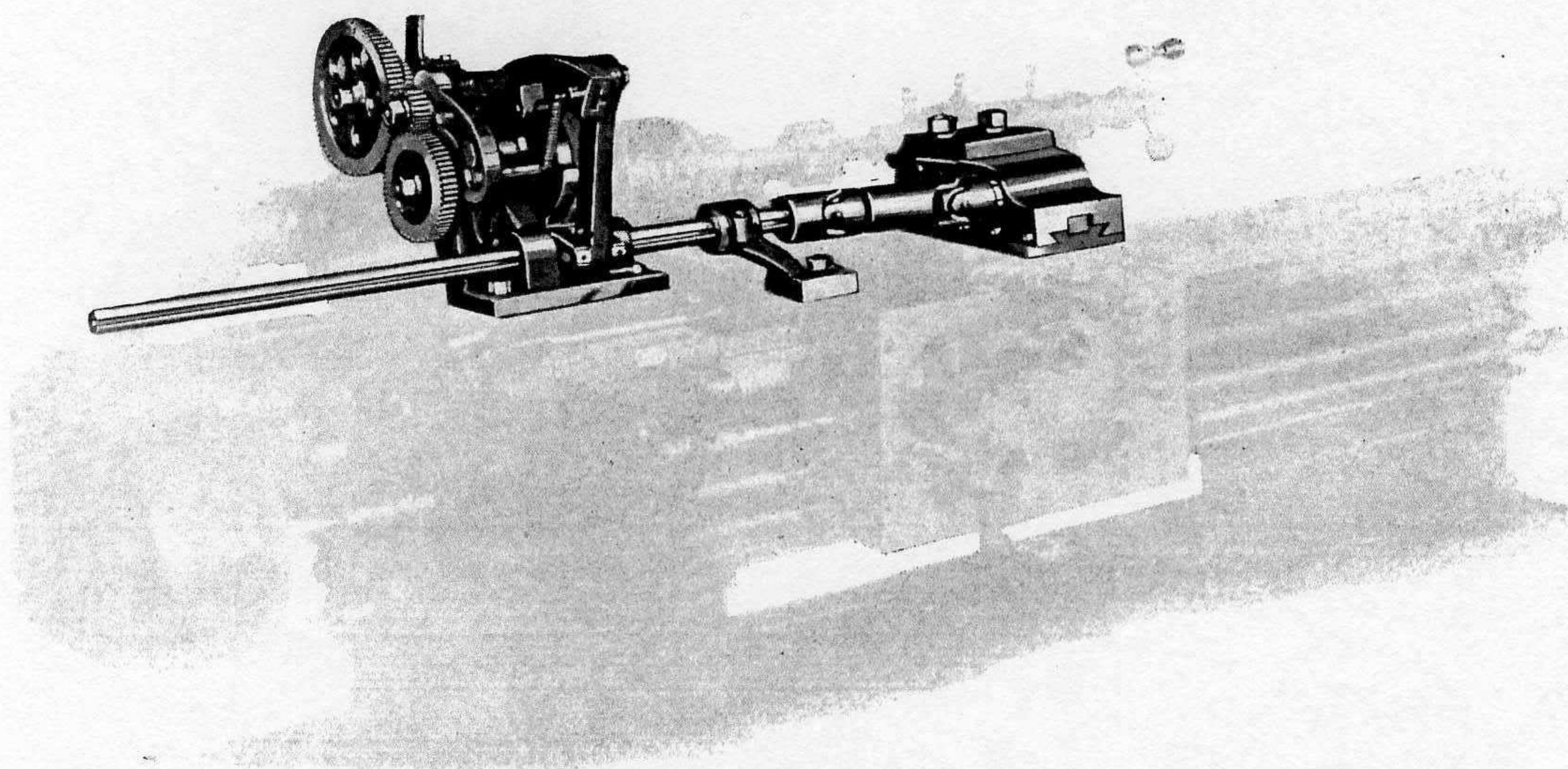


ILLUSTRATION OF RELIEVING ATTACHMENT IN POSITION

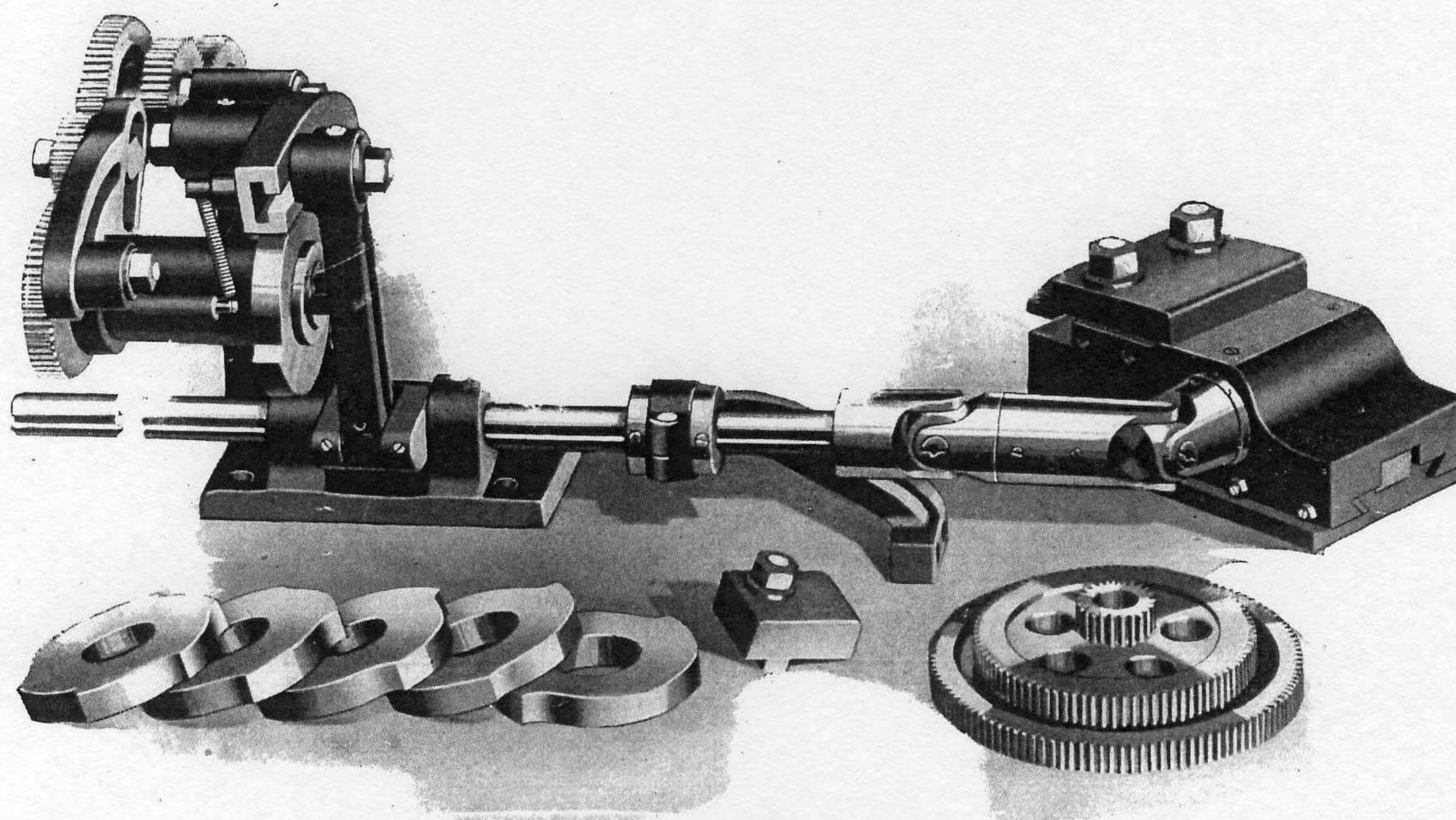


FIG. No. 205

CHARACT
QUICK CHANGE SWING PRECISION LATHE

RELIEVING ATTACHMENT							
COMBINATIONS FOR NUMBER OF FLUTES							
GEARS		CRMS					
STUD GEAR	CAM SHAFT	1	2	3	4	5	6
100	20					25	30
100	25				16	20	24
90	30			9		15	18
60	30				8	10	12
60	60	1	2	3	4	5	6

USE ANY GEAR FOR INTERMEDIATE

GEARS FURNISHED 20-25-30-60-90-100.
CRMS FURNISHED 1-2-3-4-5-6 THROW
WEIGHT COMPLETE 58½ LBS.

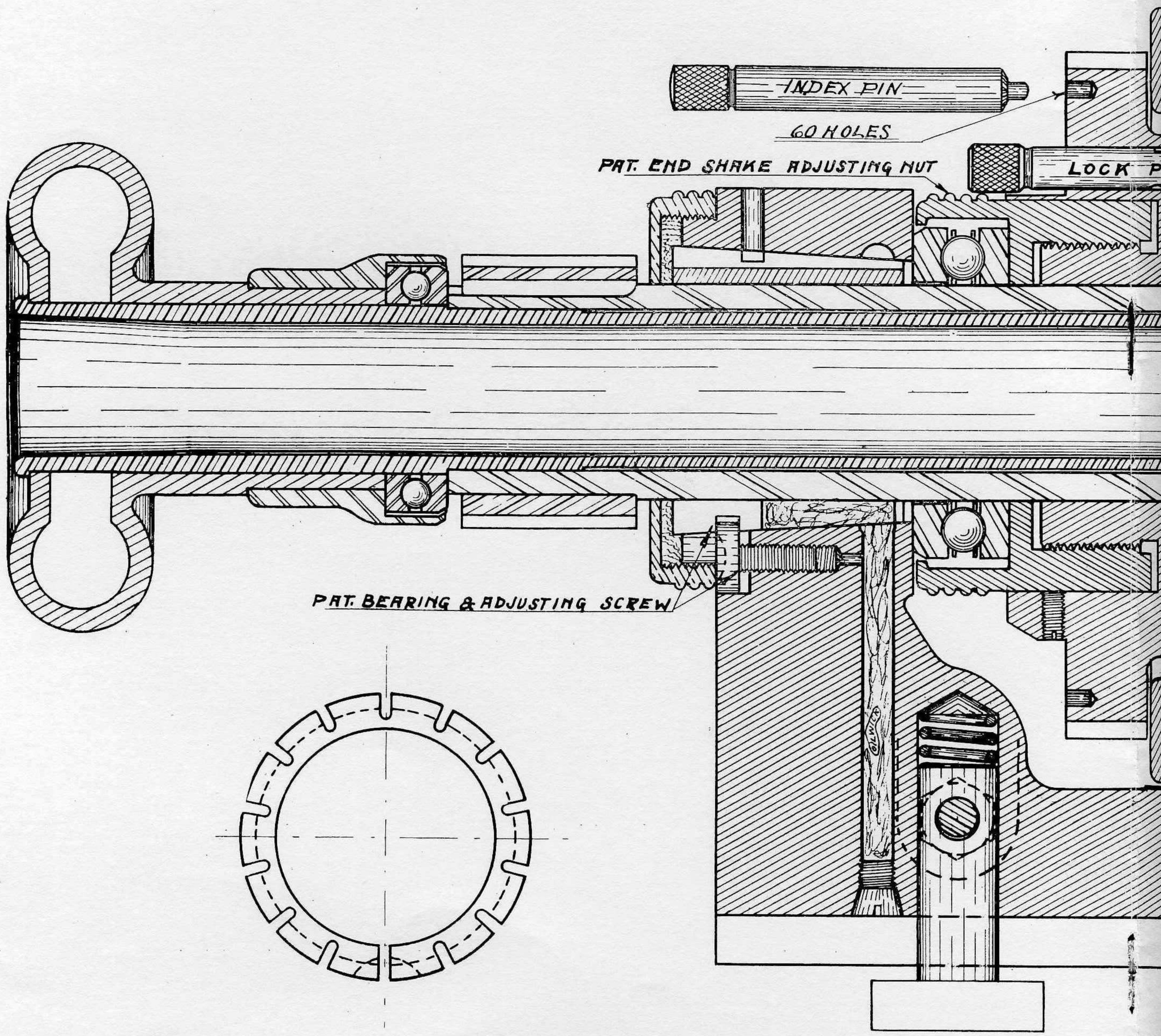
RELIEVING ATTACHMENT:

To attach the Relieving Attachment, remove plate on top of gear box, remove Compound Rest by withdrawing eccentric clamping bolt, and set Relieving Attachment Slide in position on Cross Slide, using the same eccentric bolt for clamping.

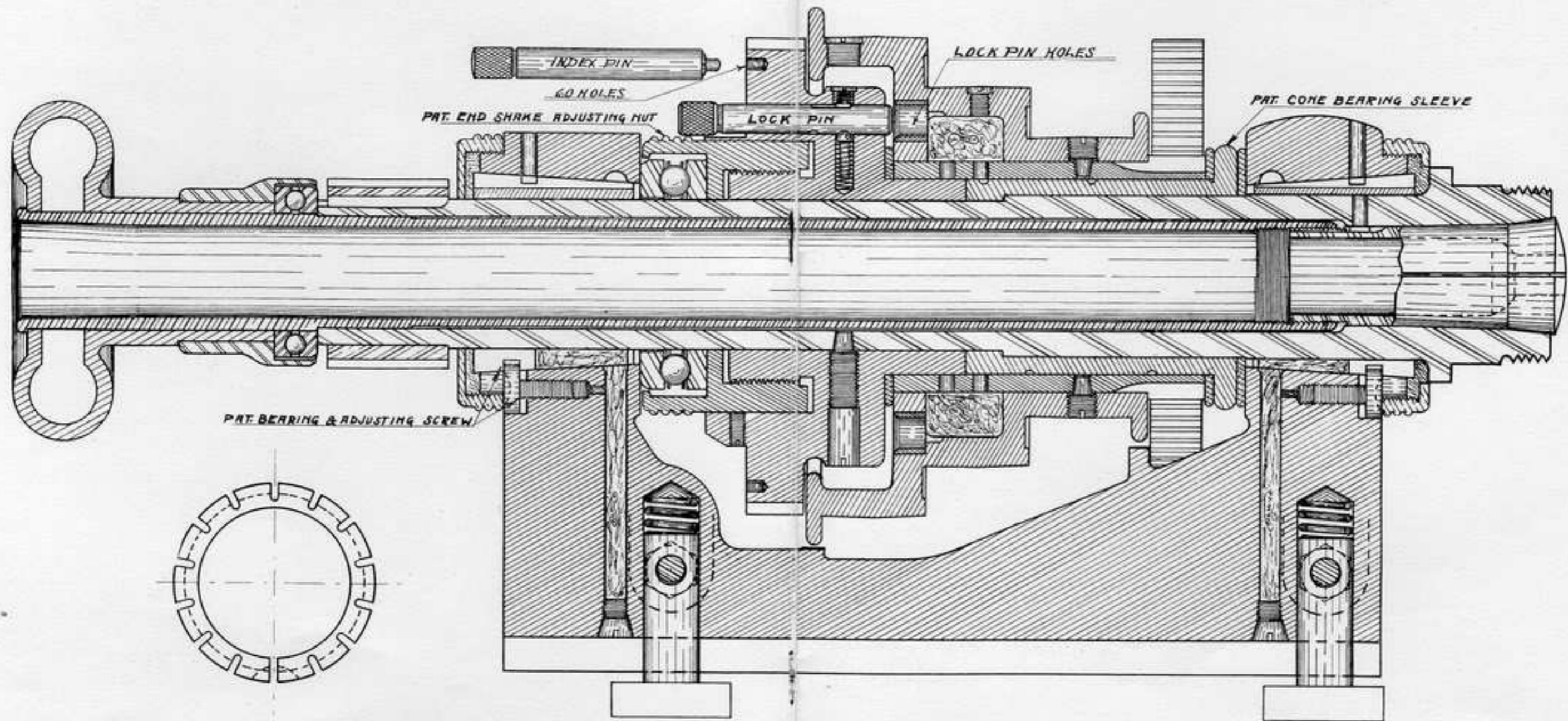
A Tee slot will be found in the carriage into which the tongue of the base rocker shaft supporting bracket is fitted and is so held by clamping bolt.

For setting of cams and gears for work of different numbers of flutes, see table on gear guard or in catalogue, page 13.

Angular cutters may be relieved, the included angles of which do not exceed 90 degrees. Through the application of a bracket with knuckle joints it is possible to relieve the cutting surface of counterbores, side mills, etc. This bracket, however, is only furnished to order.



SECTIONAL VIEW OF CATARACT



SECTIONAL VIEW OF CATARACT No. 5 BACK-GEARED HEAD

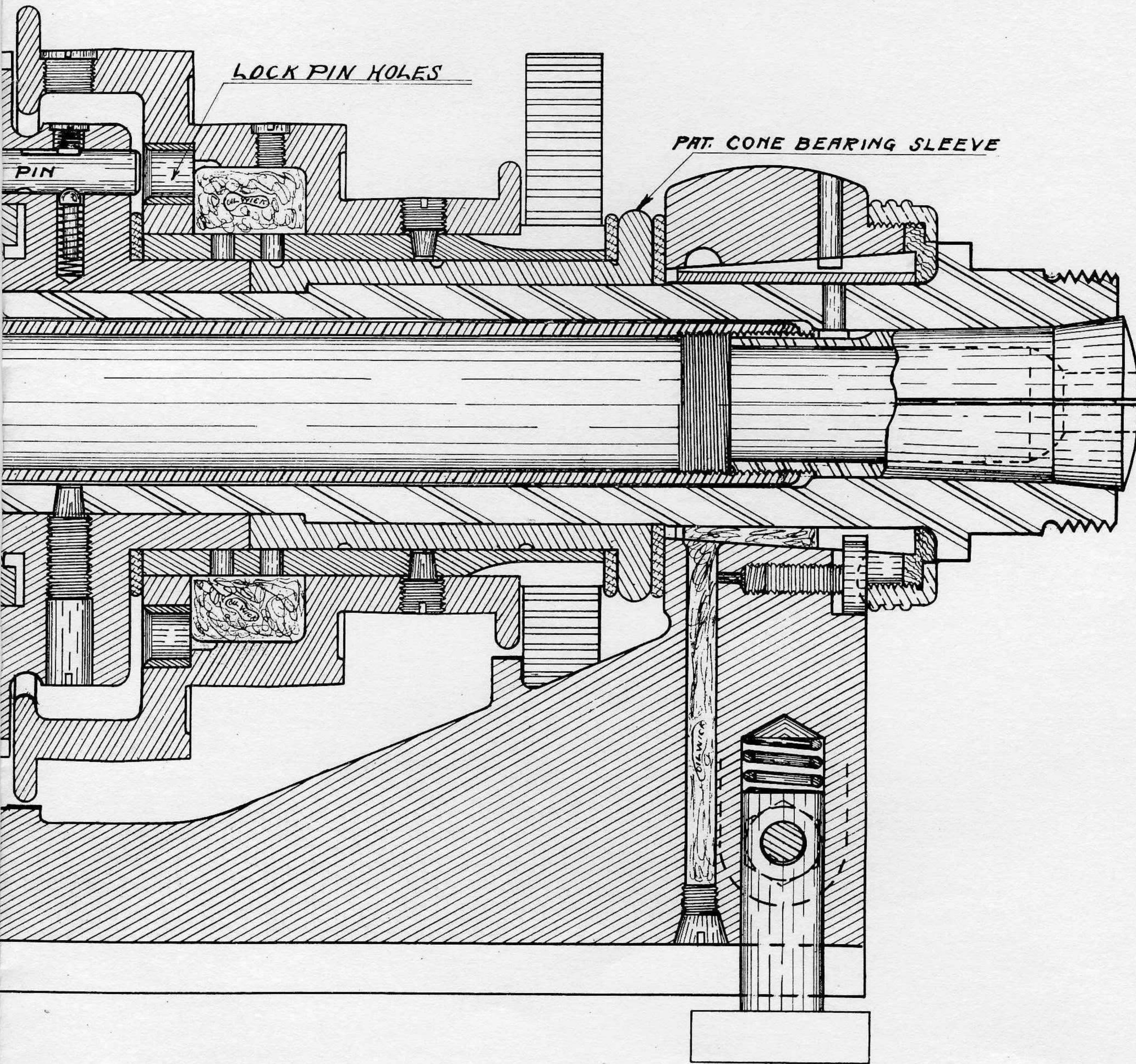


FIG. 5 BACK-GEARED HEAD

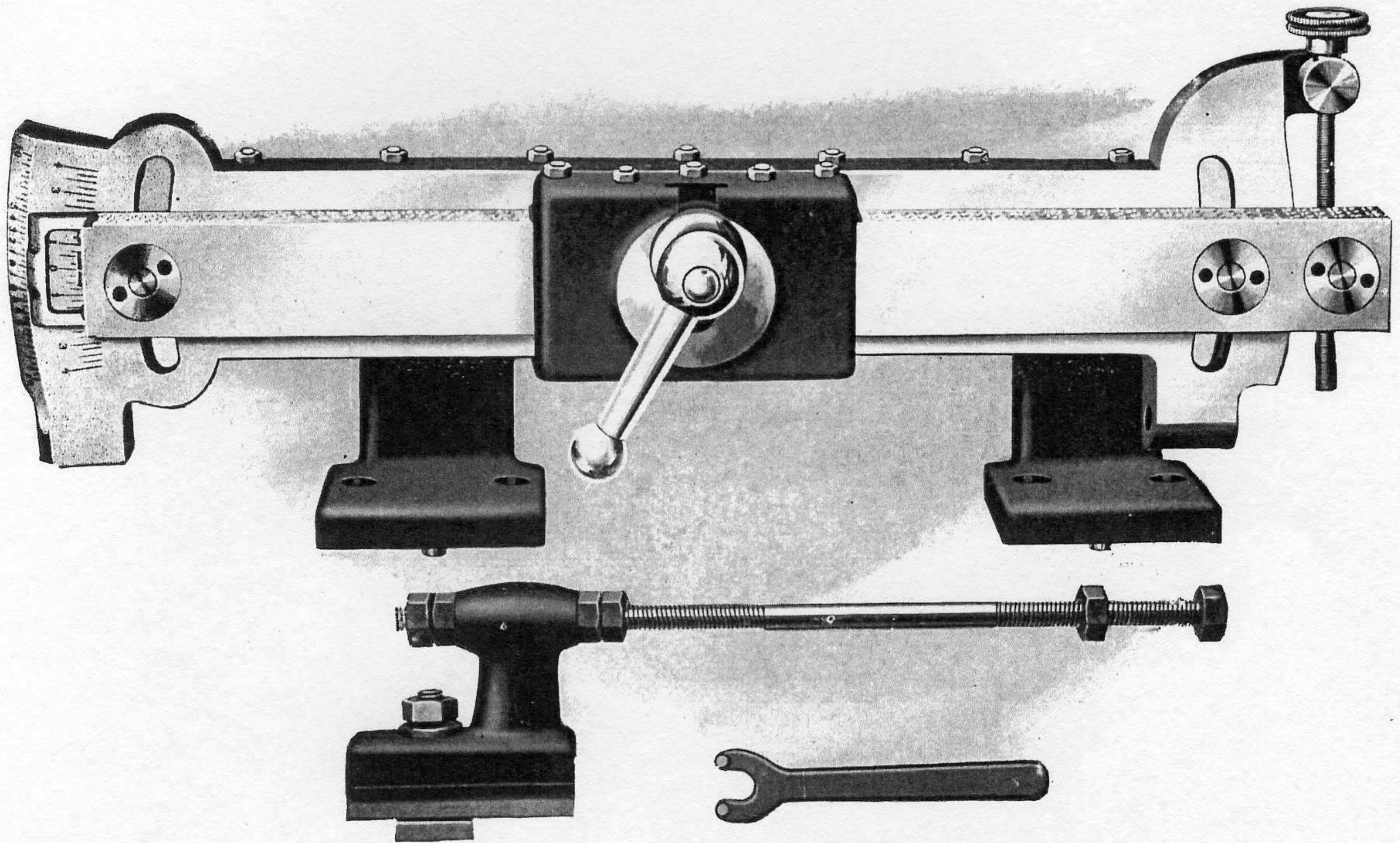


FIG. No. 201—TAPER TURNING ATTACHMENT

TAPER TURNING ATTACHMENT:

The Taper Turning Attachment which is attached to the carriage is designed to be readily detached from the Cross Slide (see slot "W", illustration 3), thus allowing the removal of the Cross Slide for inserting raising block bolt for compound rest.

This attachment may be used on work up to 15" in length, and adjusted in inches per foot, also to 5 degrees either side of the zero line, the adjustments being controlled by a fine pitch screw "V", illustration No. 3 page 17.

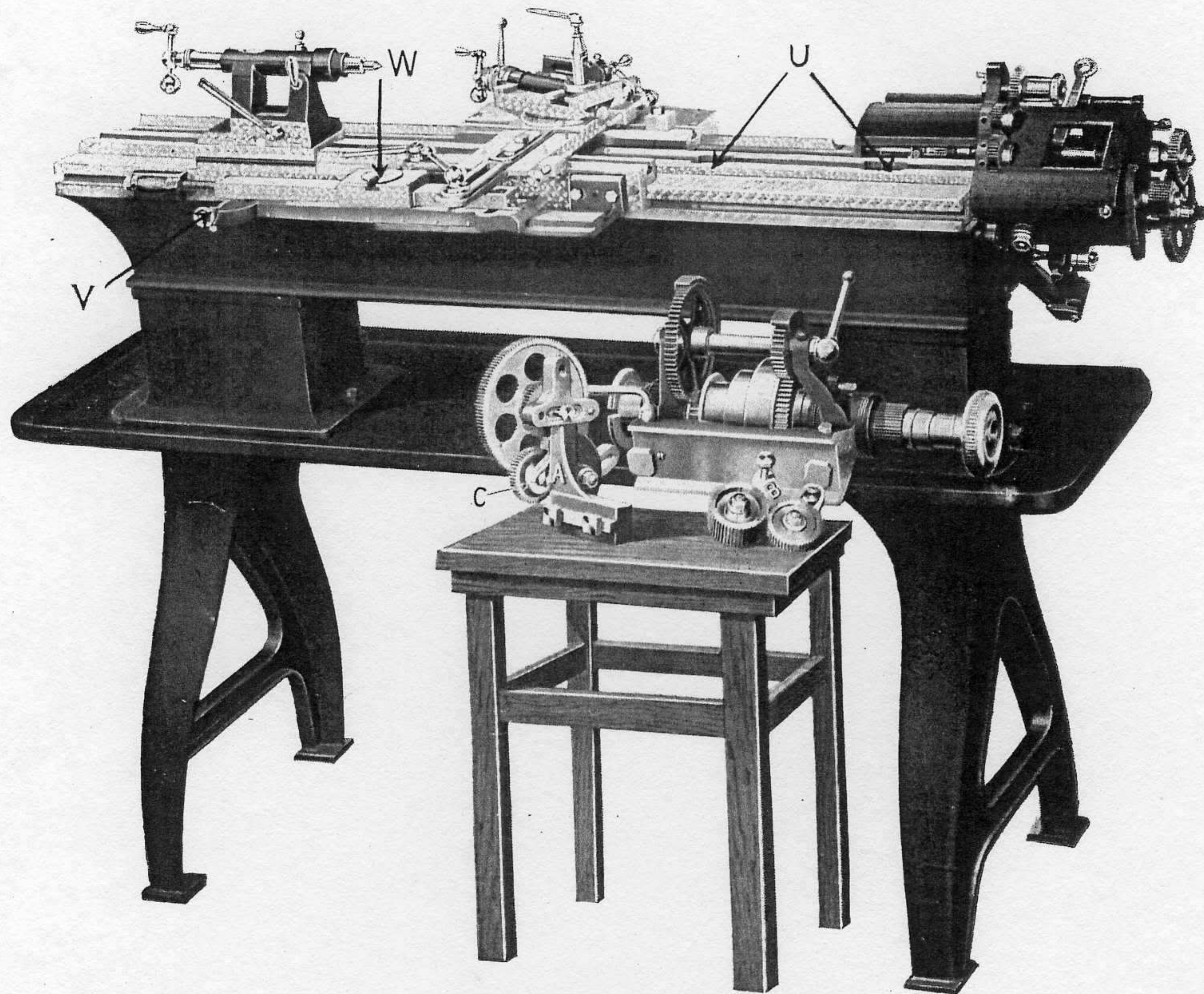
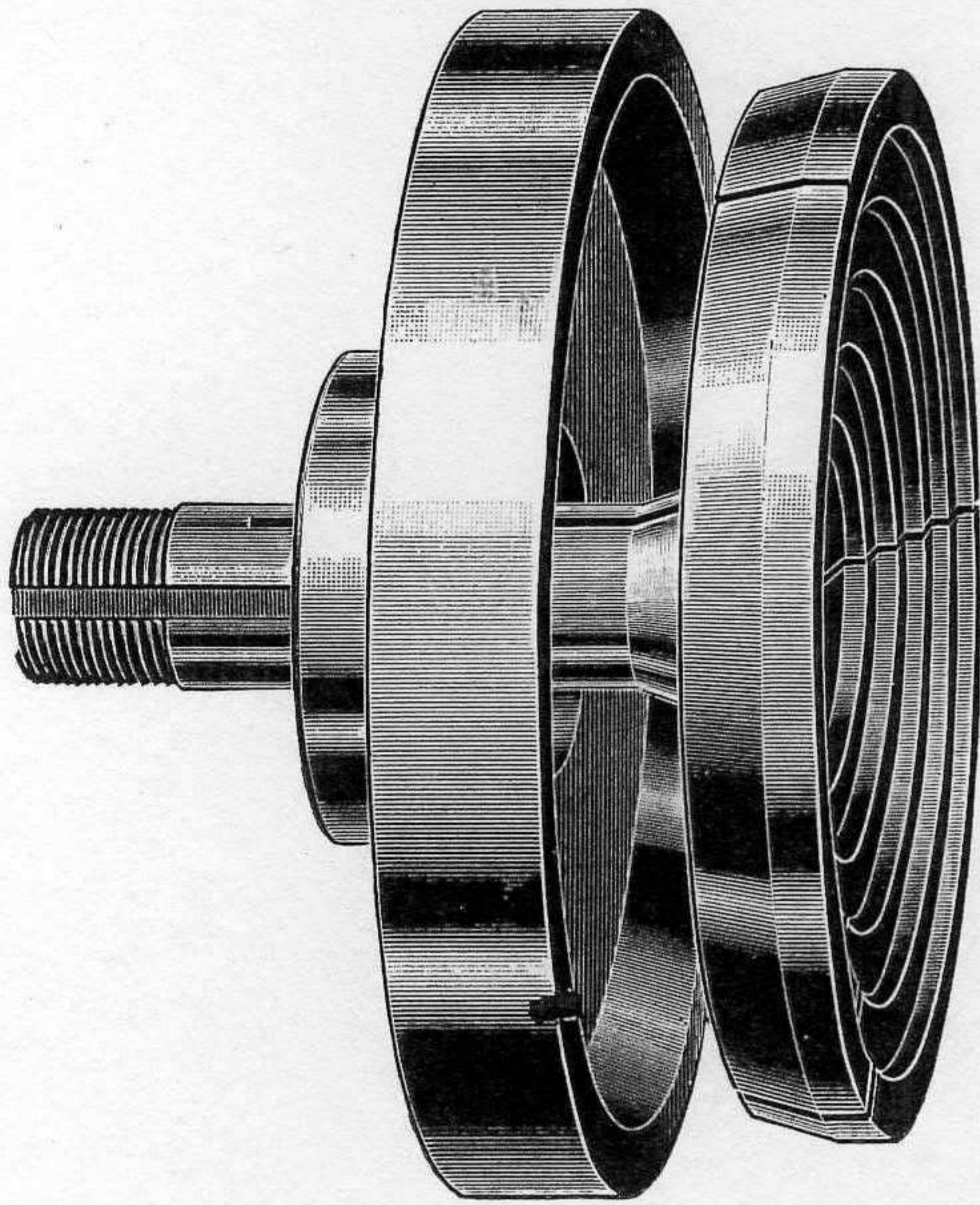


ILLUSTRATION No. 3

Above shows slot "U" through which the draw bolts for head raising blocks pass, also adjusting screw of taper attachment and brackets "A" and "B", used for connecting spindle gear and change-gear box when head is raised to 15" swing.



STEP CHUCK AND CLOSER

STEP CHUCKS AND CLOSERS:

These accessories are extremely useful in holding large and small punchings, thin tubing, etc., the chucks being readily turned out for receiving the work to be held.

The CLOSERS are carried on nose of spindle. The mouth of closer is finished with taper coincident with that on outer periphery of step chuck, and grip is given to work thereby through pull of draw-in spindle.

May be ordered in sizes from 2 to 6" inclusive.

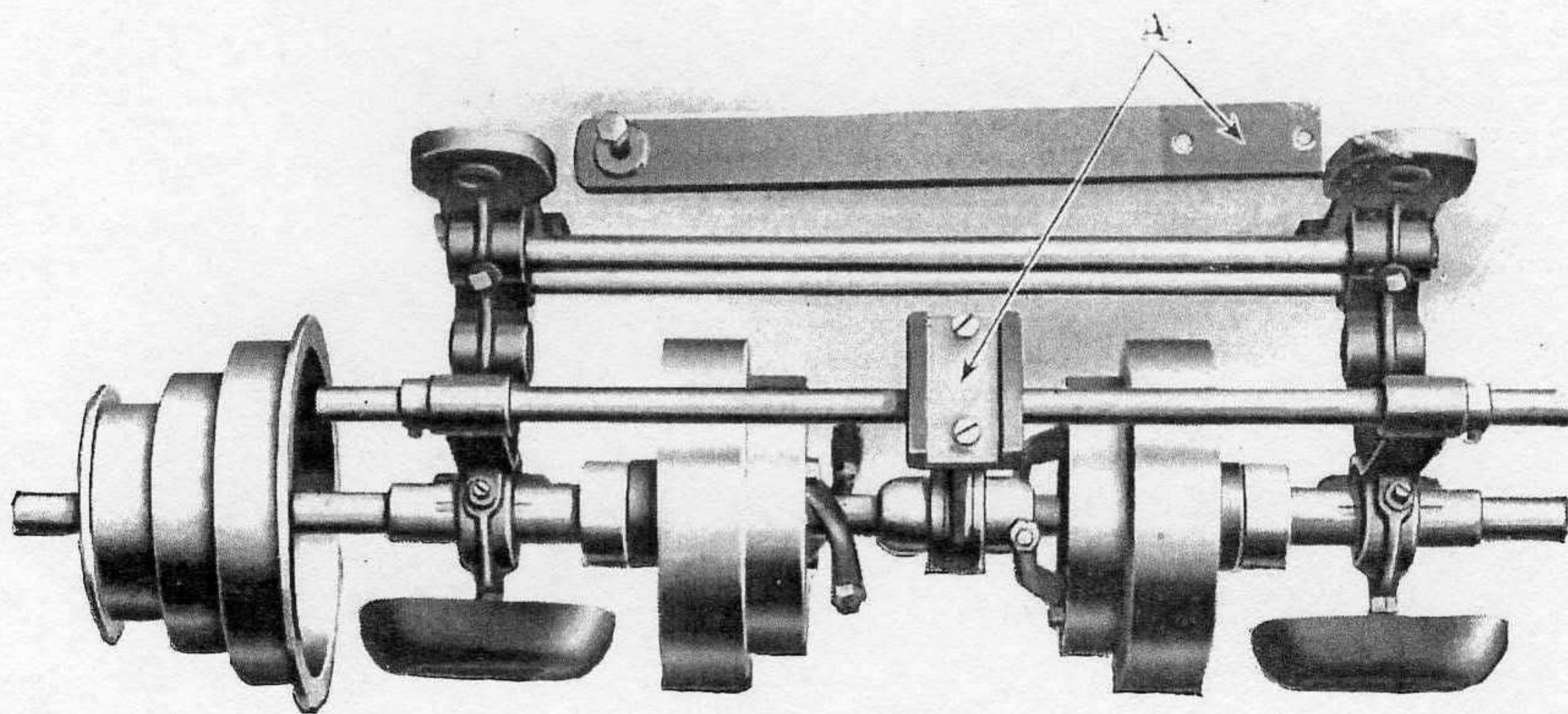
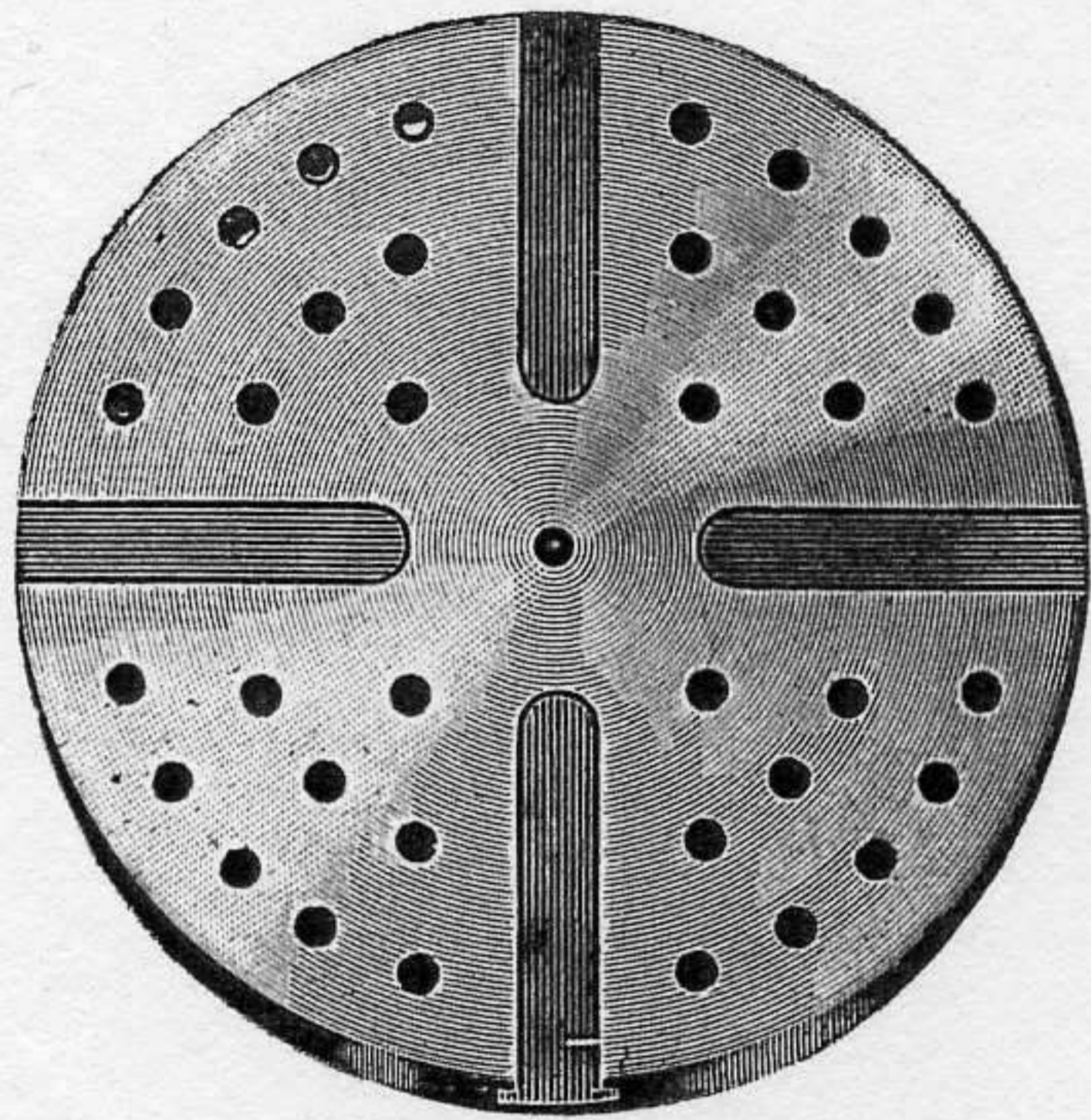


FIG. No. 202

COUNTERSHAFT:

The Countershaft is a two-speed clutch pulley type. The pulleys are 7" in diameter by $1\frac{3}{4}$ " face.

Fast Countershaft speed.....	450 R. P. M.
Slow Countershaft speed.....	125 R. P. M.

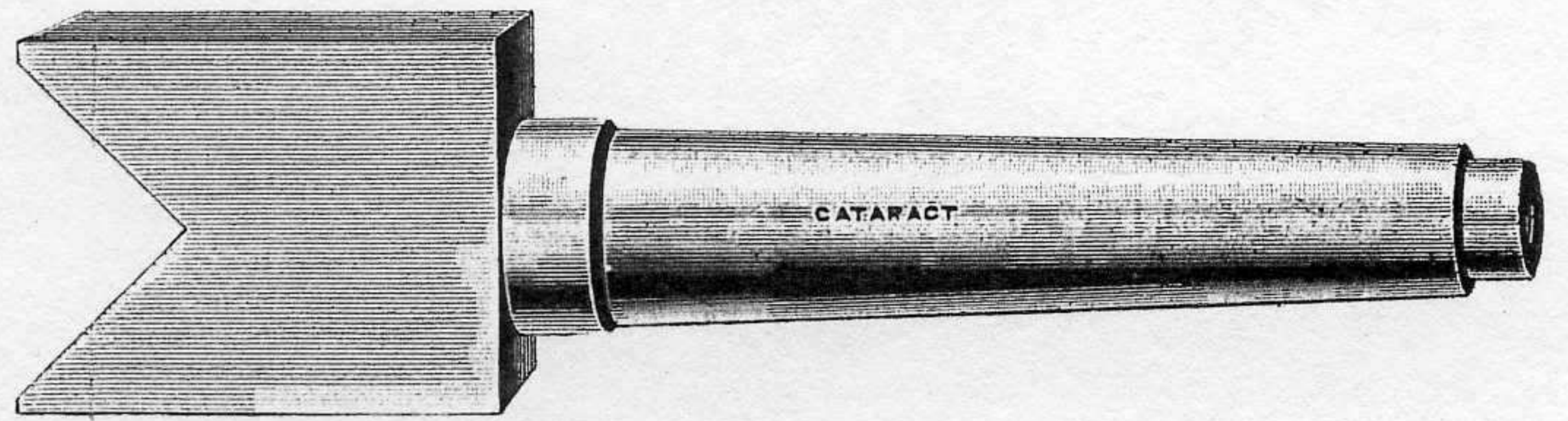


FACE PLATES

Fig. No. 205—9" diameter.

Fig. No. 212—14½" diameter.

Slotted, drilled and tapped $\frac{5}{16}$ "x18 R, 9" and 14½" diameter. Tee slots are made standard to take Angle Plate, Fig. No. 11. (See Bench Lathe catalogue.)



V CENTERS

Fig. No. 213—Solid V Center for Tailstock.

Fig. No. 214—Swivel V Center for Tailstock.

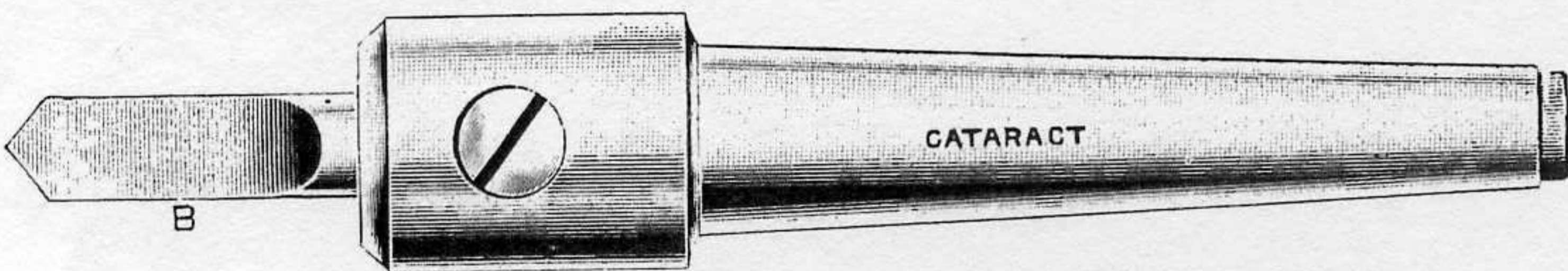
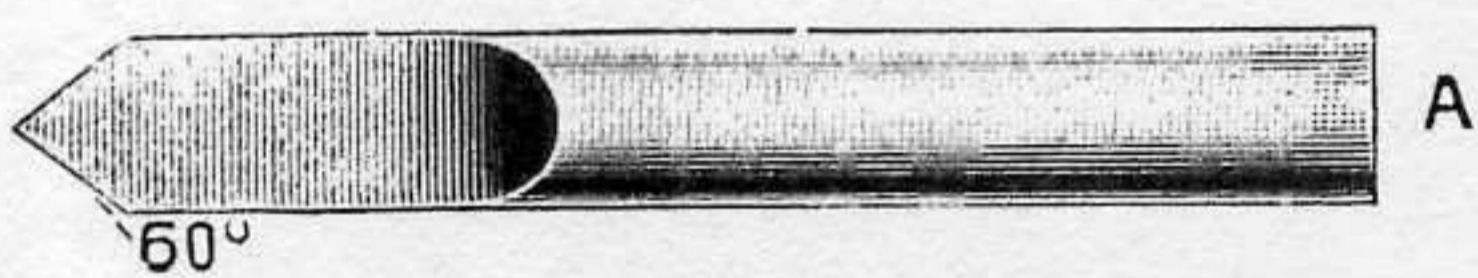


FIG. No. 215

CENTERING TOOL HOLDER

Centering Tool Holder with properly ground Drill Starting Center in place.

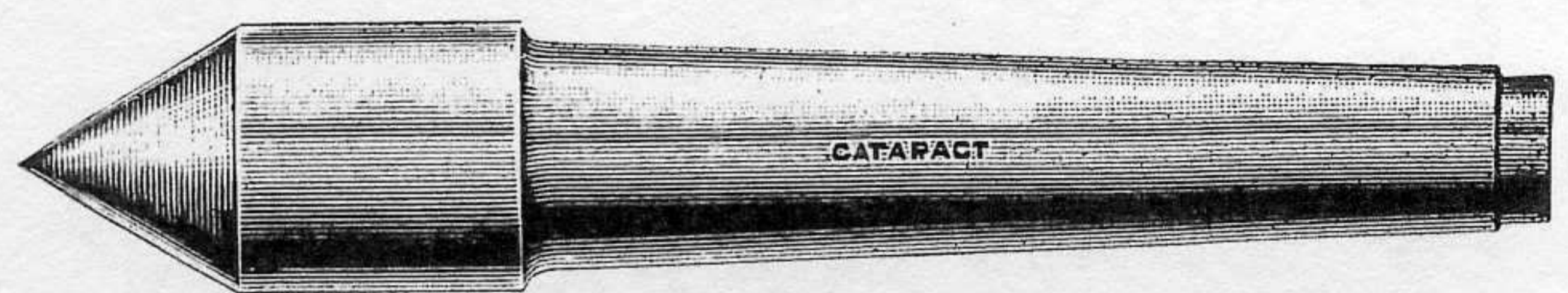


FIG. No. 216

MALE CENTER FOR TAILSTOCK

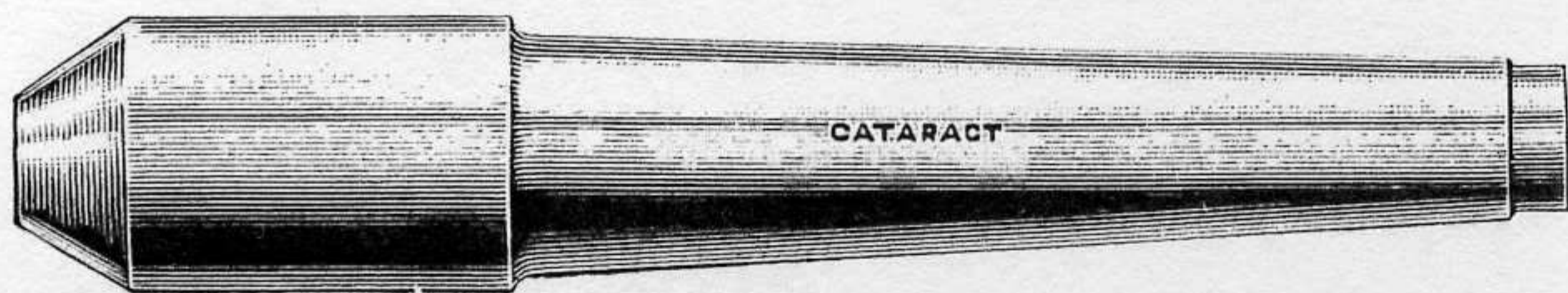


FIG. No. 217

FEMALE CENTER FOR TAILSTOCK

For different sizes of cups "A" (Fig. No. 217), state what you want, giving sketch if you wish a hole at bottom of cup "A".

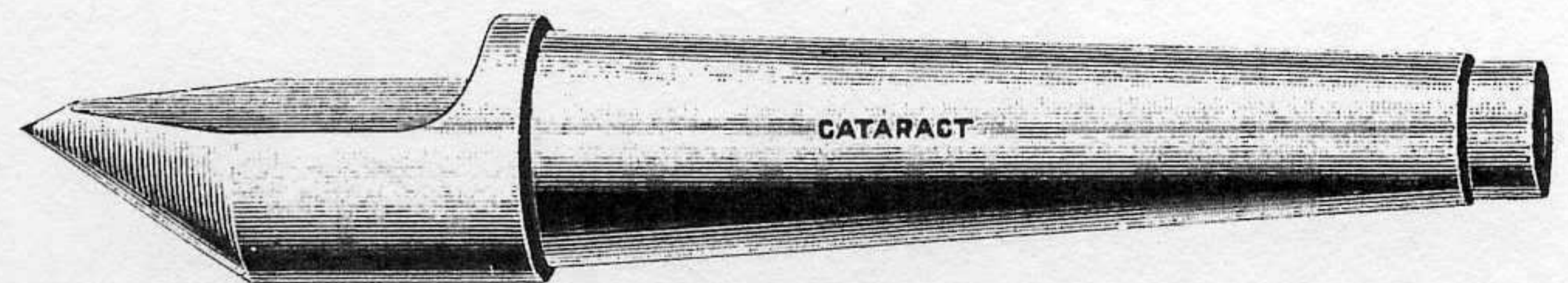


FIG. No. 218

HALF CENTER FOR TAILSTOCK

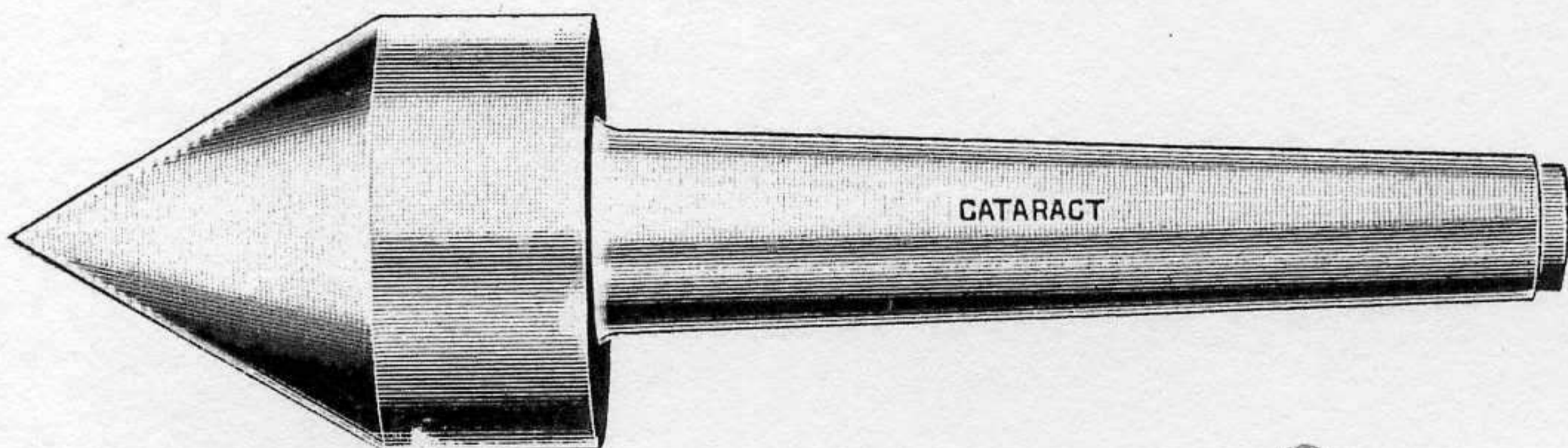


FIG. No. 219

MALE CENTER, 1-IN. HEAD DIAMETER

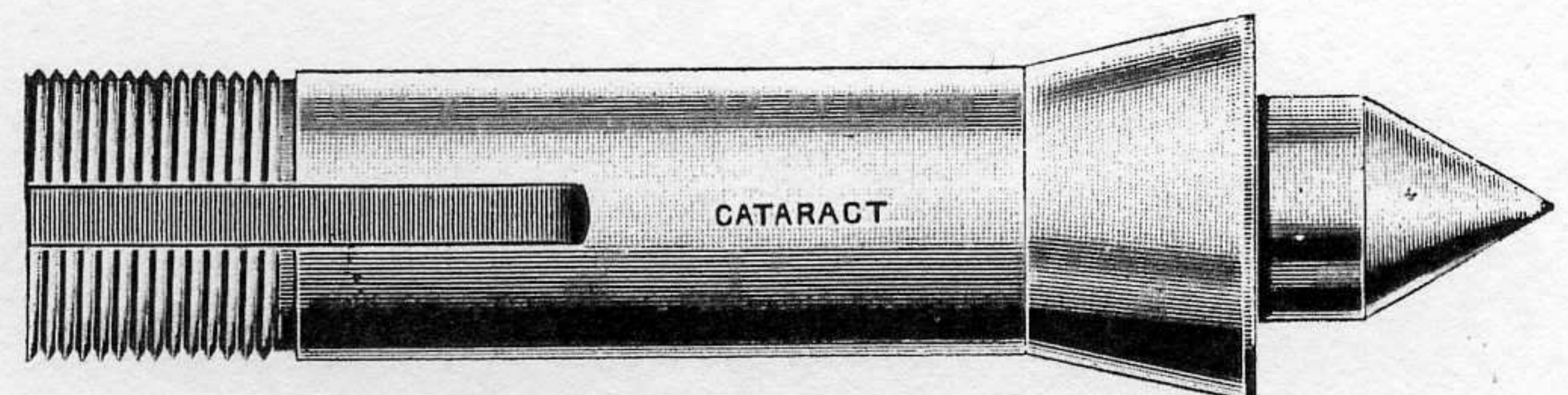


FIG. No. 220

SOLID MALE CENTER FOR LATHE HEAD

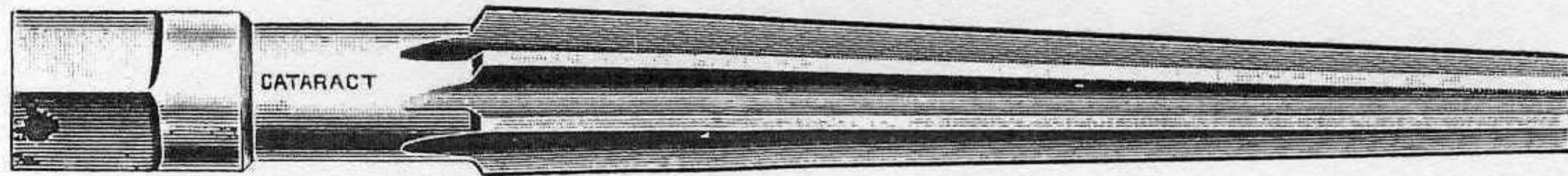


FIG. No. 221—REAMER

Reamer for Tailstock of Cataract Quick-Change-Swing Precision Lathe.

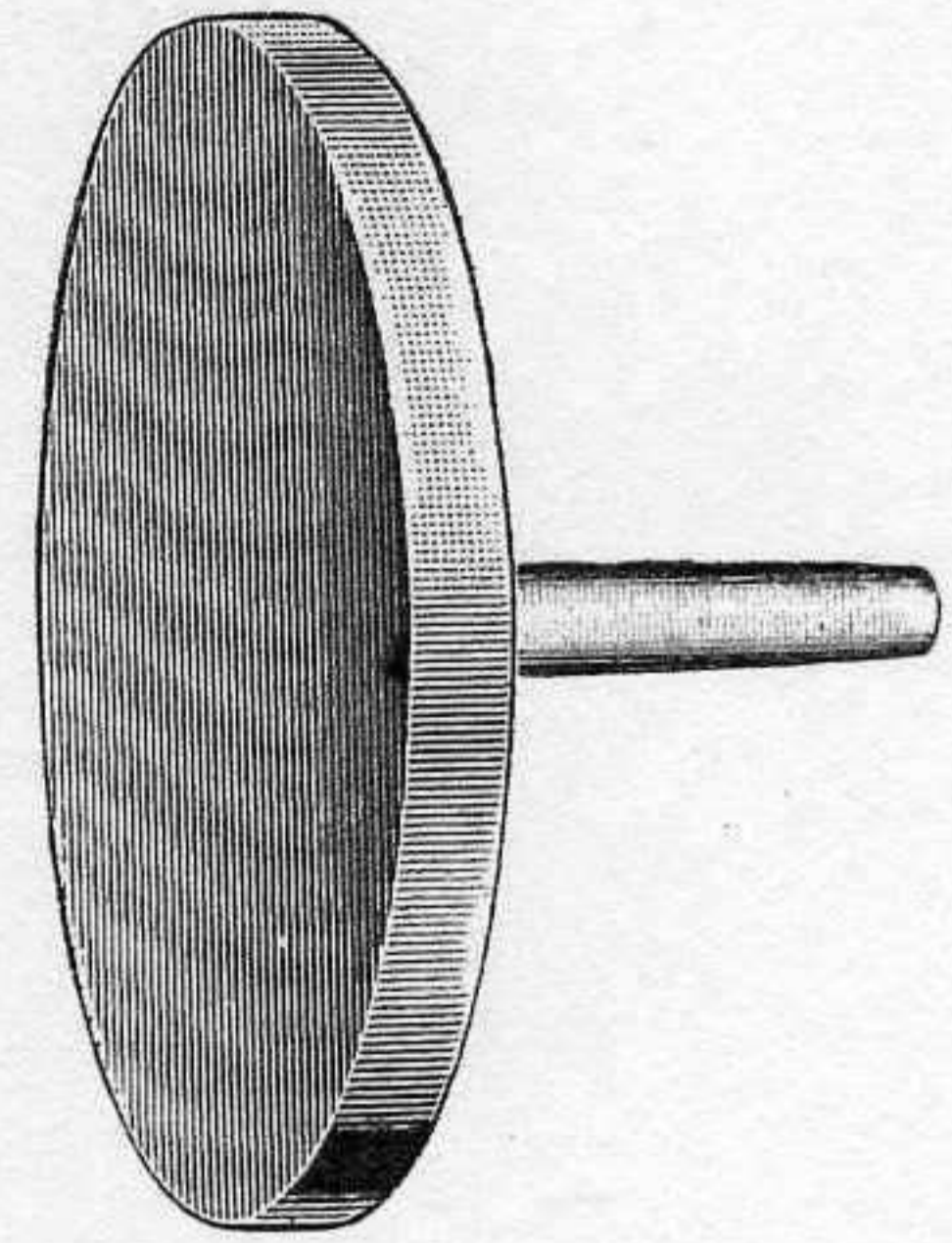
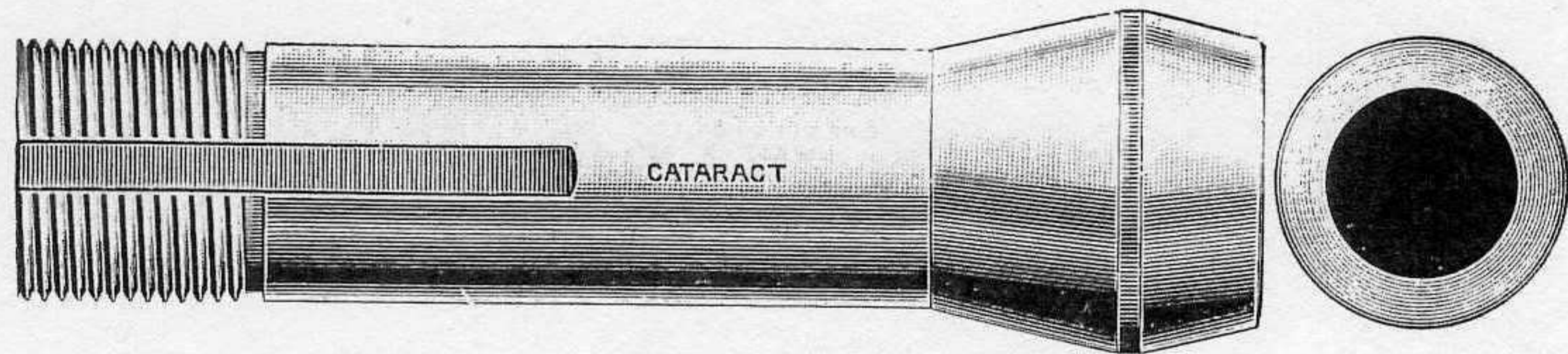


FIG. No. 222—DRILL PLATE

Drill Plate for Tailstock. Is made of cast iron with steel taper center. Plates are $4\frac{1}{2}$ " in diameter.



TAPER CHUCK

Fig. No. 224—Soft.
Fig. No. 225—Hard.

Taper Chuck having the same taper as Tailstock, which is Morse No. 2.

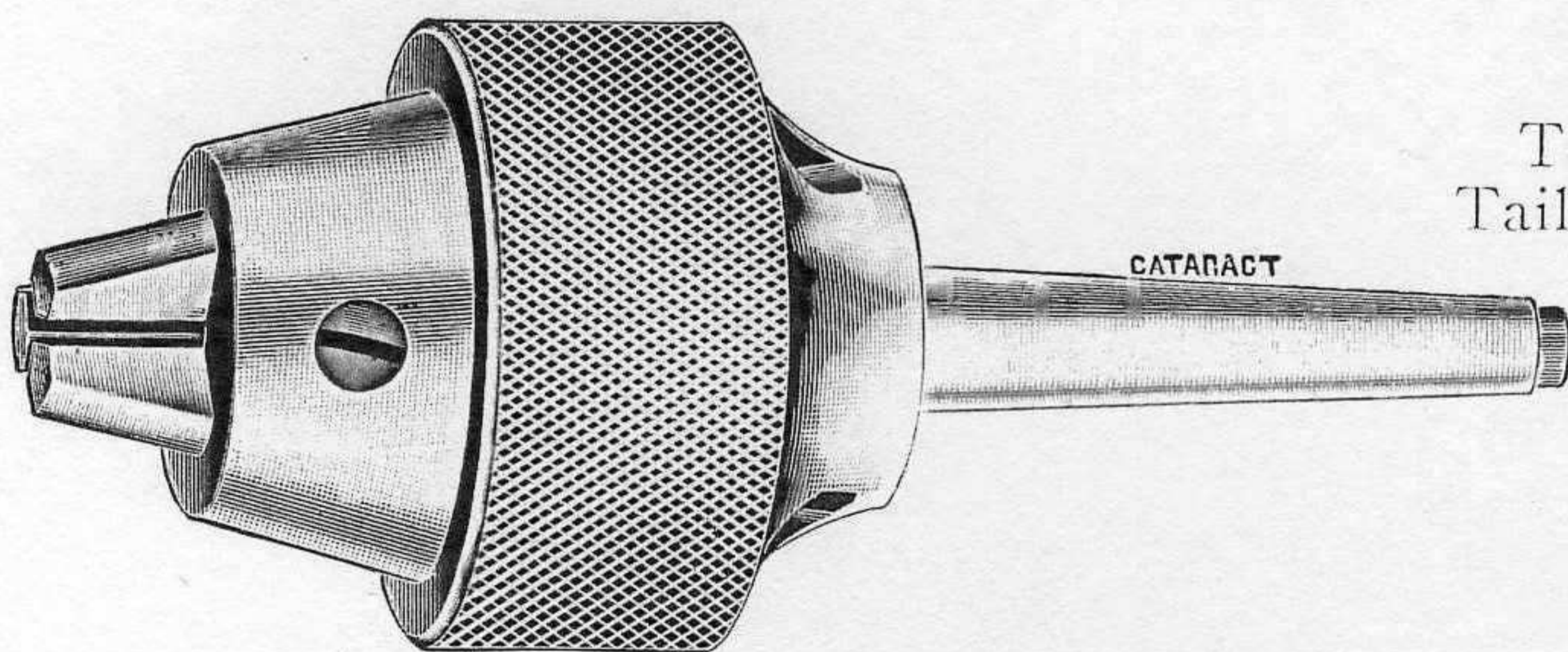


FIG. No. 223—DRILL CHUCK

Drill Chuck, $\frac{1}{2}$ " capacity, mounted on Morse No. 2 taper.

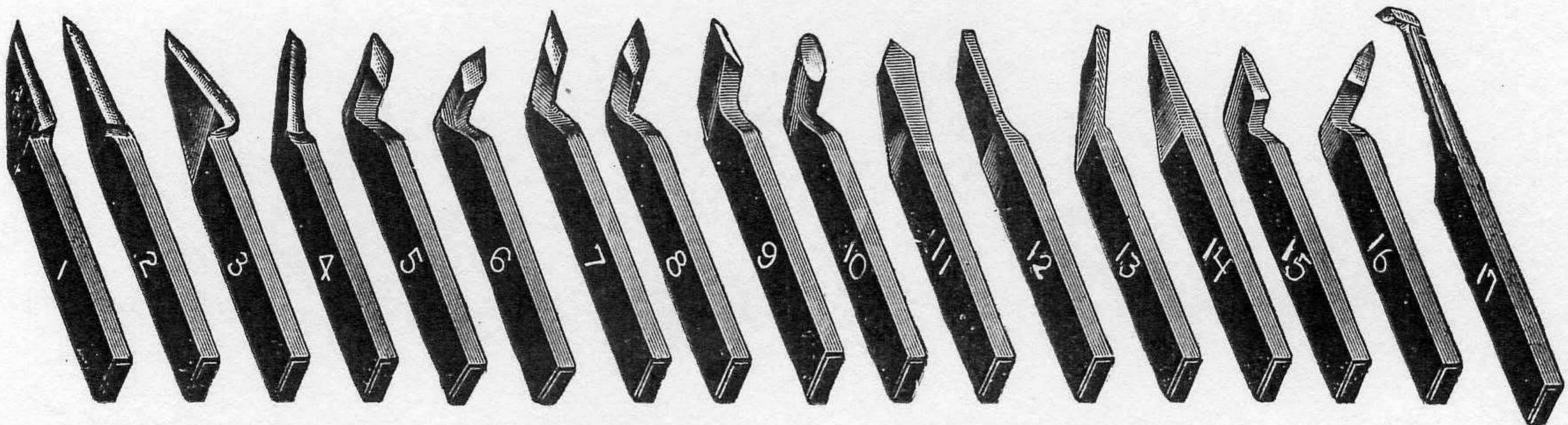


FIG. No. 233—LATHE TOOLS
Size of Stock, $\frac{3}{8}$ " x $\frac{7}{8}$ "

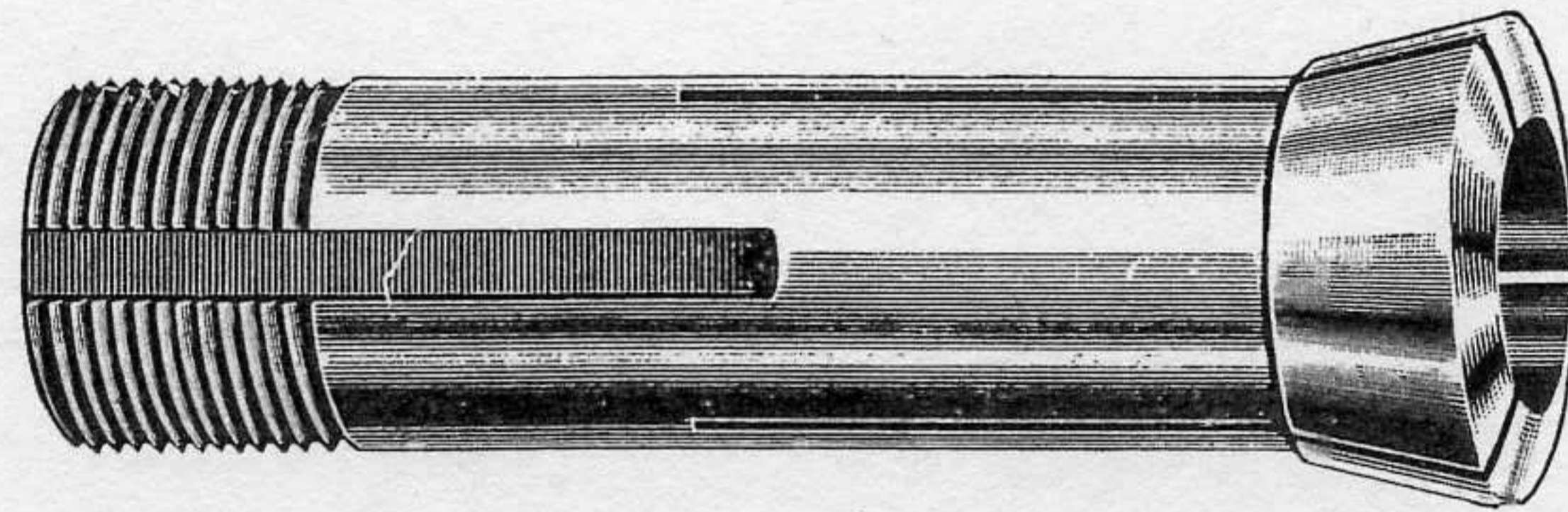


FIG. No. 226—DRAW-IN CHUCK

For Quick-Change-Swing Precision Lathe. Maximum capacity 1". Cut, $\frac{1}{2}$ size.

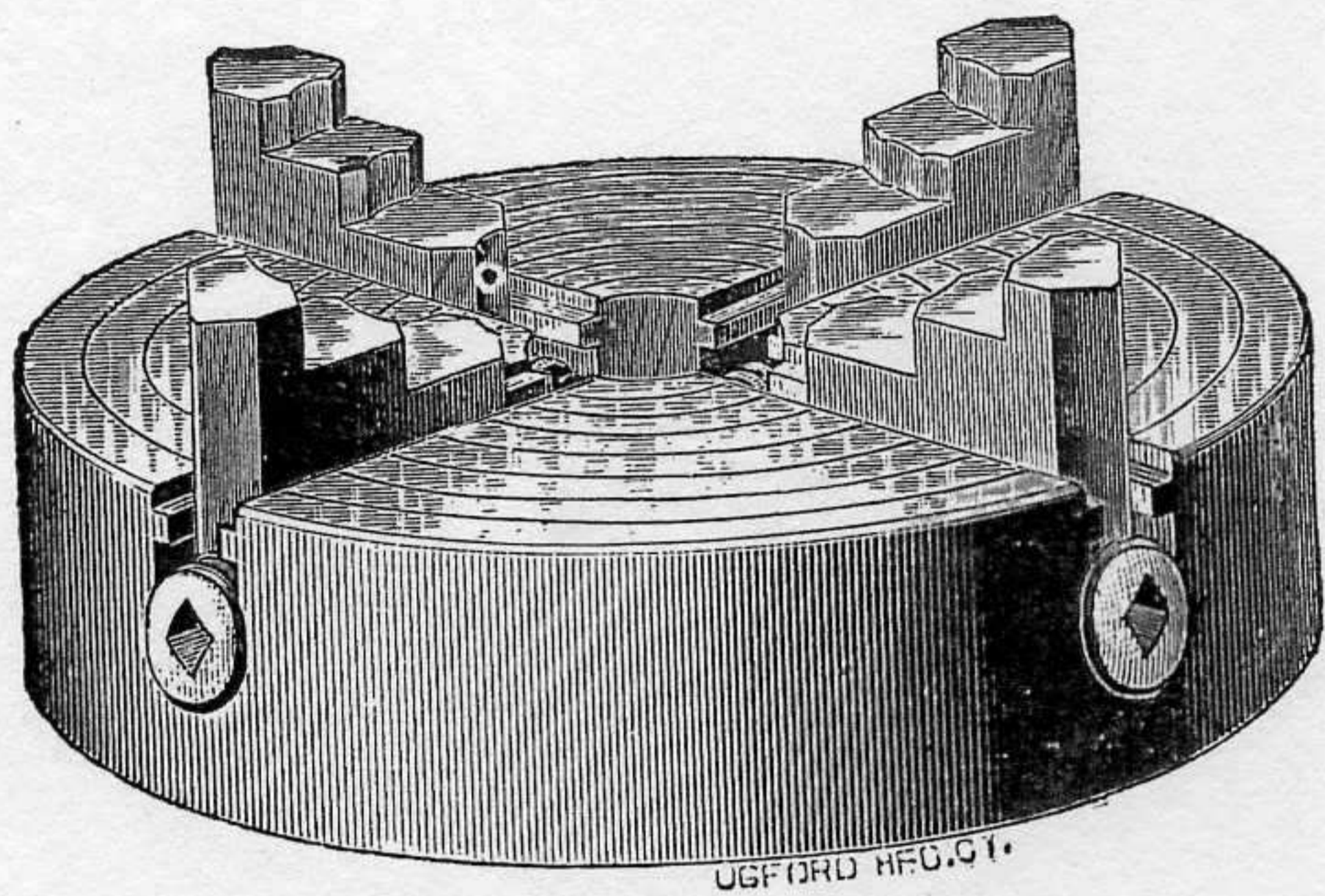


FIG. No. 228—SIX-INCH FOUR-JAWED INDEPENDENT CHUCK

Six-inch Four-Jawed Independent Chuck mounted to fit lathe.

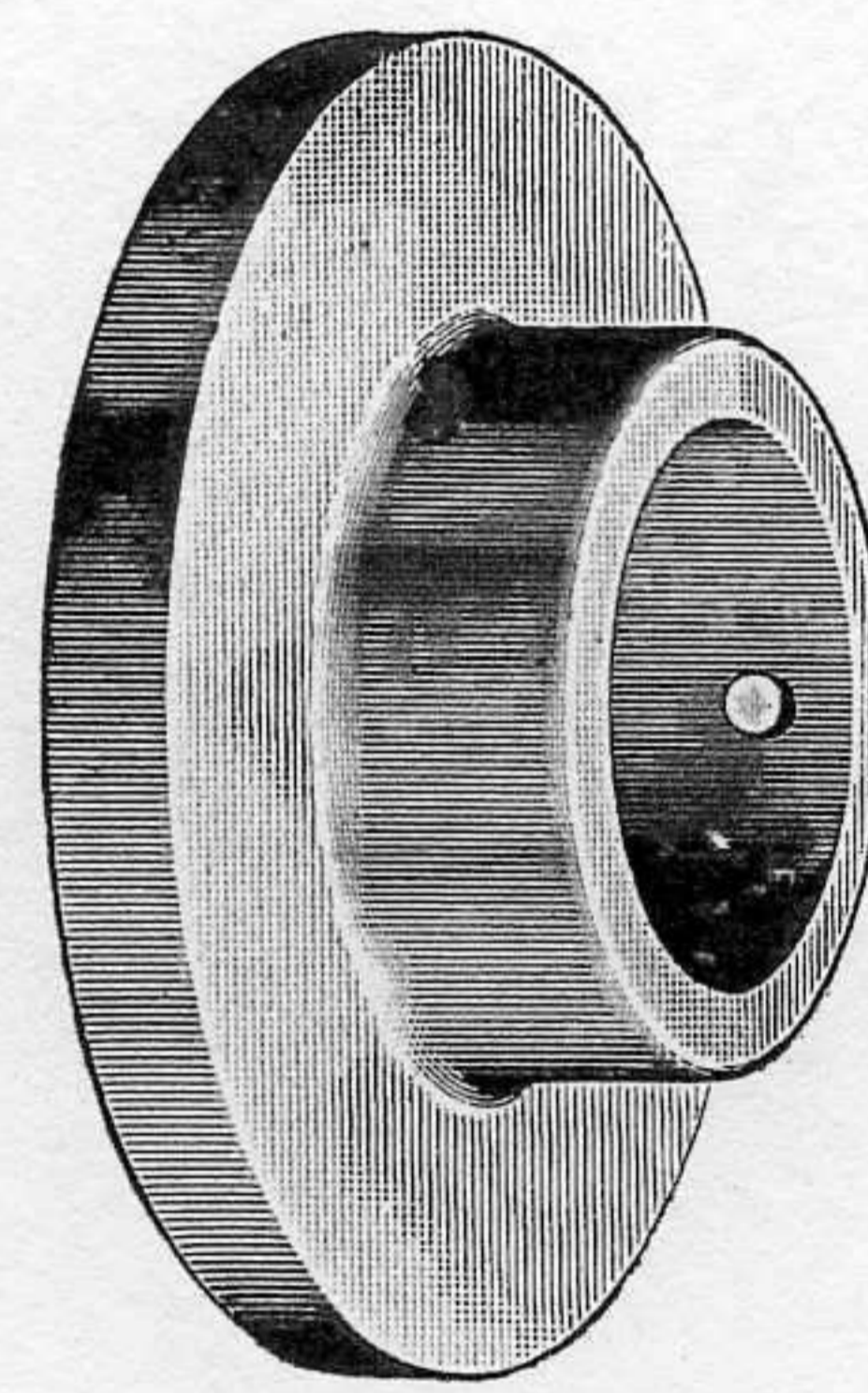


FIG. No. 227—CAST IRON MOUNTS

For Three Jawed Chucks or Jigs. These are fitted to the spindle nose. The backs are finished and fronts are turned ready for the final cut. 4", 5" and 6" diameter are carried in stock.

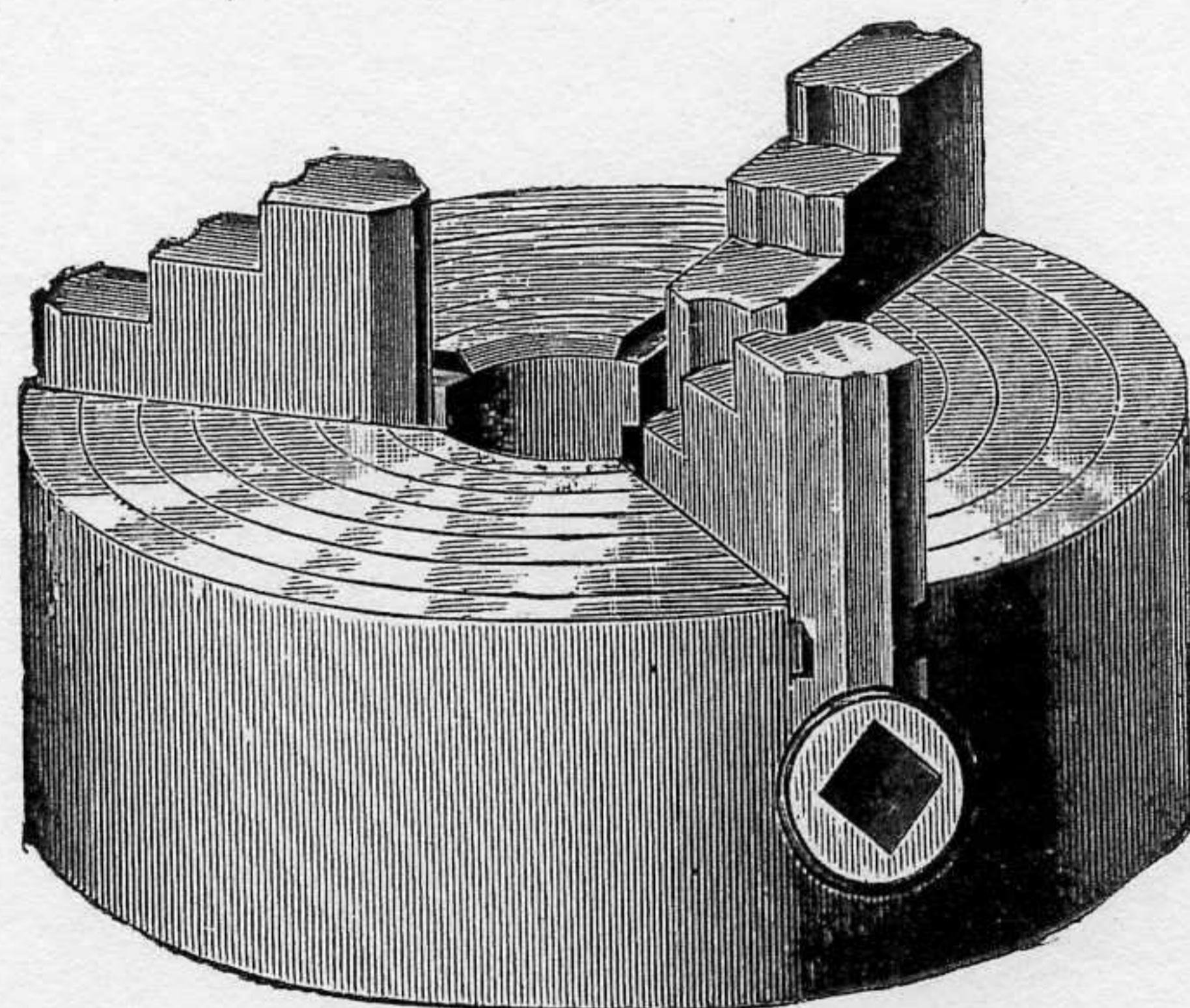


FIG. No. 230—SIX-INCH THREE-JAWED CHUCKS

Fig. No. 228.—Six-inch Three-Jawed Combination Chuck with two sets of jaws, mounted to fit lathe.

Fig. No. 230—Six-inch Three-Jawed Independent Chuck, mounted to fit lathe.

Illustration No. 7. shown on page 25, is a combination of the Standard R-2 Double Bench Under-Drive equipment and the Cataract Quick-Change-Swing Precision Lathe.

The equipment illustrated consists of one bench upon which two Cataract No. 5 7" machines are mounted (one bench being eliminated).

This equipment otherwise is standard with the exception that one of the countershafts is arranged with a pair of clutch pulleys for operating the Quick-Change-Swing Precision Lathe.

It will be noted this equipment is driven by a motor through an Under-Drive Jack-shaft, and therefore may be set anywhere in a work-shop, laboratory or manufacturing department independent of the walls or ceiling.

We are prepared, as may be seen in our general Bench Lathe catalogue, to furnish several different styles of Cataract Standard Benches which may be used for operating unit combinations of equipment consisting of from one to six machines in a group.

Group drives for Bench Lathe equipment are becoming more and more popular and we solicit further investigation.

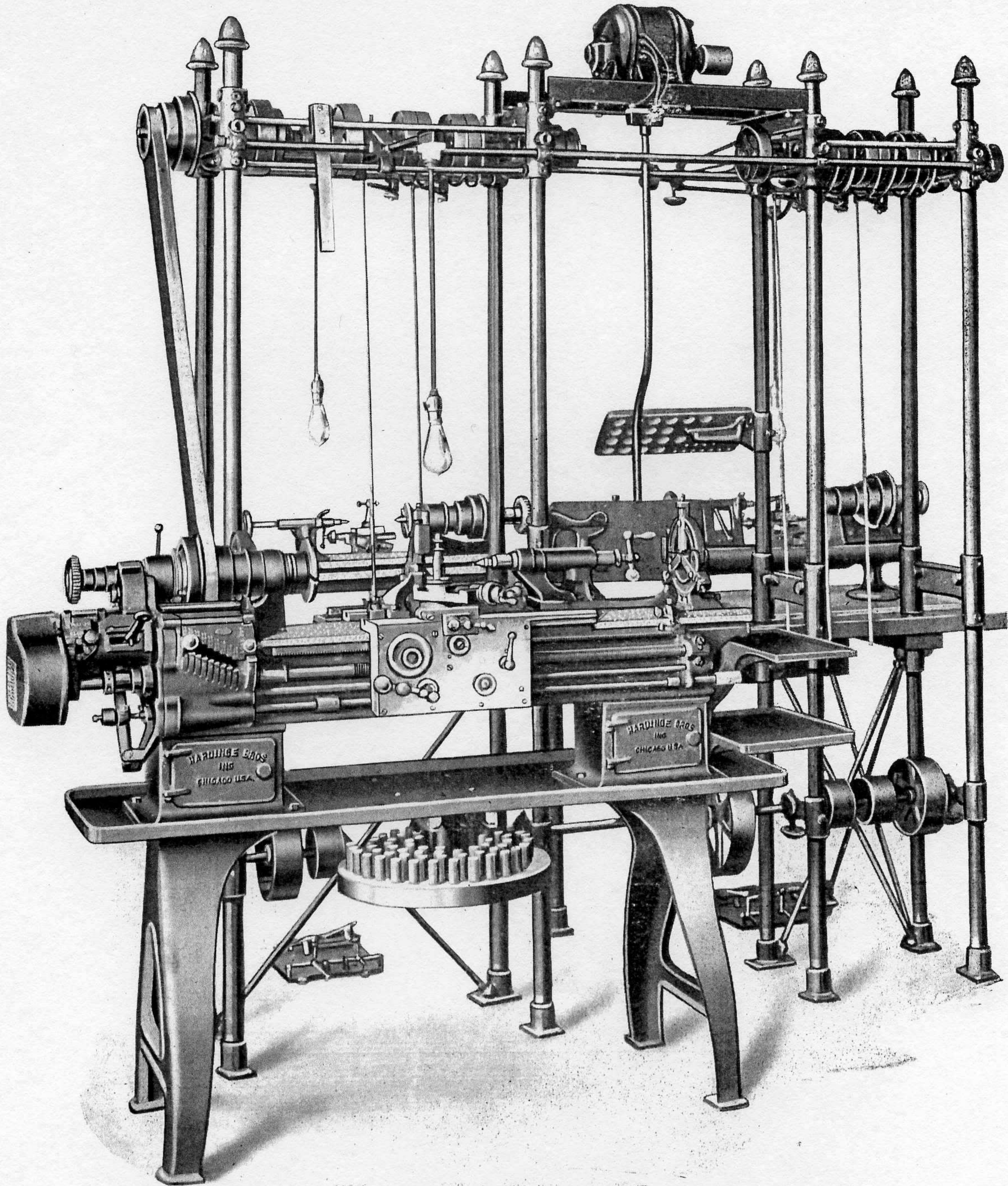


ILLUSTRATION No. 7

SHOWING R-2 STANDARD BENCH AND QUICK-CHANGE-SWING PRECISION LATHE
COMBINATION GROUP DRIVE

GENERAL DIMENSIONS OF Cataract Quick-Change-Swing Precision Lathe

<p>Length of bed, 52".</p> <p>Total length of lathe, 65".</p> <p>Distance between centers, 28".</p> <p>Swing, 9" and 15", or more if desired.</p> <p>Swing over carriage 5½" by 1⅛".</p> <p>Size of tool ordinarily used ⅜" by ⅞" (Armstrong No. 0-S).</p> <p>Diameter of lead screw, 1" by 6-Pitch by 39" long all over.</p> <p>Cone diameters, 3¼", 4¾" and 6" for 1¼" belt.</p> <p>Diameter of tailstock spindle, 1", taper Morse No. 2.</p> <p>Front spindle bearing, 2½", rear spindle bearing, 1⅞" diameter.</p> <p>Length of spindle, 15", hardened and ground, threaded nose.</p> <p>Hole through spindle, 1¼".</p>	<p>Draw-in chuck capacity 1" (interchanging with Cat. No. 5 Bench Lathe).</p> <p>Net weight of lathe, Figure 200 (9" swing), with 2-speed friction counter, 4½" Back Rest, 9" Face Plate, Follow Rest and Chuck, 850 pounds.</p> <p>For Figure 200 (15" swing lathe) add for raising blocks, Gear Bracket "B" and 14½" face plate, 75 pounds.</p> <p>Floor space, 24" by 65".</p> <p>Cubic feet, 48.</p> <p>Gross weight, boxed for export, 1,200 pounds.</p> <p>Countershaft, fast speed 500 revolutions.</p> <p>Countershaft, slow speed 125 revolutions.</p> <p>Diameter of countershaft pulleys, 7" by 1¾".</p>
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EQUIPMENT REGULARLY FURNISHED WITH Quick-Change-Swing Precision Lathe

Figure 200, Page 5

<p>One 2-Speed Friction Countershaft.</p> <p>One 9" Face Plate.</p> <p>One 4½" Center Rest.</p> <p>One Follow Rest.</p> <p>One 1" Draw-In Chuck.</p> <p>One Driving Plate and Centers.</p>	<p>One Set of 5 wrenches</p> <p>One Taper Turning Attachment.</p> <p>One Set of Gears with the following number of teeth: 32, 36, 40, 44, 46, 48 52, 54, 56, 60, 80, 84, 88, 100, 110. (20-tooth double width pinion for stud.)</p>
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Memorandum