

CATARACT

QUICK CHANGE SWING

PRECISION LATHE



MANUFACTURED BY

HARDINGE BROTHERS, INC.

1770 Berteau Avenue

Ravenswood

CHICAGO

U. S. A.

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INTRODUCTION

THIS lathe is the net result of thirty-three years of practical experience, coupled with twelve 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-four 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 fixtures and chucks and is prepared to supply all tools usually required in manufacturing precision machinery.

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.

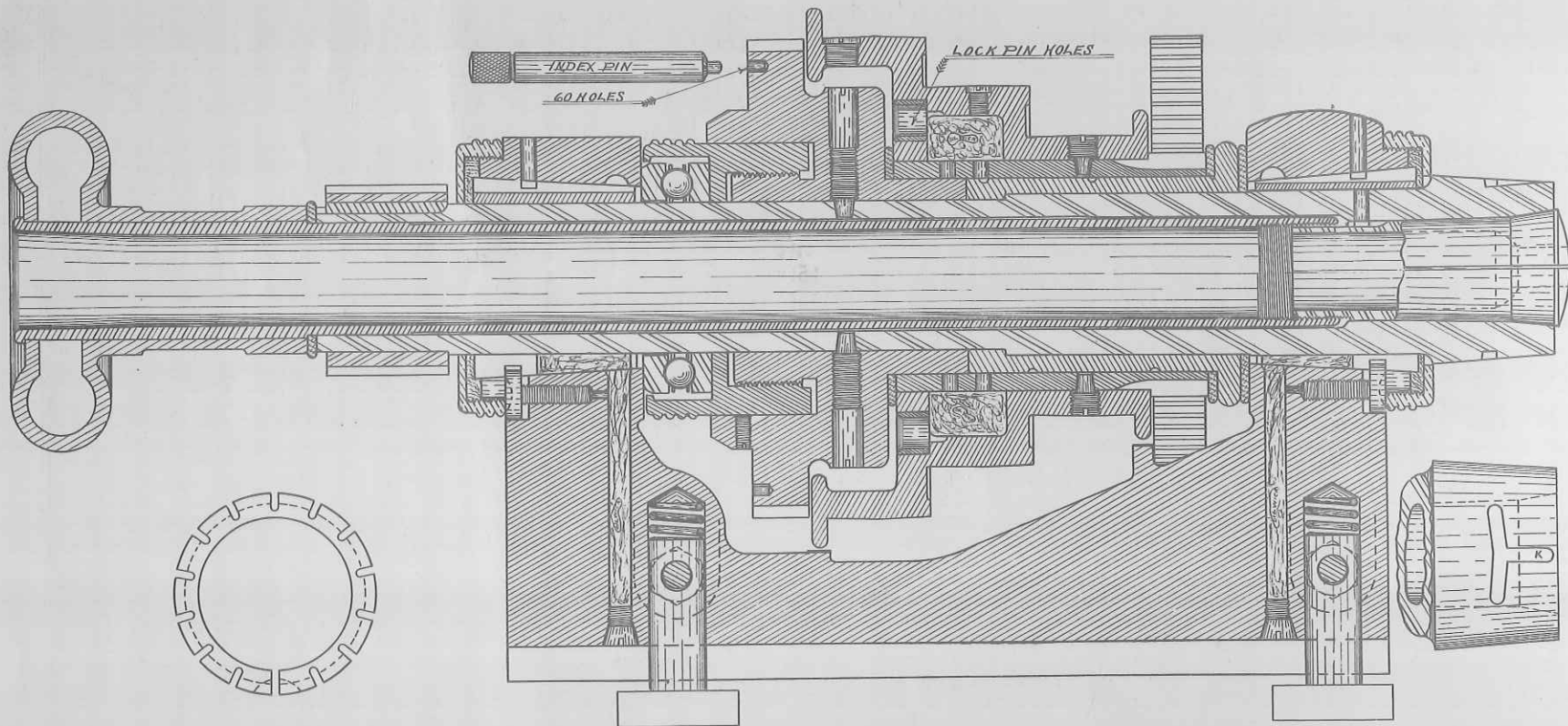


FIG. No. 7—SECTIONAL VIEW OF CATARACT No. 5 BACK-GEARED
PRECISION LATHE HEAD.

HEAD—The back-geared Precision Lathe Head is 12 in. long and is constructed with adjustable journals, the same in design as our Bench Lathes, the front one being 2 in. long by $2\frac{1}{2}$ in. in diameter, while the rear journal is 2 in. long by $1\frac{7}{8}$ in. in diameter. These journals have given universal satisfaction. There are now in use over two thousand of them, covering a period of over ten years and we have replaced but two journals, one of which was accidentally broken. The oil coming from these journals is clear, demonstrating that there is practically no wear. This result is due to correct design, proper selection of material and close workmanship. These features preserve perfect alignment of heads and give to the user the greatest amount of service and satisfaction.

The bases of both head and tail-stock are planed to interchange with standard Cataract Bench Lathe Beds, the draw bolts and tee slots are much stronger than those used with Bench Lathes. The head and tail stocks are aligned with the same special boring machine as the Bench Lathe heads and Tail stocks. The spindle end-shake is taken up between the housings by means of a Patent End-Shake Take-up Nut, thus making it practical to use the Ball Bearing Thrust, which feature has been so successful with 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. We also use the same oiling and dust cap protection which have proven so satisfactory with our Bench Lathes. The cone pulley diameters are $3\frac{1}{2}$ in., $4\frac{3}{4}$ in. and 6 in., for $1\frac{1}{4}$ in. belt. Our No. 3 Bench Lathe Heads safely stand a spindle speed of 5000 R. P. M., the No. 4, 3000, and the No. 5 and this Precision lathe, 1500.

MULTIPLE THREADS—A 60 hole index is drilled on rear face of spindle driving gear intended for spacing spindle when cutting double, triple and quadruple threads. To index the spindle independent of change gears, revolve spindle in forward direction until "0" on gear index comes opposite index pin; raise handle "E" (Fig. No. 1) thereby disconnecting gears. The spindle may then be revolved in forward direction to the desired division of index.

SPINDLE—The spindle is hardened and ground, is $15\frac{1}{2}$ in. long and has a $1\frac{1}{4}$ in. hole clear through. It is designed with our Patent spindle nose, such as has been used most successfully with all our Bench Lathes, but is provided with a safety locking device for three-jawed chucks and face plates so they cannot come off while the spindle is in motion, should they be improperly put on. From the universal satisfaction given by the Bench Lathes we concluded that this would be the best form of spindle nose to adopt, because it is hard and not liable to injury and is a practical, interchangeable, true lathe spindle nose.

DRAW-BACK CHUCK—The draw-back chuck is our Standard Cataract No. 5. This chuck has a 1 in. capacity clear through and will interchange with the No. 5, 7 in. or 9 in. Swing Bench Lathes.

TAIL STOCK—The Tail Stock has a bearing surface on the bed 7 in. long. It has two inner and two outer 30-degree angular guiding surfaces, making 2 in. of wearing surface; also two flat surfaces $\frac{5}{8}$ in. wide, making a total wearing surface of $3\frac{1}{4}$ in. by 7 in. long.

BED—The Bed is 52 in. long, $8\frac{3}{4}$ in. wide by $7\frac{1}{2}$ in. deep and is well-braced, the weight of the casting being 230 pounds. It has one large 45 degree way in front and one flat way in the rear for 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. The change is necessary because the Tee slot is much heavier than 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, and also admits bracket "A" for extra fine feeds and the 15-in. swing bracket and the Relieving Attachment bracket for the driving cone pulley. The bed and legs have a three-point bearing which prevents the bed from warping when set upon an uneven floor.

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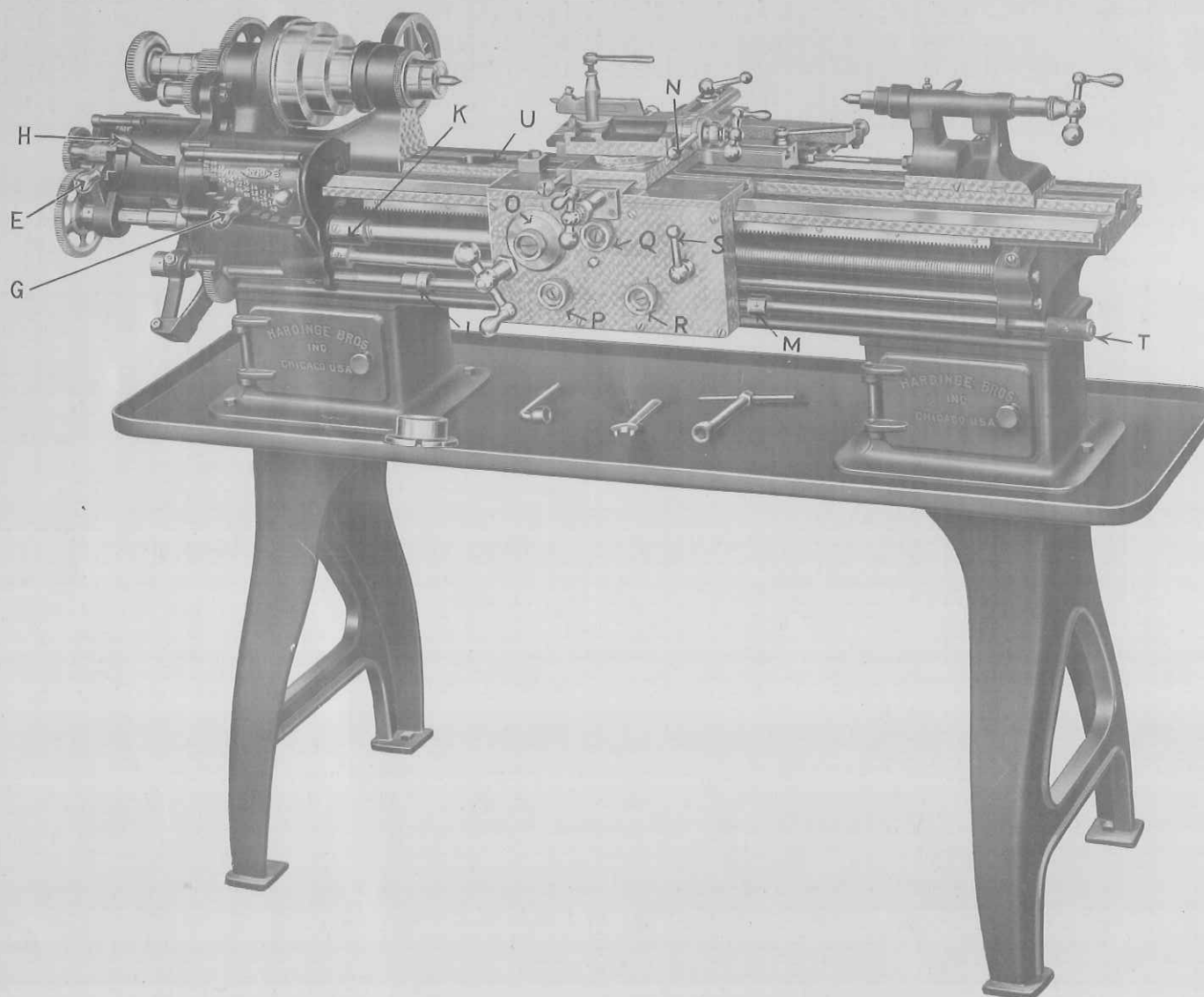


FIG. No. 1.—CATARACT QUICK-CHANGE-SWING PRECISION LATHE

CARRIAGE AND APRON—The Carriage is $13\frac{1}{2}$ in. long and 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 and oiled. This method makes the wick easy to replace, it can never be lost and is out of sight. There is a gib with a $3\frac{1}{4}$ -in. by $\frac{1}{2}$ -in. wearing surface directly over the carriage feed pinion at the front end of the 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 way; thus the carriage cannot be lifted from the bed. The feed pinion and the 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 "T" and "S" and stop collars "L" and "M" (Fig. No. 1). 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 vernier reading to .005, which magnifies the longitudinal travel of the tool four times. This makes the recessing of holes or internal work convenient to read (see letter "O," Fig. No. 1).

The apron mechanism is entirely encased, having all important bearings double, and the means for oiling are carefully provided for. In all places both in apron and gear boxes, where wear on shaft is greatest, there are hardened bushings, running loosely; 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 in. by $4\frac{1}{2}$ in. wide, fitted all over. The cross slide nut is phosphor bronze and is $2\frac{1}{2}$ in. long. The long slide will keep true and is in proper proportion for 15-in. swing.

COMPOUND SLIDE—The Compound Slide is equipped with a quick-acting graduated nut, requiring one-half revolution of handle "N" to move the slide $\frac{5}{32}$ -in. to a solid stop in either direction. This will be found exceedingly convenient in cutting external or internal threads, or in turning operations. It does not interfere with the regular uses of compound slide screw which, on this machine, is supplied with adjustable indexes graduated in thousandths of an inch. This device with the automatic stops "L" and "M" and reversing lever "H" (Fig. No. 1) makes thread cutting a pleasure instead of a disagreeable task.

LEAD SCREW—The Lead Screw is 6 pitch, 1 in. in diameter, 39 in. long, without a spline and is constantly translated to 10 pitch through the gears in the reversing gear box.

This screw is connected to change gear shaft of Fig. "K," (Fig. No. 1); consequently, it may be readily detached without interfering with the change gear mechanism.

This feature will be found very convenient in replacing worn lead screws or inserting a screw of special accuracy.

This feature also allows for the proper cleaning of lead screw nut, for, without being able to remove the lead screw, the nut cannot be properly cleaned.

The change gears, also the lead screw, revolve on roller bearings. The lead screw nut is $3\frac{3}{4}$ in. in length.

Handle "H" (Fig. No. 1) reverses the screw, eliminating the necessity of reversing spindle for return of carriage.

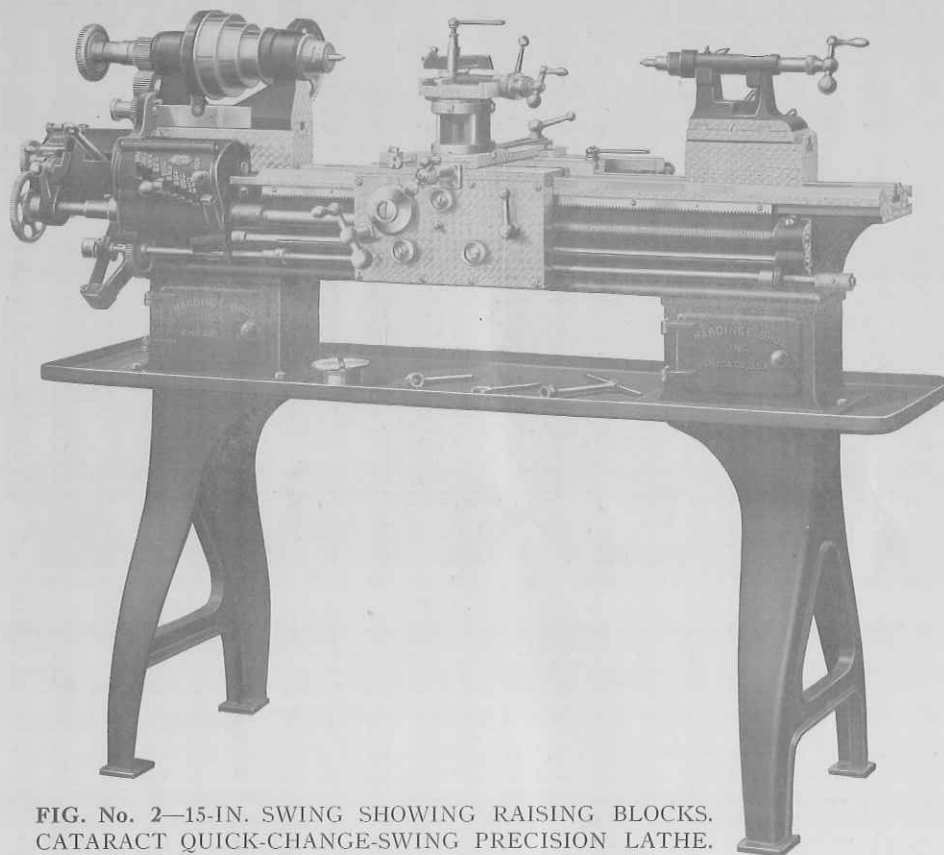


FIG. No. 2—15-IN. SWING SHOWING RAISING BLOCKS.
CATARACT QUICK-CHANGE-SWING PRECISION LATHE.

BRACKET "B"—Bracket "B" which is attached to Bracket "A" (Fig. No. 4) is for connecting spindle gear with change gear mechanism when head is raised to 15-in. swing.

BRACKET "C"—Bracket "C" (Fig. No. 4), which is also attached to Bracket "A," carries intermediate gears for connecting 2 or 3 to 1 reduction feed gear, though gear "F" (Fig. No. 4), must be disengaged. Regular feed of carriage is 200, and cross feed 240 per inch, when using the slowest feed through the change gear box.

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 can be changed from 9 in. to 15 in. without interfering with the arrangement of gears, by simply adding Bracket "B" (Fig. No. 4) containing two connecting gears, then everything is in readiness for feeds and thread cutting. In removing head, when changing from 9-in. to 15 in. swing, the head and raising block binding bolts pass through two oblong slots "U" (Fig. No. 3, page 8), so it is a simple matter to put on and take off the head without interfering with either the end gearing or the carriage.

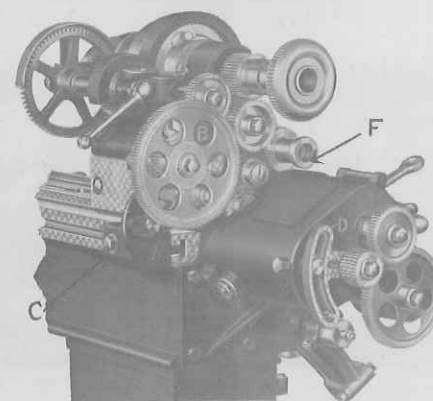


FIG. No. 4—SHOWING BRACKET "B."

CHANGE GEAR BOX—The Change Gear Box consists of a nest of nine gears, 48 to 80, and through the manipulation of levers "H" and "G," (Fig. No. 5 and No. 1) twenty-seven changes in pitch are possible. Other pitches are cut through different combinations of gears on stud "J" and screw "I" with lever "G" in lock-out position (Fig. No. 5), or when necessary through compounding on bracket "D," (Fig. No. 4). All gears of 80 teeth and under are made of steel, both in gear box and apron.

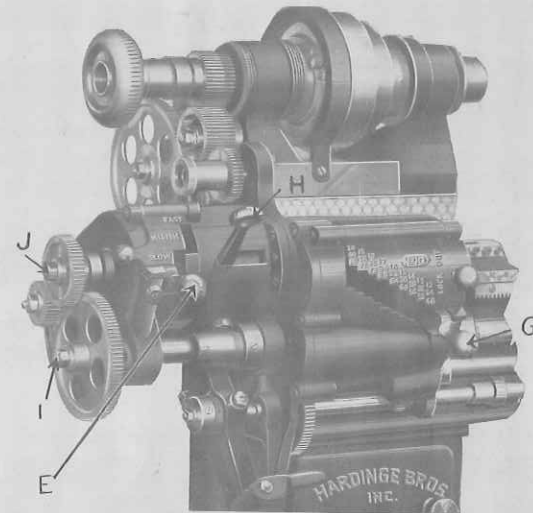


FIG. No. 5—CHANGE GEAR BOX.

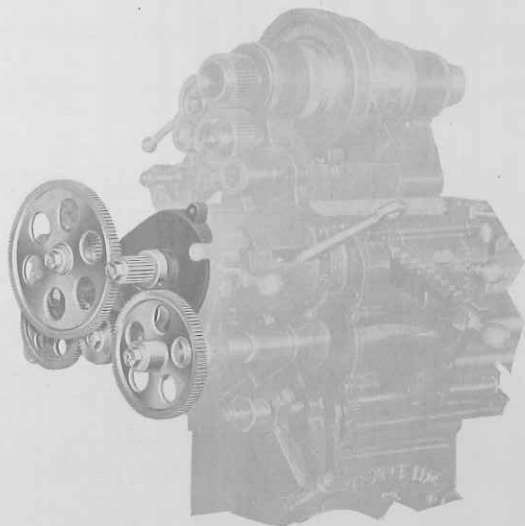


FIG. No. 6—METRIC BRACKET.

METRIC BRACKET—The Metric Bracket as shown in Fig. No. 6 is set for 10/100 M. M. pitch with handle "E" in "Slow," and handle "G" in lock-out position (Fig. No. 5). When handle "E" (Fig. No. 5) is set in "Medium" position the thread will be 20/100 M. M., and when set in "Fast" 40/100 M. M. will result. Thus it will be seen that each tooth in the stud "J" represents 1/100 M. M. when handle "E" is in "Medium" feed and when 100 tooth gear is on screw "I."

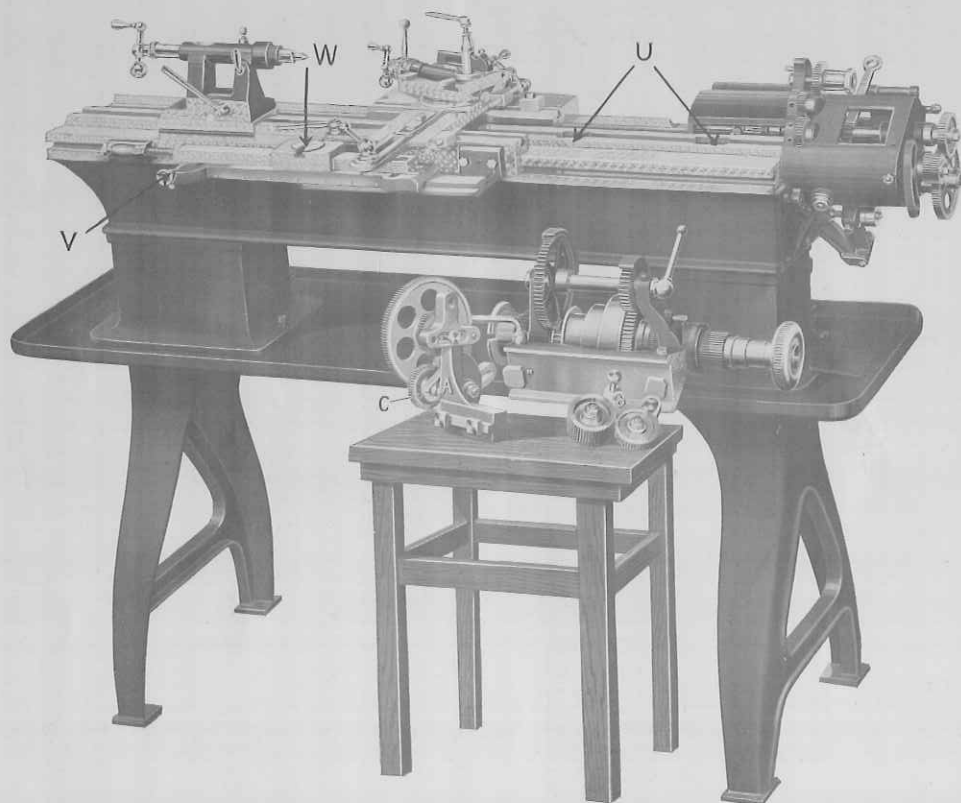


FIG. No. 3.

COUNTERSHAFT—The Countershaft is a 2-speed clutch pulley type. The pulleys are 7 in. in diameter by $1\frac{3}{4}$ in. face.
 Fast Countershaft speed 450 R. P. M.
 Slow Countershaft speed 125 R. P. M.

TAPER TURNING ATTACHMENT—The Taper Turning Attachment, which is attached to the carriage, is designed to be detached readily (see Slot "W," Fig. No. 3), and allows removal of cross slide for inserting raising block bolt for compound rest. The attachment may be used on work up to 15 in. in length, and adjusted in inches per foot also to ten degrees, by a fine pitch screw "V" (Fig. No. 3).

RELIEVING ATTACHMENT—The Relieving Attachment is applied by using a large gear upon the Patent Spindle Nose, which drives left or right, using the spindle as an arbor and is driven by a pinion through a set of change gears and an extra cone pulley back of lathe head, supported by a bracket held on the lathe bed by the tee slot in the rear. This pinion operates the cam, which works the cross slide to any desired division of the large gear. The cam is supported by the main bracket of the taper turning attachment and fastened to the cross slide by the same bolt as the top slide of the taper turning attachment; thus it is easily applied and is suitable for relieving cutters or taps.

ILLUSTRATION:

(Quick Change Gear Table)

Fast	20, 19, 18, 17, 16, 15, 14, 13, 12
Fast	20, 19, 18, 17, 16, 15, 14, 13, 12
Medium	40, 38, 36, 34, 32, 30, 28, 26, 24
Slow	80, 76, 72, 68, 64, 60, 56, 52, 48 gears on screw

Standard gears outside of quick change nest;
 32, 36, 40, 44, 46, 48, 52, 54, 56, 60, 80, 84, 88,
 100, 110 (20-tooth double width pinion for
 stud).

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

4, $4\frac{1}{2}$, 5, $5\frac{1}{2}$, 6, $6\frac{1}{2}$, 7, $7\frac{1}{2}$, 8, 9, 10, 11, $11\frac{1}{2}$,
 12, 13, $13\frac{1}{2}$, 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.

ILLUSTRATION:

Using a 20-tooth gear on stud "J" and 32 on screw "I" (Fig. 5), 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."

Price of extra gears, \$1.00 for 32-tooth gear and 2 cents for each additional tooth above 32.

We are prepared to furnish this machine with the No. 4 or No. 5 plain heads having a 3-step cone pulley for a 2-in. belt. These heads can be furnished at a lower cost than the back-geared head and are suitable for certain classes of duplicate operations where the back-geared head is not required.

We also make a No. 4, 9-in. back-geared head which interchanges with our Bench Lathes or this machine.

GENERAL DIMENSIONS
of
"CATARACT" QUICK-CHANGE-SWING
PRECISION LATHE.

Length of bed 52 in.

Total length of lathe 65 in.

Distance between centers 28 in.

Swing 9 in. and 15 in. or more if desired.

Swing over carriage $5\frac{1}{2}$ in. and $11\frac{1}{2}$ in.

Opening in tool post 7-16 in. x $1\frac{1}{8}$ in.

Size of tool ordinarily used $\frac{3}{8}$ in. x $\frac{7}{8}$ in. (Armstrong No. O-S).

Diameter of lead screw 1 in. x 6 pitch x 39 in. long all over.

Cone diameters, $3\frac{1}{4}$ in., $4\frac{3}{4}$ in. and 6 in. for $1\frac{1}{4}$ in. belt.

Diameter of tail stock spindle 1 in., taper same as Cataract Lathes.

Front spindle bearing 2 1-32 in., rear spindle bearing $1\frac{7}{8}$ in. diameter.

Length of spindle 15 in. hardened and ground.

Hole through spindle $1\frac{1}{4}$ in.

Draw-in chuck capacity 1 in. (interchanging with Cat. No. 5 bench Lathe).

Net weight of lathe, photo No. 1 (9 in.), with 2-speed friction counter, $4\frac{1}{2}$ in. Back Rest, 9 in. Face Plate, Follow Rest and Chuck, 850 pounds.

For Photo No. 2 (15-in. lathe) add for raising blocks, Gear Bracket "B" and $14\frac{1}{2}$ in. Face Plate, 75 pounds.

Floor space 24 in. x 65 in.

Cubic feet 48.

Gross weight boxed for export 1200 pounds.

Countershaft, fast speed 500 revolutions.

Countershaft slow speed 125 revolutions.

Diameter of counter pulleys 7 in. by $1\frac{3}{4}$ in.