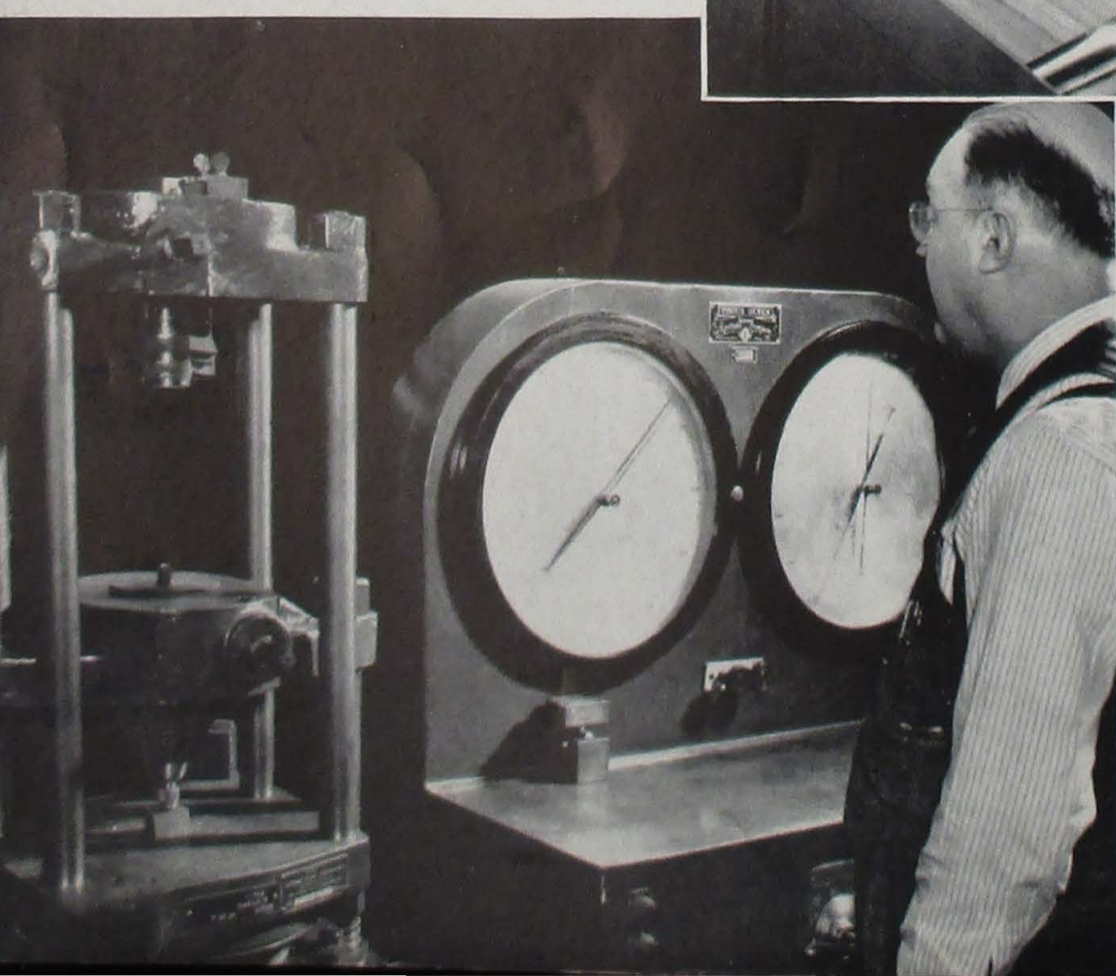
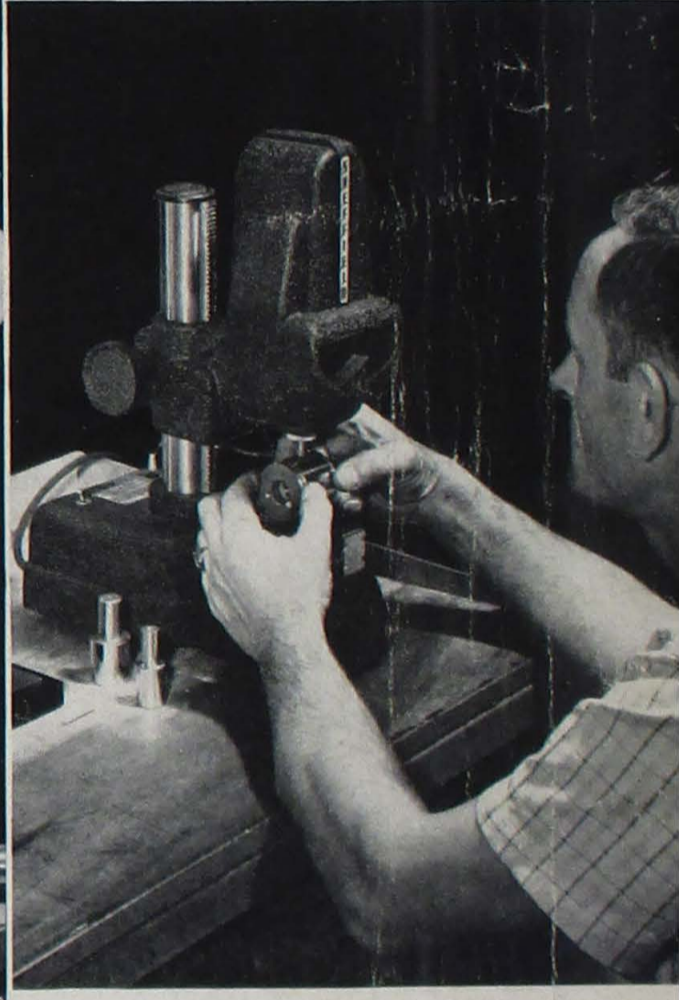
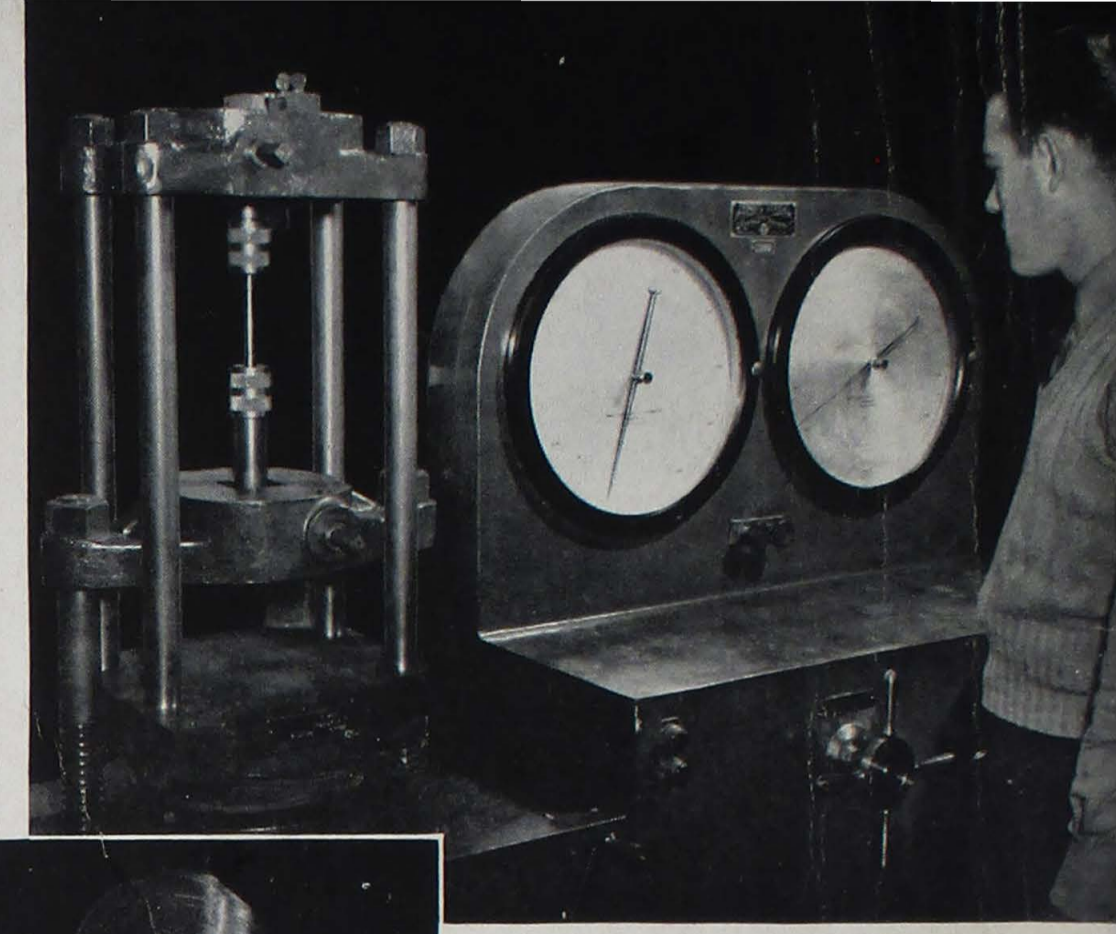


Monarch

**ENGINE AND
TOOLMAKERS
LATHES**

Series 60





Quality Control

MEANS BETTER MONARCH LATHES FOR YOU

The name Monarch has always stood for the finest in metal turning equipment.

Just look at any Series 60 Engine or Toolmaker's Lathe. Many of its superior features are immediately evident. But quality is not always tangible. Often it is the total of the intangibles that marks the difference between the ordinary and the outstanding.

So it is with Monarch Series 60 lathes. You can see the outstanding features of design which are pictured and described in the pages of this booklet. What you cannot see is the testing, checking and rechecking which is constantly taking place in every phase of our manufacturing operations.

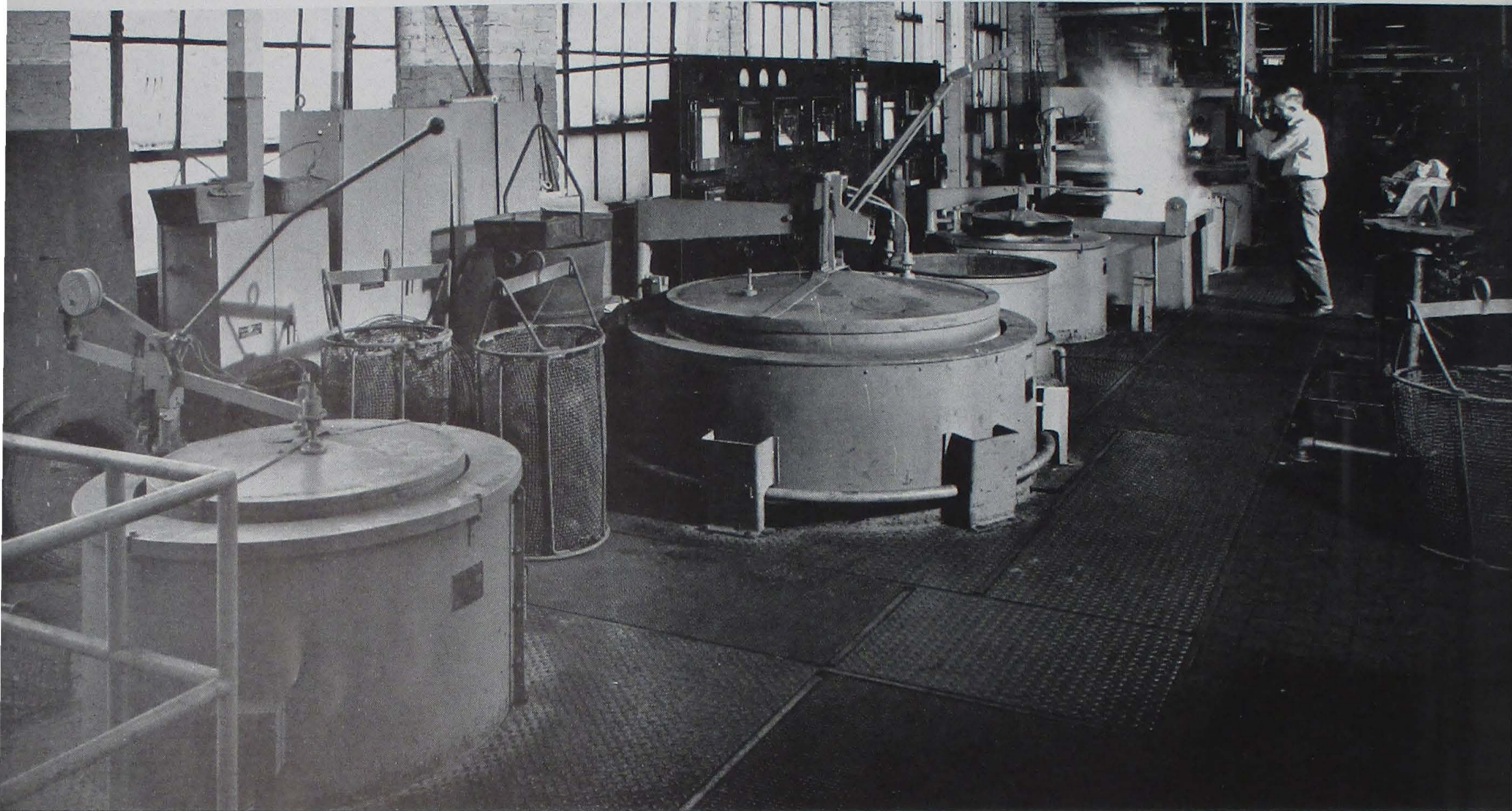
The illustrations on these two pages indicate the scope of these numerous quality controls. They are your guarantee of that *extra* performance which assures peak production at a profit to every Monarch user.

For a good turn FASTER—turn to Monarch



THE MONARCH MACHINE TOOL CO., SIDNEY, OHIO

Monarch . . . THE HARDENED STEEL STRUCTURE LATHE



The mere act of building accuracy and productivity into a lathe is not sufficient in itself. You, the user, judge the machine on the basis of its year in and year out performance in your plant. That is the test as to whether you have made a good investment.

Years ago Monarch set the pace in the lathe field by first introducing the hardened steel structure lathe. All parts subject to wear are hardened in our own electric heat treating department where we have absolute control of all factors involved. The latest type of electric heat treating furnaces are used. Decarburization is prevented; distortion held to a minimum.

Induction Hardening Does it *Better*

High frequency induction hardening, also employed, permits the addition of wear resistance to certain parts which it is not practical to harden in any other manner.

For example, the process makes possible the selective hardening of sections subject to wear, when a low over-all hardness is required. An interesting example of this modern method, as practiced at Monarch, is the progressive induction hardening of the cross-feed screw illustrated to the left.

The ultimate in performance is built into every Monarch lathe. Skillfully applied hardening processes keep it there for continuing peak production at a profit.



Flame Hardened AND GROUND BED WAYS FOR YEARS OF TROUBLE-FREE SERVICE

The fact that Monarch lathes remain "Factory Fresh" after years of severe service is due in no small part to their flame hardened and ground bed ways.

Bed castings are made from a strong, dense, wear-resistant nickel alloy cast iron. Then the way surfaces are flame hardened to a uniform depth of at least $\frac{1}{8}$ " by means of the exclusive Monarch process. Tested for hardness, they show a Scleroscope reading of 70 to 72 Shore.

After flame hardening, the way surfaces are ground to a tolerance of .0005" in their over-all length on precision surface grinders. It is important to note that both bed ways for the carriage and the tailstock are so treated.

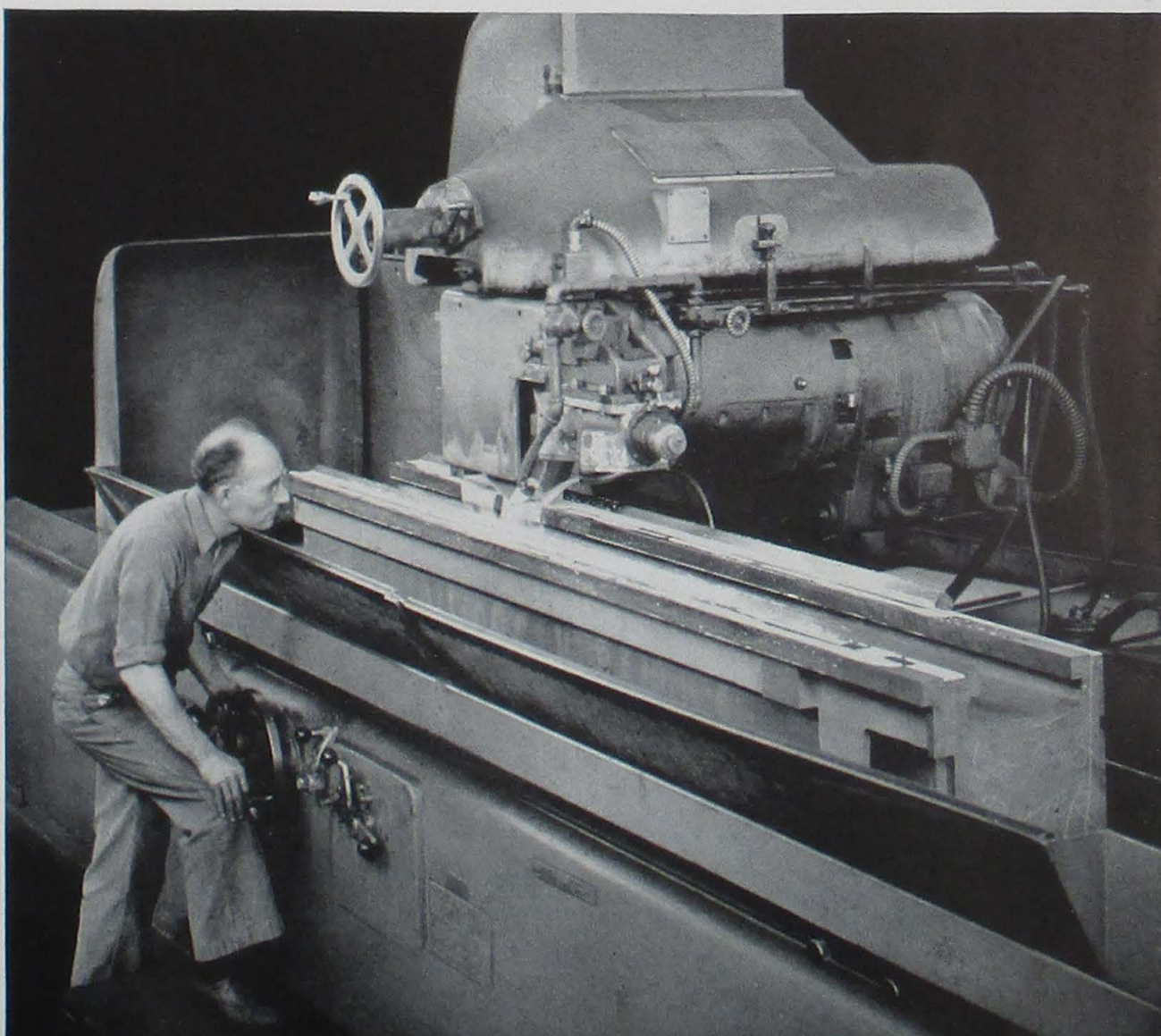
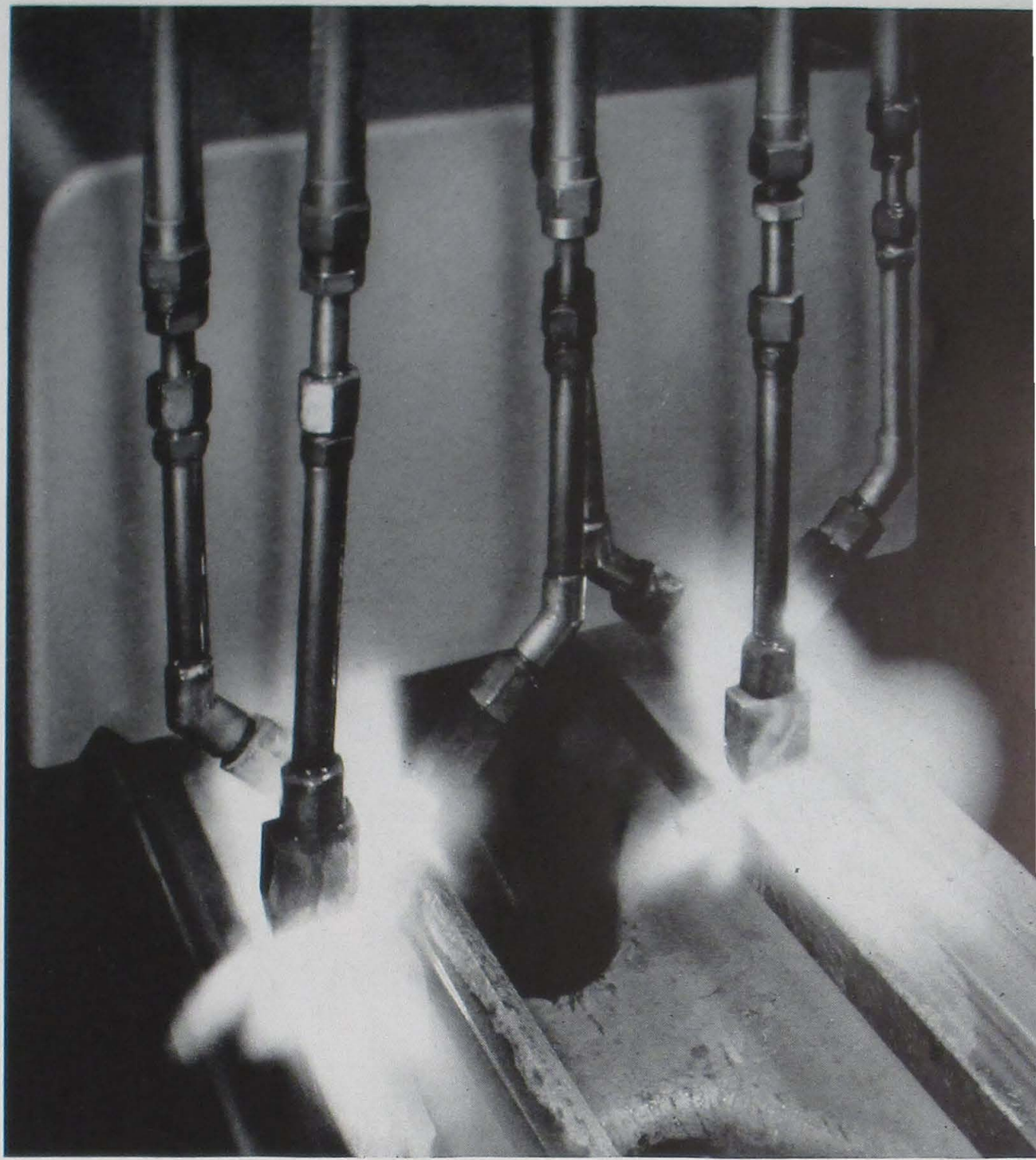
Flame hardened, cast iron alloy ways have many desirable characteristics. There is a gradual blending of the Martensitic structure, flame hardened layer into the tough underbody of the fine Pearlitic iron. The way sections have unique wear-resisting qualities while at the same time they are permanently an integral part of the bed casting. Extensive experiments conducted by us years ago showed the Monarch flame hardening method to be far superior to the use of hardened strips which frequently loosen, thereby causing uneven wear and requiring eventual replacement.

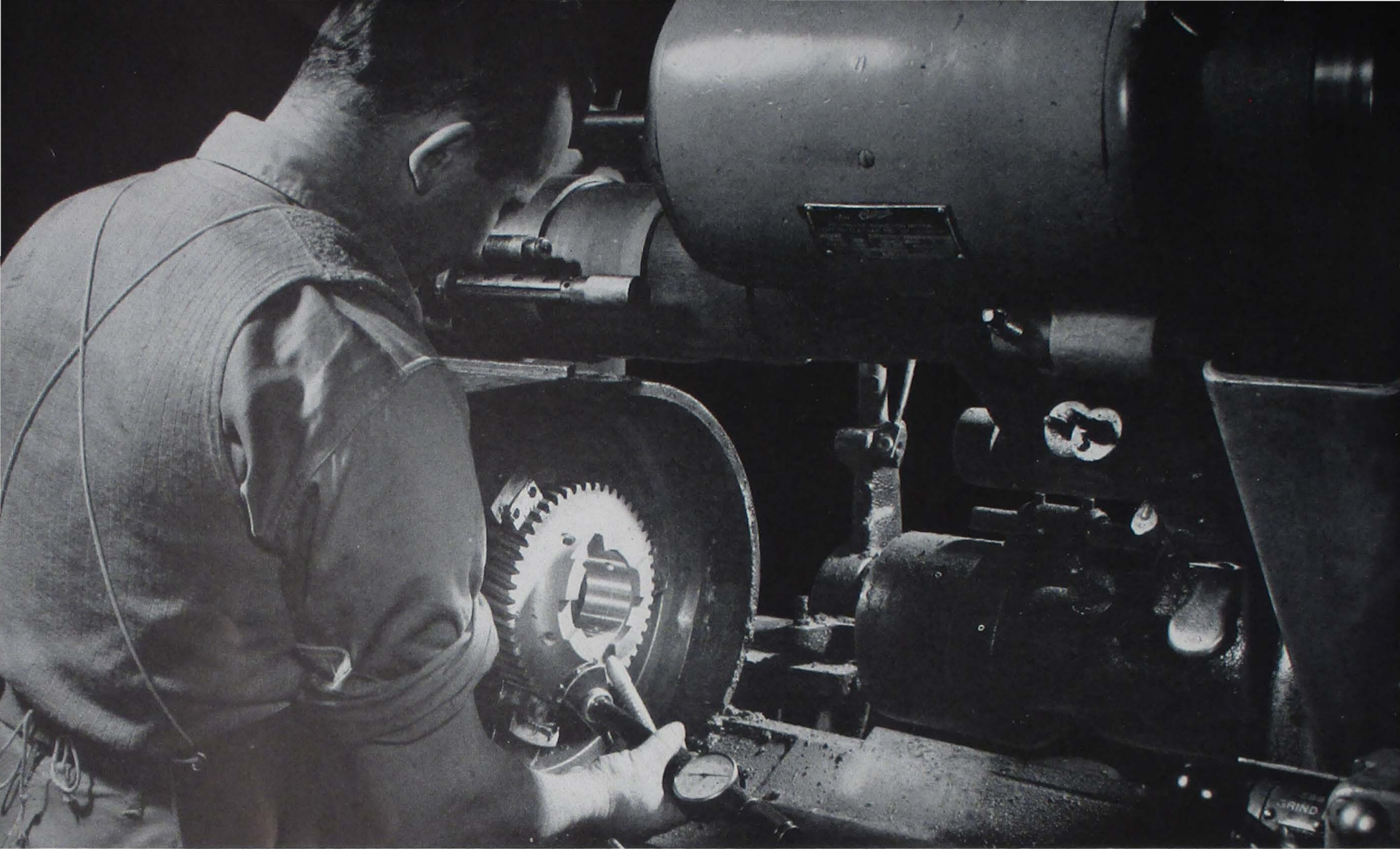
Monarch flame hardened bed ways have the hardness of hardened steel. The graphitic carbon normally found in Pearlitic iron is retained. This provides a multitude of microscopic reservoirs for retention of lubricant on the ground way surfaces. As a consequence the film adheres longer and more tenaciously than possible on a hardened steel surface. The Monarch method of automatic lubrication supplied from the underside of the carriage, whether it is being moved by power or manually, guarantees a more than adequate film under all operating conditions.

Flame hardening has been applied to over 25,000 Monarch lathes. Their users are profiting from a maintenance of original bed way accuracy not ordinarily associated with machine tools of any kind.



Above. Unretouched illustration of an etched "V" and flat way bed cross section after flame hardening. All Monarch sales offices have actual sections available for your examination.

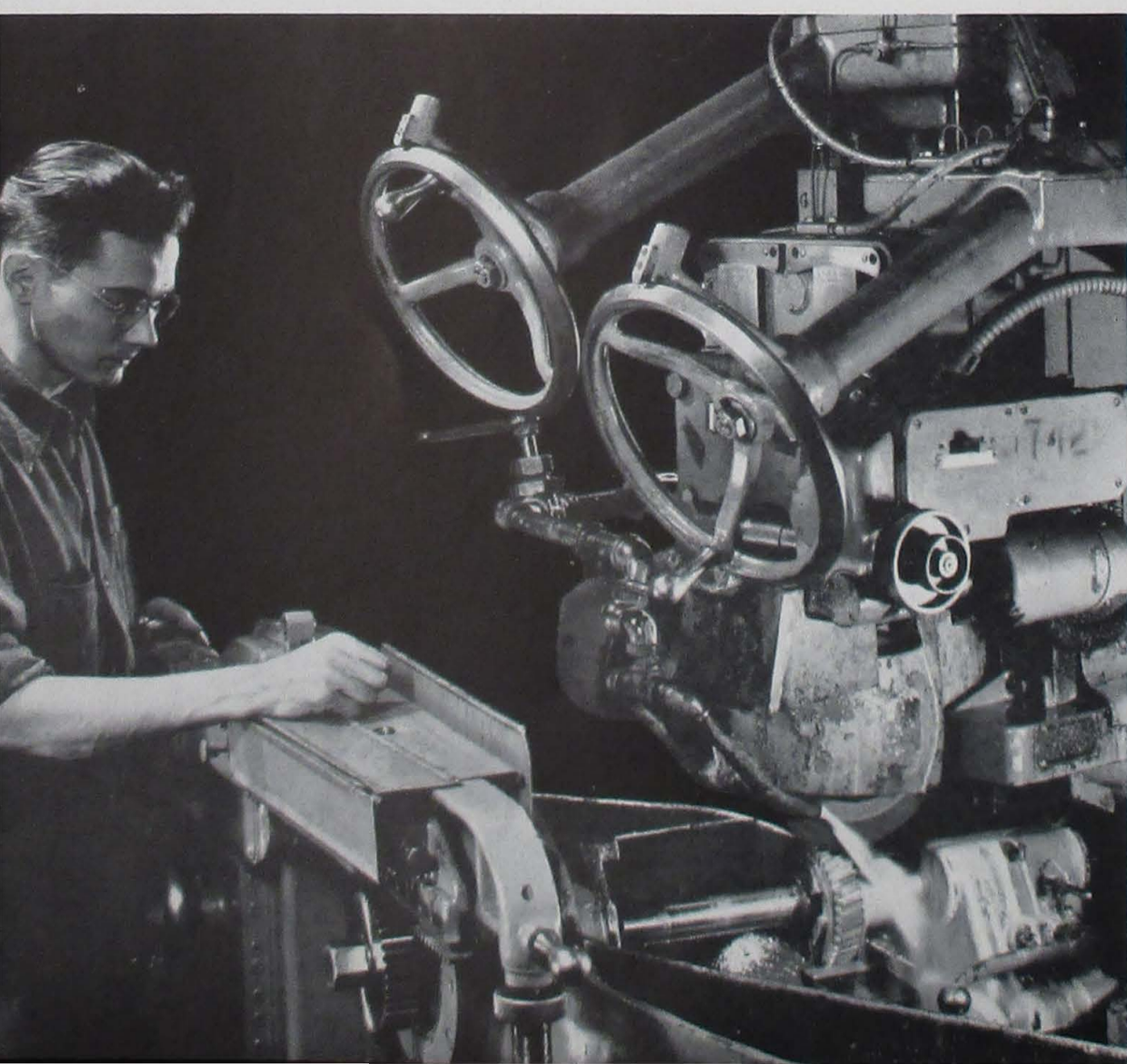




Above. Grinding the bore of a helical headstock gear within a tolerance limit of .0008".

Precision Made Gears

ASSURE SMOOTHNESS, LONGER LIFE AND BETTER WORK



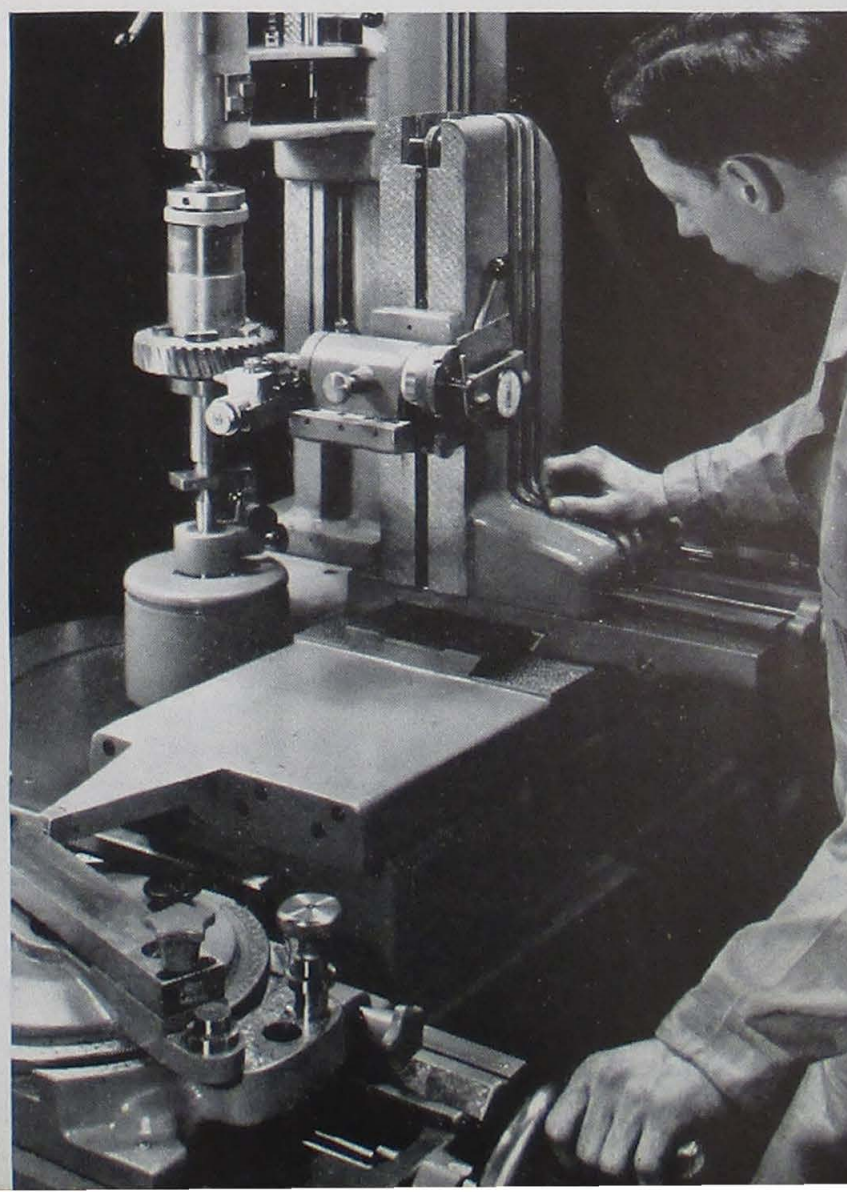
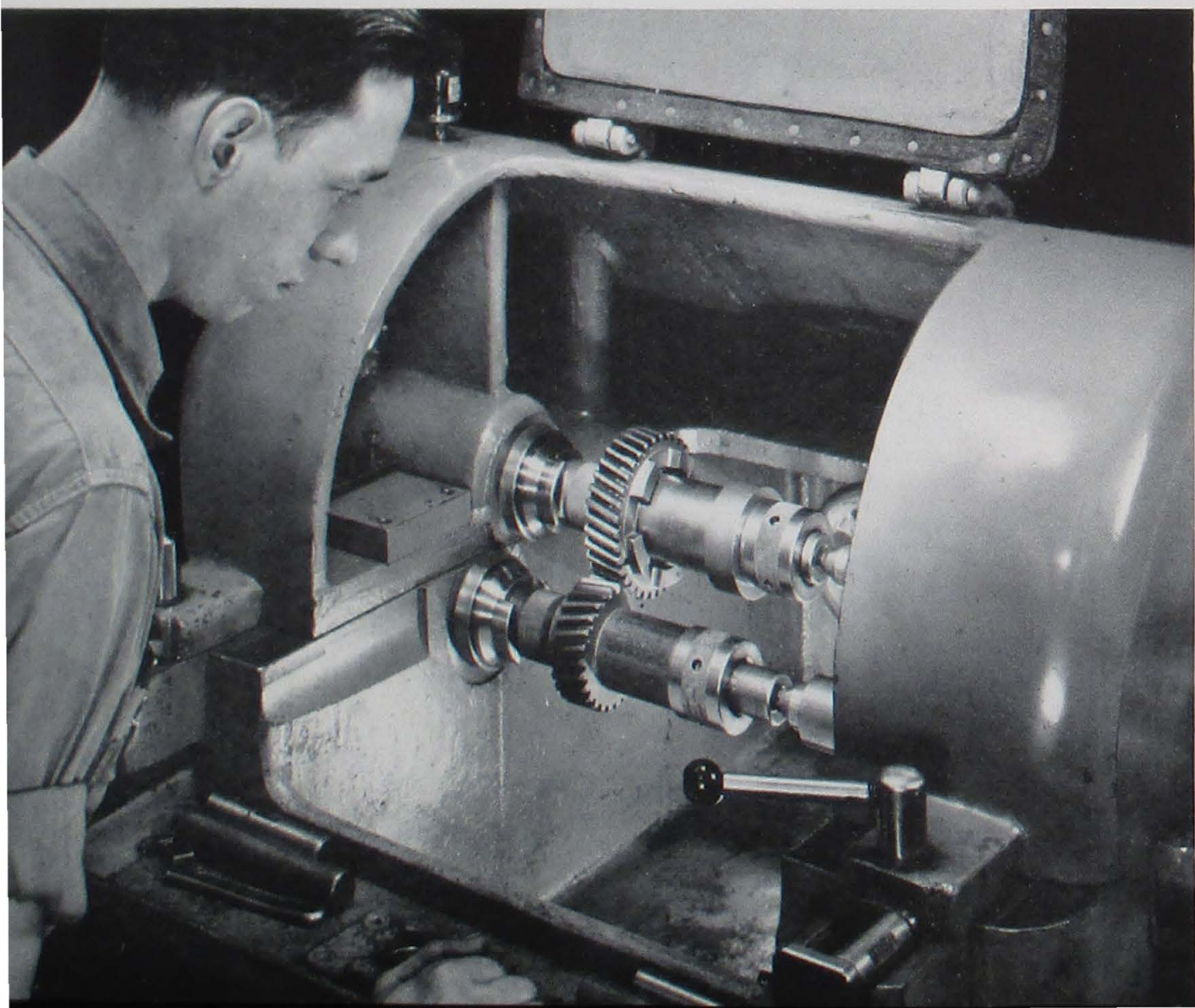
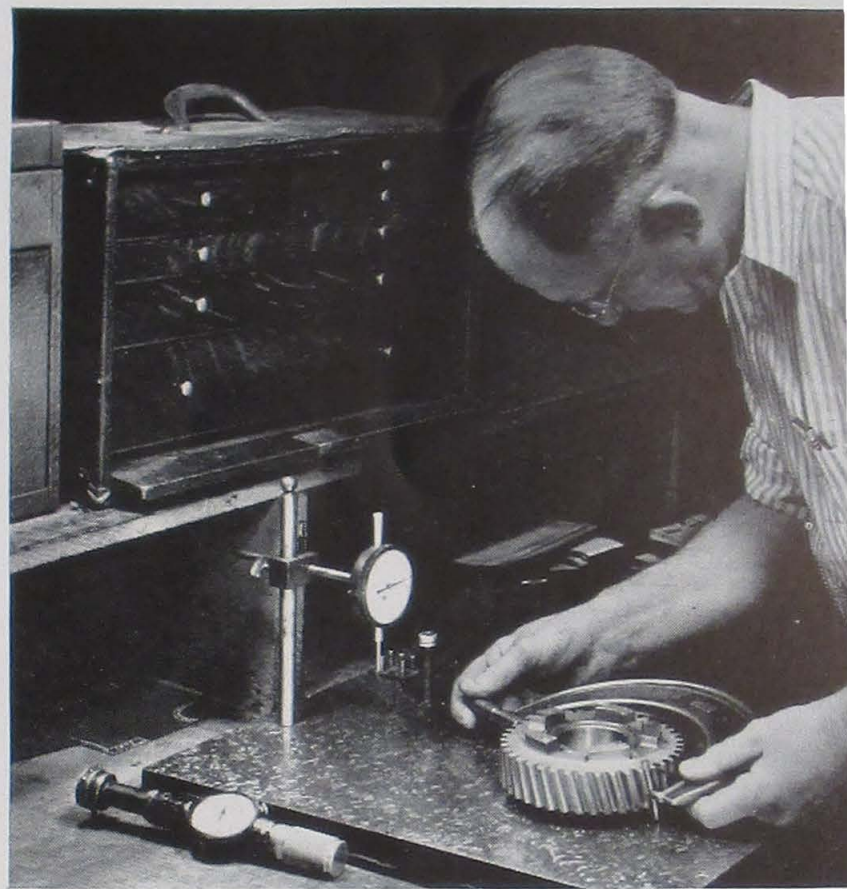
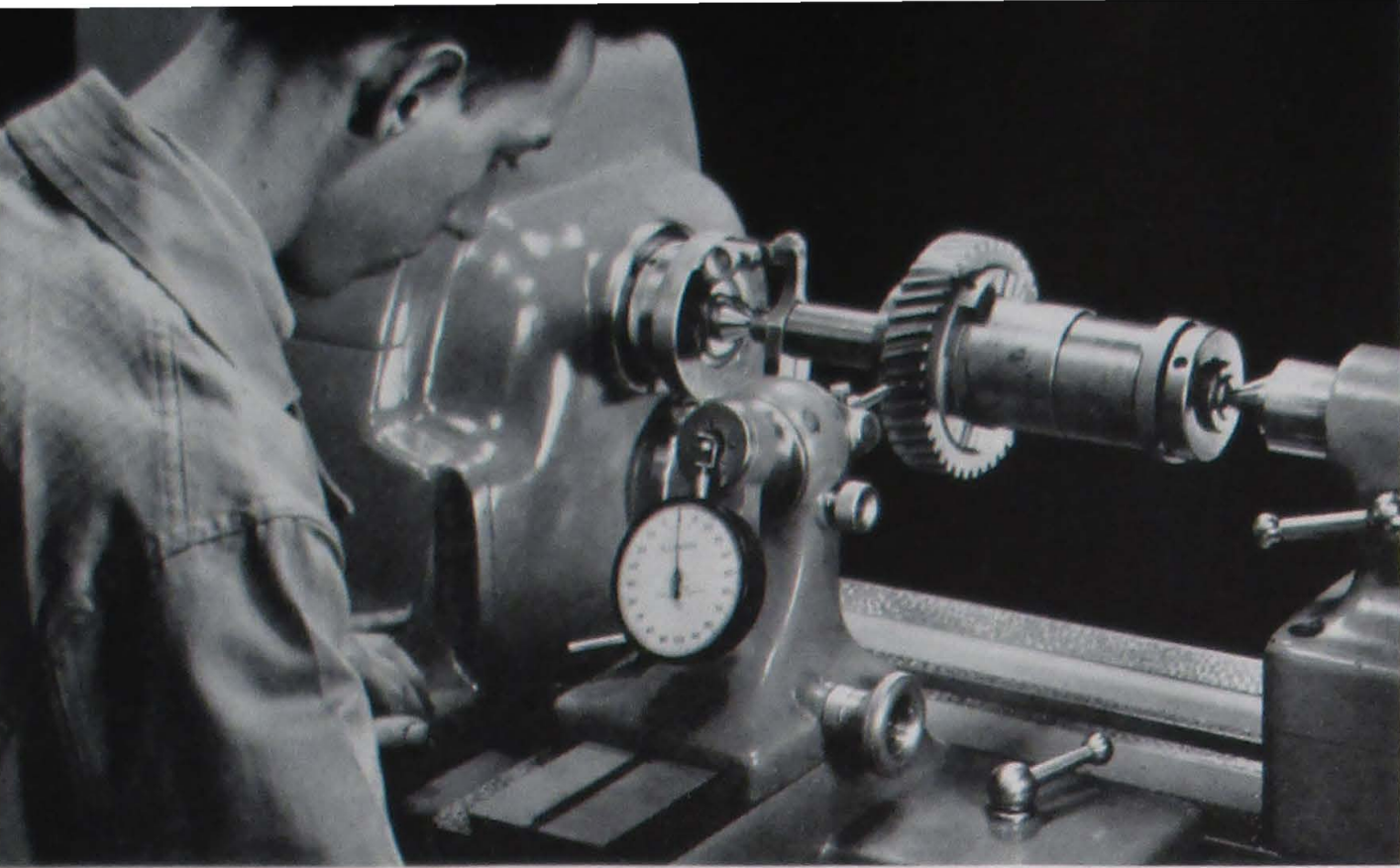
The deep rooted reputation of Monarch helical geared headstock design is due, in no small measure, to the precision of the gears.

Power flows through them smoothly, quietly and without transmittal of gear tooth marks to the work. Such is the service which can be expected from every Monarch Series 60 lathe.

On the opposite page is visual evidence of the thoroughness with which Monarch proves each step in accurate gear making. These include the helix lead angle check, the tooth contour check, the test for noise and bearing, checks for accuracy of bore diameter and pitch diameter and the tooth spacing check.

These are not isolated examples. Every gear which goes into a Monarch lathe is subjected to such painstaking tests.

Left. Grinding helical headstock gear teeth. On this operation the tolerance limit is .0002" but on the average seldom exceeds .0001".



Spindle-spection...

ANOTHER MONARCH PLUS



It has often been said that the headstock spindle is the heart of any lathe. Recognizing the truth of this, Monarch Series 60 spindles are made to the most exacting tolerance limits.

Following this, they must pass spindle-spection. That's our way of referring to spindle inspection but the methods used are so modern, so thorough and so accurate that they deserve this special designation.

The bore is checked by means of Sheffield Precisionaire gauges, as illustrated above. Limit for bore size is .0005" and for accuracy of taper, .000". The center illustration to the right is the check for draw, the limit being .0003" to .0005". Below to the right is illustrated the test for bearing and gear bearing seat sizes. A separate indicator snap gauge is used for each diameter. Bearing sizes are held within a limit of .0002", all gear bearing seat diameters within a limit of .0005".

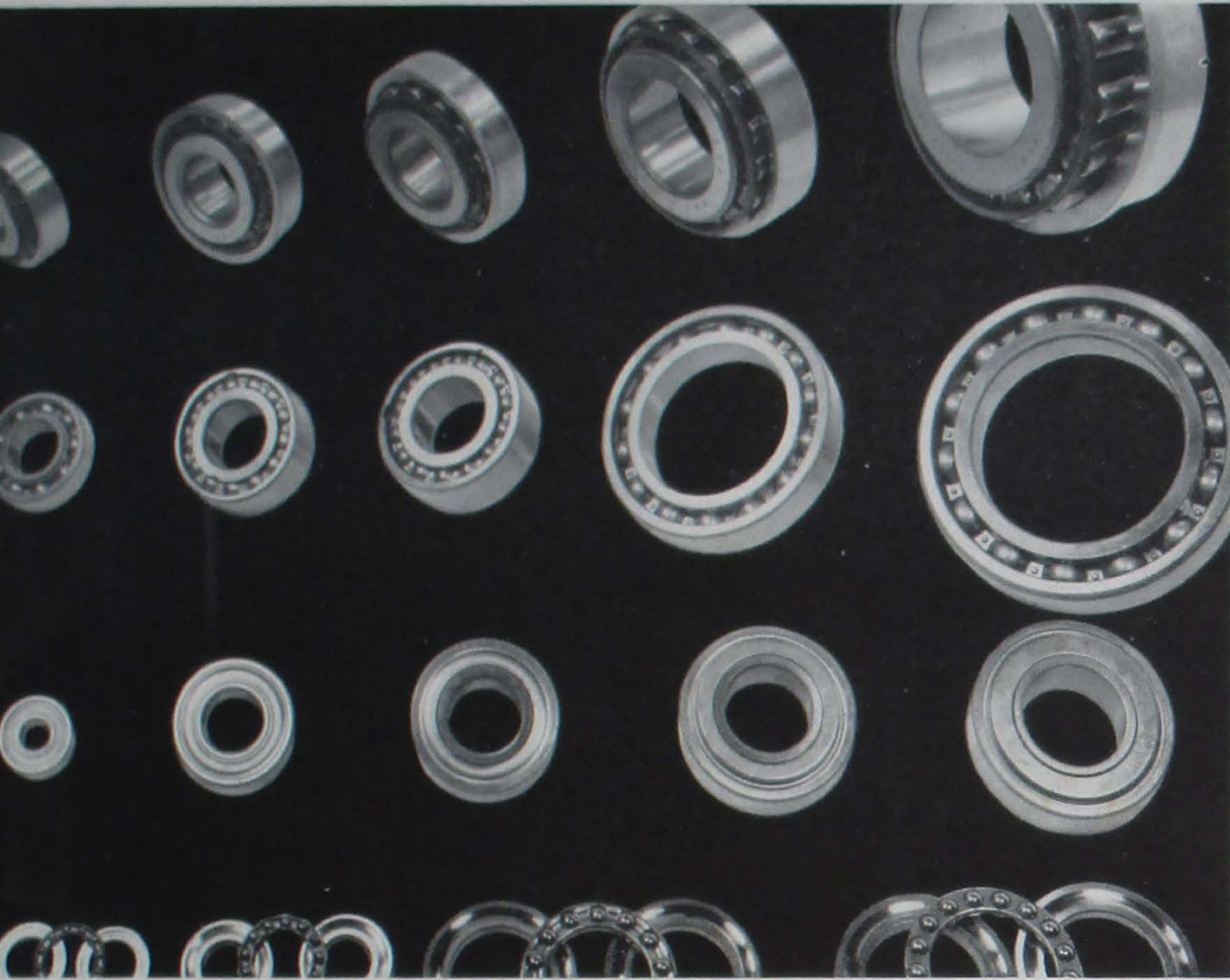
There are still other checks. One determines whether the spindle nose is within the prescribed limits for size and runout. Another severe check is for runout on a test bar inserted in the spindle and at a point 14" out from the spindle nose. Bearing and gear bearing seat runout is also checked.

With the realization of what such thoroughness means it can be better understood why users always associate accuracy of performance with Monarch turning equipment.



Anti-Friction Bearings . . .

PLENTY OF THEM FOR THE SMOOTH, QUIET
DELIVERY OF MORE POWER



The liberal use of anti-friction bearings has long identified one of the major design features of Monarch turning equipment.

Their advantages are so well known that an extended discussion here is unnecessary. Summed up it might be said that a 100 per cent anti-friction bearing lathe is assurance that it will deliver more power with greater smoothness and with a minimum of maintenance worries.

The Monarch Series 60 lathes are complete anti-friction bearing equipped in the headstock, the end gear train, the gear box, the apron, the tailstock and the cross-feed screw. For the ultimate in economical operation, every lathe you purchase must be so constructed.

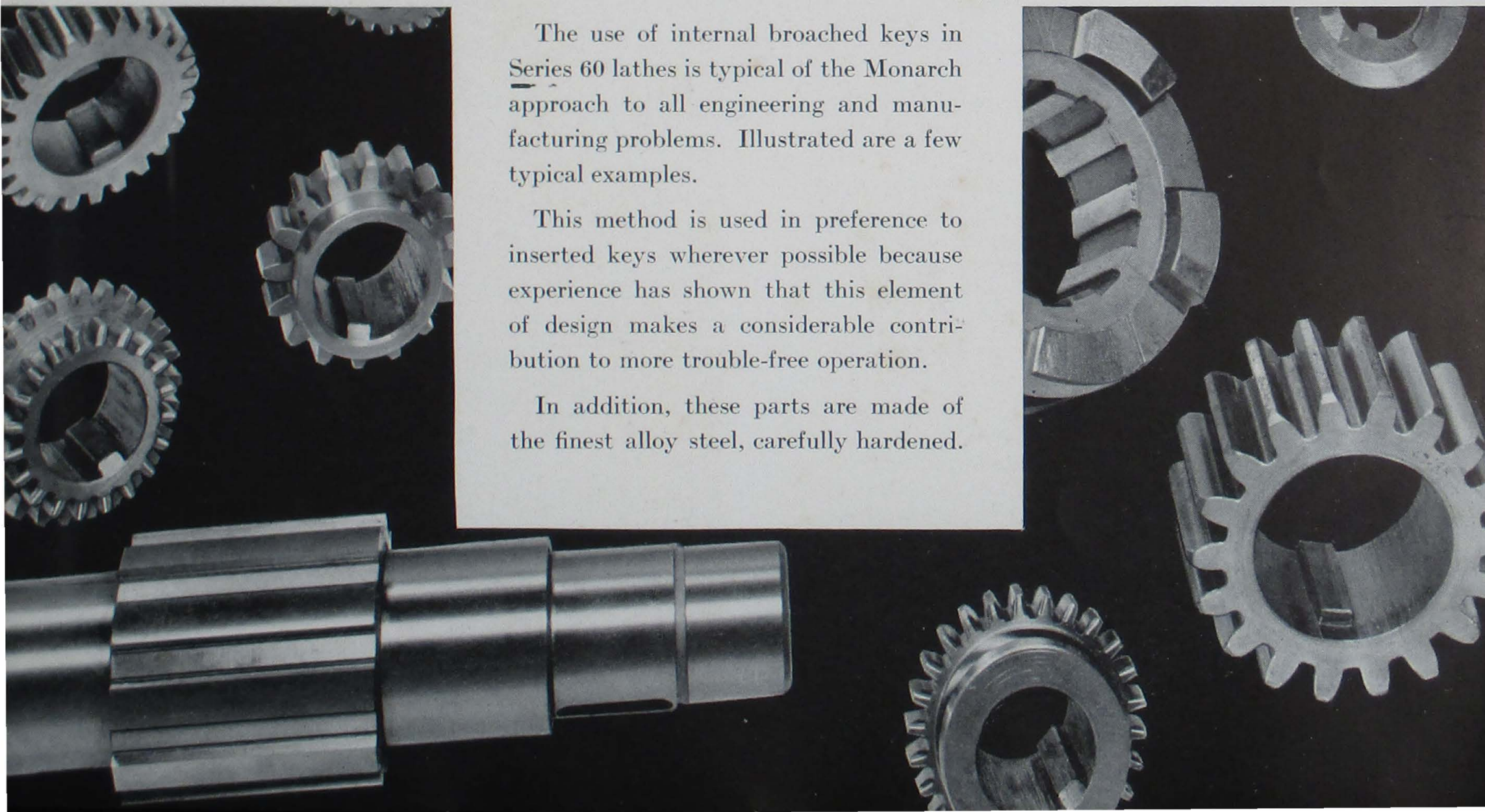
LONG LIFE FROM *Broached Keys*

9

The use of internal broached keys in Series 60 lathes is typical of the Monarch approach to all engineering and manufacturing problems. Illustrated are a few typical examples.

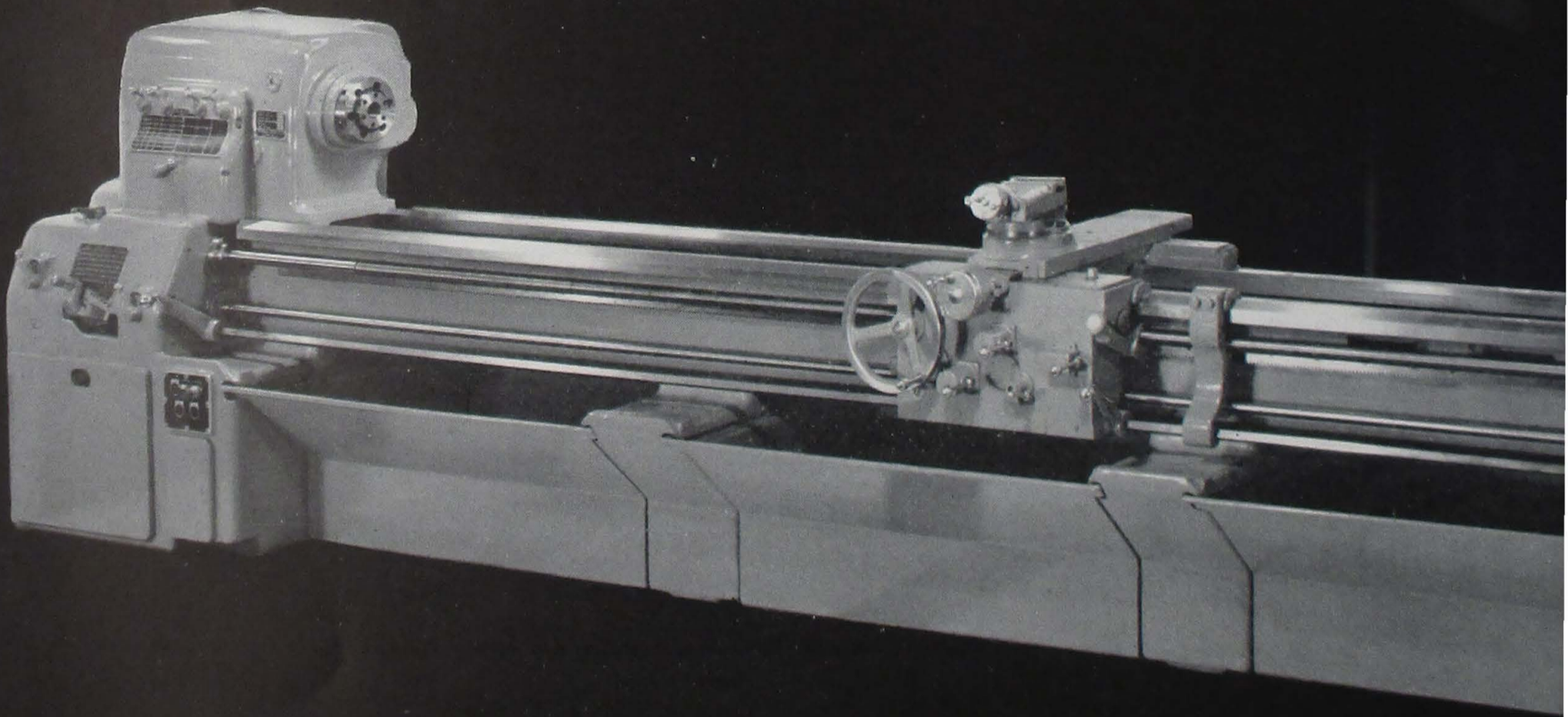
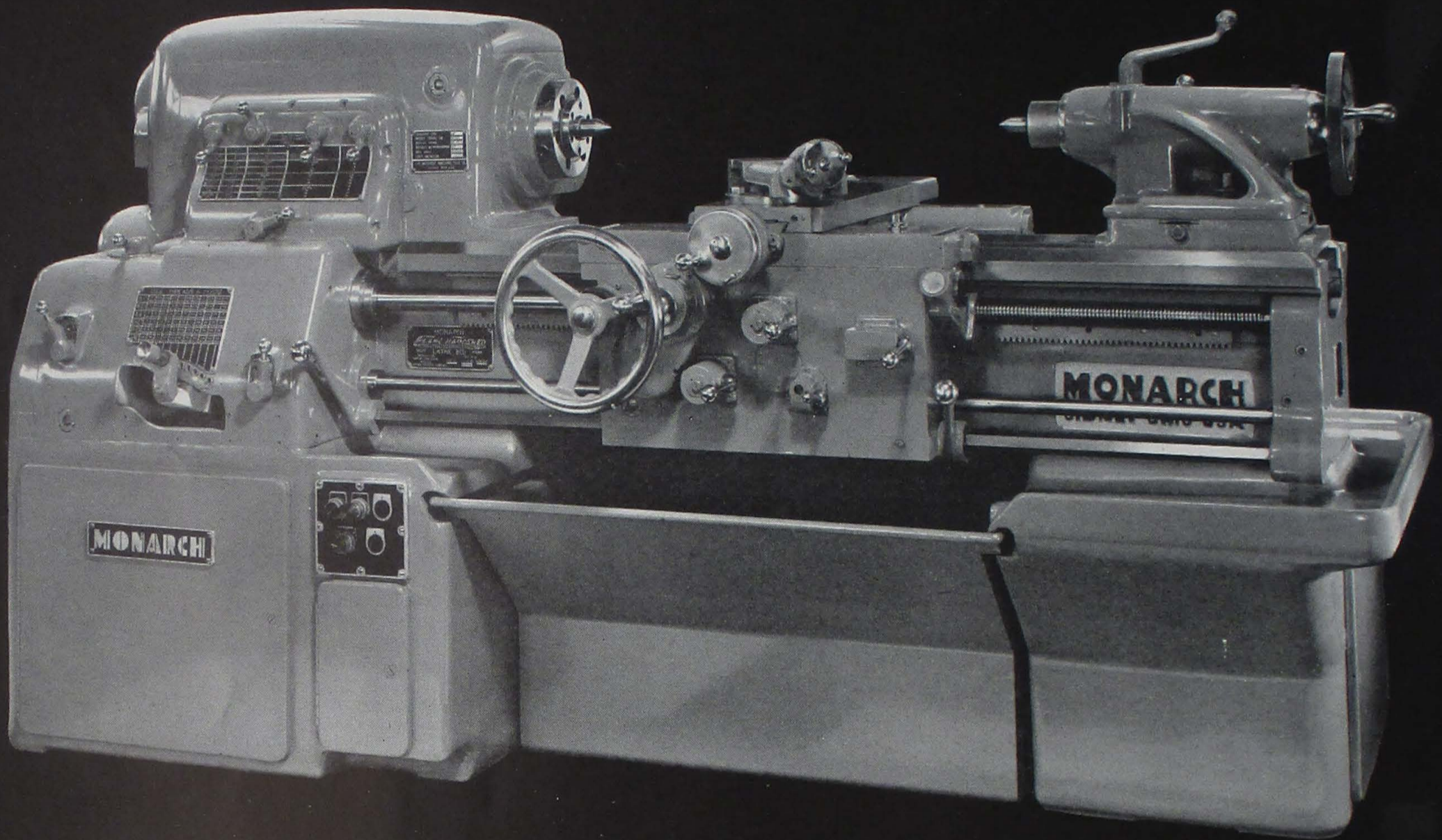
This method is used in preference to inserted keys wherever possible because experience has shown that this element of design makes a considerable contribution to more trouble-free operation.

In addition, these parts are made of the finest alloy steel, carefully hardened.



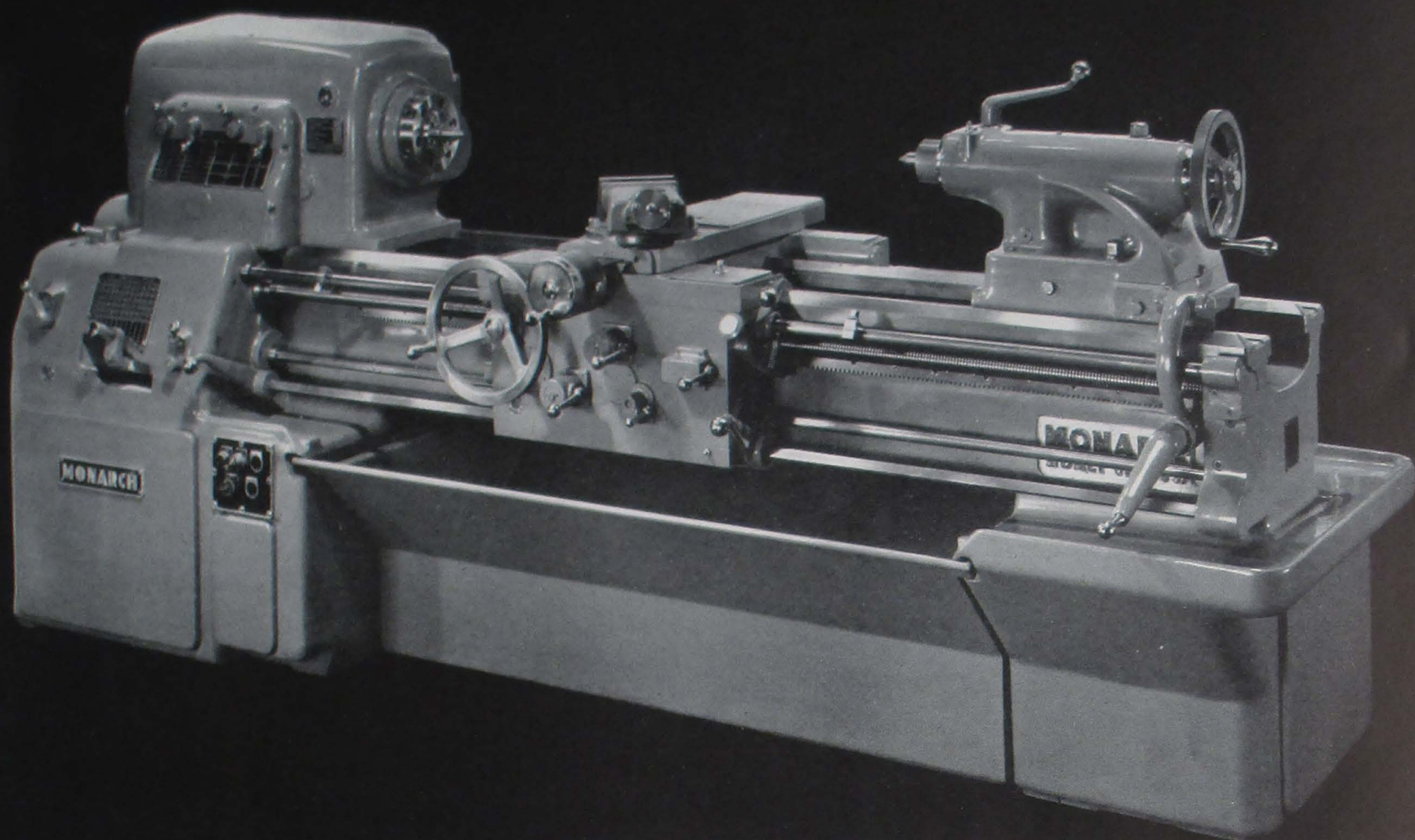
Monarch

ENGINE AND TOOLMAKER'S



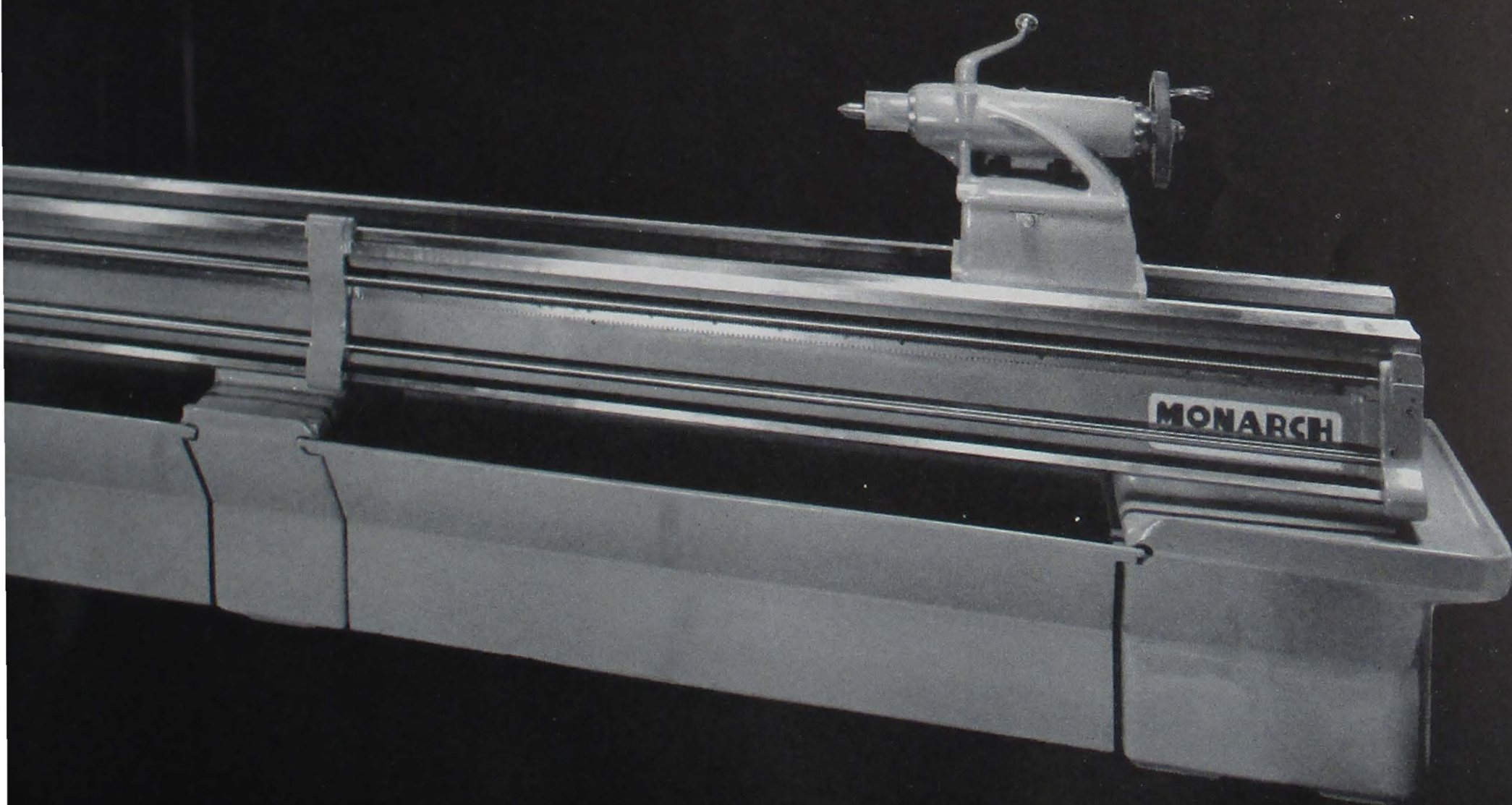
Engine Lathes. Available in 14", 16", 18" and 20" swings; each swing in a variety of lengths. At the top of the page is illustrated one of the shorter 16" machines while extending across the bottom of this spread is a 16" x 246" size.

LATHES . . . Series 60



Toolmaker's Lathes. Offered in 14", 16", 18" and 20" swings; each swing in a variety of lengths. Pictured above is an 18" size machine. See our individual lathe bulletins for complete specifications covering either the toolmaker's or the engine lathes.

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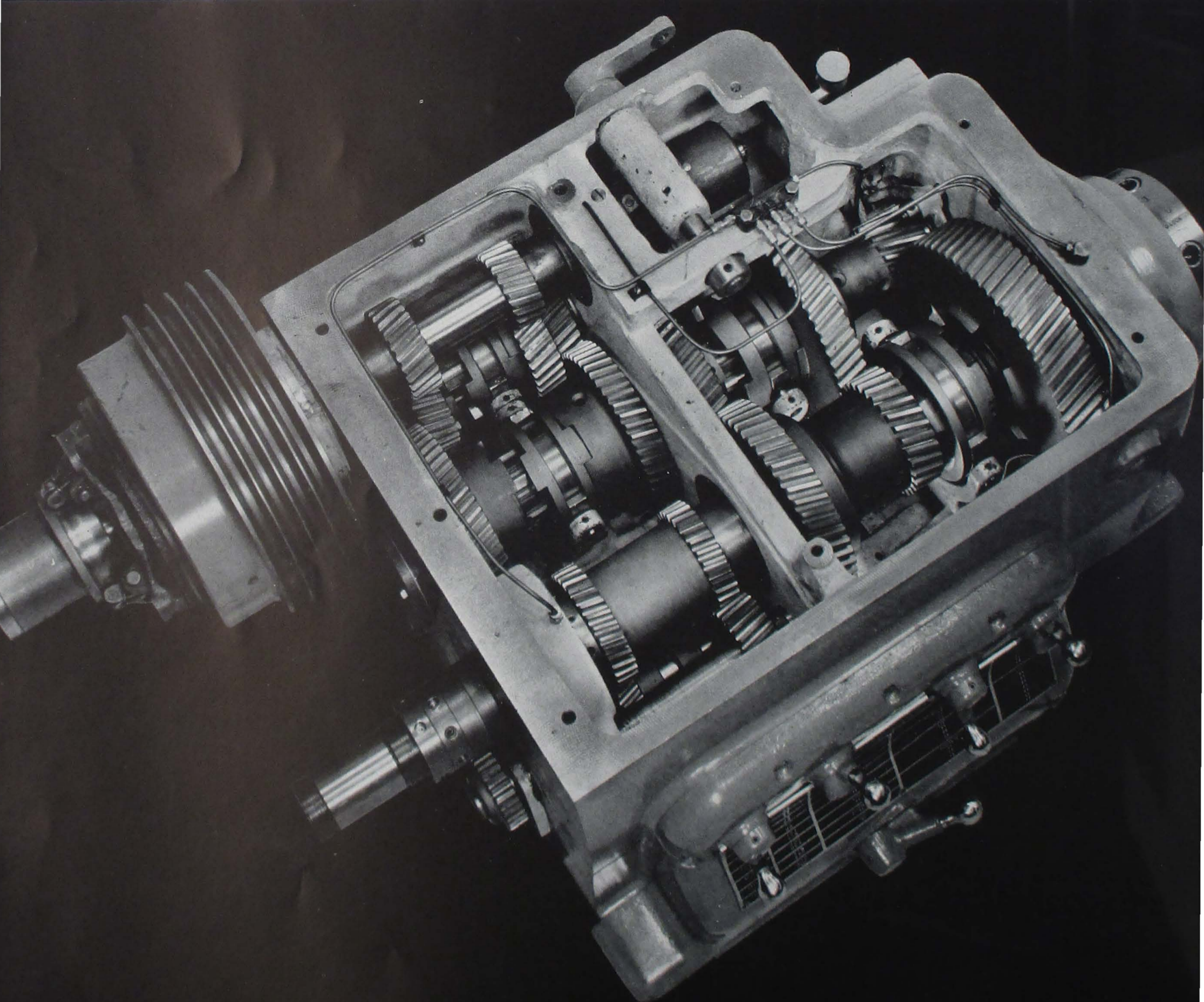


The Headstock . . .

HELICAL GEARED FOR SUPERIOR PERFORMANCE

- Helical gears used throughout.
- All gears hardened and ground.
- Spindle and long intermediate shaft have center bearing support.
- Spindle and all shafts are hardened, have ground threads and integral milled and ground splines.
- Alloy steel used for spindle, shafts and all other steel parts.
- Spindle and all shafts rotate on anti-friction bearings.
- Spindle speed changes made by sliding heavy-sided jaw clutches. With gears in constant mesh, their accuracy is not impaired by this method of speed change.
- Combined pump and splash lubrication with filtered, metered oil to each bearing.
- No pockets on inside to trap foreign matter when oil is drained for lubrication change.

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CATALOGUE
 MFGR'S
 ACTUAL
 DISTANCE
 DATE BUI
 COST INS
 THE MO

DRIFT CLUTCH WHEN
 CHANGING TO HIGHER
 SPEEDS

DOWN UP	17 23	DOWN "	DOWN "	DOWN "
DOWN UP	28 37	UP "	" "	" "
DOWN UP	45 59	DOWN "	UP "	" "
DOWN UP	74 98	UP "	" "	" "
DOWN UP	121 158	DOWN "	DOWN "	UP "
DOWN UP	200 264	UP "	" "	" "
DOWN UP	319 420	DOWN "	UP "	" "
DOWN UP	532 700	UP "	" "	" "

QUICK AND POSITIVE SPINDLE SPEED CHANGE

- Spindle speed changes made with half the effort normally required.
- "Down" movement of each lever selects the lowest speed in its range, "up" movement of each lever selects the highest speed in its range.
- Standing at carriage, operator can determine the spindle speed quickly by the lever positions. This is possible only because of the use of multiple levers whose positions have a logical relationship to high and low speeds.
- Speed change plate on front of head instantly shows operator the position of the levers for any of the sixteen speeds.

Below. Making spindle runout test during final inspection of machine. Test bar is checked 12" out from spindle nose and at three points 120° apart. Runout may never exceed .0006".

THE QUICK CHANGE *Gear Box*

- Anti-friction bearings used throughout.
- All gears made of hardened alloy steel with tooth contours ground or shaved.
- Wide range of feed and thread changes provided including the frequently requested 27 threads per inch.
- Over-all range of threads either 1 to 60 or 2 to 120, the latter being furnished unless order specifies other range.
- Fingertip control of multiple disc brake assures positive stopping easily and quickly at all speeds.

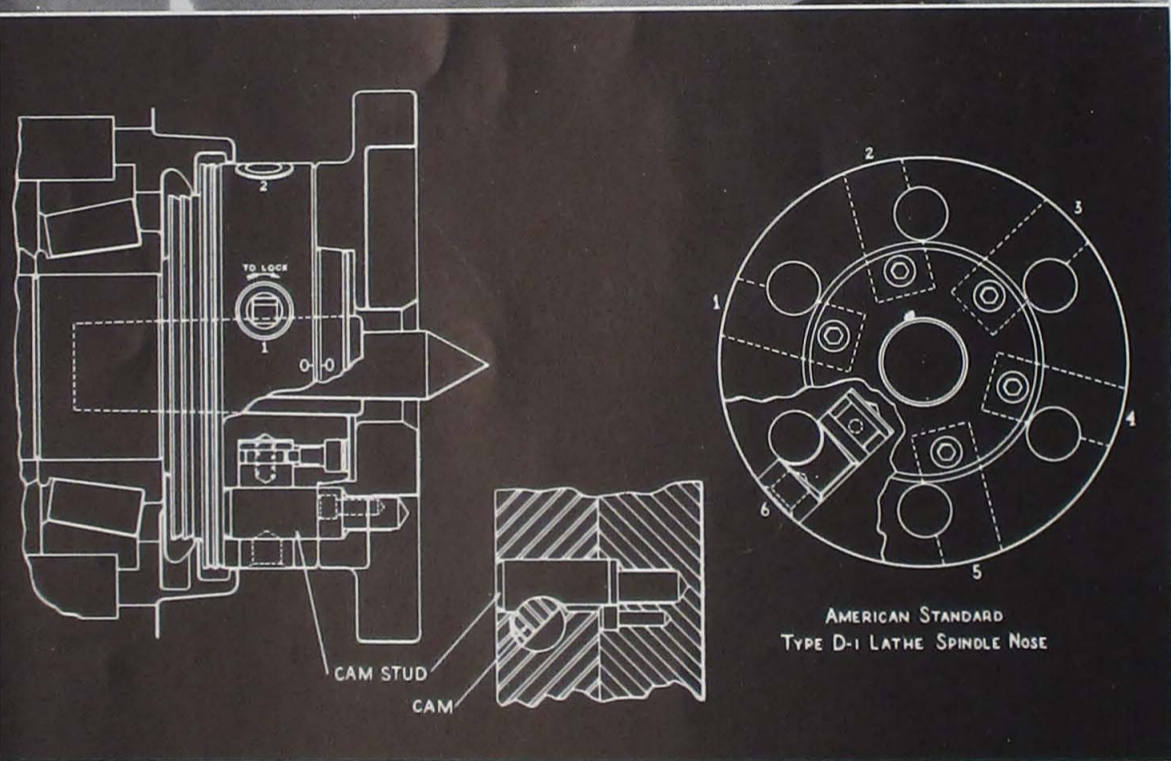


AMERICAN STANDARD

Camlock Spindle Nose

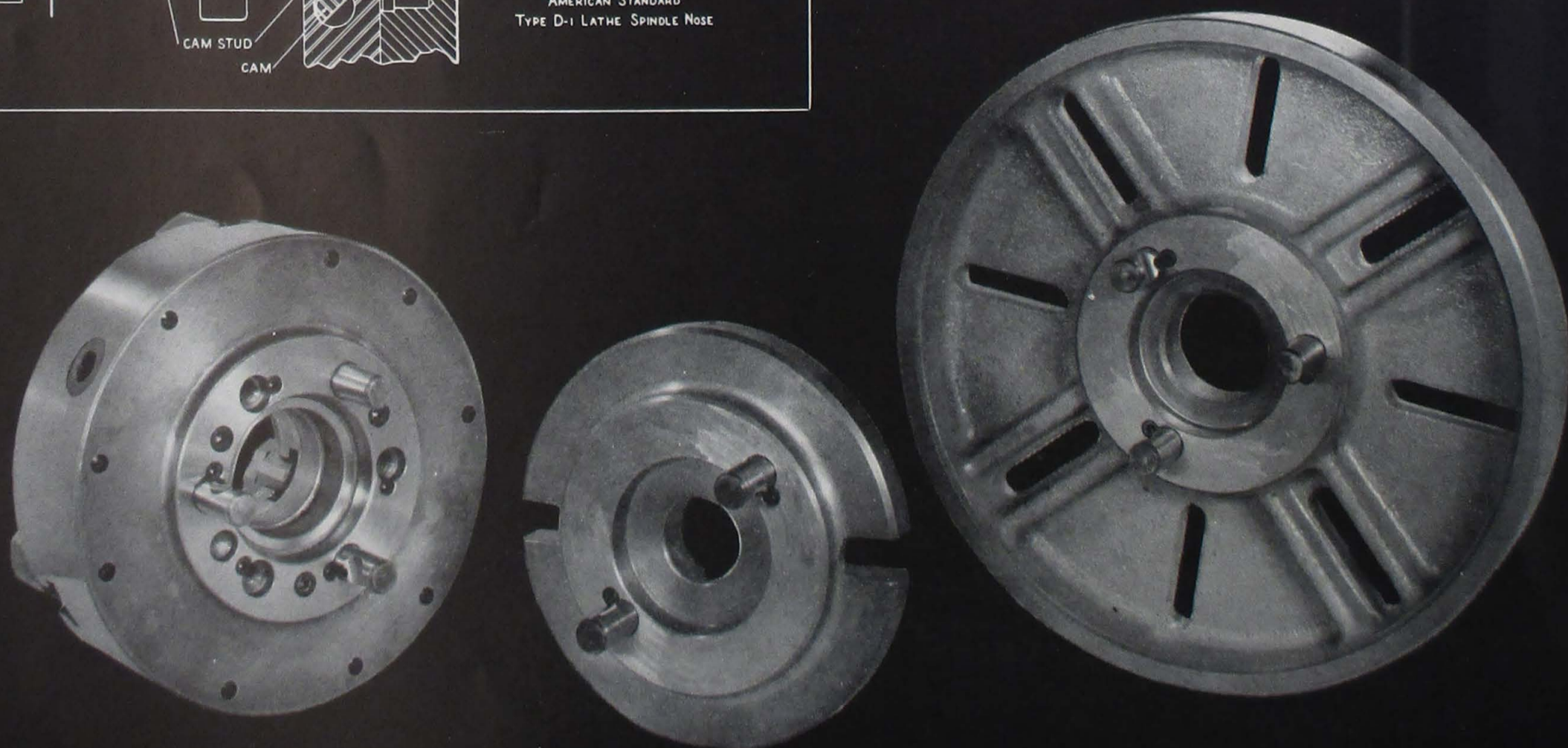
FOR ACCURACY AND QUICK CHANGEABILITY

- Official "American Standard" spindle nose approved by the American Standards Association.
- Large diameter ground locating surface insures accurate chuck, plate and fixture alignment.
- Faster removal and attaching of chucks, plates and fixtures than any other type.
- Less overhang than with spindle nose of other designs.
- Chucks, plates and fixtures fit directly on spindle nose without adapter plates.
- Provides the most rigid means known of holding chucks, plates and fixtures to spindle.
- Chucks, plates and fixtures cannot possibly come loose under the most severe operating conditions.
- Spindle nose of same dimensions as used on many makes of turret lathes and other equipment, making for standardization and interchangeability.
- Chucks, plates and fixtures readily interchangeable from one Monarch lathe to another.
- Insures close duplication of mounting, so important when turning work within the limits frequently demanded.



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Below. Chuck, dog plate and face plate for Camlock spindle.

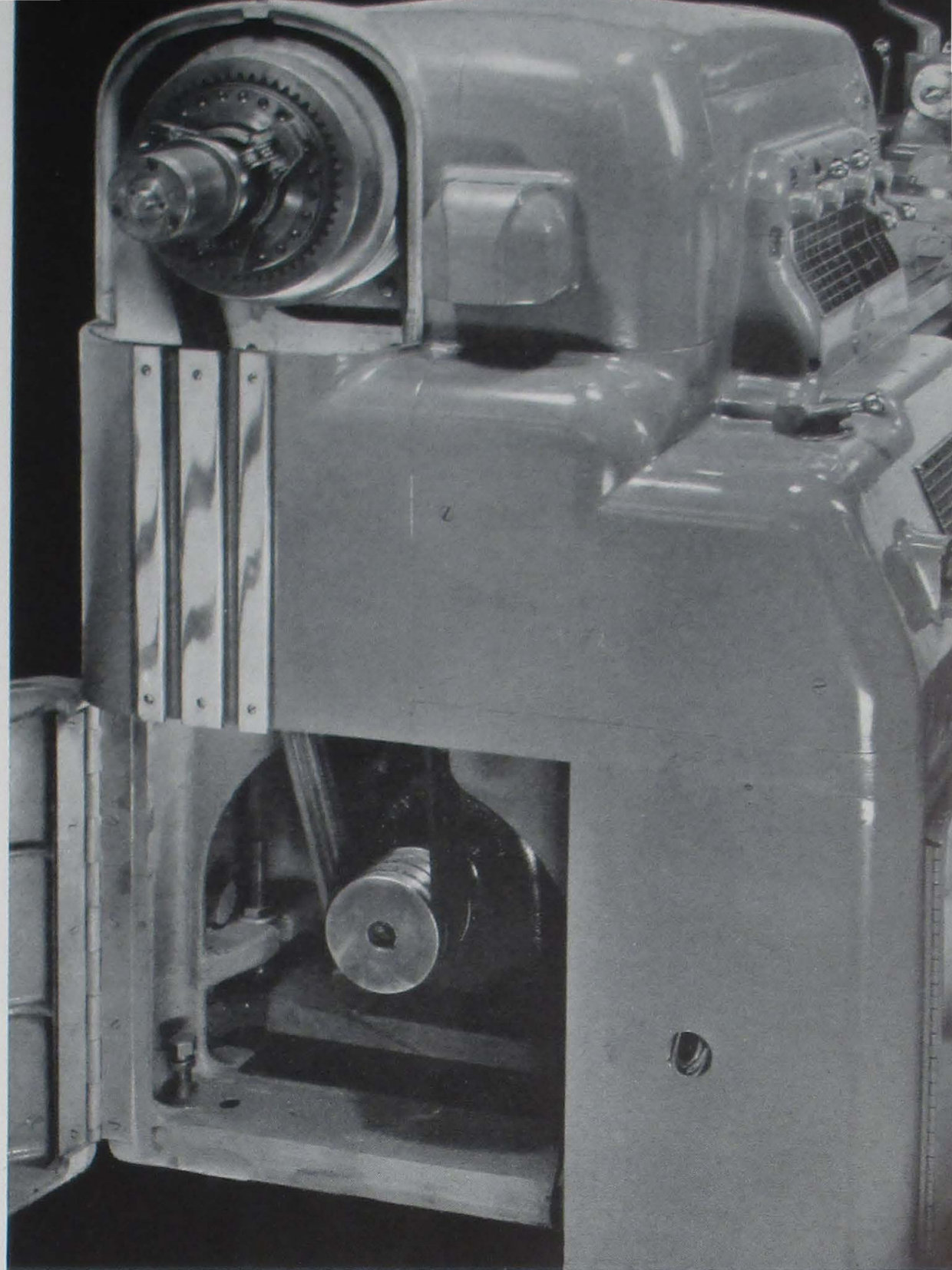


The Main Drive

SMOOTH AND POWERFUL THROUGH MULTIPLE "V" BELTS

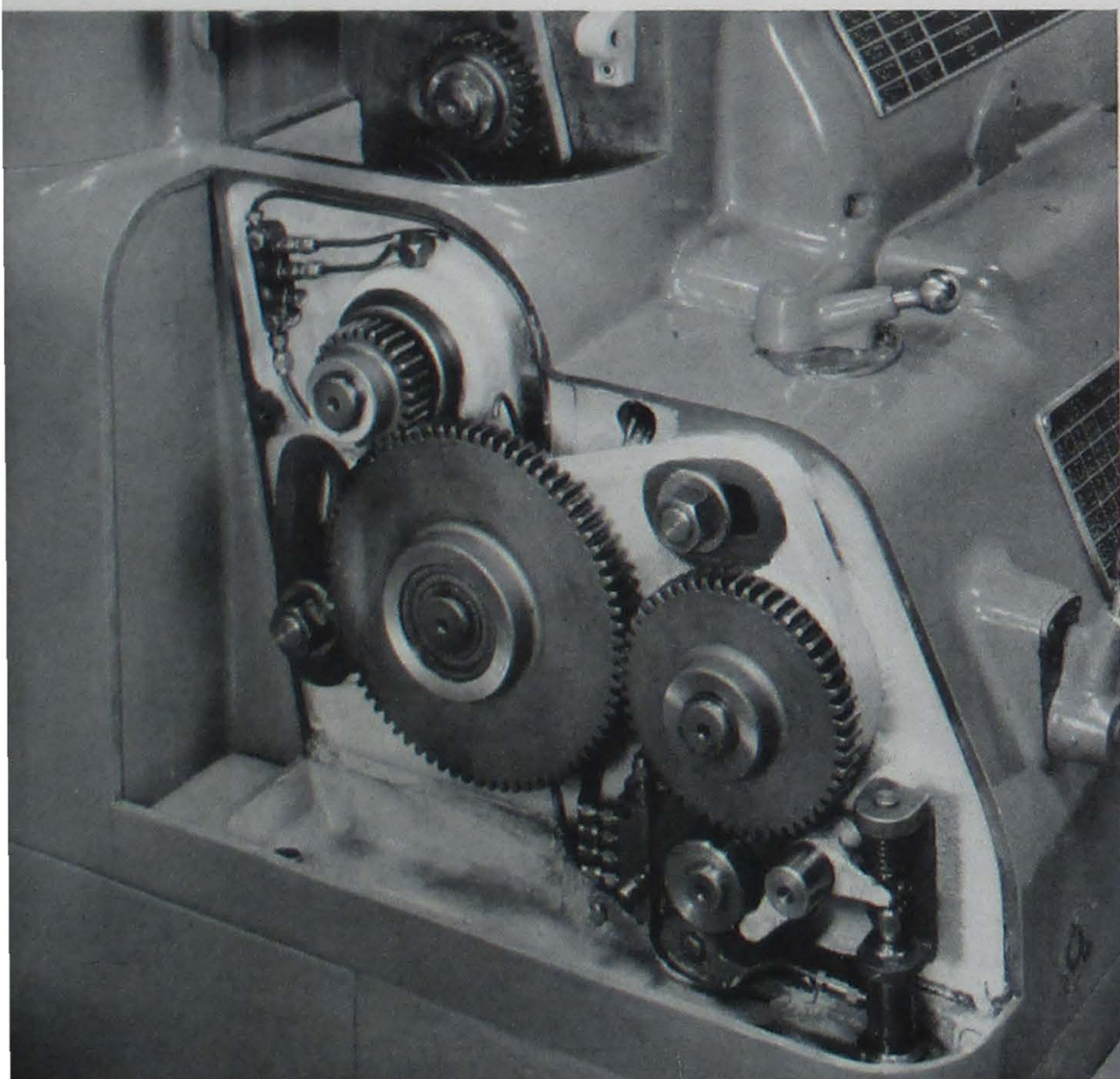
- Main drive motor inside cabinet leg and mounted on hinged plate which may be adjusted readily to change tension on driving belts.
- Drive is through wire core, balanced, multiple "V" belts.
- Drive clutch, mounted on its own support, operates in conjunction with pulley shaft which runs on ball bearings.
- Driving clutch and multiple disc brake fingertip controlled by dual levers; one at left hand end of bed, one at apron. As control lever is pulled upward through a short arc, it passes from clutch to neutral to brake position.
- Method of control permits instant stopping, gradual stopping with modified braking or drifting to a stop without braking. With lever in brake position, spindle is automatically locked against rotation to facilitate operation of collet chucks.

Right. Closeup view at left hand end of Series 60 machine with upper cover removed and lower door opened to show the multiple "V" belt main drive. Also clearly illustrated is the main drive clutch.



THE COMPLETELY ENCLOSED

End Gear Train

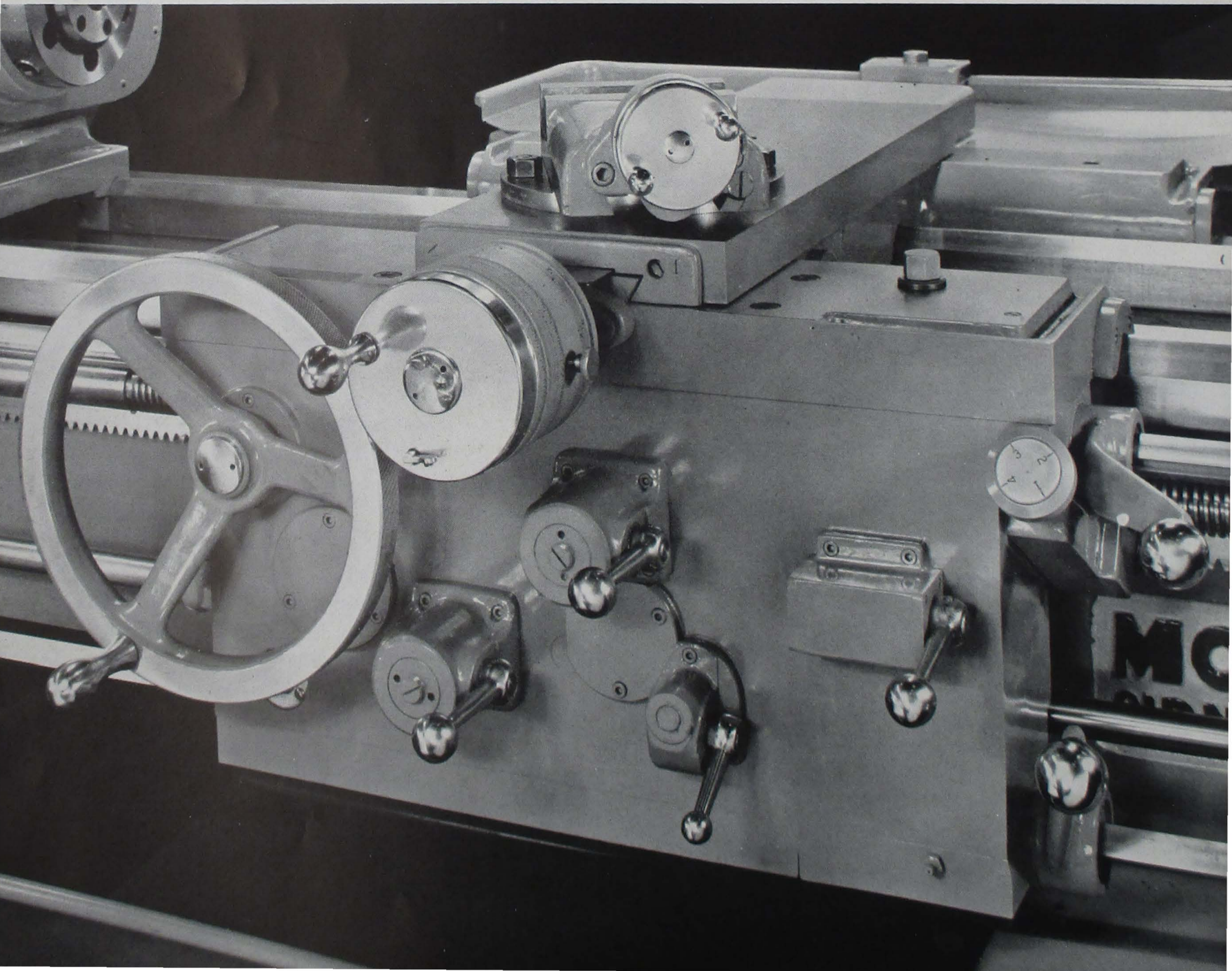


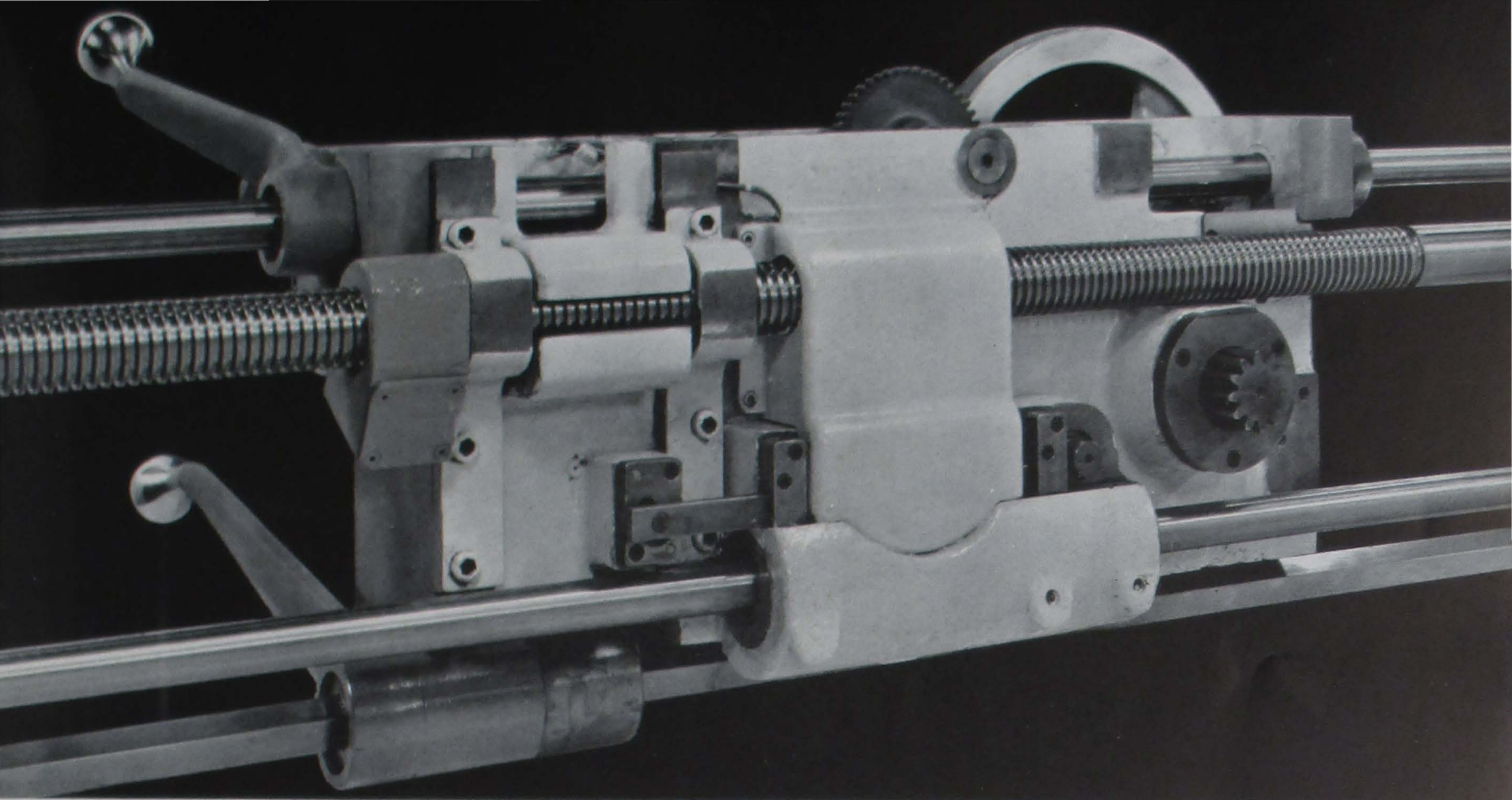
- End gearing completely enclosed to prevent entry of foreign matter.
- Individual pressure lubrication system supplies oil to all gears in end gear train as well as all operating parts such as bearings and gears in the gear box.
- Anti-friction bearings employed throughout.
- Gears made of hardened alloy steel with tooth contours ground or shaved.
- Gears on quadrant have fixed centers permitting changes of gearing for chasing odd leads or for the substitution of metric transposing gears, with only one quadrant adjustment necessary.
- End gears held in place by Tru-Arc rings, eliminating the conventional threaded studs.

The Apron . . .

CONVENIENT, COMPACT AND EFFICIENT

- Fast, fingertip controls for longitudinal feed, cross-feed reverse and half nut.
- Same natural downward motion of their respective control levers engages cross-feed, feed reverse and half nut; same upward motion disengages any one of them.
- Large chasing dial tells operator at a glance the exact instant at which to engage the half nut.
- Cross-feed and longitudinal feed drive through worm and worm gear unit to large, efficient frictions.
- On toolmaker's lathes, leadscrew reverse operated by lever at right hand side of apron. Stops on reverse rod provide close control in both directions of carriage travel, either when threading or feeding.
- All revolving shafts ball bearing mounted.
- On engine lathes, leadscrew reverse operated by lever at front of headstock.
- All gears made of hardened alloy steel with tooth contours either ground or shaved.
- Pressure pump, within apron and automatically driven, supplies metered lubrication to all moving parts in apron, to carriage bearings on bed and to compound rest bottom slide bearings on carriage.
- Lubrication system operates continuously whether carriage is traversed by power or hand and also during power cross-feed.
- As oil feed lines are kept full at all times, lubrication is supplied immediately to bearing surfaces even though lathe has been idle for some time.





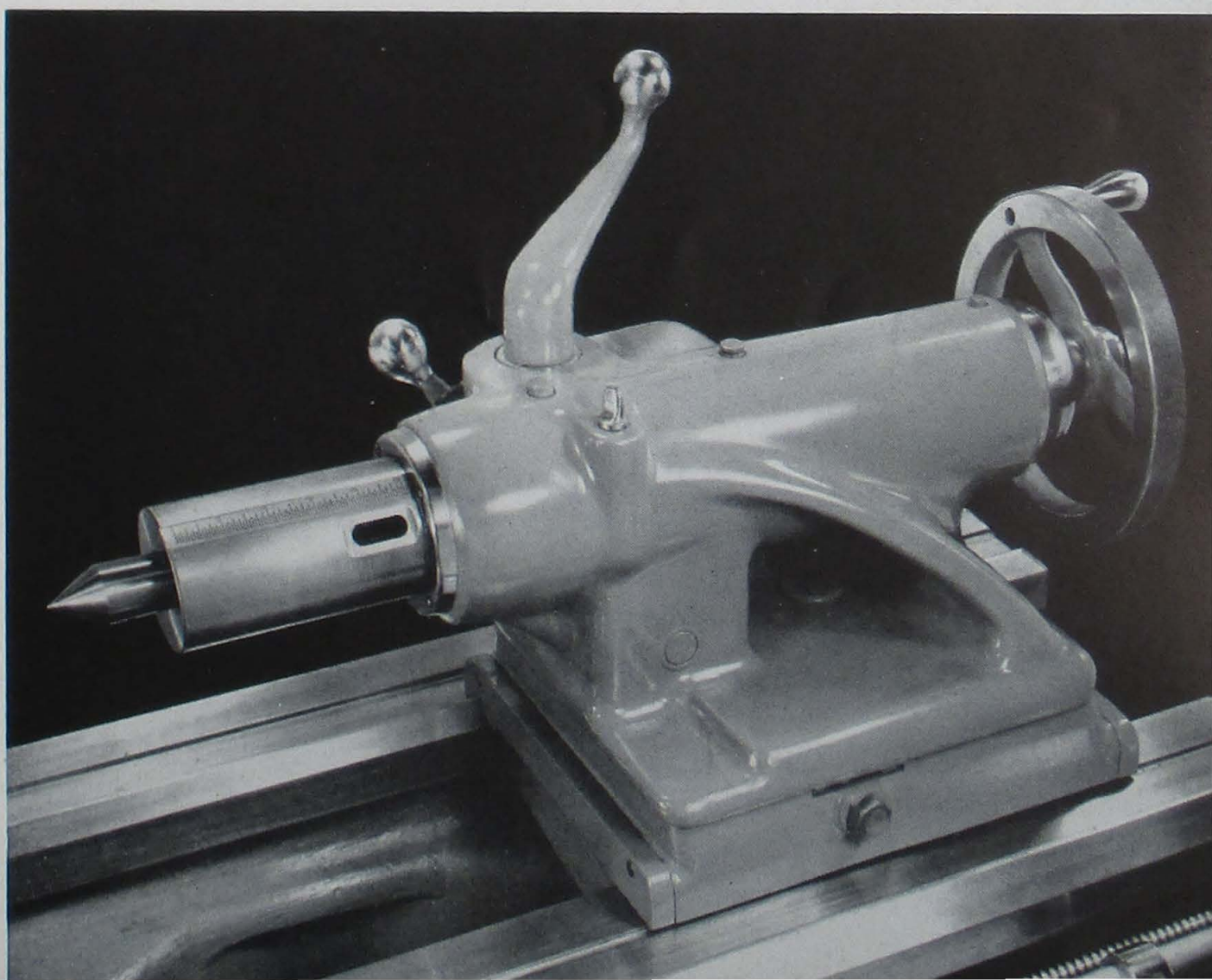
Above. Rear view of a Series 60 Toolmaker's Lathe apron. An interlock prevents simultaneous engagement of the feed rod and leadscrew, the latter being used only when threading.

The Tailstock . . .

QUICK CLAMPING ON TOOLMAKER'S LATHES

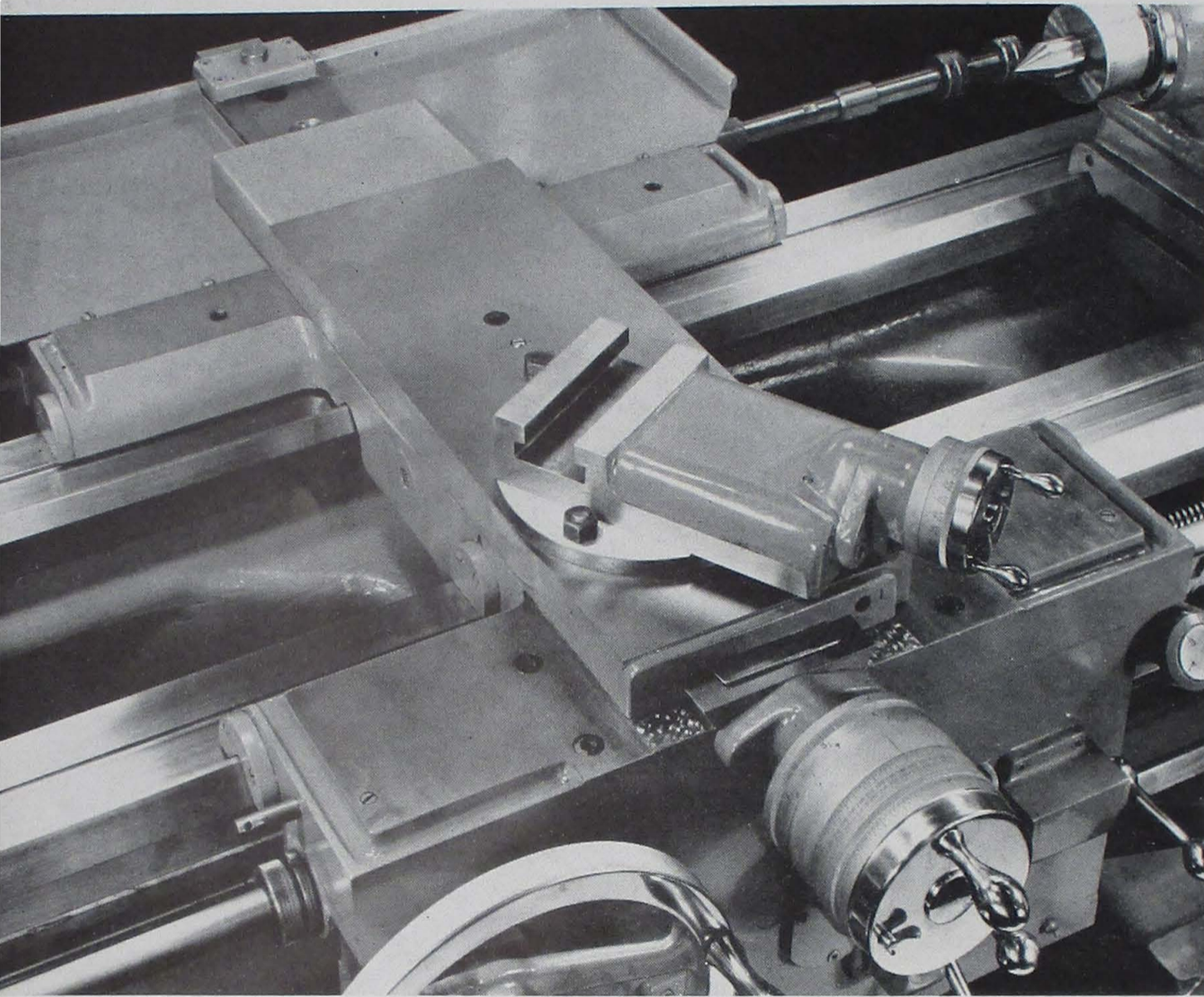
- Quick clamping type tailstock furnished as regular equipment on all toolmaker's lathes.
- Hardened and ground alloy steel spindle provided with tang slot to facilitate ejection of drill and reamer sockets.
- Accurate scale on spindle graduated in sixteenths.
- Spindle anchored rigidly and accurately by a large flange back key with laminated shim adjustment for removal of rotating play.
- Stop on spindle prevents use with a partial bearing of the tailstock screw and nut.
- Tailstock screw takes thrust against ball thrust bearing.
- Reservoir in base feeds oil to hardened bed ways. Efficient wipers prevent entry of foreign matter under the base as tailstock is moved along top of the bed.
- Engine lathe tailstocks have all foregoing features except quick clamping and tang slot in spindle.

Below. Closeup view of the sturdy Monarch Series 60 Toolmaker's Lathe tailstock. Tailstock bed ways are flame hardened and ground, a feature not ordinarily found on engine and toolmaker's lathes.



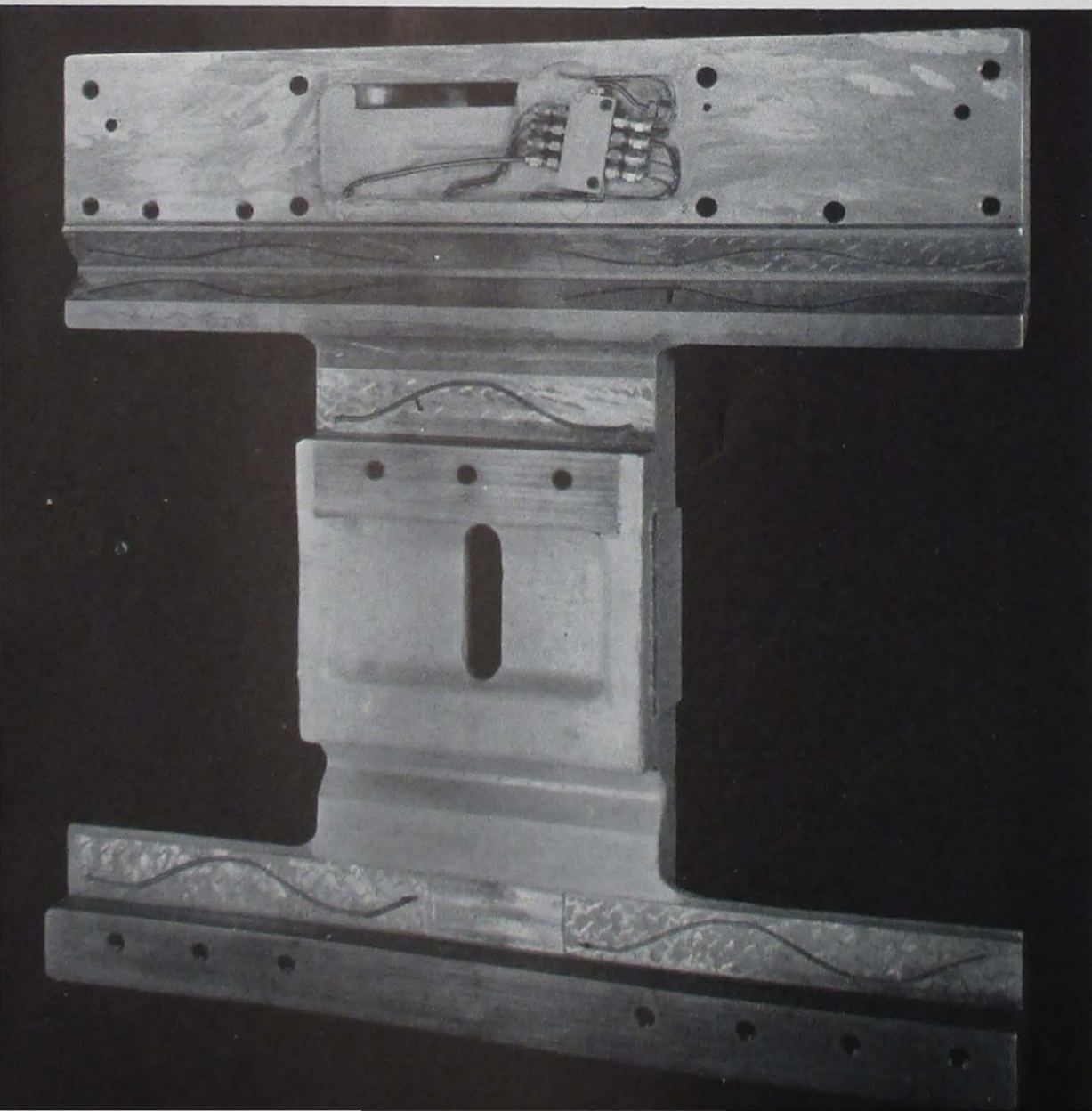
The Carriage and Compound Rest

FURNISH RUGGED TOOL SUPPORT



- Both cross-feed screw and compound screw hardened and ground.
- Cross-feed screw thrust taken at rear of carriage. Screw is in tension instead of compression, assuring more accurate performance.
- Large diameter cross-feed and compound micrometer dials, graduated in thousandths to read in diameter; satin finish, chrome plated with dark lines and figures.
- Swivel graduated 180° either side of center.
- Adjustable thread chasing stop permits tool repositioning for finishing of thread without disturbing original setup.

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- Carriage way surfaces carefully hand scraped to flame hardened and ground bed ways.
- Automatic force feed pump located in apron provides complete lubrication under all operating conditions.
- Carriage casting of unusually sturdy design gives more than ample tool support.

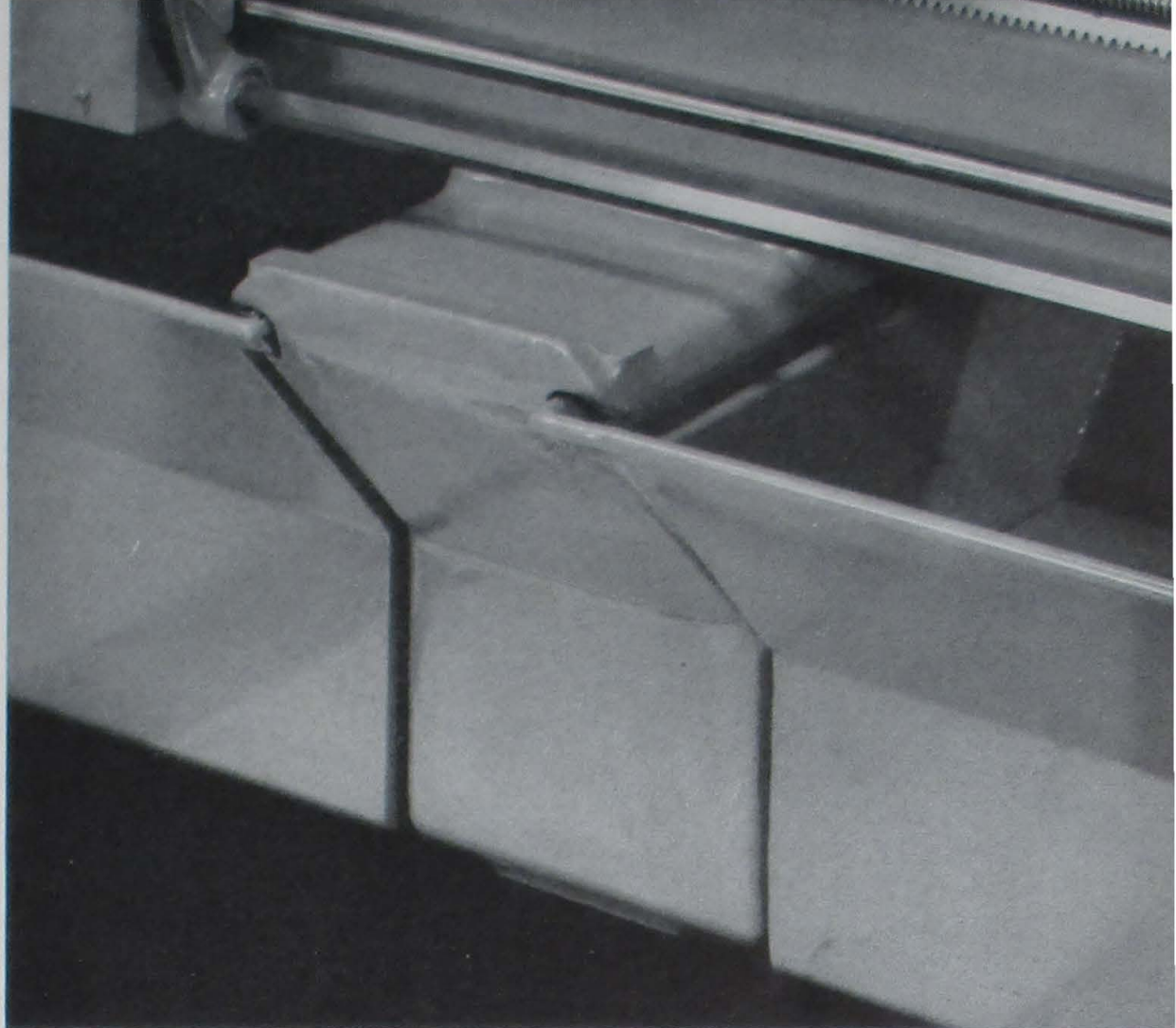
Left. View of underside of carriage. Manner in which way surfaces are lubricated is clearly shown.



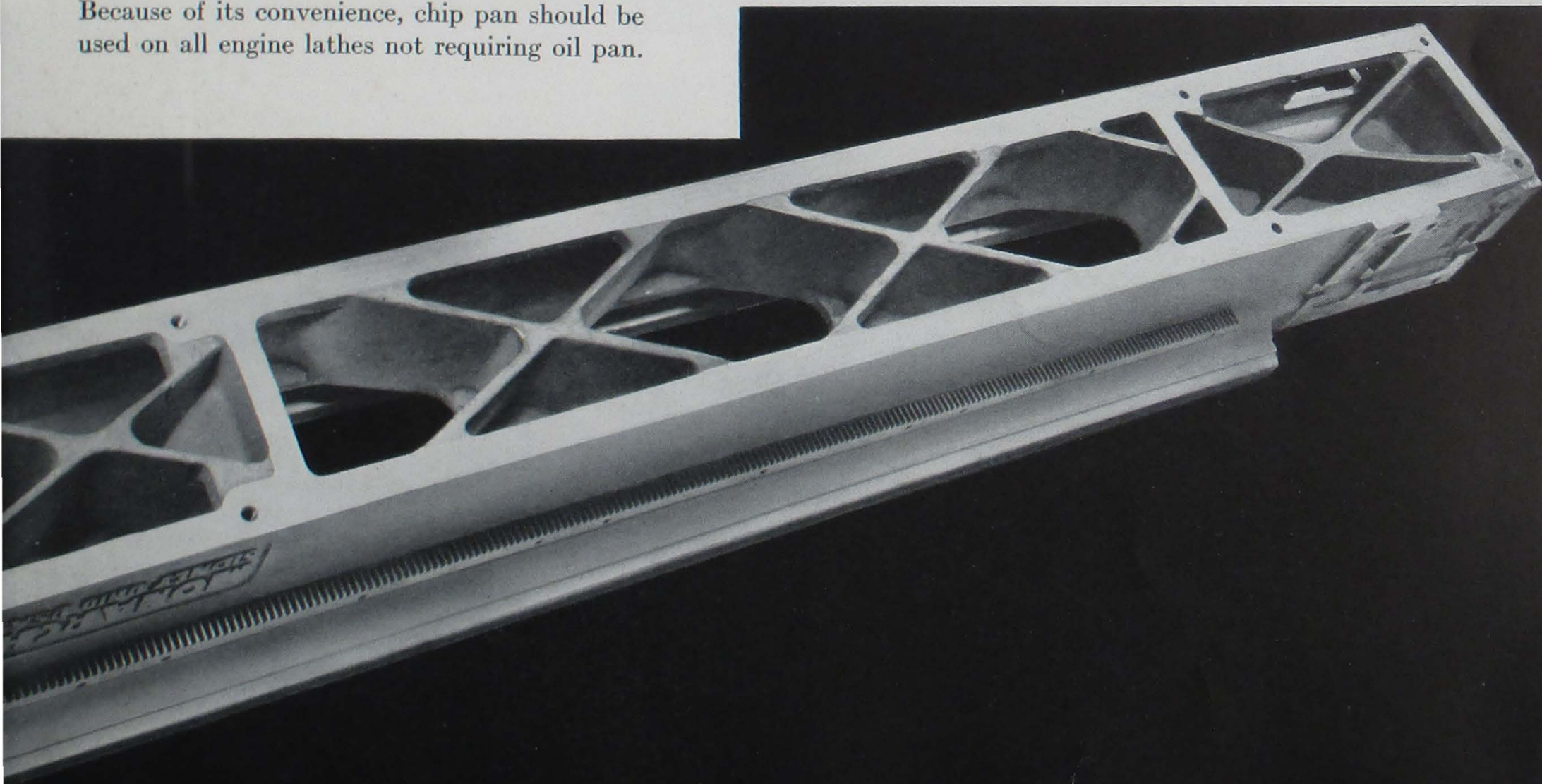
The Bed and Cabinet Legs

THE SOLID FOUNDATION OF A SUPERB MACHINE

- Heavy bed casting has triangular bridge type girth throughout entire center section, giving it twice the ordinary rigidity. See illustration below.
- Bed ways for both carriage and tailstock flame hardened by the exclusive Monarch process and precision ground.
- Motor and starting equipment housed in front cabinet leg. Rear cabinet leg provided with compartment for storage of tools and accessories.
- Leveling screws and hold down bolts located within cabinet legs.
- Cabinet legs slotted to receive oil pan or chip pan which may be removed quickly without dismantling any part of machine.
- Oil pan made of heavy material with rolled edges, will slide to front or rear and extends to floor, thereby eliminating accumulation of chips and dust underneath machine.
- Ample size of pan makes cleaning out of chips a less frequent operation and provides generous coolant capacity.
- Oil pan regular equipment on toolmaker's lathes. Because of its convenience, chip pan should be used on all engine lathes not requiring oil pan.



- One or more center cabinet legs supplied beginning with the 78" center distance machines in the 14" and 16" sizes and with the 72" center distance machines in the 18" and 20" sizes.
- Center cabinet legs of heavy box type construction for rigid bed support. See illustration above.
- Coolant pump, when supplied, mounted inside oil pan at headstock end. On lathes with center cabinet legs each individual pan drains through center legs to pan at headstock end. Baffle plates in pans remove sediment from coolant.



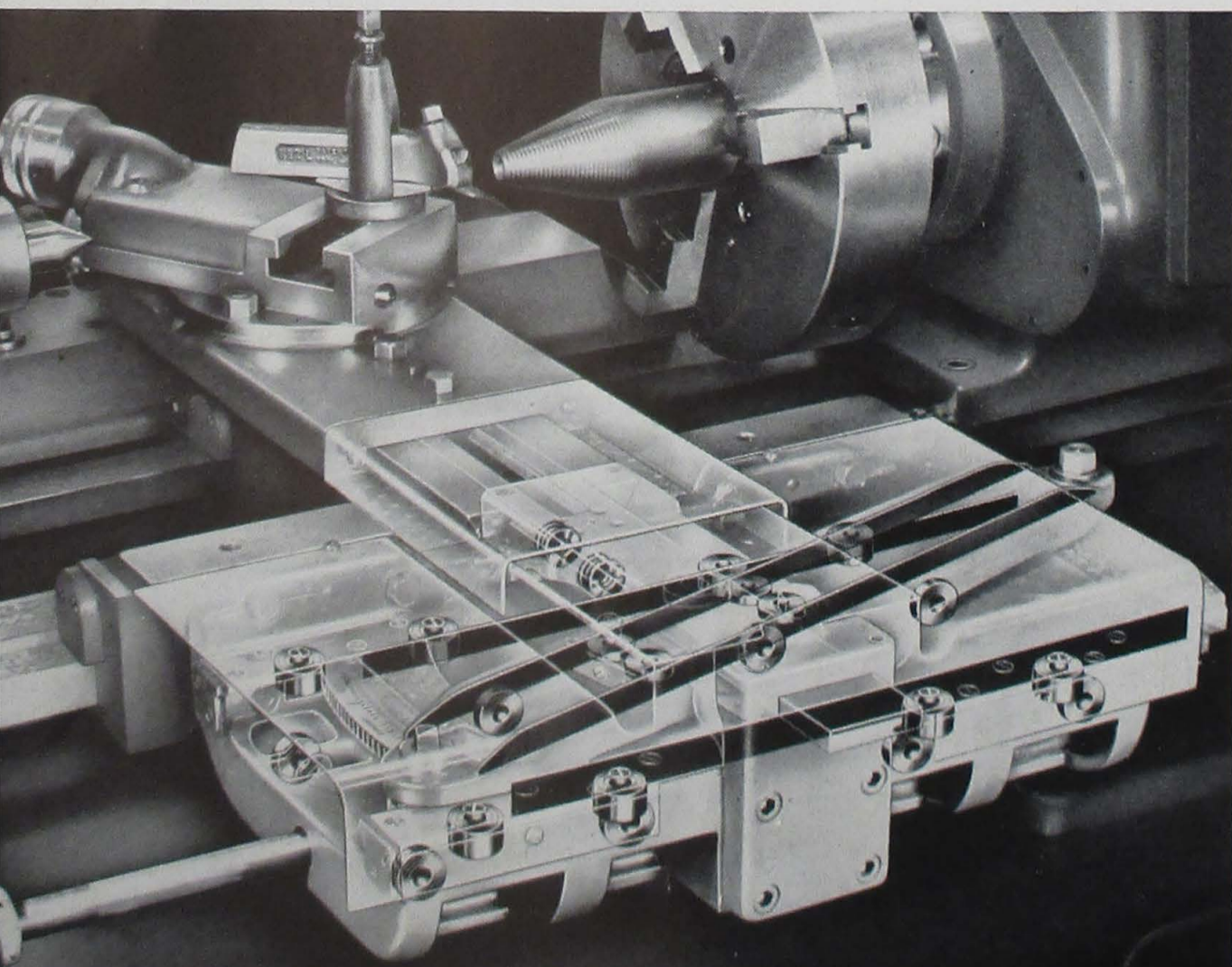
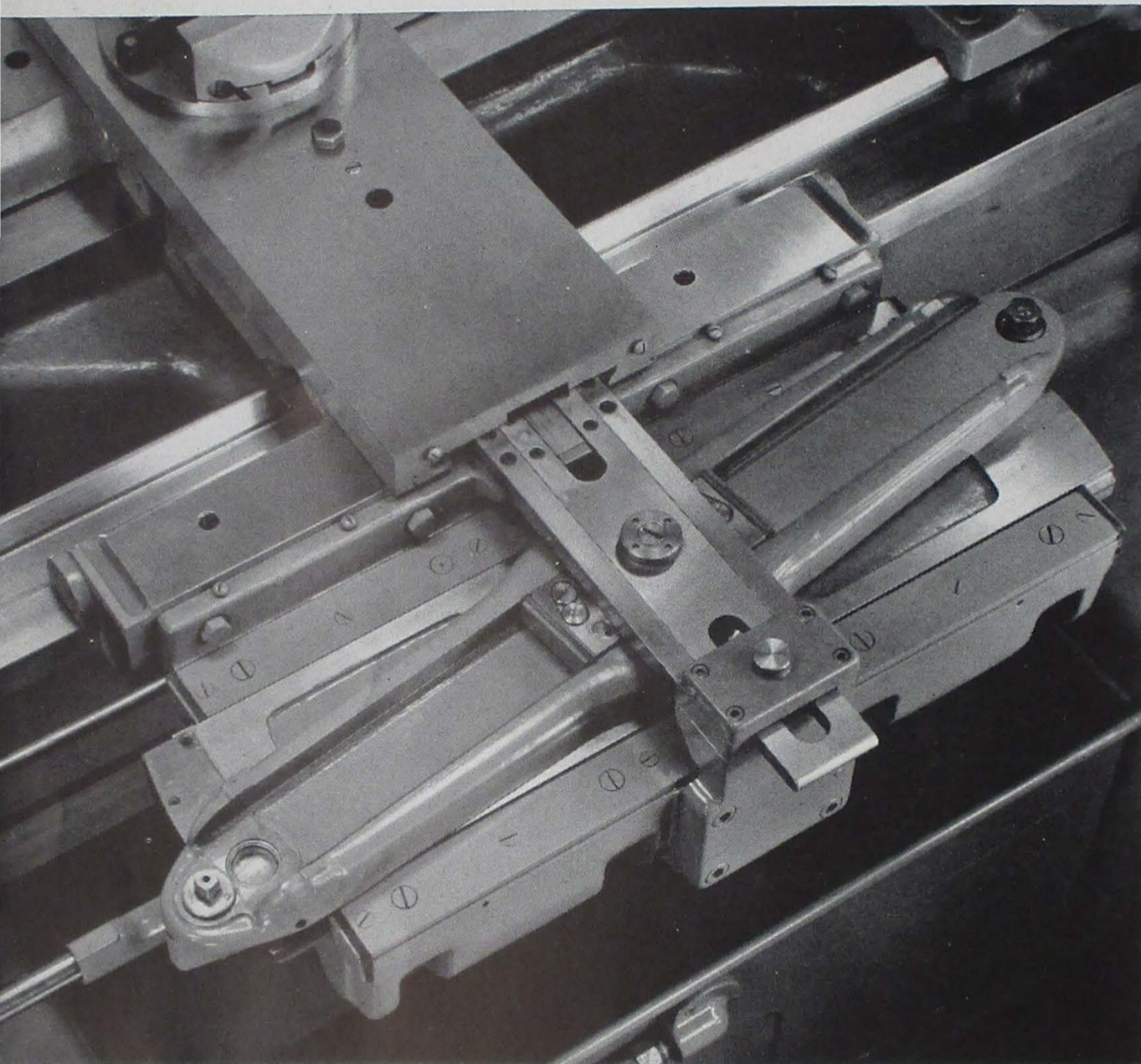
Series 60 Accessories

Monarch accessories cut turning costs by saving operator's time and increasing production.

On the pages which follow many of the more commonly used Series 60 accessories are illustrated and briefly described. It will pay to study their possibilities whether you are considering the purchase of new turn-

ing equipment or considering means of increasing the output of the Monarch lathes now in your own plant.

Still other accessories are available for numerous special requirements. Ask any Monarch representative for further information relative to supplementary equipment which you might have in mind.



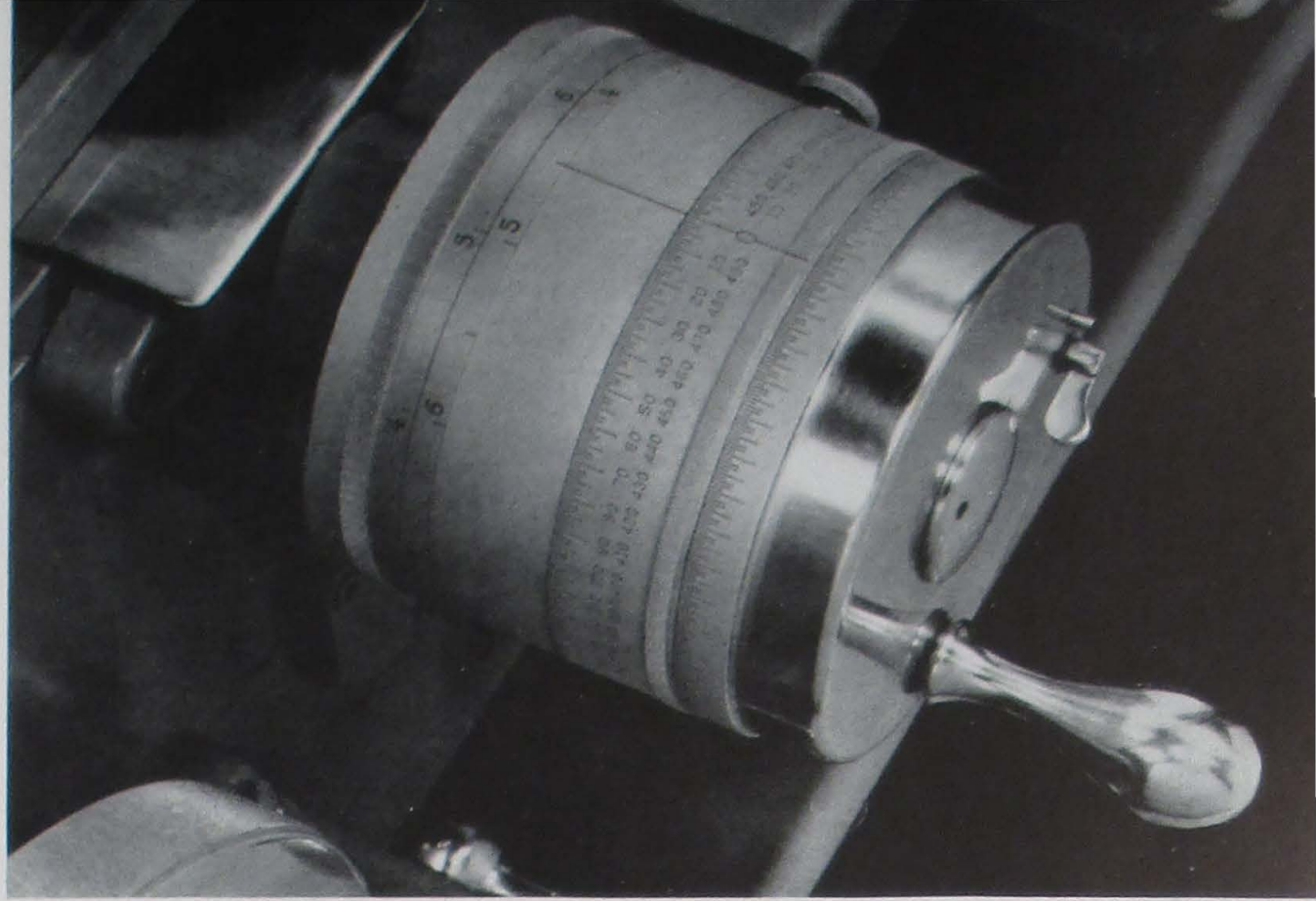
THE ANTI-FRICTION BEARING TAPER ATTACHMENT

- Smooth, accurate tapers consistently turned or bored due to use of ball bearings with permanent, sealed in lubrication. No bearing surfaces to clean after a period of non-operation.
- Use of ball bearings practically eliminates lost motion, backlash and friction.
- Bearings mounted on eccentric studs which provide adjustment, should it ever be required.
- All bearing surfaces against which ball bearings take a bearing are flame hardened and precision ground.
- Construction permits the taking of exceptionally heavy cuts even when boring or turning acute angles, without sacrifice of accuracy.
- Attachment slides have scales accurately graduated both in degrees and inches taper per foot. Swivel has magnifying glass for more accurate setting.
- Taper turning capacity on all sizes Series 60 Engine and Toolmaker's Lathes is 4" maximum taper per foot and 18" maximum length at one setting. Maximum included angle, 18°.
- Versatility extended by addition of taper attachment variator which consists of a simple gearbox with pick off gears and a rack to control motion of taper attachment slide.
- Variator increases degree of taper which can be turned or bored, increases length taper turning capacity at one setting to length capacity of machine and provides a pantographing means for contour turning and boring from a master template.
- With variator, steep tapers up to 67° included angle or 16" taper per foot may be turned or bored. See Accessory Bulletin No. 707 for detailed information as to lengths which may be so handled.
- Taper attachment can be furnished with still other features for a wide variety of form turning and form boring operations.

Left. Phantom view of Monarch Series 60 taper attachment showing the generous use of ball bearings. Note also the darker strips which indicate the flame hardened and ground bearing surfaces.

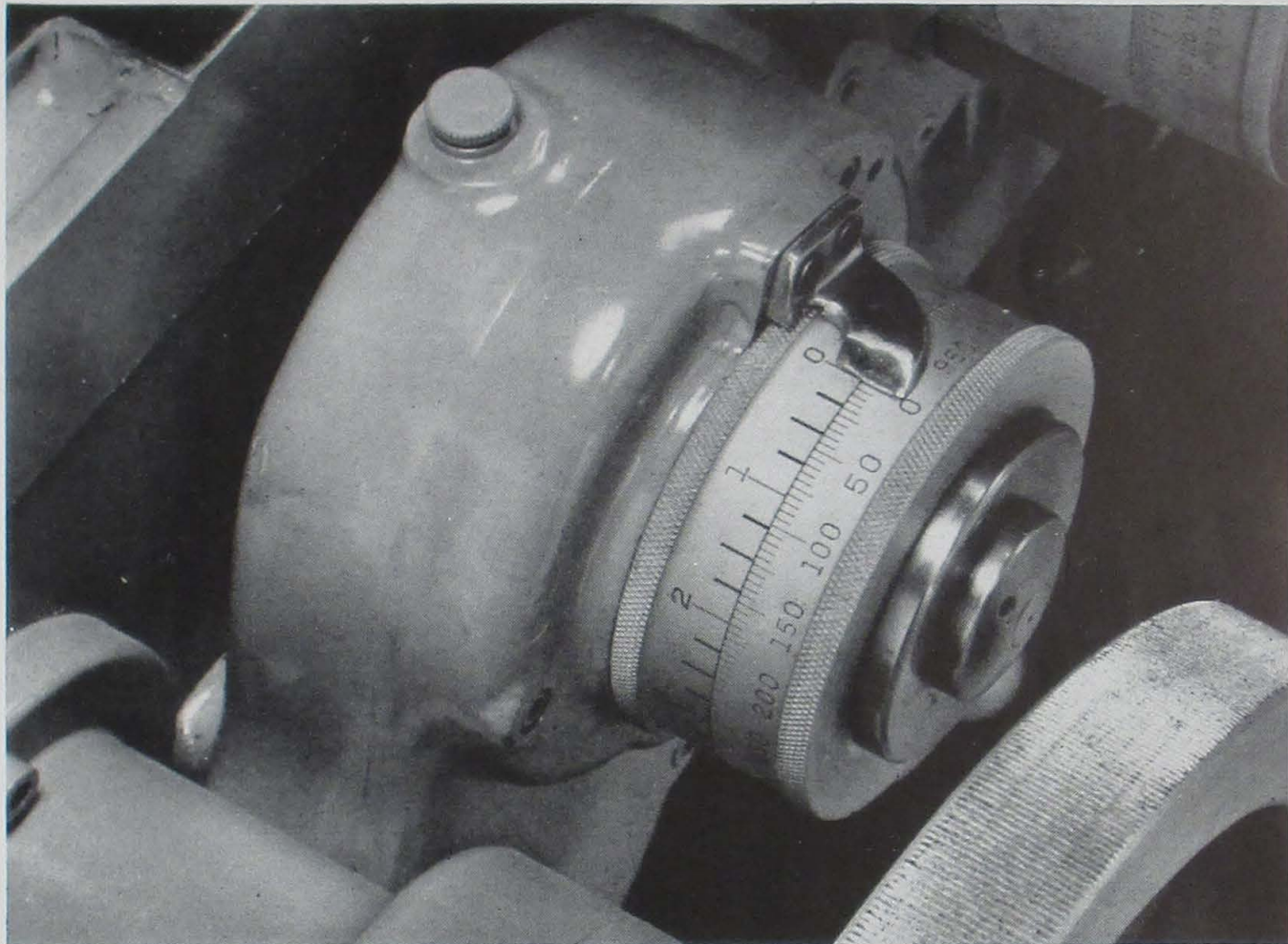
MICRO-GAUGING DIAL

- Used to facilitate multiple diameter turning or boring.
- Mounted on cross-feed screw. Consists of large diameter cross-feed dial with graduations reading in thousandths of diameter and an inner dial graduated in inches. Dials geared to each other and both may quickly be set to zero.
- Outer dial has two sets of numbers; one for turning, the other for boring. Direct diameter therefore may be read without calculation.



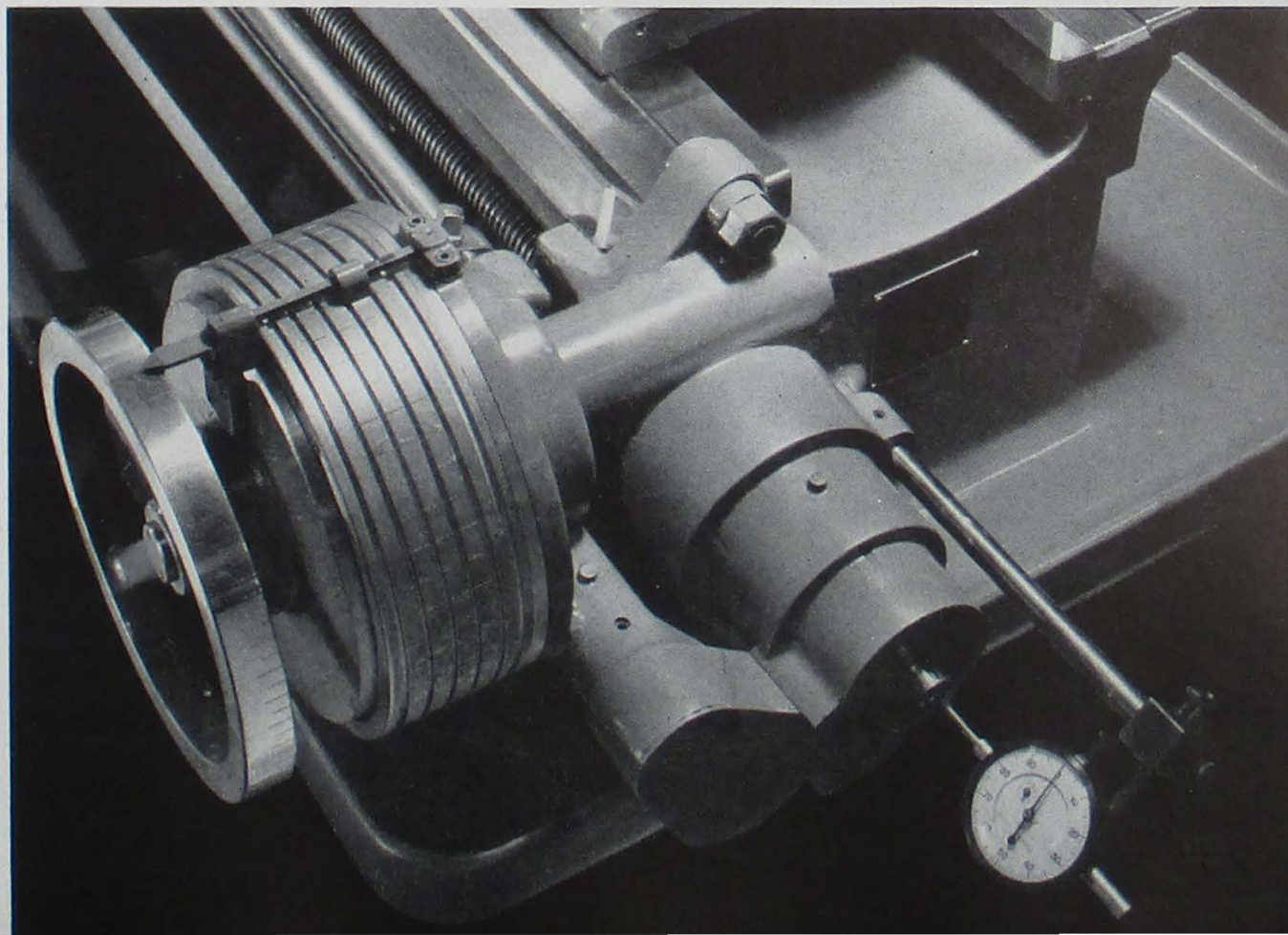
DIRECT LENGTH READING DIAL

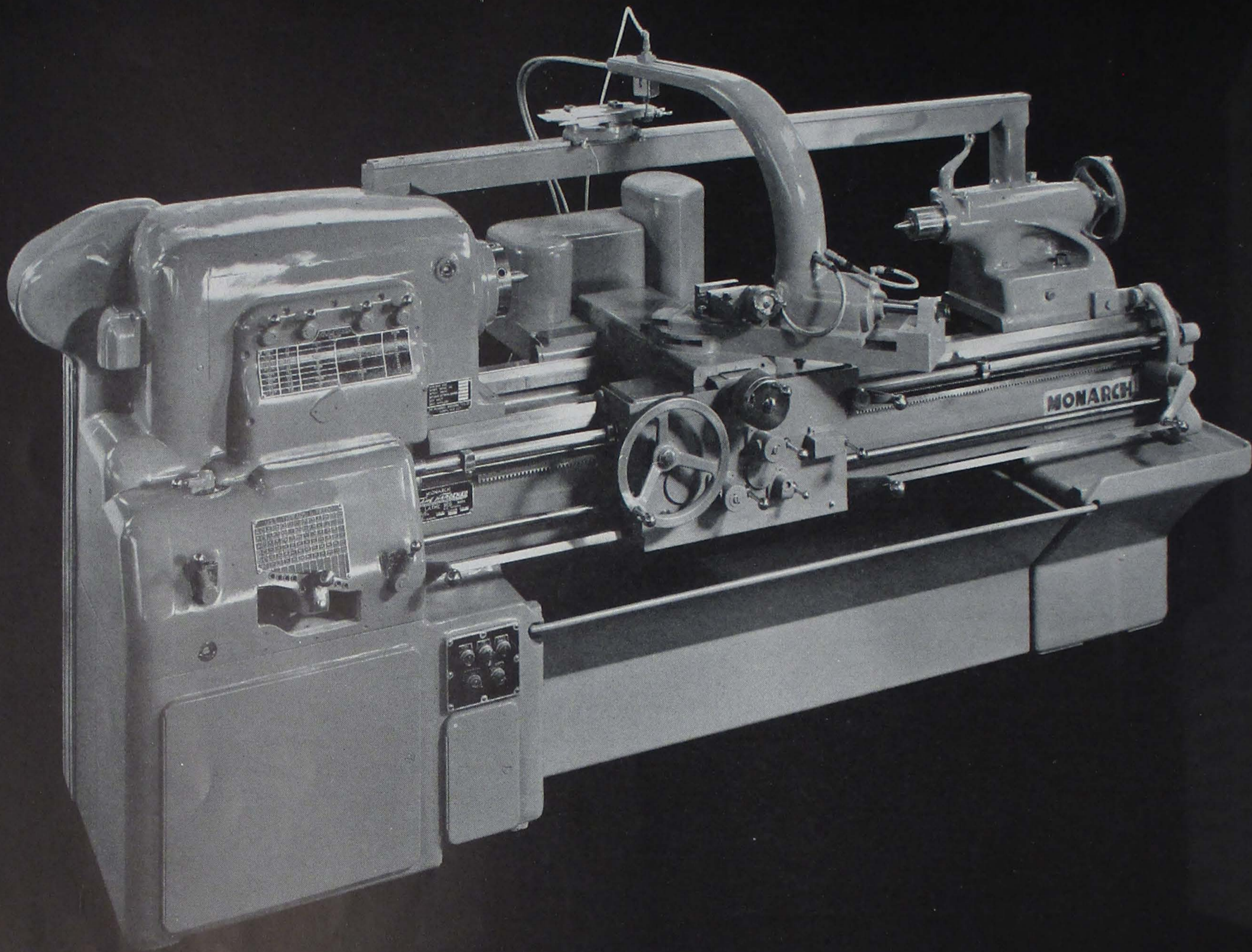
- For multiple diameter turning or boring. Especially valuable when boring blind holes.
- Through gearing in dial mechanism housing, one foot of length carriage travel results in one complete revolution of inner dial. One inch of carriage travel equivalent to one revolution of outer dial which is graduated in $.005''$ readings.
- Both dials can be reset quickly to zero so that successive length measurements can be made quickly and read directly on the dials.



LEAD VARIATING ATTACHMENT

- A requisite for finish chasing super-accurate threads.
- Prior to finishing cut, lead errors are recorded on spiral track of drum. Automatic follower shows correction necessary as tool advances from one end of work to the other.
- Large graduated handwheel with pointer makes quick correction a simple matter while an indicator dial supported at the end of the mechanism provides a visual check of the correction made.





“AIR-GAGE TRACER”

- A versatile, cost-reducing production method for turning multiple diameter shafts and turning, boring or facing contours.
- Imparts a smooth, stepless finish because of the continuous single tool cut.
- Provides automatic sizing.
- Generally reduces by half amount of stock left for grinding.
- Frequently eliminates hand polishing or grinding because of fine finish imparted to work.
- Produces more accurate work than any other duplicating device.
- Eliminates need for expensive forming tools and the cost of multiple tool setups.
- Makes possible complete setup change in less than ten minutes; tool change in less than one minute.
- Permits turning of diameters, tapers, bevels, forms, grooves, undercuts, shoulders, necks, radii and chamfers in a single continuous cut, if necessary.
- Reduces chance for human error thereby practically eliminating spoiled work.
- Often saves time and money and gives better accuracy than machining by multiple tool methods.
- Completely described in separate bulletins which may be had upon request.

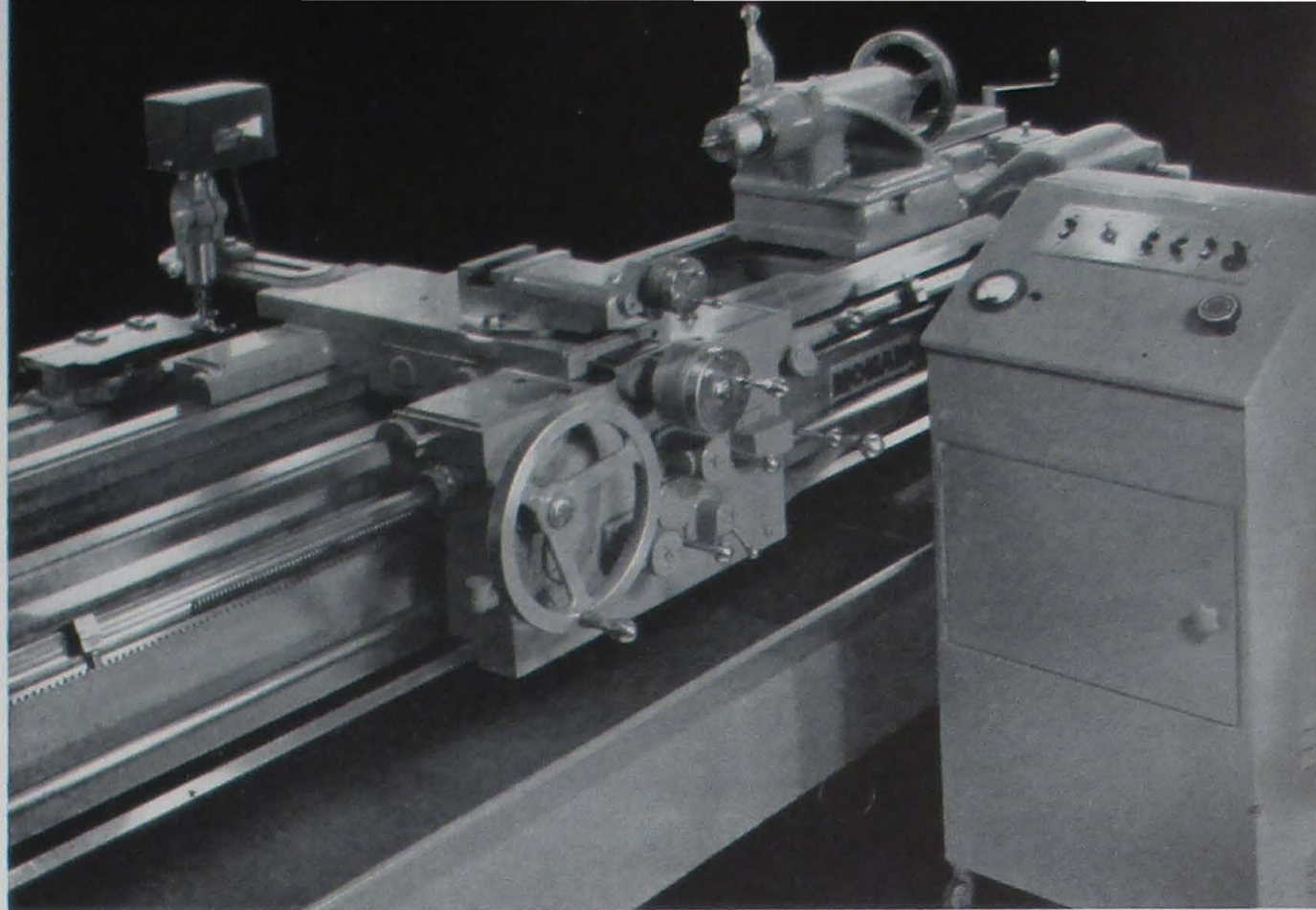
AUTOMATIC SIZING

- Recommended primarily for turning the larger step shafts. May also be used for step boring, step facing and contour turning or any combination of these operations.
- With rear vertical turret, necking and chamfering operations may be performed during same setup.
- Makes it possible to convert a Series 60 Monarch lathe from manual operation to automatic operation in about one minute.

AUTOMATIC SIZING

(Continued)

- Saves time on lots as small as two or three pieces because total set up never requires more than fifteen minutes, often as little as five minutes.
- Enables one operator to handle two or more machines on most work with less fatigue than one manually operated lathe.
- May be applied on new machines at factory or lathes may be ordered arranged for addition of automatic sizing later on in user's plant.
- Ask your Monarch sales representative for further information.

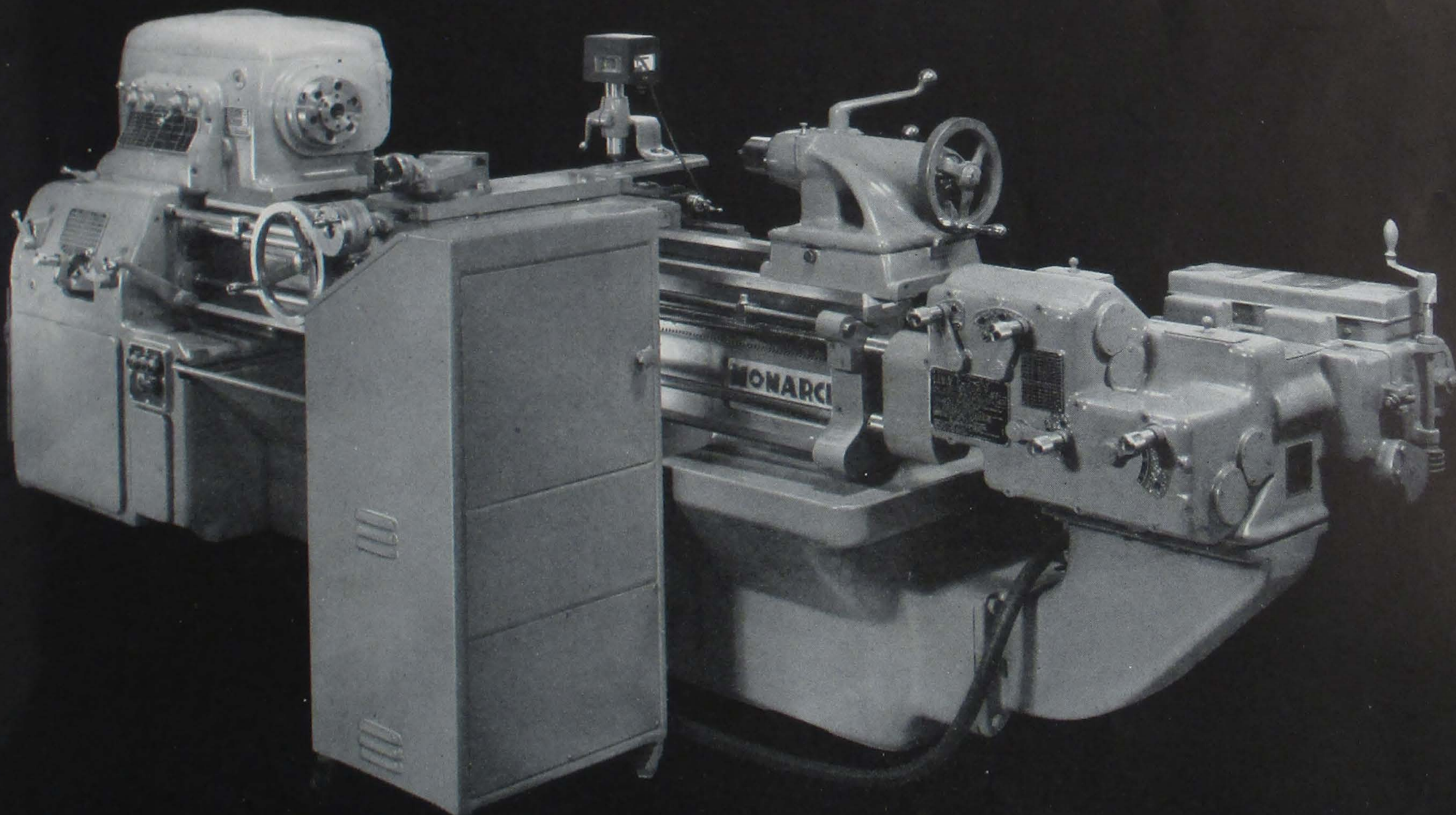


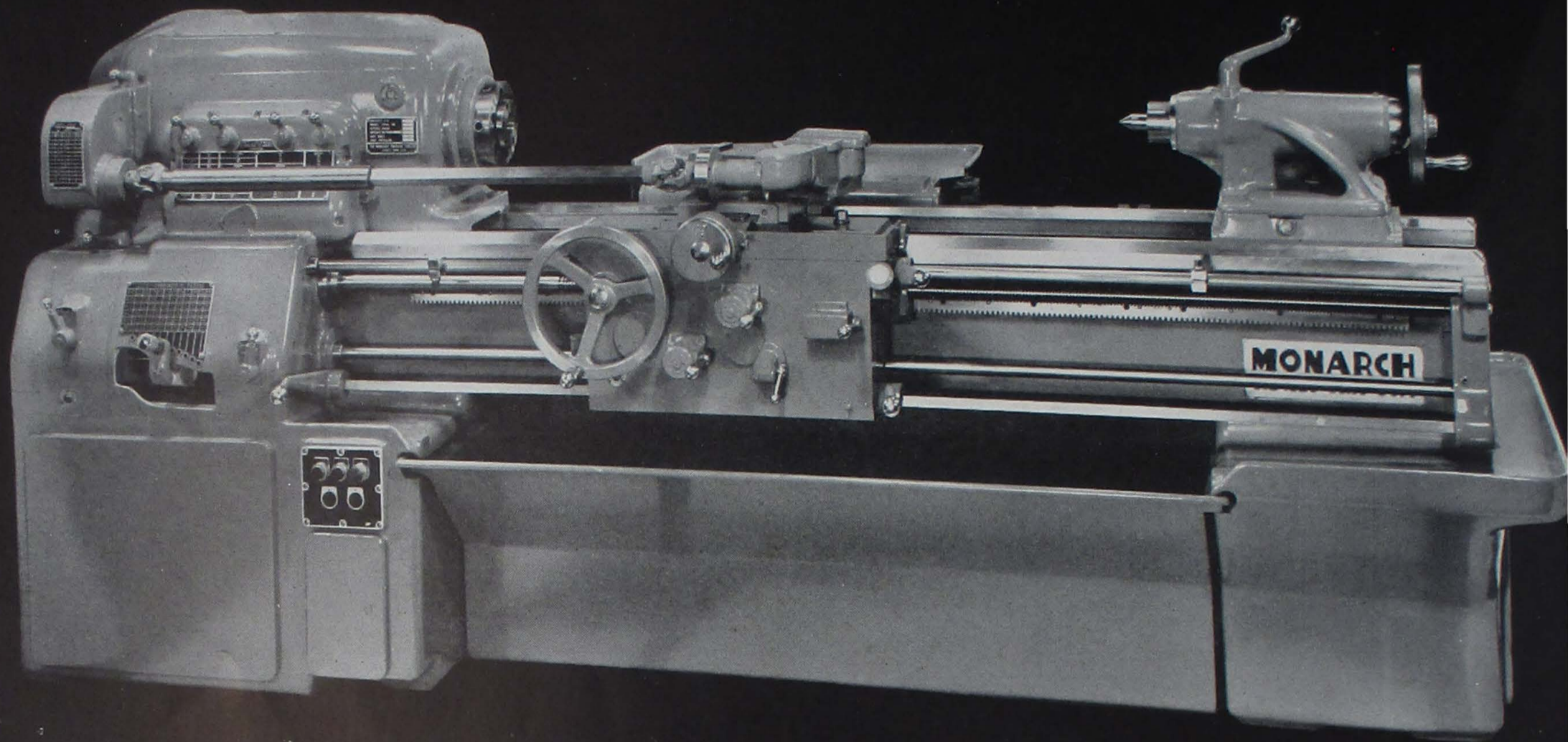
KELLER CONTROLS

- Typical uses are for form turning and boring such work as molds, punches, dies, form rolls and spinning chucks. Used extensively for quantity production of many intricately shaped parts.
- Consists of tracer unit mounted at rear of machine, magnetic clutch mechanism attached to right hand end of bed and control cabinet which may be located at any point in front of the machine where it is most convenient to the operator.

- Shape of thin metal template accurately imparted to work piece by means of tracer which electrically controls both carriage and tool slide feed through the medium of magnetic clutches.
- Range and metal removing capacity not limited by use of controls.
- Controls may be disconnected in an instant, making machine available for regular lathe work under manual control.
- This feature may be applied to all new Series 60 lathes at the factory before shipment or, at small additional cost, new lathes are prepared to receive Keller controls which may be attached at some future time by our serviceman.
- Almost 900 Monarch Keller-controlled lathes are in use.

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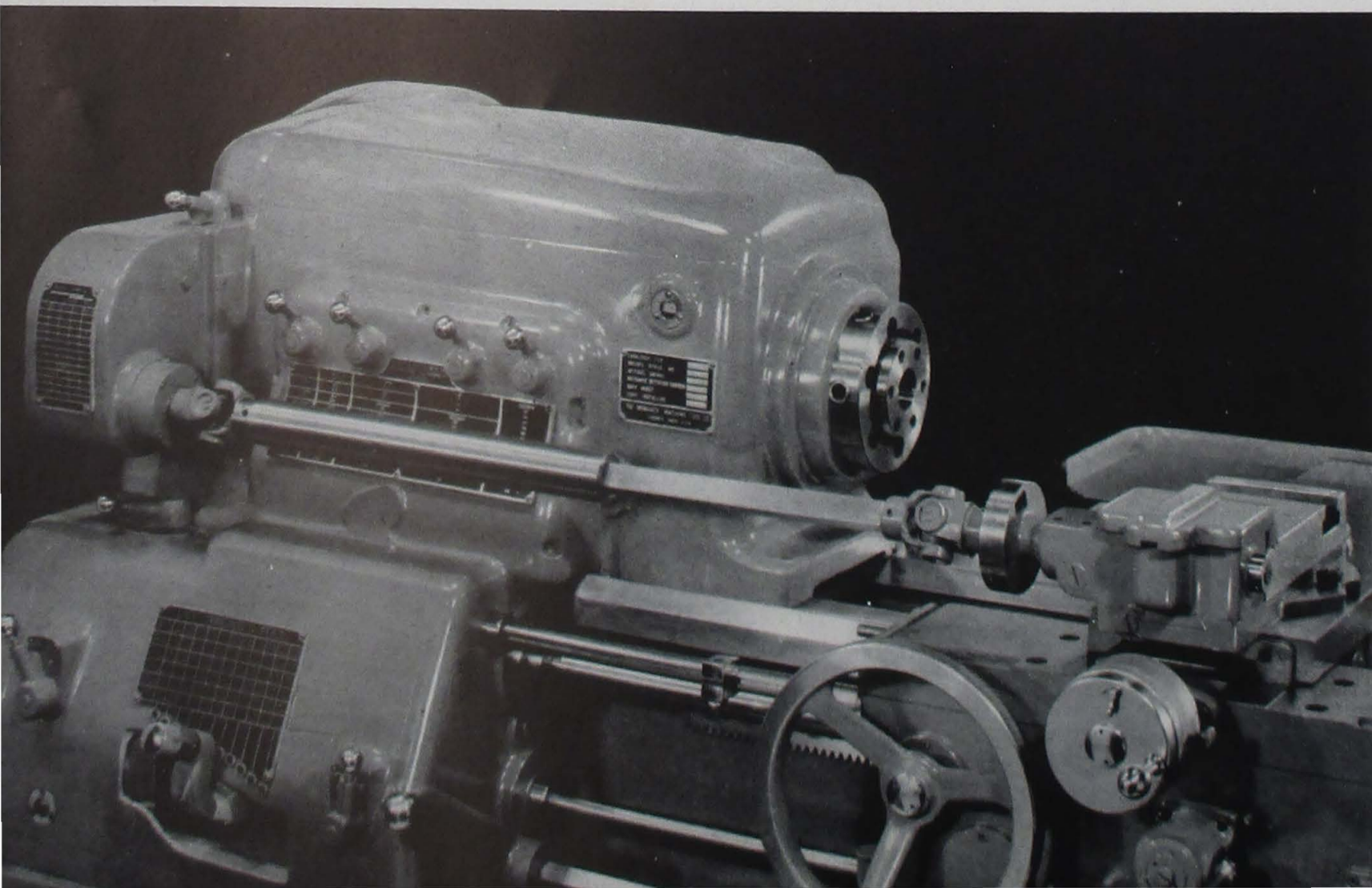


THE UNIVERSAL RELIEVING ATTACHMENT

(Furnished only on Toolmaker's Lathes)

- A highly efficient attachment for external, internal and end relieving operations.
- May be attached on any machine at factory or after machine has been in use in the field.
- Drive housing, containing change gear mechanism, attached to end of headstock where it can remain permanently. May be readily disconnected when not required.
- Relieving tool slide mounts on regular cross slide of machine. Can be swiveled for angular or end relieving.
- Universal joints provide smooth, positive drive to cam at all slide positions.

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Left. Here the relieving attachment is set up for external and internal relief. Changing over to the end relief setup is a quick and simple procedure.

RELIEVING ATTACHMENT CAPACITIES

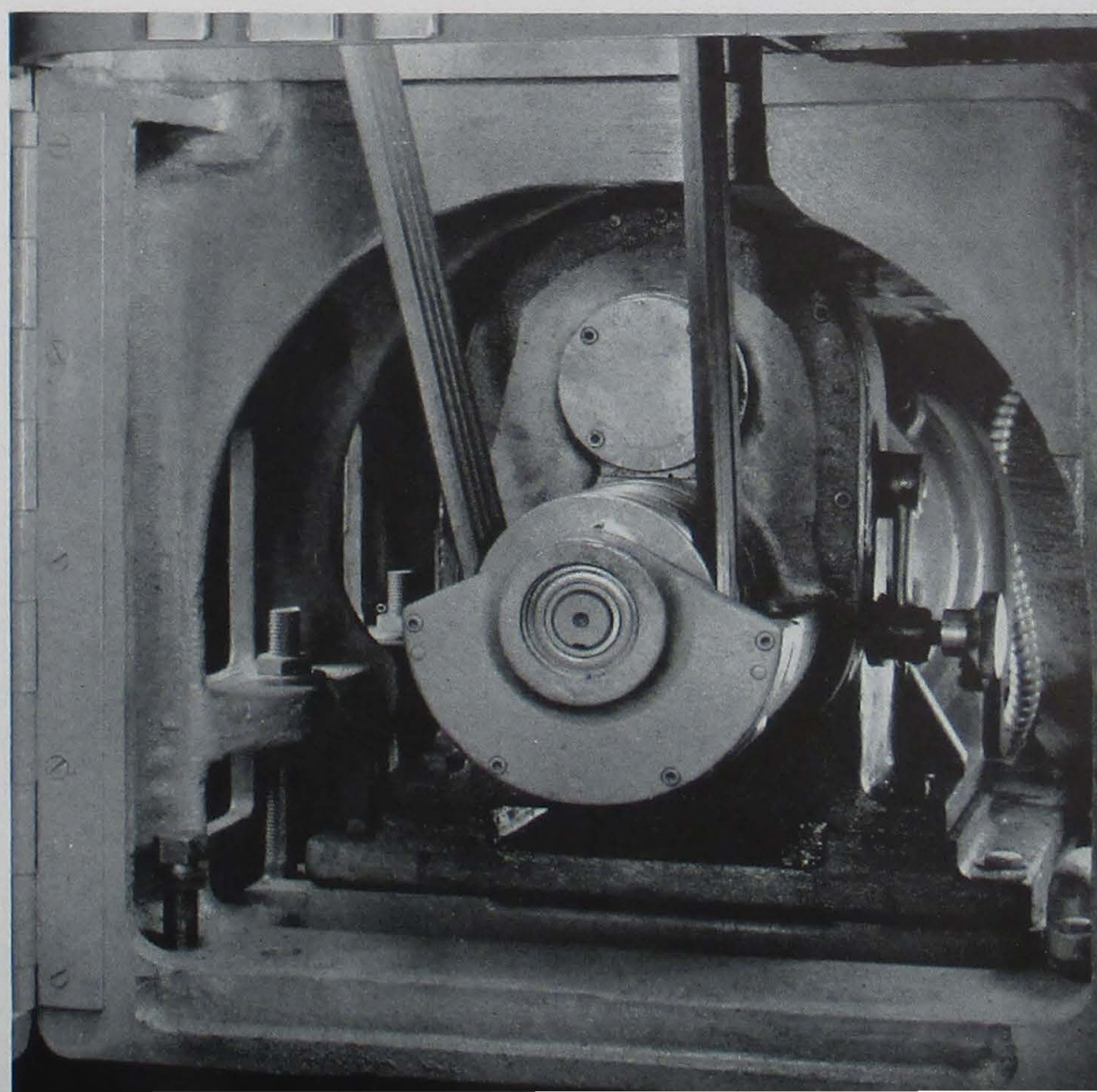
	14"	16"	18"	20"
Number of Flutes with Single Throw Cams	2, 3, 4, 5, 6, 7, 8, 10, 12, 14, 16	2, 3, 4, 5, 6, 7, 8, 10, 12, 14, 16	2, 3, 4, 5, 6, 7, 8, 10, 12, 14, 16	2, 3, 4, 5, 6, 7, 8, 10, 12, 14, 16
Maximum Diameter Cutter for External Relief	8	8	8	8
Longest Piece that can be End Relieved	13	13	13	13
Recommended Maximum No. Actuations per Minute	90	90	90	90
Size of Standard Relief Cams	$\frac{1}{16}$, $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$	$\frac{1}{16}$, $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$	$\frac{1}{16}$, $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$	$\frac{1}{16}$, $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$
Number of Flutes with Double Throw Cams	4, 6, 8, 10, 12, 14, 16, 20, 24, 28, 32	4, 6, 8, 10, 12, 14, 16, 20, 24, 28, 32	4, 6, 8, 10, 12, 14, 16, 20, 24, 28, 32	4, 6, 8, 10, 12, 14, 16, 20, 24, 28, 32

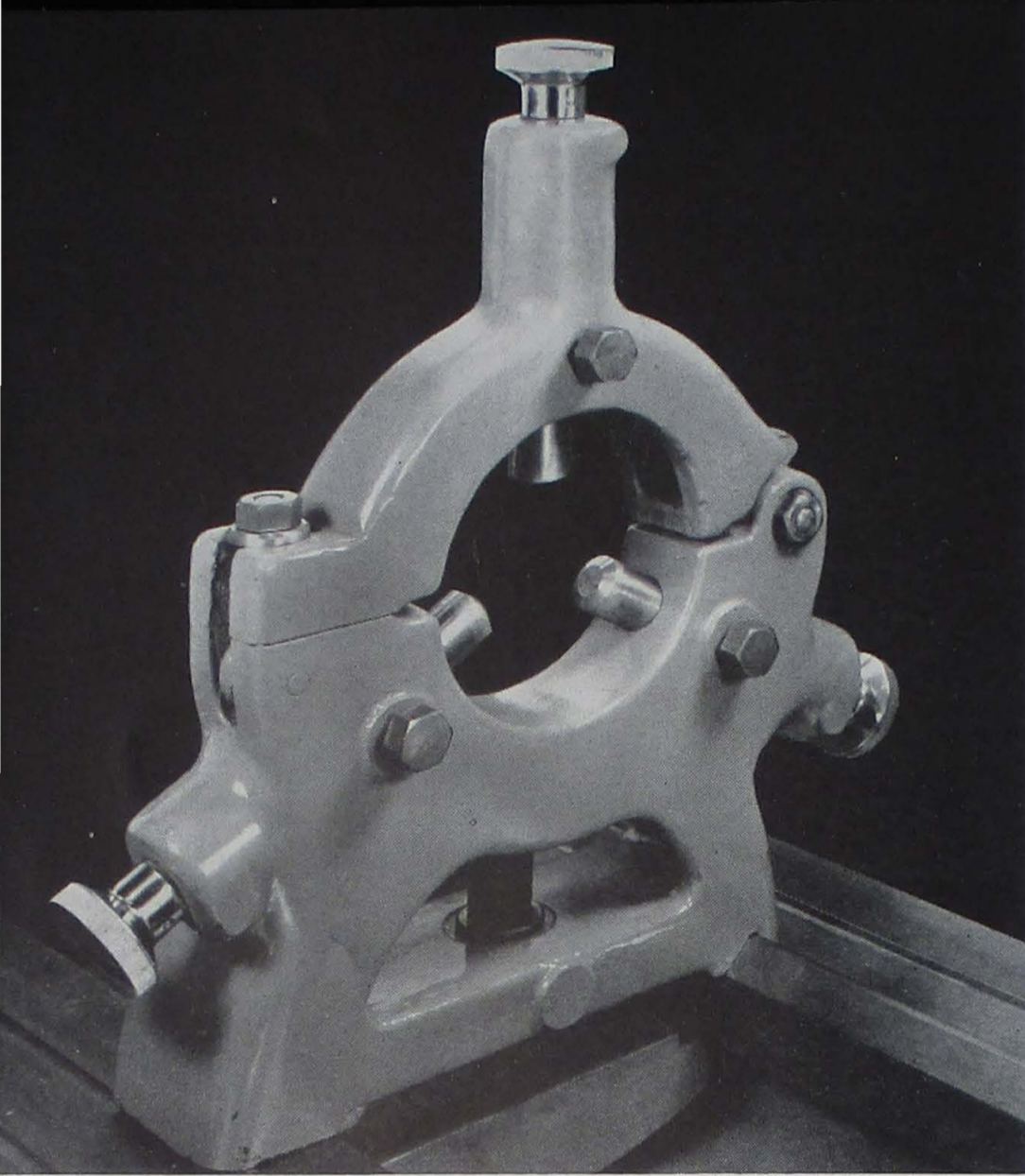
- Cam in oscillating tool slide has large, graduated timer to facilitate accurately setting the correct relation between the cam and the work.
- Regular cams create a mathematically uniform relief but special cams can be furnished for various other relief forms.
- Double throw cams may be had for work with a larger number of flutes than produced by single throw cams.
- With special gears in the end gear train, spiral relieving can be accomplished.
- When ordering special gears for spiral relieving give the lead, number of flutes and state whether right hand or left hand. For spiral tap relieving it is necessary that the number of threads per inch be given in addition to the foregoing.

SPINDLE SPEED REDUCER FOR RELIEVING ATTACHMENT

- Required in connection with relieving attachment for relieving multi-fluted cutter.
- Six to one reduction unit mounted on motor plate along with main drive motor.
- Removable outboard sheave support facilitates belt change.
- Unit engaging lever easily accessible merely by opening front cabinet leg door. When normal range of spindle speeds is used, driving sheave is directly connected to motor shaft.
- Speed range provided on machines equipped with regular 1800 R. P. M. motor is 3 to 116 R. P. M.

Right. Cover removed at left hand end of cabinet leg to show mounting of spindle speed reducer, generally required in connection with relieving attachment.





STANDARD STEADY RESTS

- Exceptionally sturdy design for maximum work support.
- All jaws have renewable tips.
- Capacities are as follows:

Size of Lathe	Minimum	Maximum
14", 16"	1/2"	5"
18", 20"	1/2"	6"

OVERSIZE STEADY RESTS

- Design similar to standard steady rests with capacities as follows:

Size of Lathe	Minimum	Maximum
14", 16"	5"	8"
16", 18", 20"	6"	12"

ROLLER JAW STEADY RESTS

(Anti-Friction Bearing)

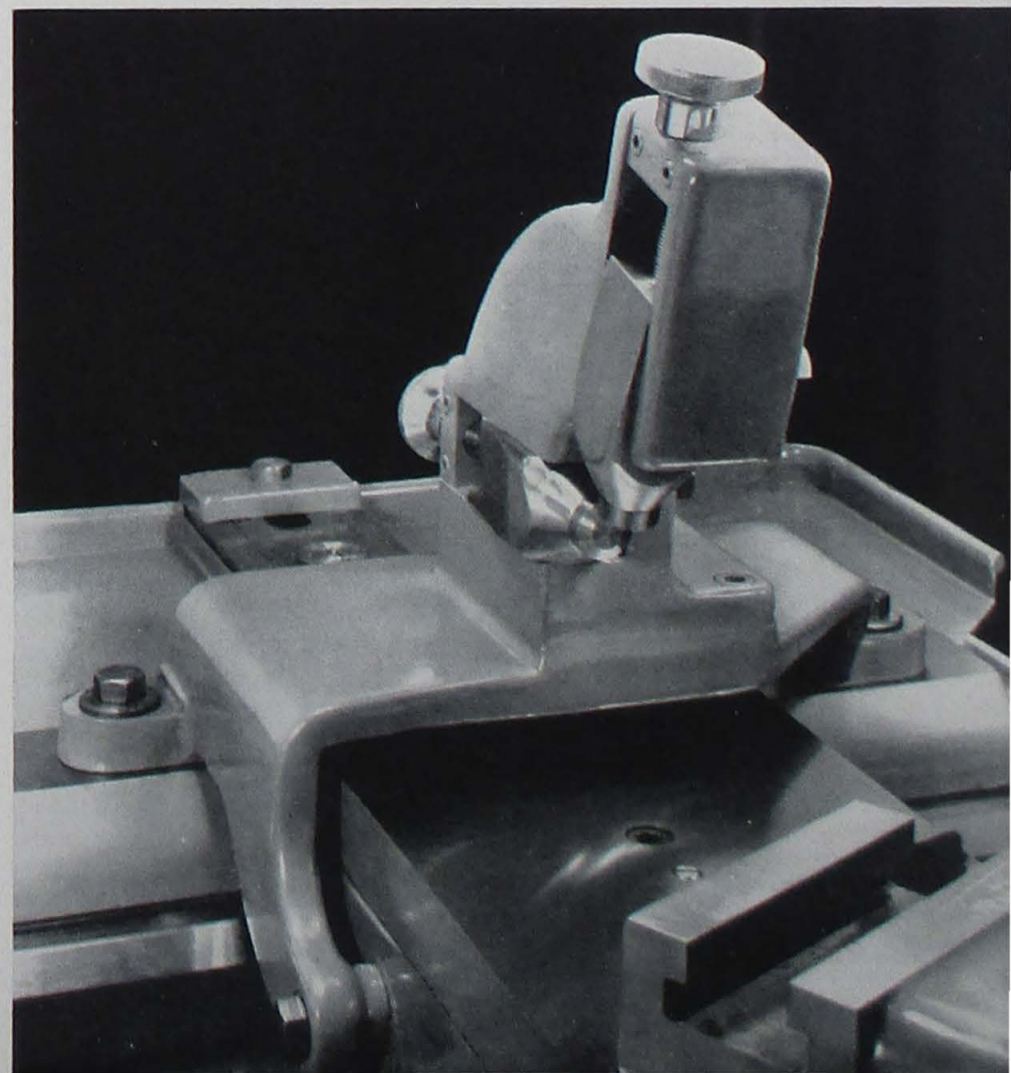
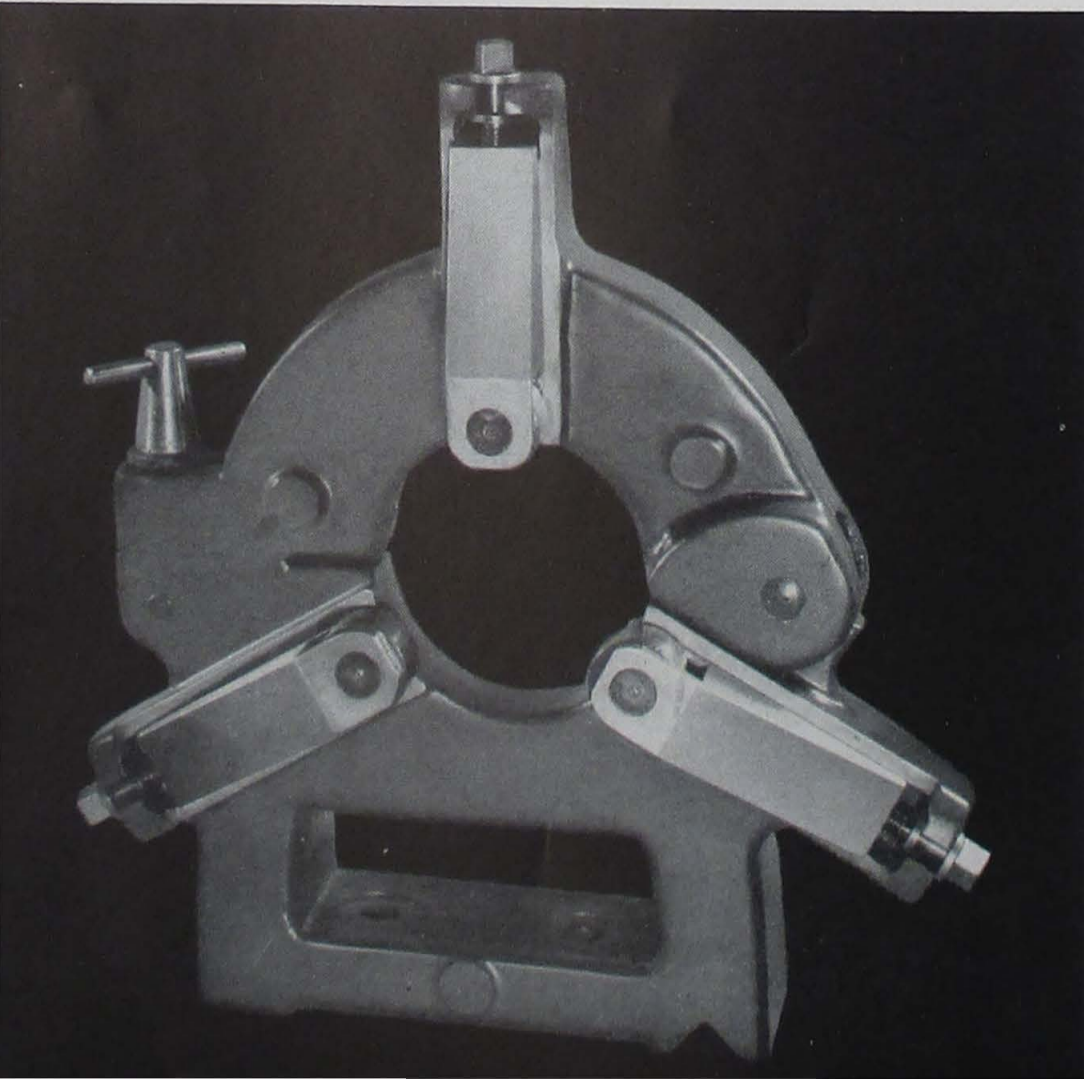
- Recommended for all operations requiring the higher work speeds.
- Capacities are as follows:

Size of Lathe	Minimum	Maximum
14"	1/2"	5"
16", 18", 20"	1/2"	6"
16", 18", 20"	6"	12"

FLAT JAW TYPE FOLLOW RESTS

- Jaws have renewable tips.
- Available in the following capacity.

Size of Lathe	Minimum	Maximum
14", 16"	1/2"	3 1/2"





TUBULAR JAW TYPE FOLLOW RESTS

- A rugged accessory which gives solid support under severe operating conditions. Jaws have renewable tips.
- Available in the following capacity.

Size of Lathe	Minimum	Maximum
18", 20"	1"	6"

OVERSIZE TUBULAR JAW TYPE FOLLOW RESTS

- Design similar to standard follow rests with capacity as follows.

Size of Lathe	Minimum	Maximum
16", 18", 20"	3"	6"

HIGH DUTY DOUBLE SCREW TOOL POST

- Should always be used when exceptionally heavy cuts have to be taken.
- Tool block is an alloy steel casting and is provided with Mac-It unbreakable screws.
- Supplied as regular equipment on all Series 60 machines equipped with the "Air-Gage Tracer".

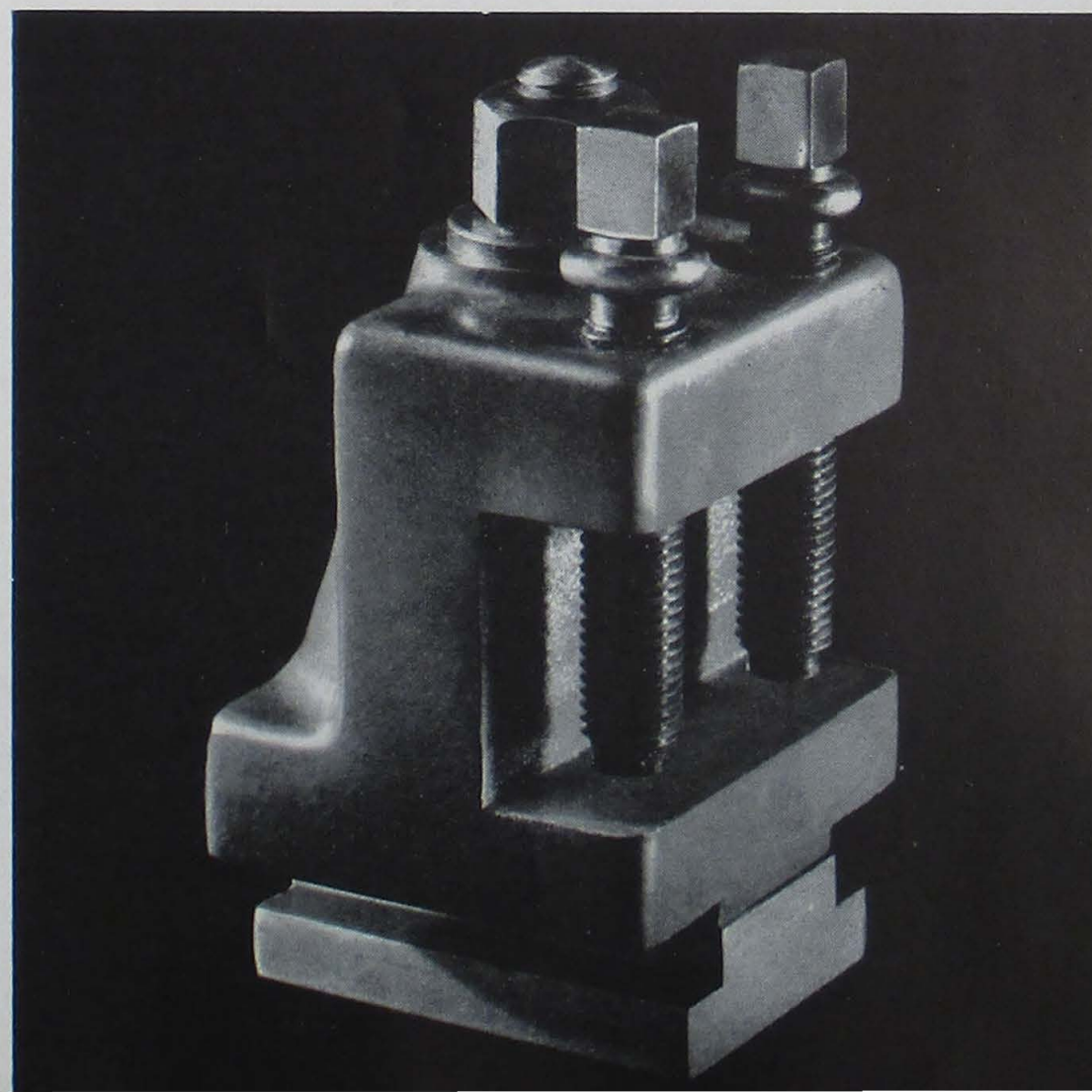


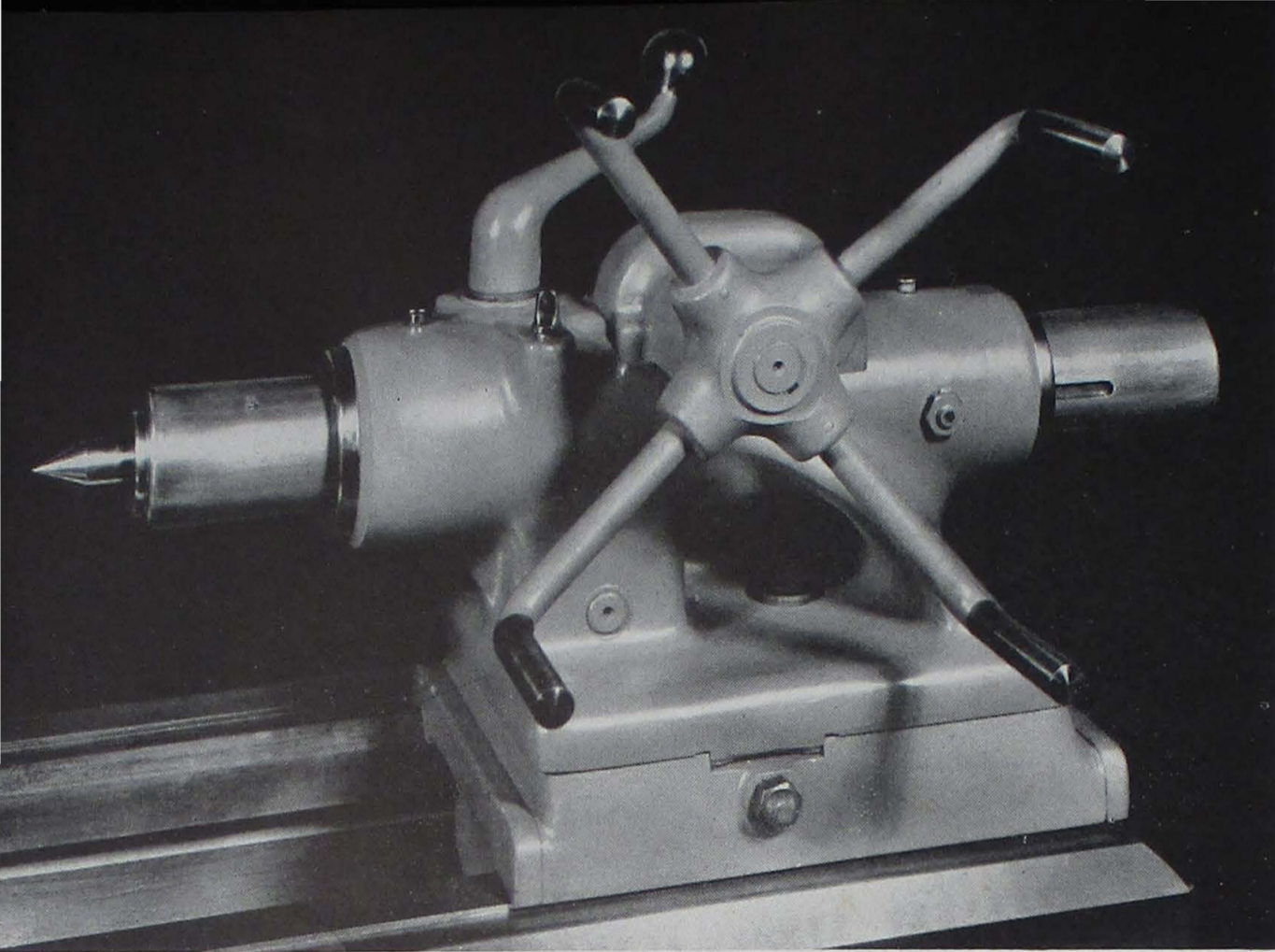
ROLLER JAW TYPE FOLLOW RESTS

(Ball Bearing)

- Recommended for the higher speeds required when turning with carbide tools.
- Supplied in the following capacities.

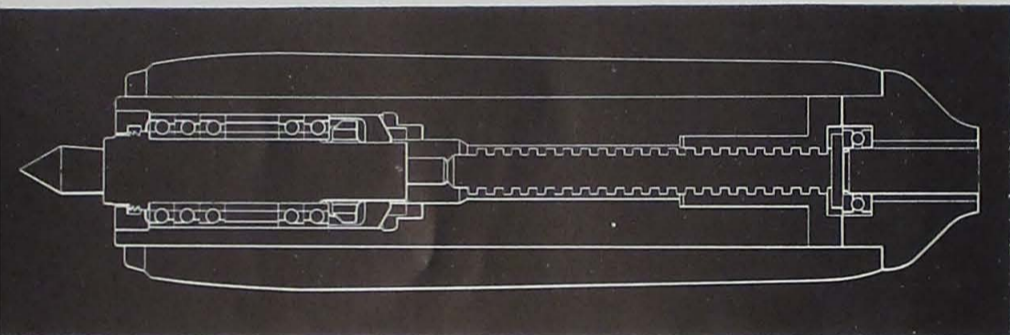
Size of Lathe	Minimum	Maximum
14", 16"	1/2"	3 1/2"
18", 20"	1"	4"





CAPSTAN TYPE TAILSTOCK

- A valuable production aid when nature of operation requires a large amount of spindle travel during changing of work pieces.
- Particularly valuable in case work pieces must be inserted some distance into a chuck.
- Large capstan handwheel is at front within easy reach of operator.



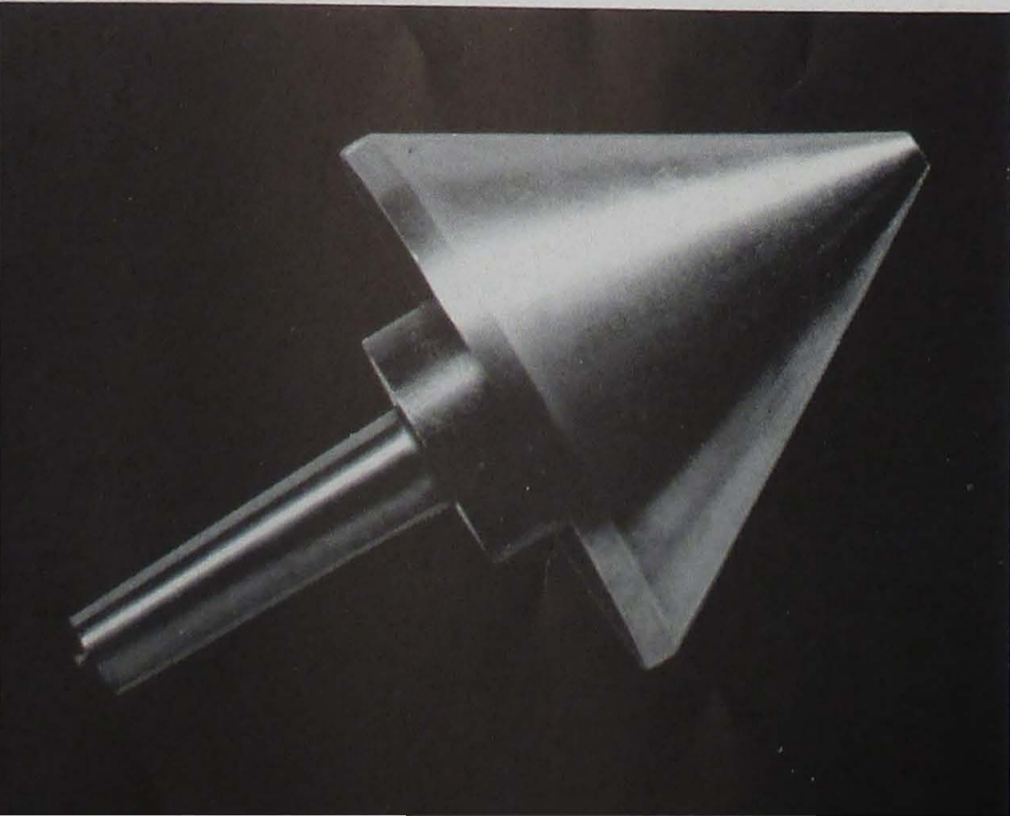
IN-BUILT BALL BEARING TAILSTOCK CENTER

- A "must" on production operations employing the higher speeds.
- Saves time by eliminating the need for oiling the tailstock center.

PIPE CENTER

- Required for pipe or any parts having large bore.
- Anti-friction type with 1" to 6" capacity.

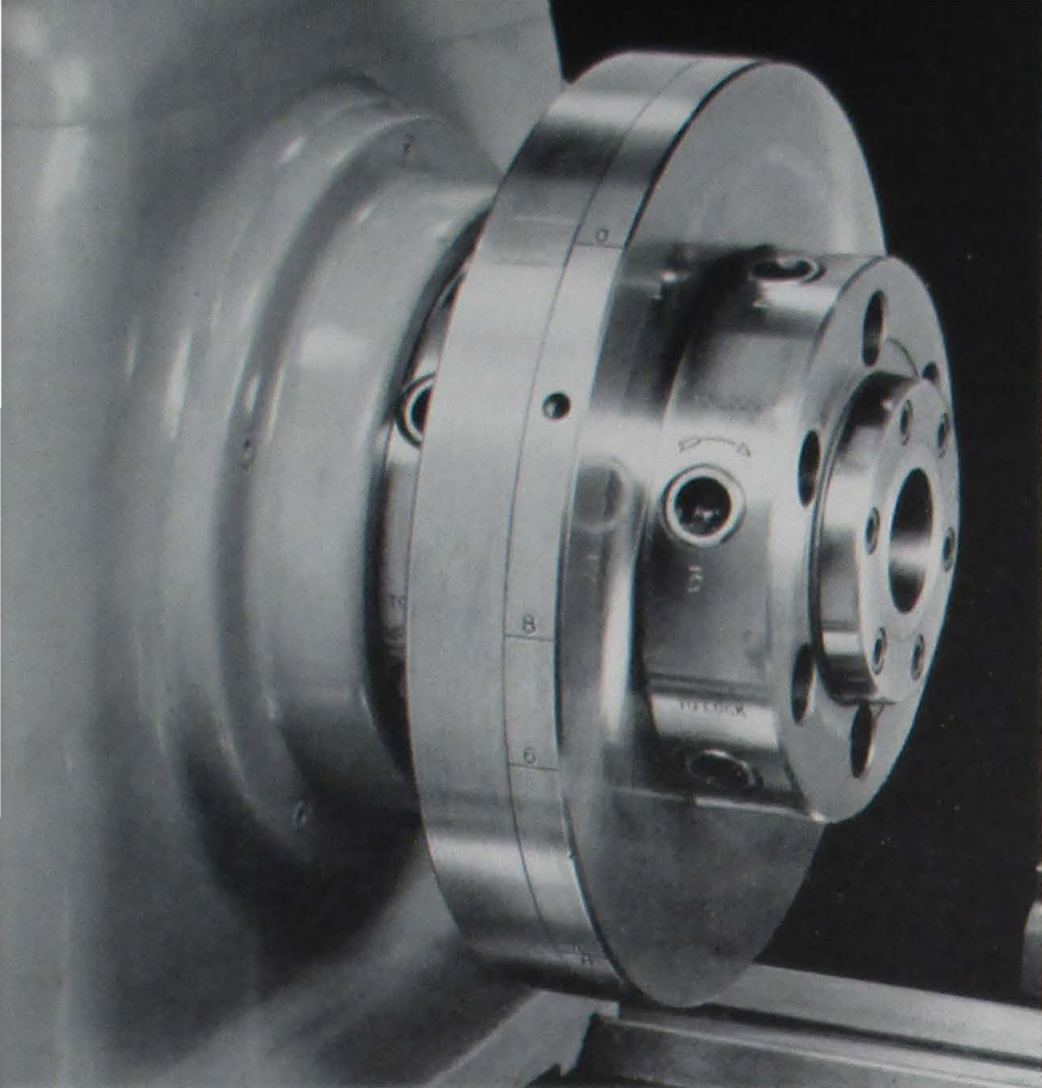
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TOOL CABINET

- Especially designed to provide proper storage space for various accessory units normally used with a toolmaker's lathe.
- Space provided for orderly storage of collets.
- Generous shelf storage space for such accessories as chucks, steady rests, follow rests and face plate.
- Top of cabinet serves as convenient place for operator's personal tool box.



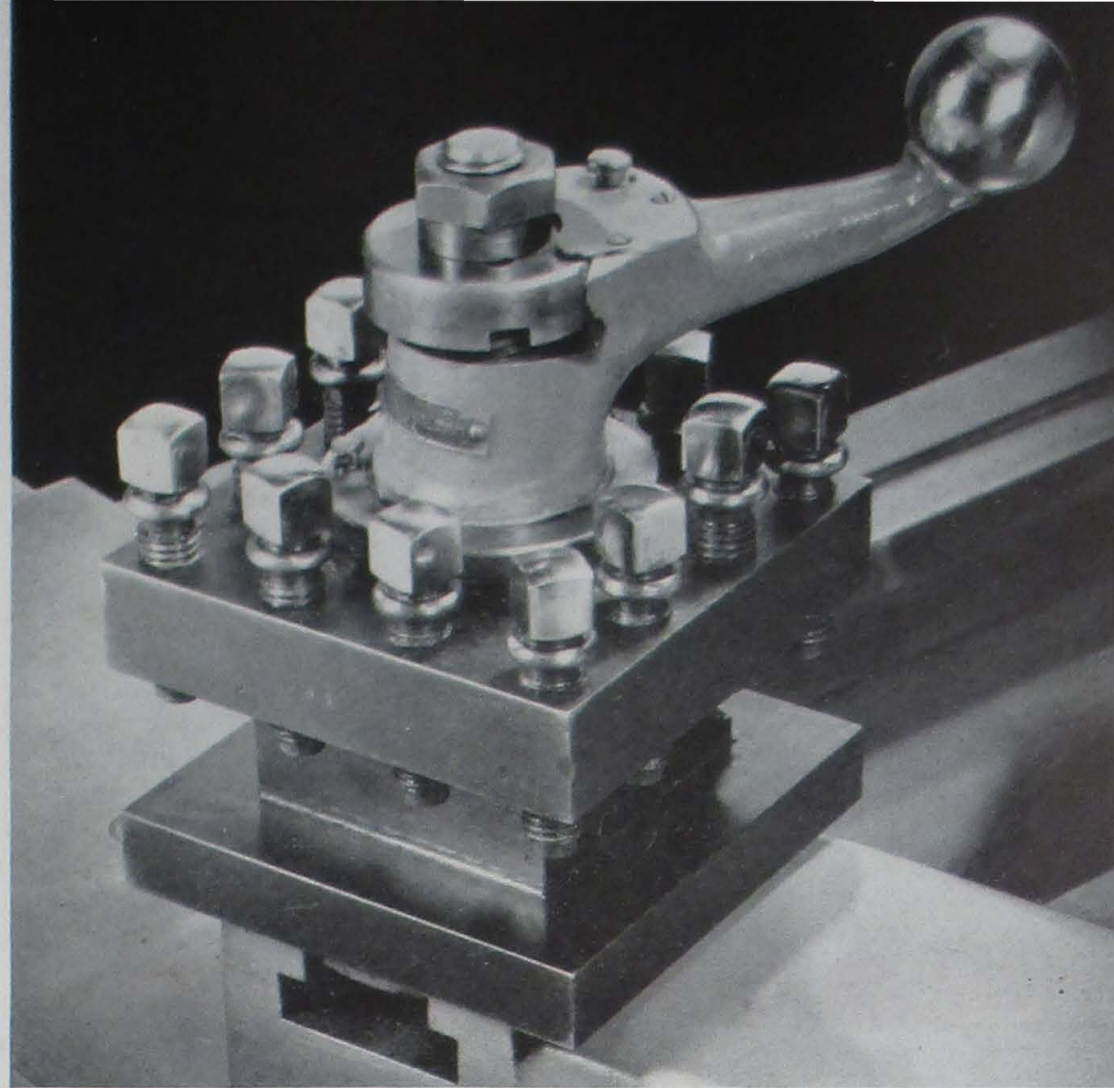


MULTIPLE INDEXING FACE PLATE

- Used principally on toolmaker's lathes for the chasing of multiple start threads.
- Mounts on Camlock spindle nose. Front plate of attachment has the same Camlock nose, permitting plates and chucks to be interchanged.
- Indexing plate provided with graduations for engaging teeth of index gear for 2, 3, 4, 6 and 8 multiple start threads.

STYLE "L" TURRET

- For continuous use. Fits directly to bolt circle of regular bottom slide.
- Square size of turret, $6\frac{1}{2}$ ". Maximum tool size, $\frac{5}{8}$ " x $1\frac{3}{8}$ ".

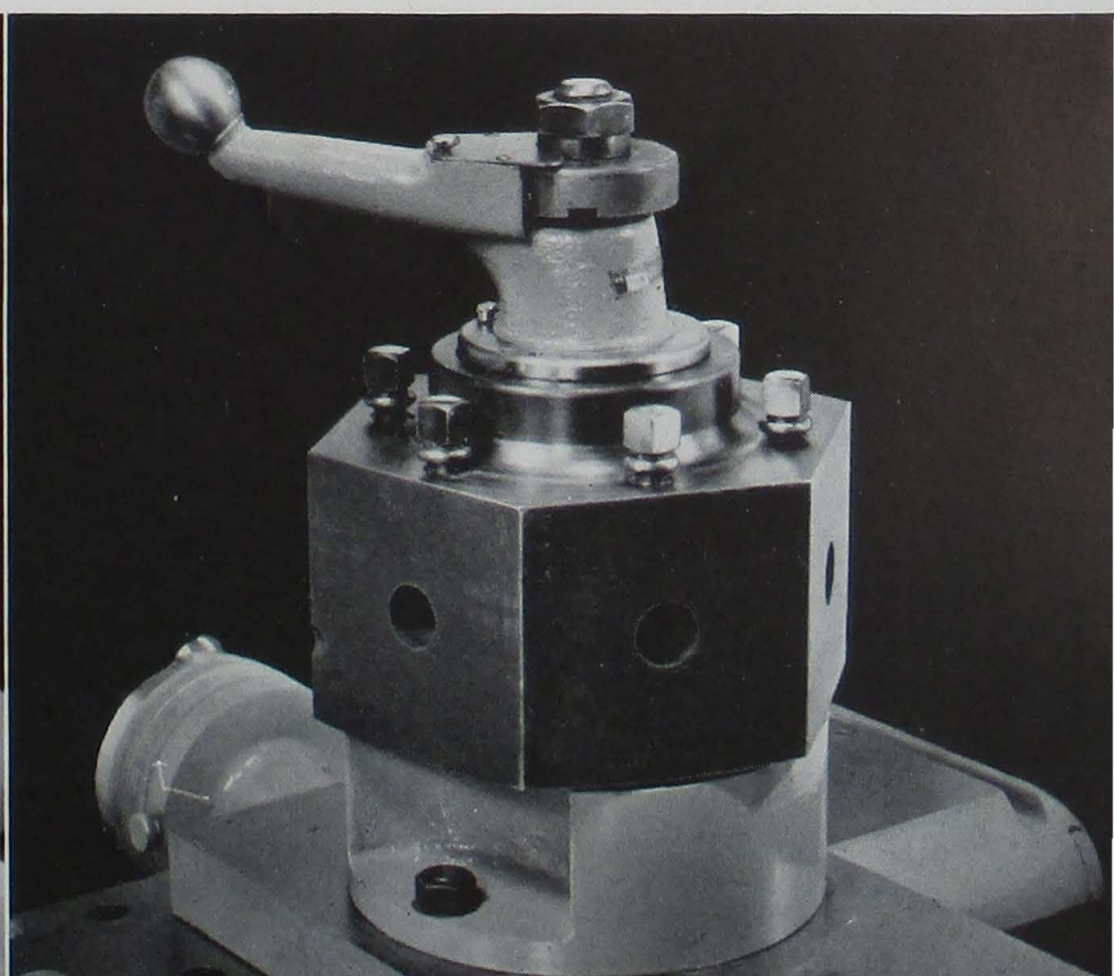
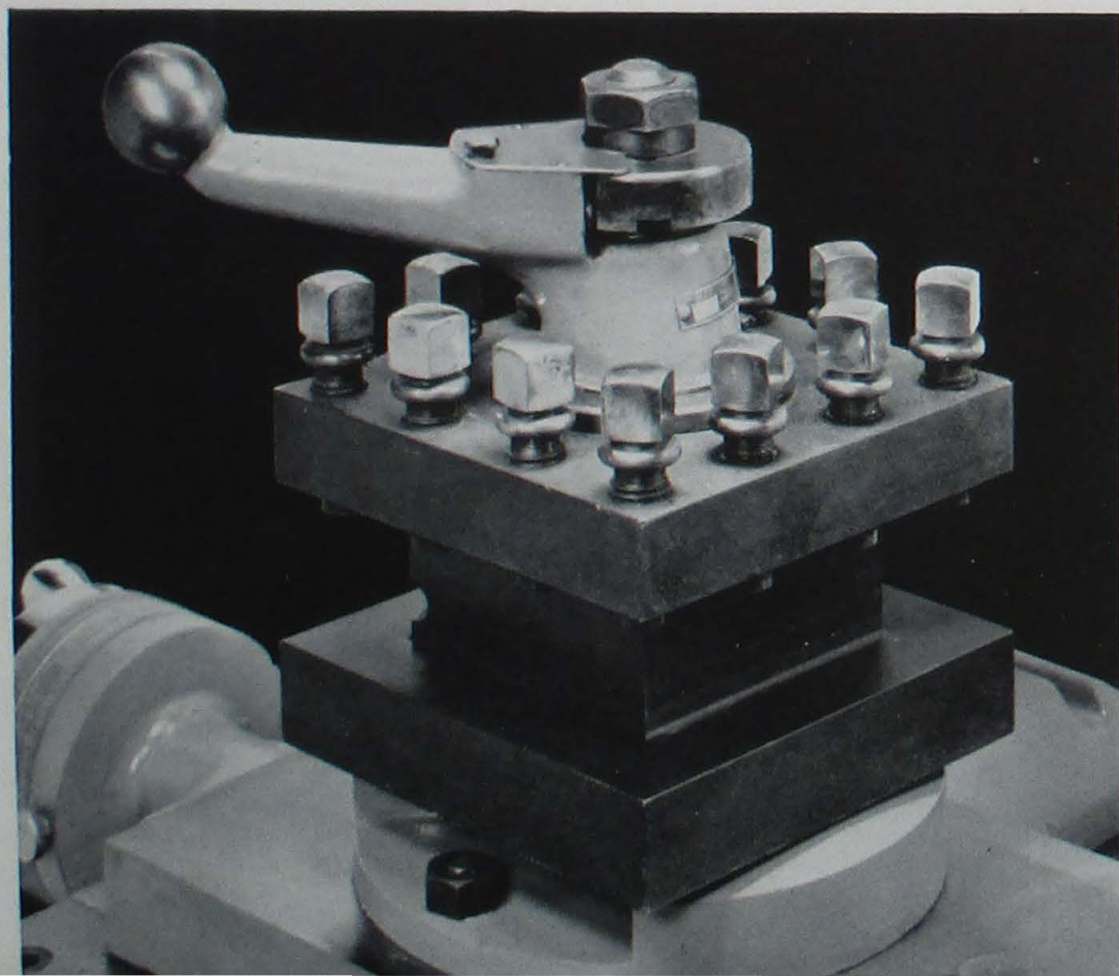


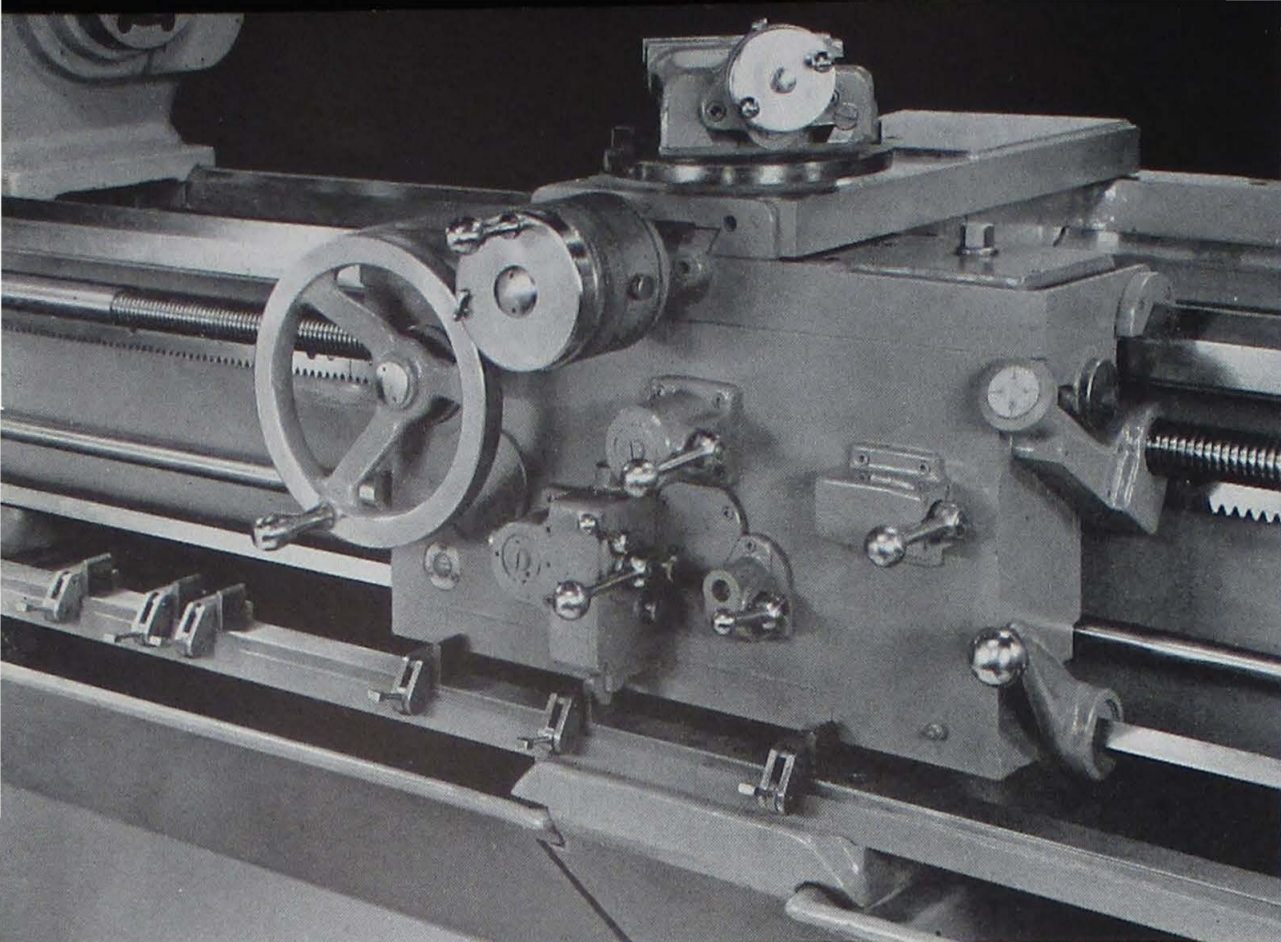
STYLE "O" TURRET

- For intermittent use. Fits directly to compound rest in same manner as regular tool post.
- Indexes accurately in twelve positions.
- Square size of turret, $5\frac{1}{2}$ ". Maximum tool size, $1\frac{1}{8}$ " x 1".

STYLE "R" TURRET

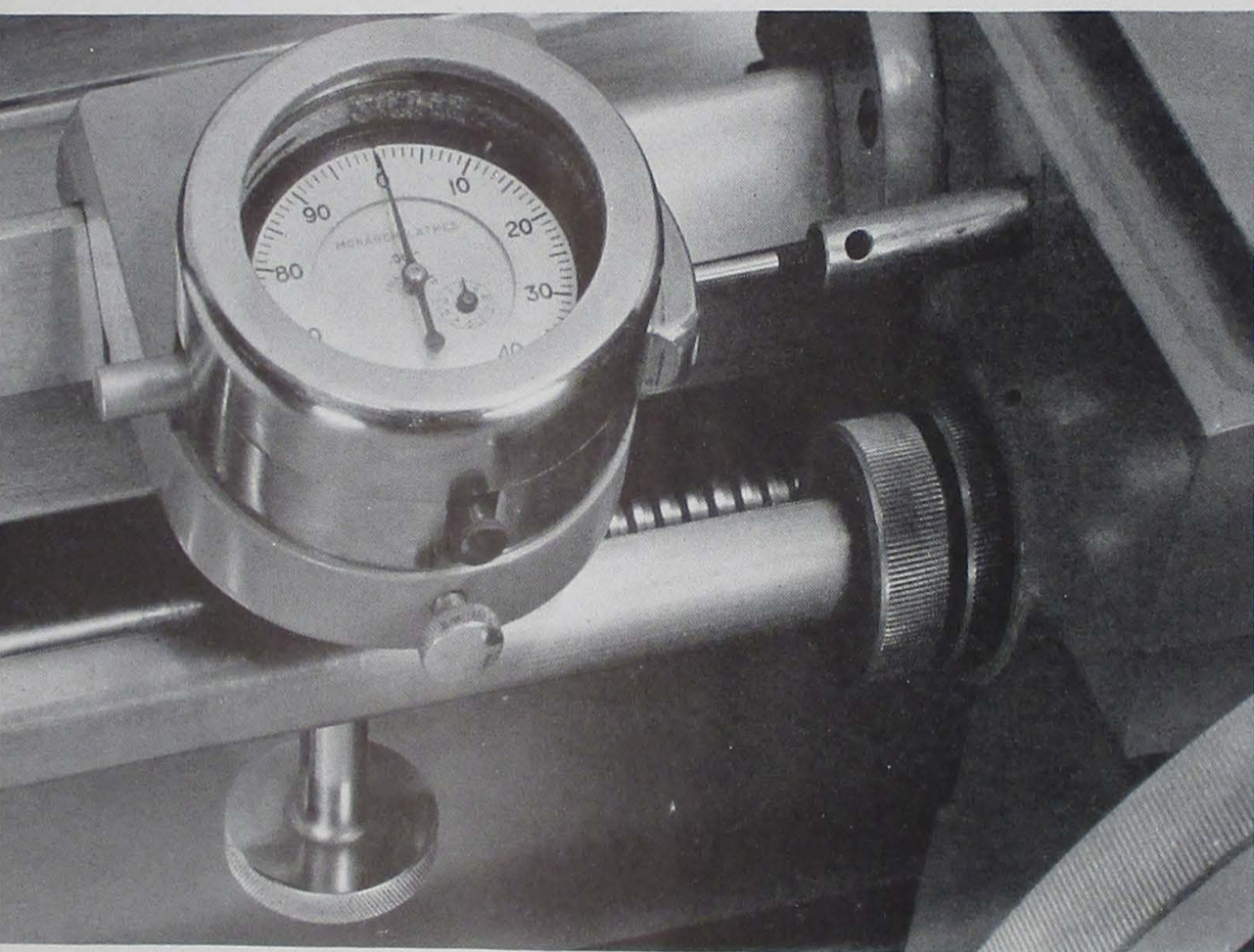
- Has six positions for boring, tapping and drilling operations.
- Mounts directly to bolt circle of regular bottom slide.
- On 14" and 16" machines, 8" across flats and $1\frac{1}{2}$ " maximum diameter hole. On 18" and 20" machines, 9" across flats and $1\frac{3}{4}$ " maximum diameter hole.





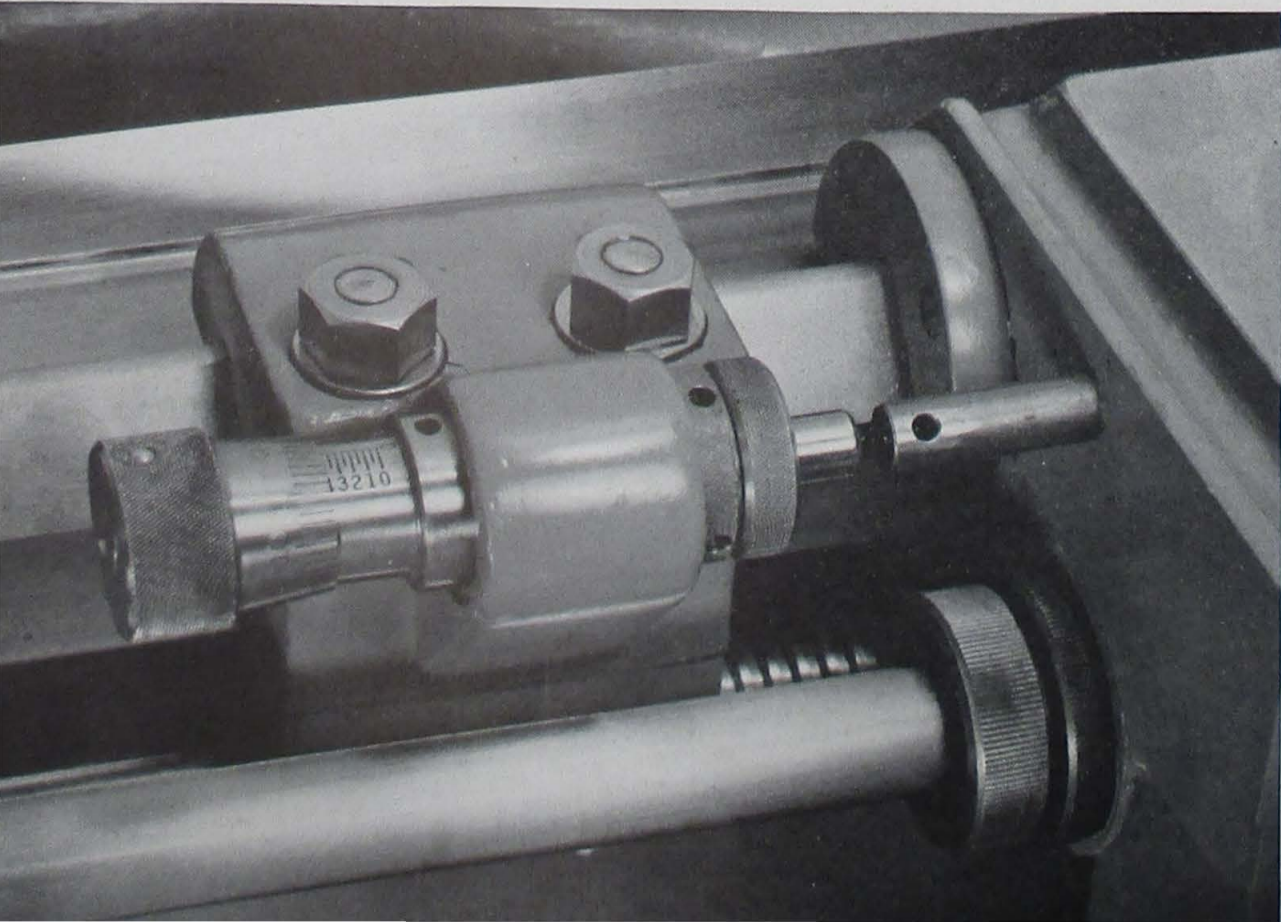
MULTIPLE AUTOMATIC LENGTH FEED STOPS

- Saves time on the small lot production of many multiple diameter shafts.
- Consists of a rail extending along front of machine immediately below apron, a set of six stop dogs and a stop plunger controlled from the front of the apron.
- Stops may be moved quickly to any desired position along rail and clamped rigidly in place.
- When disengaged, control lever functions in same manner as regular longitudinal feed lever.



DIAL INDICATOR TYPE CARRIAGE STOP

- Recommended when a facing or shoulder cut must be held within an exceedingly close limit.
- Precision dial indicator graduated in thousandths and encased for protection. Indicator stem has up to 1" travel.
- Stop bracket may be clamped at any desired position along front bed "V".

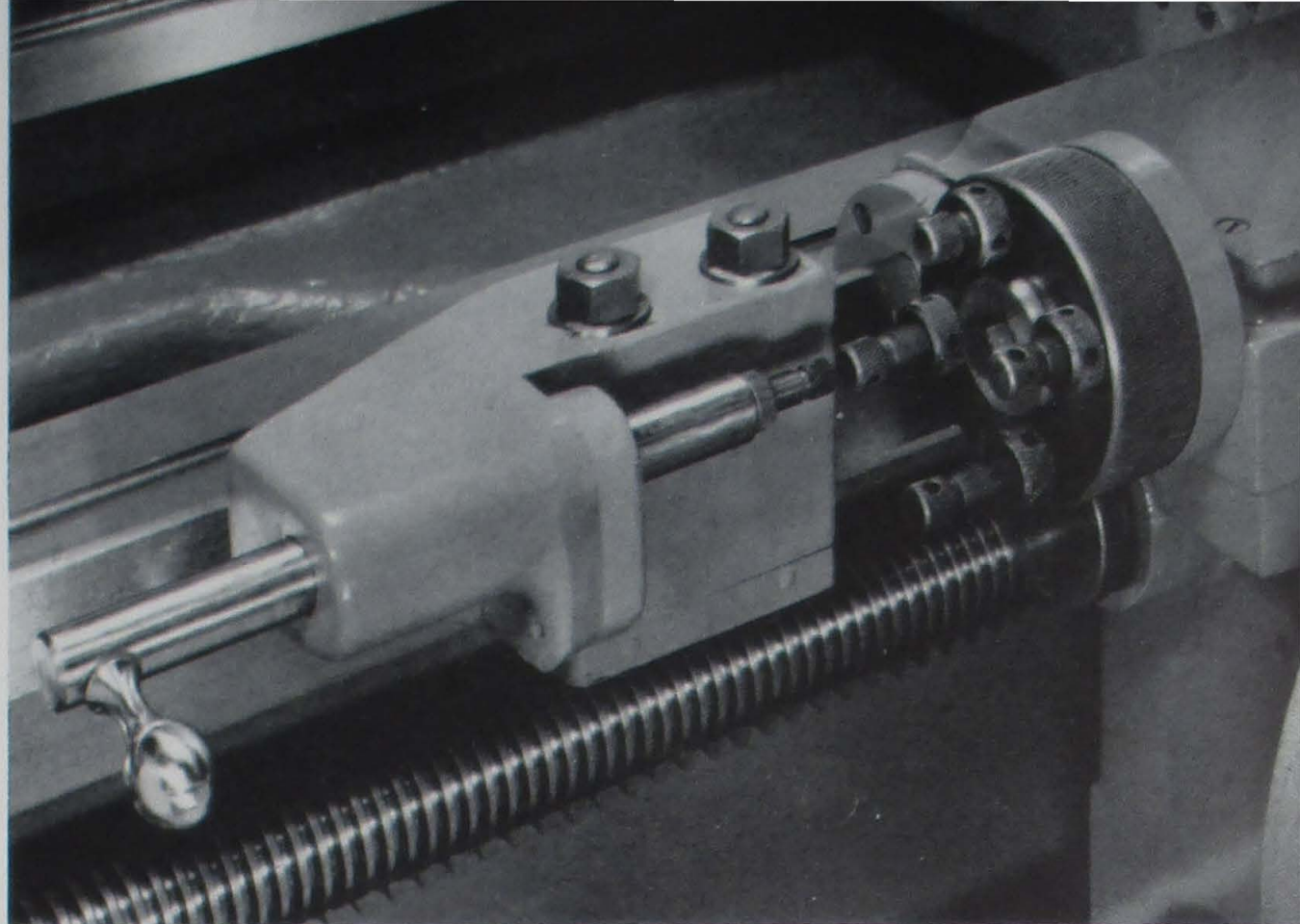


MICROMETER CARRIAGE STOP

- A quick means for accurately performing a facing or shoulder cut on a work piece.
- Micrometer screw made of induction hardened alloy steel with precision ground threads. Indications are in thousandths.
- Stop bracket may be positioned and clamped at any point on front bed "V".

MULTIPLE POSITIVE CARRIAGE STOP

- Speeds production when performing multiple shoulder operations.
- Indexing cylinder having four or more adjustable stop screws attached to left hand wing of carriage. Detent plunger positively stops each screw at proper position for engaging stop pin.
- Adjustable stop pin mounted in end of notched positioning bar, carried by bracket which clamps at any point along front bed "V".



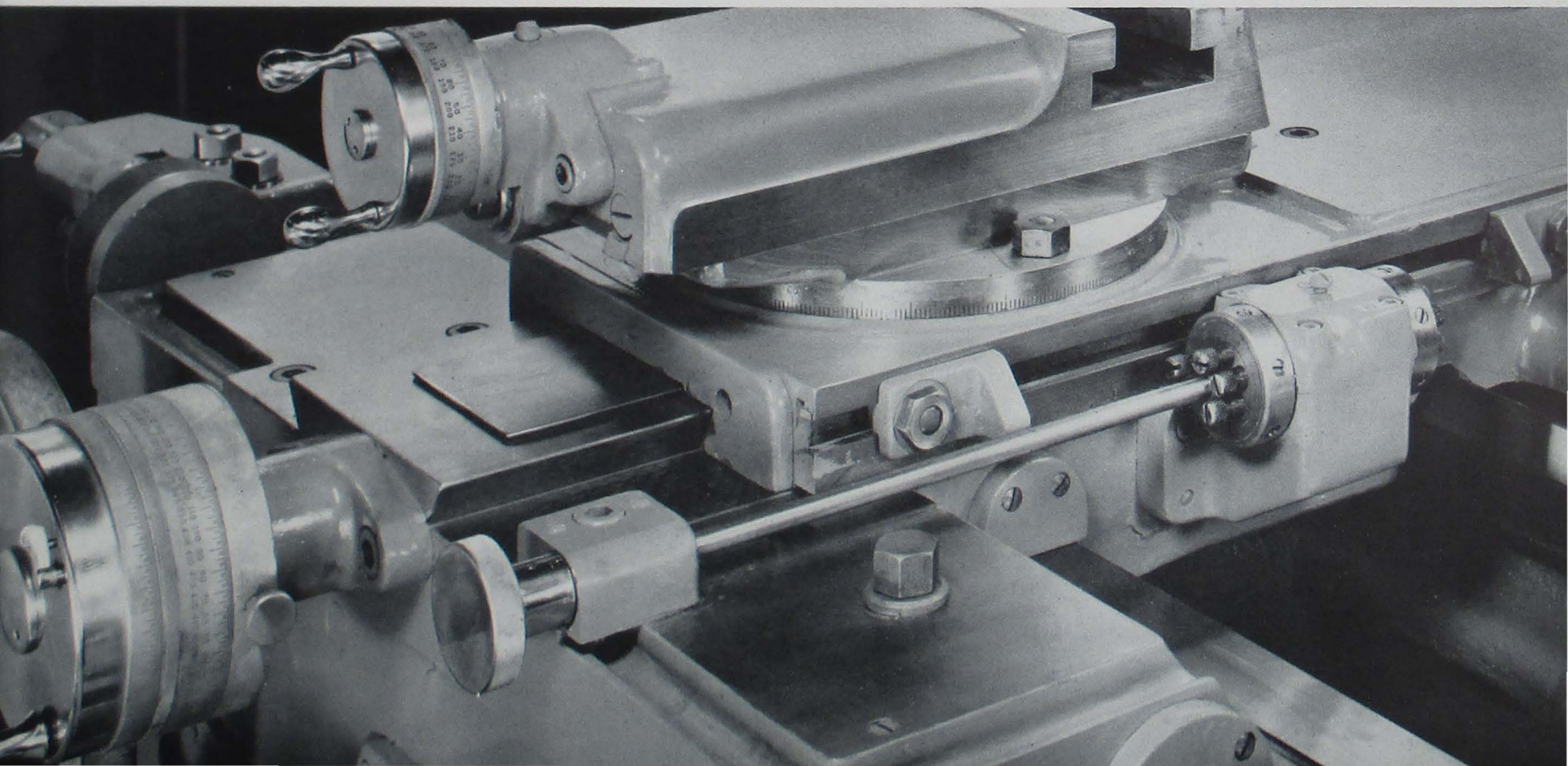
AUTOMATIC CROSS FEED STOP

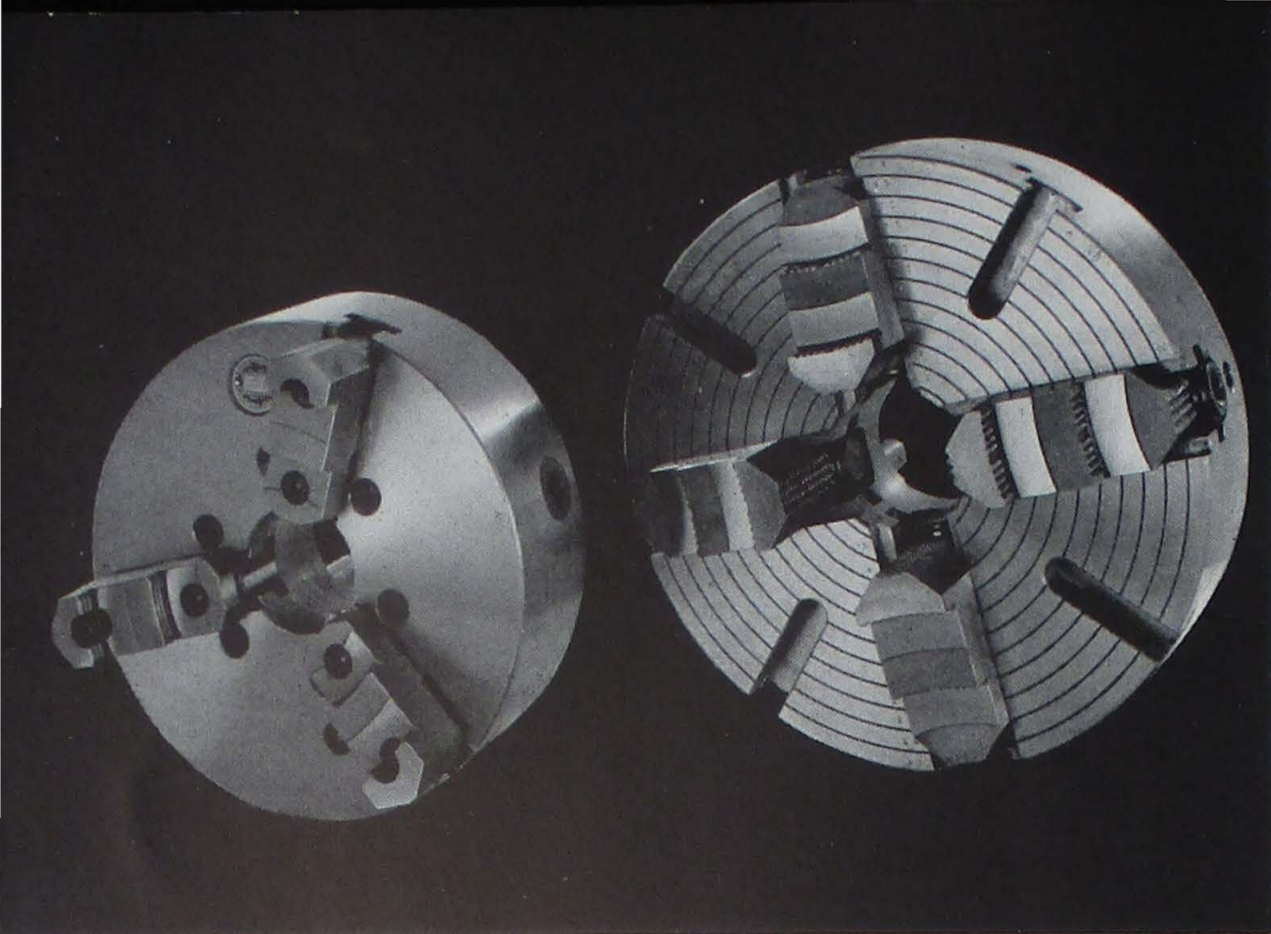
(Not Illustrated)

- Sometimes used to advantage when facing on a production run.
- After being engaged and set, operates automatically without further attention.
- Accurately disengages cross feed with tool slide traveling either in or out, at any predetermined diameter.

MULTIPLE POSITIVE CROSS-FEED STOPS

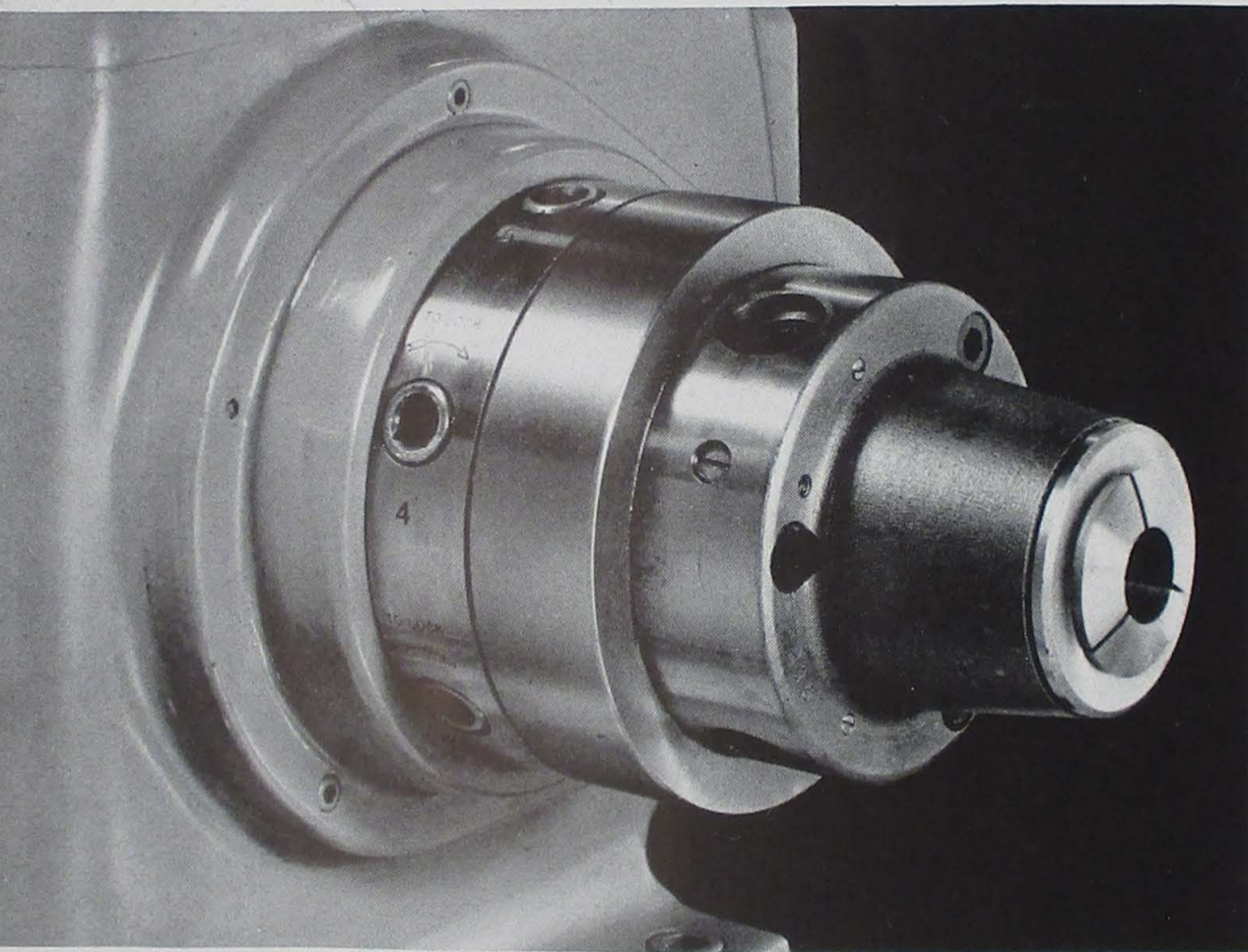
- Recommended for production operations on multiple diameter work.
- Provides four diameter stops which may be indexed conveniently by knob at front of carriage.
- Frequently used in connection with a rear adjustable tool block in which case four additional diameter stops are also provided to control its forward feed. (As illustrated below).
- Adjustable stop dog (or dogs) mounted in "T" slot at side of top block.





JAW CHUCKS

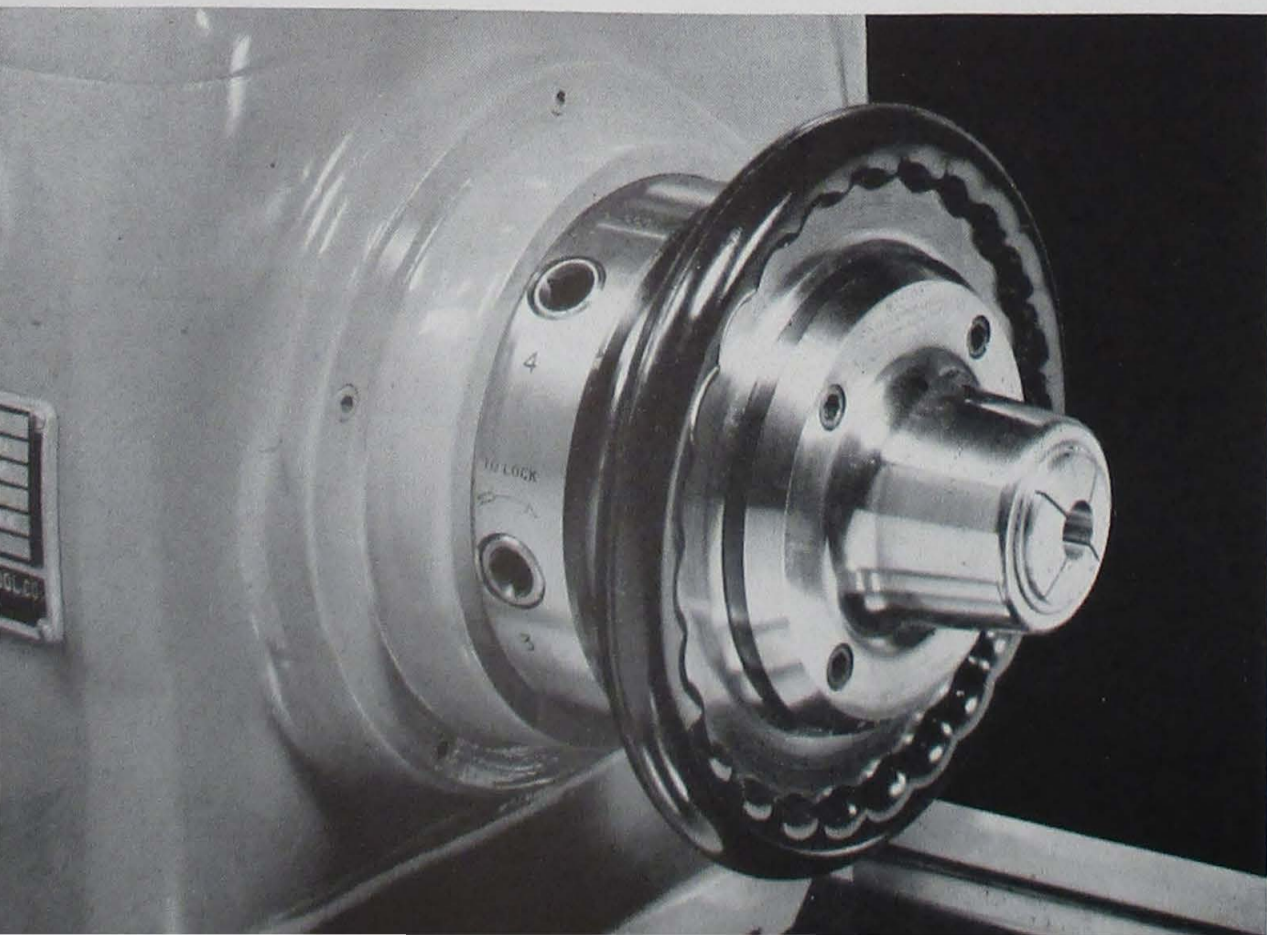
- Three jaw, universal, steel body chucks with two piece reversible jaws available as follows:
14" and 16" machines—6", 8", 10", 12"
18" and 20" machines—8", 10", 12", 15"
- Four jaw, independent, steel body chucks, with reversible jaws available as follows:
14" and 16" machines—8", 10", 12"
18" and 20" machines—10", 12", 15", 18"



CUSHMAN SPINDLE NOSE TYPE COLLET CHUCK

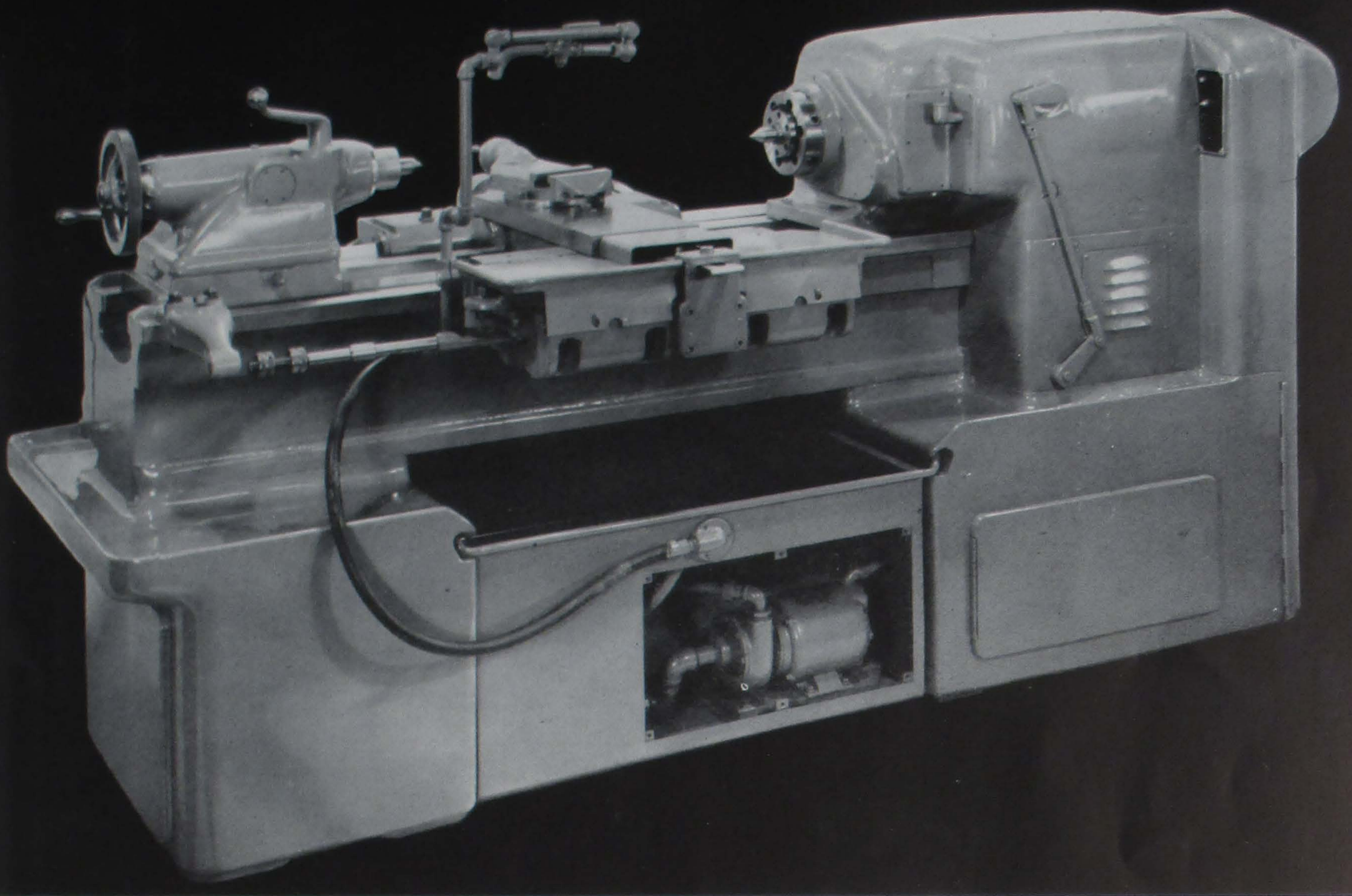
- For collet chuck operations requiring a wide range of collet capacities.
- Any piece of stock that will pass through lathe spindle can be held in collet because chuck offers no obstruction.
- Chuck is attached to intermediate plate with cam studs for mounting on Camlock spindle nose. Same wrench used to attach chuck and operate collets.
- Available in the following three sizes:

Chuck Size	Reference No.	Collet Capacity
5"	115	1/8" to 1 1/8"
5 3/4"	215	1/8" to 1 3/4"
8 1/4"	315	1" to 1 3/4"



SJOGREN SPINDLE NOSE TYPE COLLET CHUCK

- A wrenchless chuck which fits directly on the Camlock spindle nose.
- Provides faster operation than any other type of collet chuck. Clockwise movement of handwheel securely tightens collet while counter-clockwise movement releases it.
- Take a range of collets having 1/8" to 1 3/8" capacity.



COOLANT SYSTEM

- Individually motor driven coolant pump mounted inside oil pan at headstock end of machine. Motor control switch conveniently located at front of left hand cabinet leg.
- On all lathes with center cabinet legs, each in-

dividual pan drains through center legs to pan at headstock end.

- Baffle plates in pans remove sediment from coolant.
- Large size of pans provides unusually generous coolant capacity.

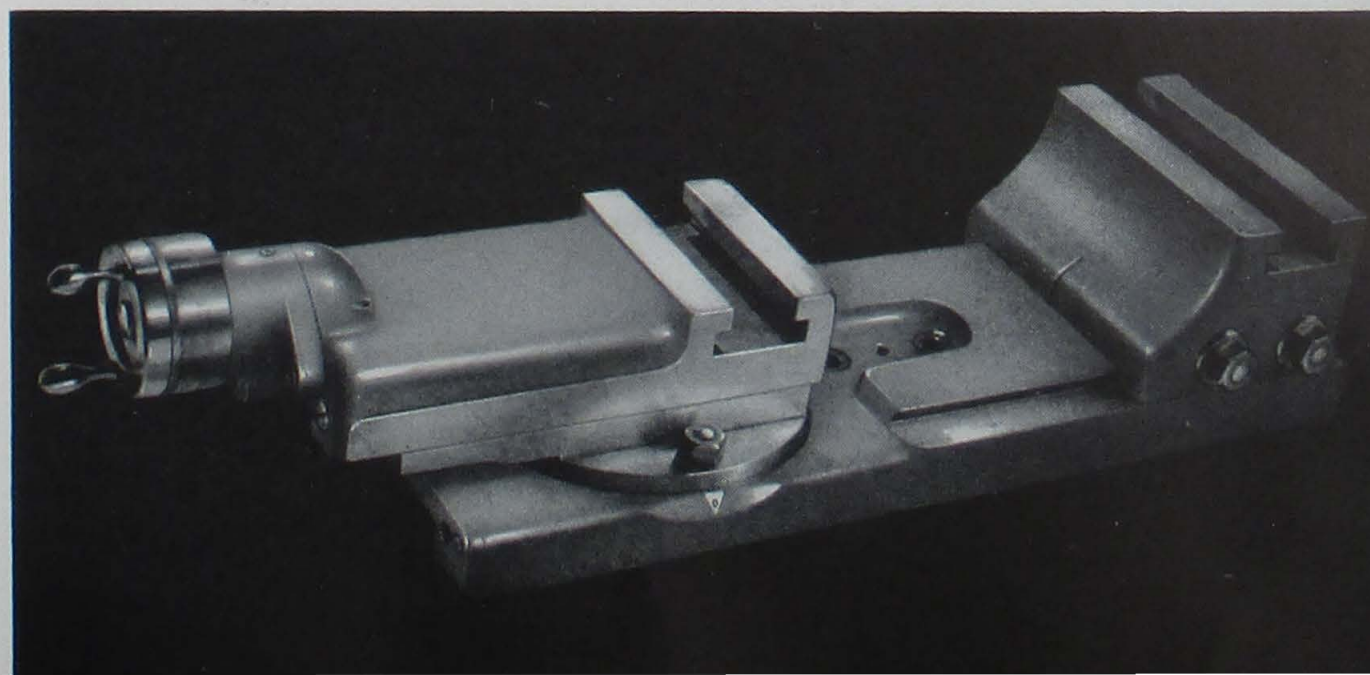
DOUBLE POWER ANGULAR FEED COMPOUND RESTS (Not illustrated). For simultaneously machining both angles of bevel gears and other classes of angle work. Either compound rest can be positioned independently of the other. Can be applied to feed both compound rests in or out simultaneously or feed either one independently of the other. Either compound rest can be used as a regular compound rest without power angular feed.

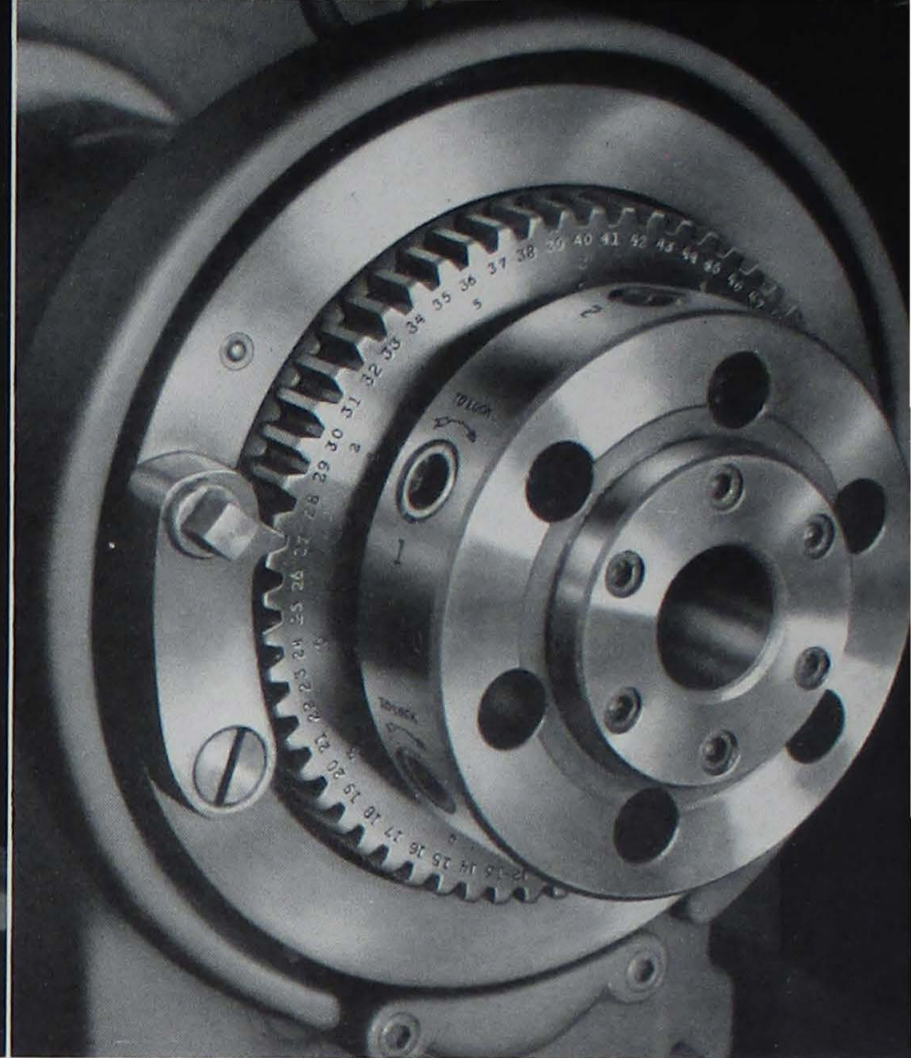
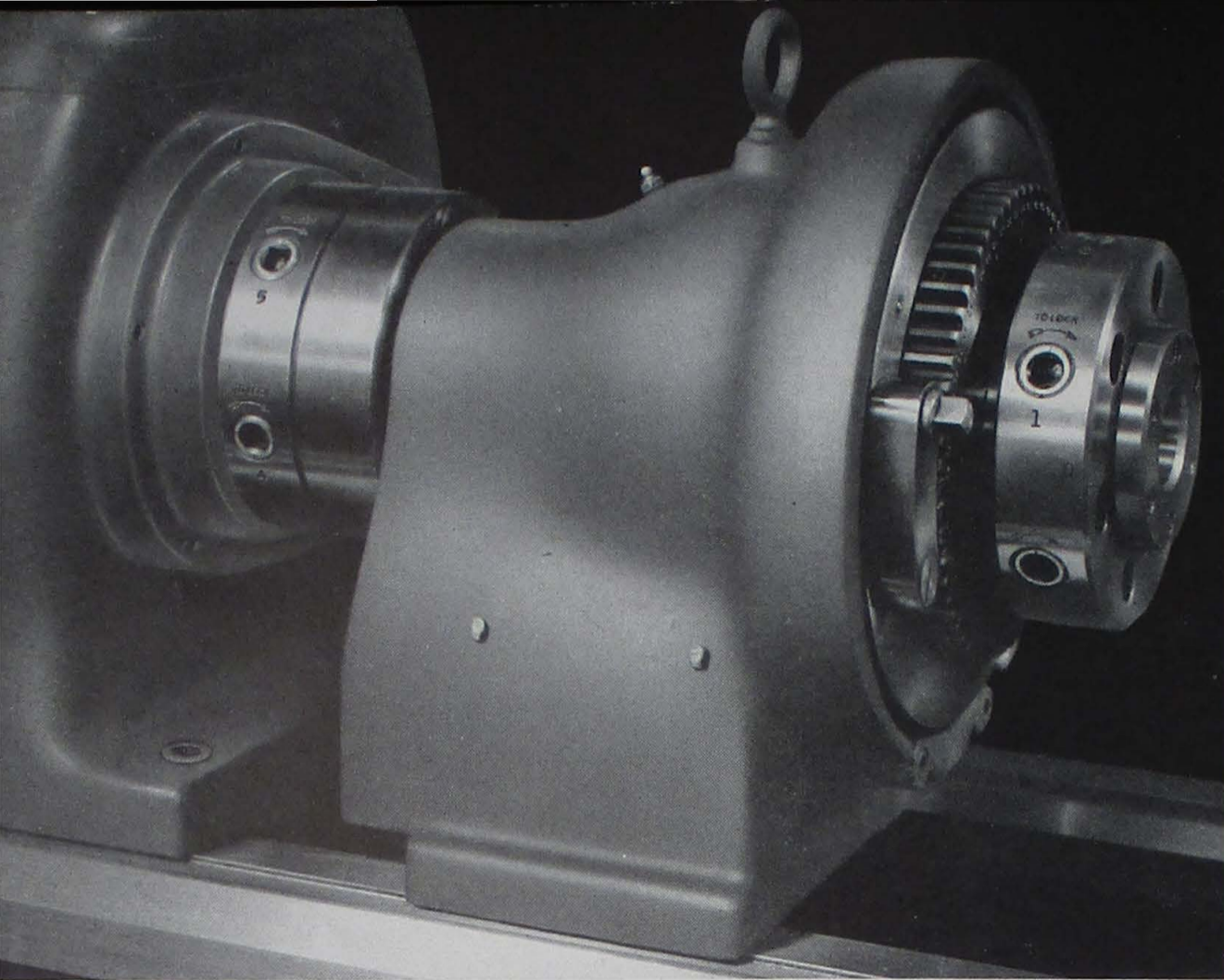
PLAIN REST (Not illustrated). Used to advantage on heavy duty work not requiring the universal feature of the regular compound rest.

BALL TURNING REST (Not illustrated). For turning or boring spherical surfaces, either concave or convex. Circular motion of tool slide can be imparted either by hand or through power cross feed of apron.

CONNECTED COMPOUND AND PLAIN BLOCK REAR REST

- Generally used for turning operations performed by tool in front rest and necking, facing or forming operations by tool in rear rest.
- Both compound rest and rear tool block mounted on same bottom slide. Rear tool block adjustable in or out from center.



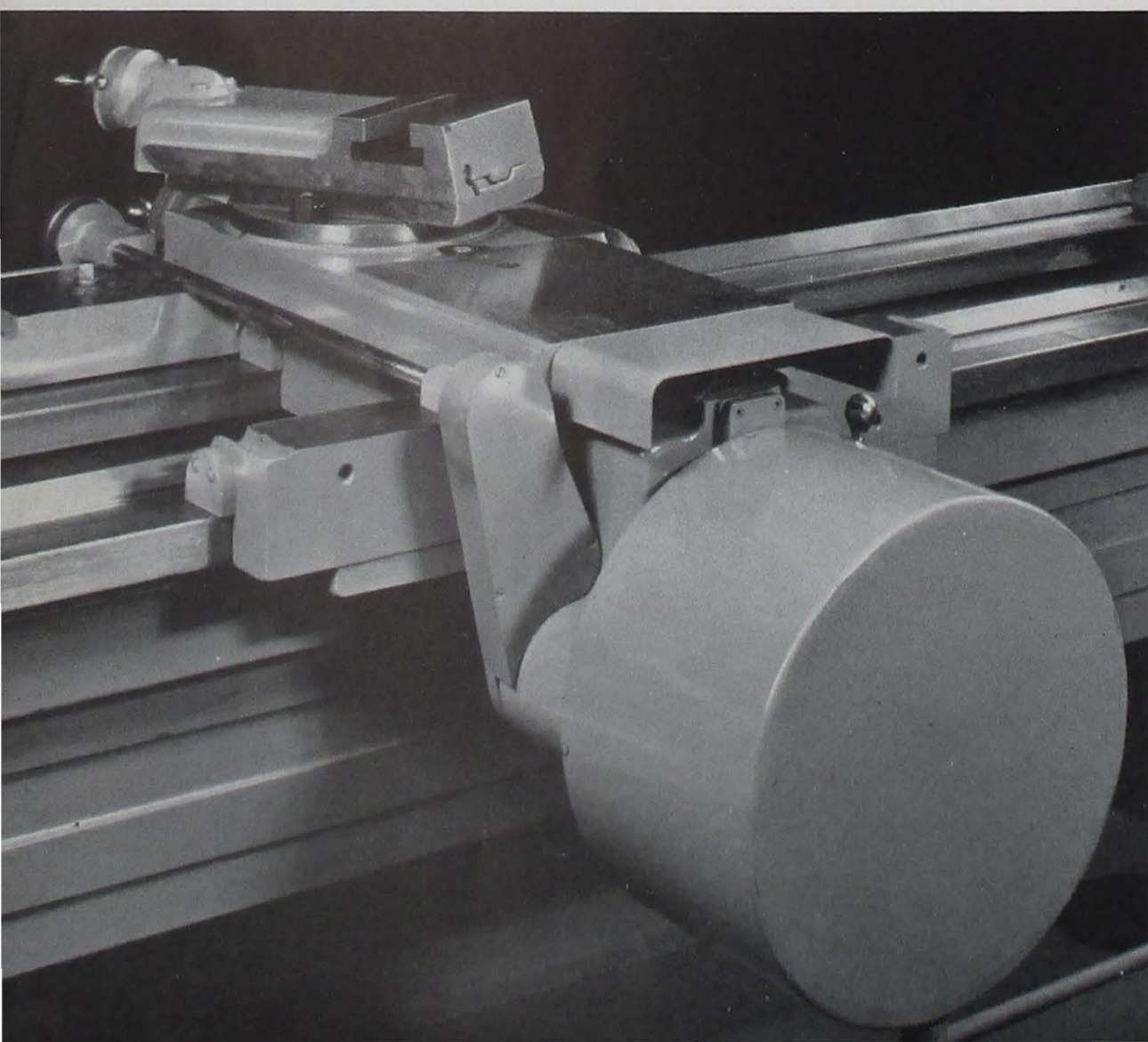


THE MONARCH SUB-HEADSTOCK

- A popular accessory which provides a means for chasing both extremely coarse leads and multiple threads.
- Bolted to bed directly in front of headstock and driven by headstock spindle.
- Reduction gearing provides a 6 to 1 spindle speed reduction without reducing speed of carriage travel. This increases distance traveled by carriage per revolution to six times normal rate shown on gear box index plate.
- Spindle is precision roller bearing mounted, attaches

to headstock spindle Camlock nose and has a similar nose so that chucks, face plates and fixtures can be interchanged.

- Multiple thread indexing plate, on front of unit, provided with graduations for engaging teeth of index gear for 2, 3, 4, 5 and 6 multiple start threads.
- Unit can be mounted readily in customer's plant on lathes already in use.
- Any lead up to maximum of 3" may be chased on machines with regular 2 to 120 thread range. Maximum is 6" on machine with 1 to 60 thread range.



CONSTANT SURFACE CUTTING SPEED

- Particularly recommended for facing operations. Using this feature on a facing cut over the entire range, time saving is 42% and finish and accuracy are vastly improved. Unit also provides constant surface cutting speed during turning or boring when the tool is being set for various diameters.
- Provides constant surface cutting speed over a range of diameters from 2½" to 10".
- A 4 to 1 D.C. main drive motor is used along with a motor generator set for conversion of A.C. to D.C. Rheostat to regulate speed of driving motor is mounted on back of carriage and is manually controlled by dial at front of carriage.
- With constant surface cutting speed feature not in use, unit provides infinitely variable speeds from the top of the speed range to one-fourth of the slowest speed.

Monarch Representatives



FOR MONARCH SERVICE . . . WHEREVER YOU ARE

BRANCH OFFICES

CHICAGO, ILLINOIS
The Monarch Machine Tool Co.
CLEVELAND, OHIO
The Monarch Machine Tool Co.

DETROIT, MICHIGAN
The Monarch Machine Tool Co.
INDIANAPOLIS, INDIANA
The Monarch Machine Tool Co.

NEW YORK, NEW YORK
The Monarch Machine Tool Co.
PITTSBURGH, PENNSYLVANIA
The Monarch Machine Tool Co.

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The Galigher Company
SAN FRANCISCO, CALIFORNIA
Moore Machinery Company
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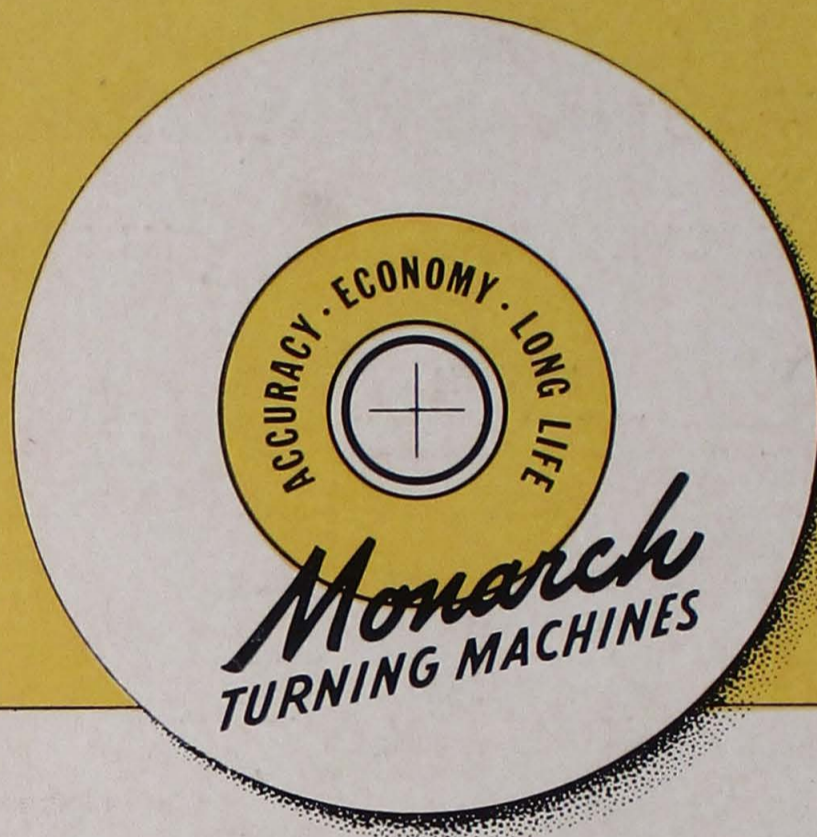
WINDSOR, ONTARIO
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WINNIPEG, MANITOBA
T. S. Taylor Machinery Co.

EXPORT DEALERS

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Torres & Citati
AUSTRALIA
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BRAZIL
Panambra, S. A.
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CZECHOSLOVAKIA
Amertool Engineering Service
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ENGLAND
Rockwell Machine Tool Co., Ltd.
Alfred Herbert, Ltd.
(Keller controlled lathes only)
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OY Machinery AB
FRANCE
Aux Forges de Vulcain
GREECE
Technica S. Malcotsis, S. A.
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