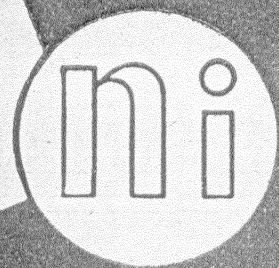
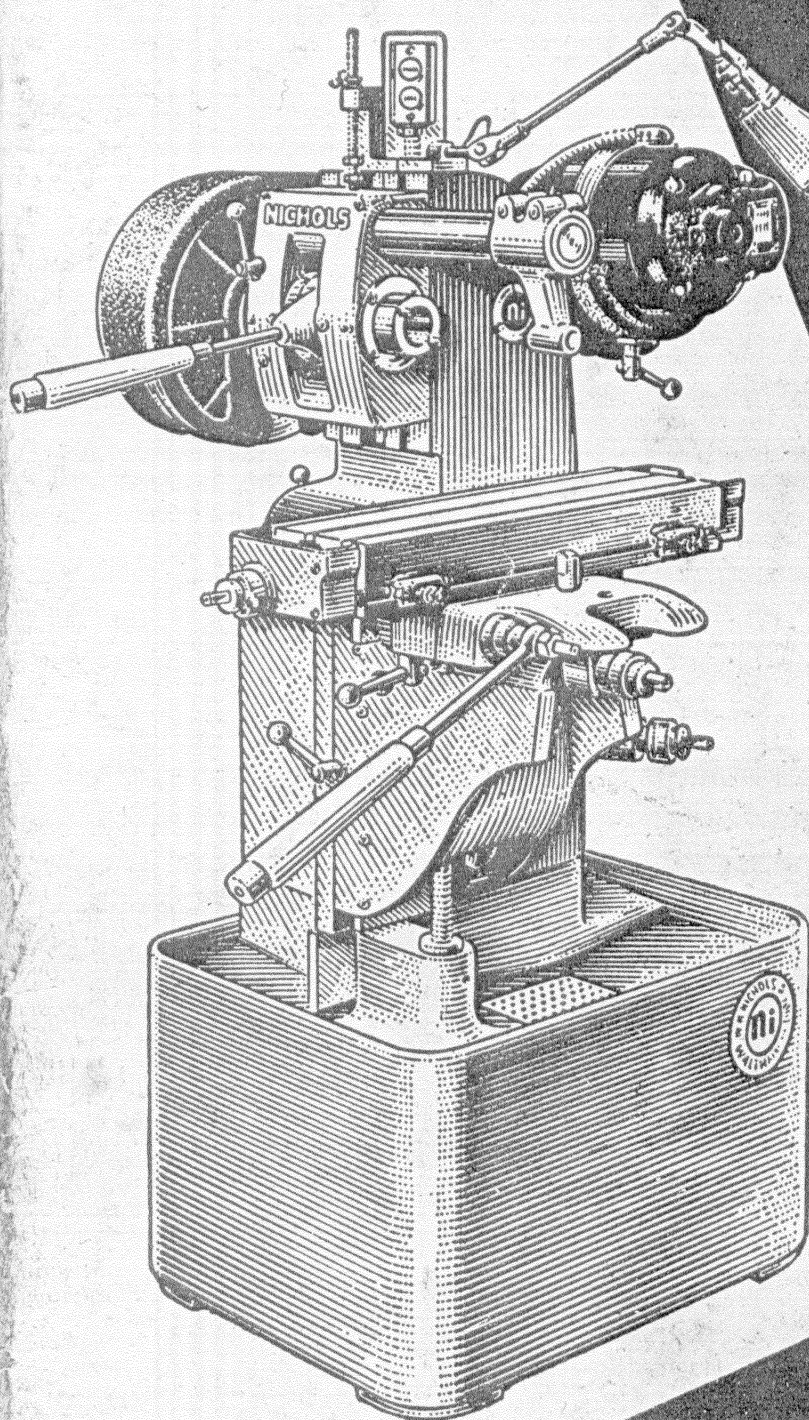


Handbook for **THE NICHOLS MILLER**



"the miller that uses its head"

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INTRODUCTION

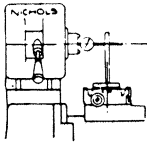
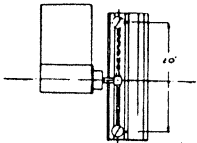
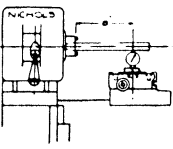
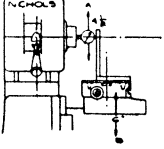
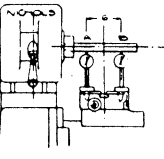
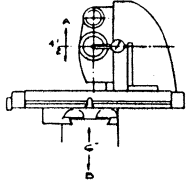
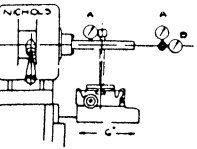
The Standard Nichols Miller is a manually operated, horizontal-type precision milling machine. In addition to the conventional movements of the table, saddle, and knee, the spindle is mounted in a counter-balanced sliding head which allows the cutter to be brought to the work, as in sinking a Woodruff keyseat. Because the "Rise-and-Fall" spindle offers such a great variety of uses, the Nichols Miller is called "*the Miller that uses its head*". This handbook describes the Standard Nichols Miller in detail and also illustrates and describes many of the variations of this standard machine which are available.

A reference to Pages 28 to 35 will show the various models of the Nichols Miller. All these machines are built for maximum ease of operation and to the highest standards of precision, so that tool room, laboratory, or production work may be produced to tolerances in "tenths" when desired. A glance at the test sheet shown on Page 2 gives some indication of the degree of precision which is built into every Nichols Miller. This, combined with rugged construction, assures an exceptionally long productive life for the machine if reasonable care is shown in its operation and maintenance. The basic Nichols qualities spell substantial savings in tool cost as they automatically provide the working conditions necessary to secure maximum life from the hundreds of expensive cutters which will be used on the machine.

The unexcelled quality of workmanship and remarkable versatility of the Nichols Miller will repay the careful operator many times over in helping him produce accurate work at good production rates.

Each new Miller shipment is accompanied by a test sheet, as reproduced on the next page, which shows maximum *permissible* tolerances and the *actual* tolerances, obtained under test, to which that particular machine has been built. No machine of this type is

built to more exacting standards. Initial accuracy and fine performance can be sustained over many years by exercising reasonable care and maintenance. This handbook contains much useful information and many suggestions aimed at keeping your Nichols Miller a profitable investment in precise dependable equipment.

	<p>SPINDLE TAPER RUNOUT ALLOWABLE ERROR .00015</p> <p>TEST <u>.0001</u></p>		<p>RIGHT ANGULARITY OF TABLE TO SPINDLE ALLOWABLE ERROR .001</p> <p>TEST <u>.0003</u></p>
	<p>SPINDLE RUNOUT ON 8" MANDREL ALLOWABLE ERROR .001 F.I.R.</p> <p>TEST <u>.0002</u></p>		<p>A — SQUARENESS OF HEAD SLIDE TO TOP OF KNEE ALLOWABLE ERROR .0005</p> <p>B — PARALLELISM OF HEAD & KNEE SLIDES ON COLUMN ALLOWABLE ERROR .0005</p> <p>TEST A, <u>.0002</u> B, <u>.0002</u></p>
	<p>PARALLELISM OF SPINDLE TO TABLE ALLOWABLE ERROR A, .0000 B, .0005</p> <p>TEST B <u>.0002</u></p>		<p>B — PARALLELISM OF HEAD & KNEE SLIDES ON COLUMN ALLOWABLE ERROR .0005</p> <p>A — SQUARENESS OF HEAD SLIDE TO TOP OF SADDLE ALLOWABLE ERROR .001</p> <p>TEST A, <u>.0003</u> B, <u>.0002</u></p>
	<p>PARALLELISM OF SPINDLE TO TOP OF KNEE ALLOWABLE ERROR .001</p> <p>TEST A, <u>.0002</u> B, <u>.0002</u></p>	<p>ACCURACY TESTS FOR NICHOLS HAND MILLER</p> <p>Ser. No. <u>000</u> Inspector <u>R. A. Milton</u> Date <u>10-20-54</u></p> <p>W. H. NICHOLS COMPANY 40 WOERD AVENUE, WALTHAM, MASS.</p>	

LOCATING AND MOUNTING THE MACHINE

Be sure to examine the machine crate carefully as soon as your Nichols Miller arrives. If the crate has been damaged in any way, it may indicate that damage has also been done to the Miller. Notify the carrier immediately if anything is wrong with the machine.

The crated machine may be placed in its final location on the shop floor if you wish; it is only necessary before uncrating to locate the eye-bolt at the top of the machine directly under your chain hoist. An arrow is painted on the top of the crate to locate this eye-bolt for you.

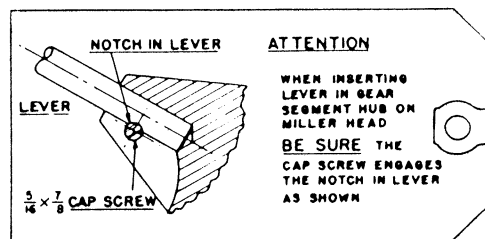
Do not tear the crate apart — it is best to take out the nails with a nail-pull which will detach the crate from the base. The top of the crate may then be lifted off by two men; next, raise the Miller slightly off the floor by use of the eye-bolt and hoist. The base of the crate may then be removed and your Miller placed directly in its exact working position on the floor.

Unpainted metal parts of the Nichols Miller are protected during shipment by ordinary machine oil which may be removed with any petroleum solvent.

In the base of the machine are four holes which may be used for bolting the machine to the floor. It is well to put leveling pads underneath the base to be sure that the machine is properly leveled.

On the standard machine, the wires for the motors and machine light (when supplied) extend from the base of the column ready for connection to your power lines and outlets. Voltage requirement, etc., will be found on tag attached to the machine. Note these carefully before connecting any wiring.

In shipping Nichols Millers, items such as cranks, handlevers and handwheels are detached and safely packed in a wooden accessory box which is fastened to the machine skid inside the crate for protection. It is a simple matter to install these items after the machine is set-up. The lever for raising and lowering the spindle head is notched for the passage of a locking screw. *Just be sure to line up the notch on the lever with the lock-screw hole when assembling.*



OPERATION

Motor and Drive

Nichols Millers are shipped from the factory equipped with 1 HP or 1½ HP Master geared head motor and pulleys for one of the following spindle speed ranges:

Standard:.....100-1350 RPM
(1 HP 1725 RPM motor with 5:1 reduction gears providing output speed of 350 RPM)

Intermediate:.....200-2800 RPM
(1½ HP 1725 RPM motor with 2.23:1 reduction gears providing output speed of 780 RPM)

High:.....250-3500 RPM
(1½ HP 1725 RPM motor with 1.89:1 reduction gears providing output speed of 910 RPM)

Five speeds in each range are obtained through 5-step pulleys on the spindle extension and motor shaft.

As a safety measure the spindle pulleys on machines in the intermediate and high speed ranges are supplied in two sections. The large 3-step section (A) provides:

spindle speeds of 200, 350 and 780 RPM in the intermediate speed range or
250, 440 and 910 RPM in the high speed range.

The smaller 2-step section (B) provides:

spindle speeds of 1500 and 2800 RPM in the intermediate speed range or
1825 and 3500 RPM in the high speed range.

Speed changes are obtainable as outlined below:

Belt Position on Motor Pulley	Belt Position on Spindle Pulley	Standard 1 HP 350 RPM Motor	Intermediate 1½ HP 780 RPM Motor	High Speed 1½ HP 910 RPM Motor
No.1 (Smallest Step)	No. 5 (Largest Step)	100	200	250
No. 2	No. 4	175	350	440
No. 3	No. 3	350	780	910
No. 4	No. 2	700	1500	1825
No. 5	No. 1	1350	2800	3500

A – Using Large Section of Spindle Pulley
B – Using Small Section of Spindle Pulley

On High Speed Millers having ball bearing spindles, speeds up to 5000 RPM are permissible. Special pulleys and belt guards for speeds of 4000 or 5000 RPM are available at extra charge.

Where speeds lower than those in the standard speed range are desired, 6:1 ratio motor reduction gears are available to provide 280 RPM motor output speed and

spindle speeds of 80, 140, 280, 560, 1080 RPM.

An additional low speed down to 50 RPM can be obtained by replacing the 5-step spindle and motor pulleys with pick-off pulleys available at extra charge.

A Master Electric Company motor dealer, who can be located through your classified directory, should be contacted for parts and service on gearmotor.

Instructions for Changing Speed Range

Millers can be changed from one speed range to another by changing the motor reduction gears to increase or decrease the outgoing motor shaft speed. The various ratio motor reduction gears are interchangeable and may be replaced by any mechanic in about an hour's time. In making a change from one speed range to another, the following should be kept in mind:

1. In increasing the speeds of a Miller now equipped for the 100-1350 RPM speed range, new 2-piece spindle pulley will be needed. The one-piece 5-step spindle pulley supplied for the standard spindle speed range only should not be run over 1350 RPM as a safety measure.
2. Higher speeds require higher power. Motors rated at 1½ HP are available for the intermediate and high speed range. When converting a standard speed Miller to higher speeds, it is advisable to replace the 1 HP motor with 1½ HP motor unless the nature of the work is such that the full motor horse power is not necessary.
3. Machines having roller bearing spindle construction should not be run at speeds over 2800 RPM.

To convert to higher speeds, ball bearing spindle construction is necessary. Consult the factory for recommendations.

Instructions for changing motor reduction gears follow:

1. Remove the pulley and key from the motor output shaft.
2. Remove the 6 bolts holding the cover of the gear motor output shaft end.
3. Grasping the output shaft in the right hand, remove cover and shaft as a unit. Take care at all times not to damage the seal which is in the cover. Remove the shaft from the cover.
4. Remove the old pinion gear from the motor shaft.
5. Press off the bearing, spacer and gear from the output shaft.
6. Assemble the key and the new gear on the output shaft against the shoulder. Slip on the spacer and press on the bearing against the spacer.
7. Install the new pinion gear on the splined motor shaft.
8. Hold this shaft assembly in place with the left hand, meshing the herringbone gears. Slip the cover over the shaft and bring it toward the gear box. Keeping the shaft in place, withdraw the left hand and complete the assembly. Install the six bolts.
9. If end thrust is present, or the shaft is bound when bolts are tightened, dis-assemble and remove or insert shims in back of the rear bearing race.

Recommended Cutter Speeds

To obtain maximum performance from your Nichols Miller, it is advisable to check the two charts appearing on the next page before proceeding with production. These charts cover both high-speed steel and carbide cutters and will assure you optimum performance and tool life regardless of the job being performed:

Milling Speed with High Speed Cutters—Standard Ratio

Cutter Dia. Inches	Cast Iron		Medium Steel		Brass		Aluminum	
	Rough	Finish	Rough	Finish	Rough	Finish	Rough	Finish
1/4	700	1350	700	1350	1350	1350		
1/2	365	700	365	700	700	1350		
3/4	365	365	365	700	365	700		
1	175	175	175	365	365	700		
1 1/2	100	175	175	175	175	365	1350	
2	100	175	100	175	175	365	1350	
3	100	100	100	100	100	175	700	1350
4	100	100	100	100	100	175	700	700
6	100	100	100	100	100	100	365	700

Milling Speeds with Carbide Cutters

Cutter Dia. Inches	Cast Iron		Medium Steel		Brass		Aluminum	
	Rough	Finish	Rough	Finish	Rough	Finish	Rough	Finish
1/4	3400	4200	2900	3400				
1/2	1700	2100	1400	1600	3200	3800		
3/4	1100	1400	900	1100	2100	2500		
1	850	1050	700	800	1600	1900	4700	
1 1/2	550	700	450	550	1100	1300	3250	4300
2	400	500	350	400	800	950	2350	3300
3	300	350	250	300	550	650	1600	2100
4	200	250	175	200	400	475	1200	1600
6	150	175	125	150	275	325	800	1100

For further recommendation consult your cutter manufacturer.

Table and Spindle Head Movements

Longitudinal table movement is by lever, rack and pinion. Approximately 4" longitudinal movement is obtained in 180° movement of the hand lever. This travel can be doubled by replacing the standard 32-tooth pinion with a special 64-tooth pinion, available at extra charge. Some Nichols Miller users have replaced the lever with a handwheel or capstan wheel which allows utilization of the entire length of the rack, giving longitudinal travel of 10" (or 19" on millers equipped with 30" tables).

Toolroom Model Millers are equipped as standard with longitudinal screw feed in addition to rack and pinion feed. On other Models, longitudinal feed screw is available as an extra.

Micrometer table stops are furnished as standard equipment with all Nichols Millers except the Semi-Automatic Model.

The movement of the spindle head — counterbalanced by the motor — is controlled by a hand lever. Adjustable depth stop is provided for the vertical movement of the head.

Hand crank is supplied for the saddle cross feed screw except on Toolroom Model Millers which have large handwheel on the saddle screw. All models have hand crank for the knee elevating screw.

Air Feed Arrangement of Nichols Semi-Automatic Miller

Air feed is available for
longitudinal table travel
transverse saddle movement
vertical spindle head movement.

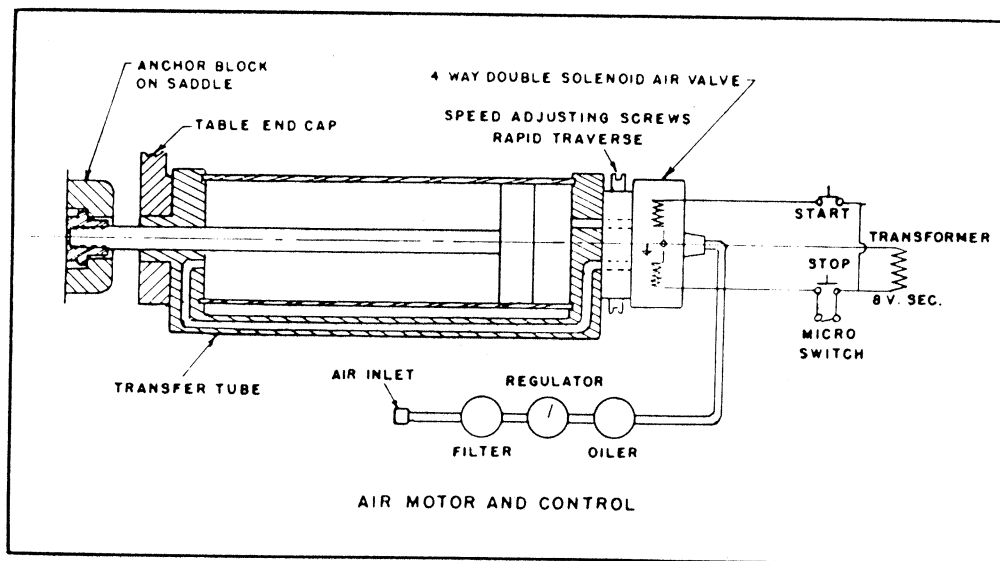
The Nichols Semi-Automatic Miller is equipped with a Bellows Air Motor providing automatic longitudinal table feed with rapid advance from loading position to the cutter, slow cutting feed and rapid return to loading position.

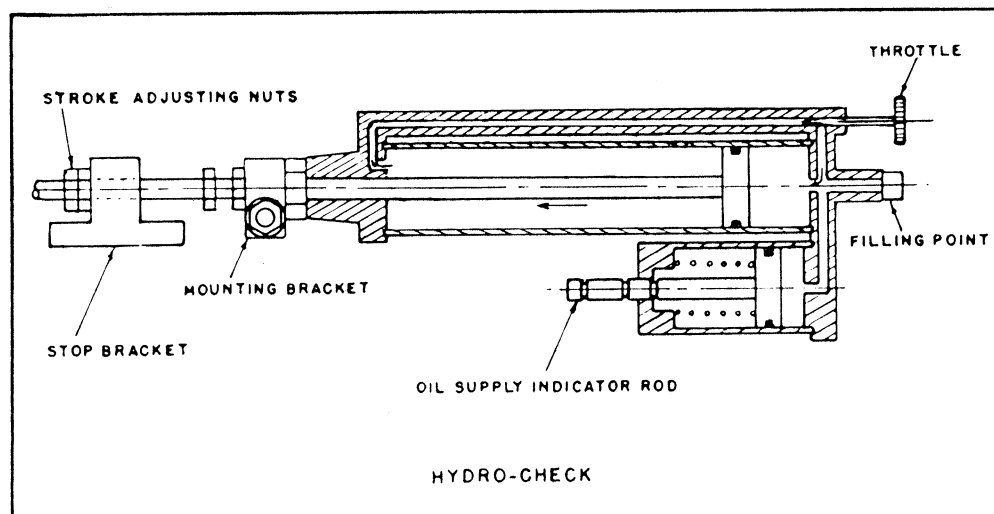
The pneumatic feed arrangement consists of two main units, a reciprocating air motor and a Hydro-check. The air motor (Bellows No. BEM-5C-90) is a double acting air cylinder. This unit powering the table feed is mounted on a special right table end cap. The direction of travel may be reversed at any point by an integral solenoid controlled 4-way valve actuated by the adjustable table dog tripping the micro-switch at the left of the saddle. The Hydro-check (Bellows No. HC12-60) is a hydraulic governor brought into play during the feed stroke to give the smooth, steady table movement required for good milling. The rates of rapid advance and return may be adjusted by screws on the air motor valve block while the rate of milling feed is controlled by a thumb screw

throttle at the end of the Hydro-check. The only maintenance necessary is to occasionally add Bellows 80-20 oil to the Hydro-check as indicated by the indicator rod on the balance cylinder of the Hydro-check. See the Bellows Instructions which accompany each installation or call in the nearest Bellows Company representative. The lubricator bowl of the Norgren Lubro-Unit should be kept filled with spindle oil. Keep all tie rods on air motor and Hydro-check tight. **CAUTION:** The quick coupler on the air line between the Lubro-Unit and the air motor should be disconnected whenever the table is moved by hand, otherwise damage to the air filter may occur. Watch out for movement of the table whenever the air is connected.

The pneumatic table movement is controlled by push button station located below the table at the left of the saddle. Pushing the START button starts a complete table cycle, the table stopping automatically when it returns to loading position.

The STOP button on the table operating switch is for emergency use only, returning the table instantly to the loading position whenever it is pressed.





Adjustment of Cutting Stroke

On the threaded piston rod of the Hydro-check are located three nuts. The single nut that is ahead of the table bracket should never be disturbed. The two that are behind the bracket should be so positioned that the bracket will contact them the instant the speed of the table movement toward the cutters (rapid approach) is to be reduced to the cutting feed rate.

Disconnecting Air Equipment

If it is desired to operate the table by hand instead of by air, take out the screws fastening the anchor block to the saddle and remove the anchor block. The shock absorber adjusting screw may be turned all the way in. Take off the Hydro-check tee bolt nut and washer and remove the Hydro-check and bracket. (Two micrometer stop assemblies should be obtained and installed in the front side table tee slot.) The air motor need not be removed.

Operation and maintenance of Nichols Millers equipped for pneumatic feed to *vertical movement of the spindle head or saddle cross movement* is the same as above.

Air motor for the transverse saddle movement (Bellows No. BEM-5C-50) is mounted on a special saddle post.

Air motor for the vertical spindle head movement (Bellows No. BEM-5C-50) is mounted on a bracket attached to the column.

Special instructions and complete parts are supplied by the Bellows Company for their equipment. *Service and parts should be ordered directly from the nearest Bellows Company representative.*

Bearings

The needle bearing in the overarm bracket is Torrington No. B-912. The thrust bearing for the overarm bracket is Boston Gear Works No. A-09. The thrust bearing for the elevating screw is Bantam No. 875. Should any of these bearings need replacing, they may be procured from their respective bearing distributors to expedite delivery. The main spindle bearings should be ordered from the W. H. Nichols Company because bearing distributors do not stock bearings having the necessary close tolerances.

OPERATING HINTS

Before mounting an arbor in the spindle, clean the tapers on both parts and make sure there are no burrs on them. Mount the arbor in the spindle and tighten the draw-in bar. Clean and check spacers and cutters thoroughly and remove any burrs before assembling them on the arbor.

No spindle lock is required on the Nichols Miller. Tap the wrench with a lead hammer to tighten or loosen the nut.

Slide the overarm assembly back, and check the arbor pilot for run-out without the support of the overarm bracket. If it does not run true, re-check for burrs or dirt before final assembly with the overarm bracket.

Do not tighten the arbor nut *without the arbor being supported by its pilot in the overarm bracket*, as the pressure applied might spring the arbor.

The draw-bar is threaded 7/16"—14 on one end and 5/8"—11 on the other. The nut is tapped correspondingly. Thus, it can be used with arbors, collets, etc., that are tapped with either of the above threads. Original Nichols arbors and adapters have 7/16"—14 thread.

IMPORTANT — Be sure the hardened mouth of the spindle and the shank of the cutter holder are clean. Dirt will cause inaccuracies and will cause an excessive load on the needle bearing in the overarm bracket, with the resulting need for replacement.

All arbors and cutter holders must be held in by the threaded draw-bar.

Avoid excessive tightening of draw-bar, which may throw the spindle slightly out of true.

Make sure cutters are locked securely in place so they can't shift out of their set position.

Make sure cutters are sharp and run at their proper speed and feed.

The table must be perfectly clean before any work or fixtures are put in place.

Make sure, before fastening a fixture to the table, that the bottom of the fixture is perfectly flat. This will avoid warping the table when the hold down bolts are tightened. The table is fitted to the ways with such close tolerances that slight warpage caused by overtightening the bolts will result in binding.

If the back of the work vise is not sufficiently strong, overtightening the work may warp the table. If the table binds, this is an indication that the vise has been overtightened.

A machined pad 9" x 2" is provided on the front of the column above the table for registering purposes, mounting of cams or controls, or other uses which will suggest themselves as familiarity with the possibilities of the machine is gained.

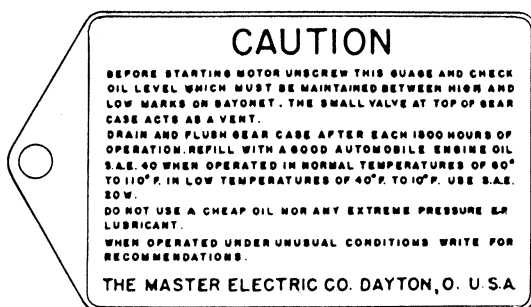
LUBRICATION

No machine can possibly give you maximum performance or accuracy unless a continuing maintenance program is followed. Of prime importance, of course, is lubrication. Complete instructions are given on the "machine lubrication chart" attached to the machine, a copy of which appears on the next page. No exceptions should be taken to the recommendations of this chart, unless the operator consults with a qualified lubrication specialist or directly with W. H. Nichols Company.

Special attention is also called to the motor lubrication, instructions for which are given on the yellow tag attached to the motor. The housing of the gear motor train is equipped with a bayonet type oil guage to which a metal instruction tag is attached (illustrated below.) Using the spindle head lever, bring the motor level before checking, and keep the oil level between the high and low marks. Add SAE 40 motor oil of good quality as needed.

In the machine crate will be found a sample of No. 600-W grease recommended for use with this machine. A Zerk Alemite grease gun is also supplied and should be used to service the Miller's 19 grease fittings. If your machine is equipped for the intermediate range of spindle speeds (200-2800 RPM), the two grease fittings for lubrication of the spindle bearings are replaced with oil cups. Add a small amount of good quality light spindle oil frequently to each oil cup to provide ample lubrication.

On high speed millers (250-3500 RPM) the spindle ball bearings are packed with grease and require no lubrication.



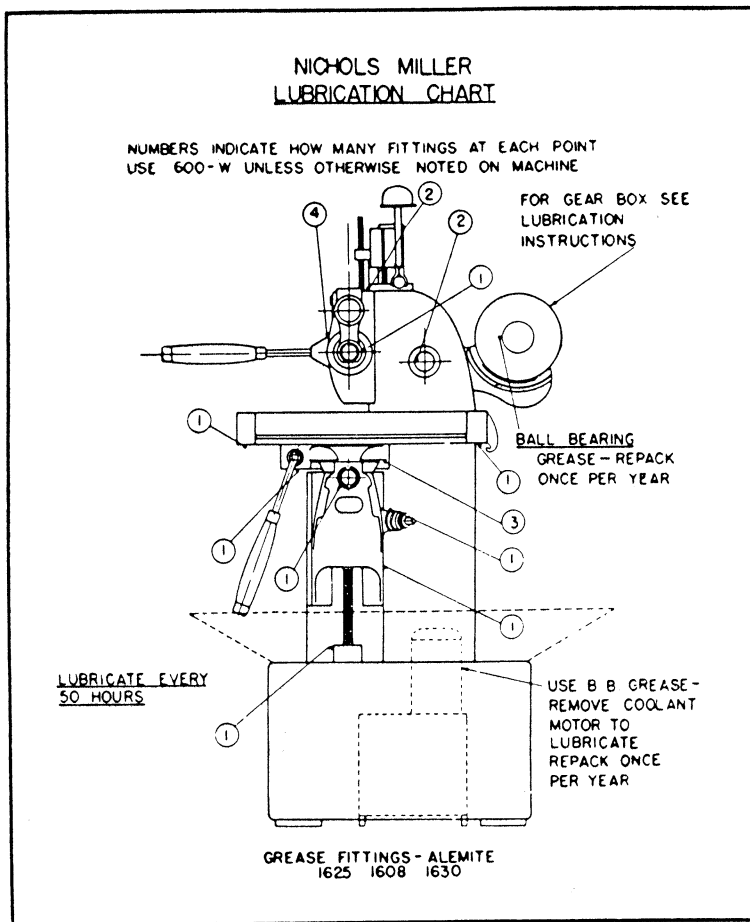


Table Ways Lubrication Semi-Automatic Model

Automatic lubrication for the table ways is optional on Nichols Semi-Automatic Millers. If the serial number of your Semi-Automatic Miller commences with the digit 8 or a higher number (e.g. #8-S-5650) you will be able to install Automatic Ways Lubrication. This accessory is obtainable as a packaged kit and comes with instructions for assembly. To operate this system a small amount of air at line pressure is bled from one of the valve ports of the Air Motor and used to actuate a Bijur lubrication pump by means of a small air cylinder mounted on the cover of the oil reservoir. This supplies a minute quantity of oil to the ways each time the table is reciprocated. The dipstick in the reservoir cover indicates when refilling is necessary. When oil level is down near the end of the dipstick, two quarts of Socony Vactra Oil #2, or its

equivalent, should be added. To provide for lubrication of the ways when the pneumatic feed equipment is detached and the table is operated by hand, an auxiliary hand operated pump is installed in the reservoir, actuated by pulling up the plunger handle. If reservoir becomes empty, refill and prime system with the hand operated pump.

Vertical Milling Attachment Lubrication

(see drawing, page 18)

The Vertical Milling Attachment is provided with a fitting for adding ESSO ANDOK-C (or equivalent) every 8 operating hours. This is all the lubrication required. It is recommended that no more than one pound of lubricant be used, as excess lubrication may cause the unit to overheat.

If the Vertical Attachment should overheat, remove all lubricant, flush with any safety solvent such as ESSO VARSOL and add one pound of grease, which is ample.

COOLANT SYSTEM

Two types of coolant equipment are available, optional at an extra charge.

The first consists of two oil pots, one a drip pot provided with a bracket which fits on the tapered stud behind the spindle motor switch. The bracket also has a tapered stud to receive the drip pot. The receiving or table pot has an integral rod across the top so that it may be hung on the turned back lip of the right table end cap.

The second type of coolant equipment consists of a pull-out tank which fits into the base of the Miller, and a motor-driven pump mounted on top of the tank which is used to circulate the coolant. The tank holds approximately 8 gallons and there must be at least

3 gallons in the tank for the pump to work efficiently. When the motor driven coolant system is furnished, splash guards for installation on the base of the machine are supplied. It is advisable *to clean the tank and strainers periodically* before an excess of chips and dirt collect. At any time *when replacement parts are needed*, it is well to *check the pump manufacturer's nameplate on the motor and contact that company direct for all replacements*.

If you use soluble oil as a coolant, and it starts to foam, add about a cup of kerosene to the coolant tank, or enough to remedy this condition. On certain work, oil may be applied directly to the cutters with a brush. This is often better than the ordinary method, particularly when working in tool steel.

ADJUSTMENTS and REPLACEMENTS

Mesh Between Table Rack and Pinion

If the table rack movement on the Nichols Miller has too much play, or is too tight, it may be adjusted in the following manner. An eccentric bushing "A" is held in place by a set screw beneath the assembly. Loosen this set screw so that the bushing may be turned by a rod inserted in the hole provided for that purpose. The eccentric action will raise the gear "B" when revolved counter clockwise — while a clockwise turn will loosen the contact between gear and rack. Check this adjustment for all positions of the table.

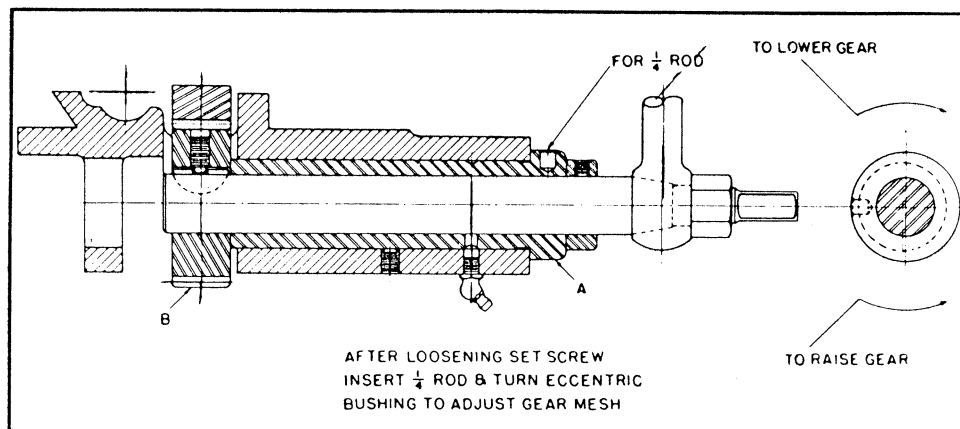


TABLE RACK AND PINION ADJUSTMENT

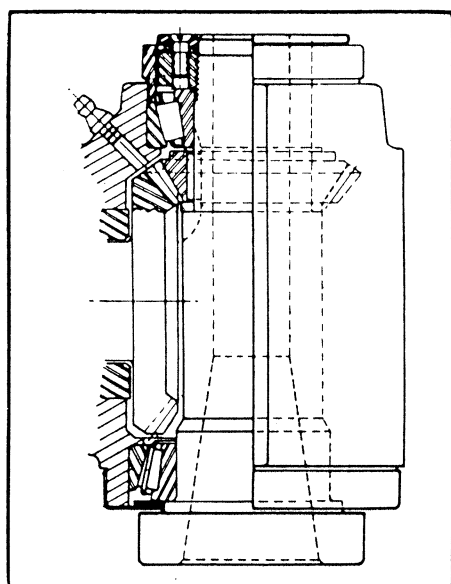
Spindle (see drawing, page 18)

The spindle of the Nichols Miller (up to 2800 RPM spindle speed) is regularly mounted in widely spaced precision tapered roller bearings, while the high speed spindle is mounted in preloaded ball bearings. The spindle nose is hardened and ground, inside and out, to fixed dimensions so that interchangeable face plates or fixtures can be mounted. Four 5/16"—18 holes for mounting screws are tapped in the spindle face. Cap screws fitted to diametrically opposite holes serve as driving lugs for arbors and other spindle tools.

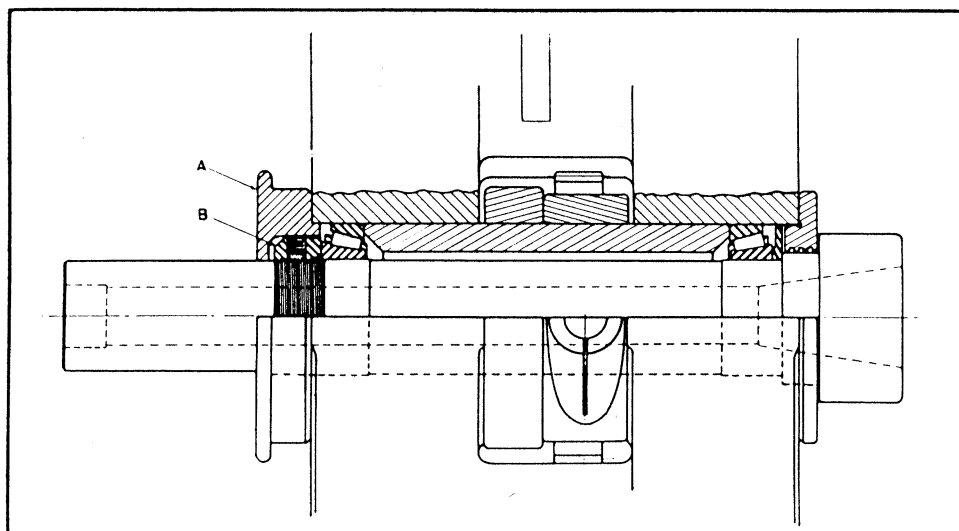
The taper hole in the spindle is milling machine standard No. 40, and the spindle is bored a full 1" diameter for its entire length.

The roller bearing spindle has an adjusting nut which may be reached by removing the dust cap "A". The nut "B" is threaded to the spindle and in assembling the Miller, the nut is seated against the bearing with an 8" spanner wrench using about 30 lbs. pressure on the wrench. Rotate spindle by hand a few turns. The spindle is then tapped at both ends with a babbit hammer to seat the bearing. After this, the adjusting nut is eased about 1/8" measured on the rim. This should assure correct adjustment because the spindle must turn with a slight drag, but smoothly without any sense of binding or any indication of play. For high-speed milling, it is sometimes advisable to loosen the nut slightly to prevent over-heating of the bearings.

For high speed applications requiring speeds up to 5000 RPM, Nichols Millers are provided with a special preloaded ball bearing spindle designed for high speed operation. Ball bearings are packed with grease as furnished by the manufacturer and require no lubrication.



VERTICAL ATTACHMENT SPINDLE



MAIN SPINDLE — TIMKEN ROLLER BEARINGS

Gib Adjustment

There are four gibs on the Nichols Miller — the head, the knee, saddle and table. If it is ever necessary to re-work the gibs to restore the machine to its original working condition, the following procedure should be followed: remove the gib, clean and stone the bottom surface. Place bottom down on a surface grinder, and grind top very carefully, taking off not more than .0005". Clean gib seat, replace the gib and try the movement. Repeat until the desired adjustment is obtained.

To remove the head gib, take off the head stop bracket, raise the head as far as possible and lock with binder. This will provide access to the top gib screw from the rear. The lowest screw is of the socket head type, accessible from underneath. The middle screw is in front. After removing this, loosen the binder and slip out the gib. For the table gib, pull out the saddle far enough to obtain access to the table gib screws; the saddle gib will slip out readily when the binder and gib screws are removed. To take out the knee gib, crank the knee to the bottom of its slide and raise the head as far as possible. *Be sure to support the knee to prevent its falling forward when the gib is slipped out.*

Head Rack and Segment

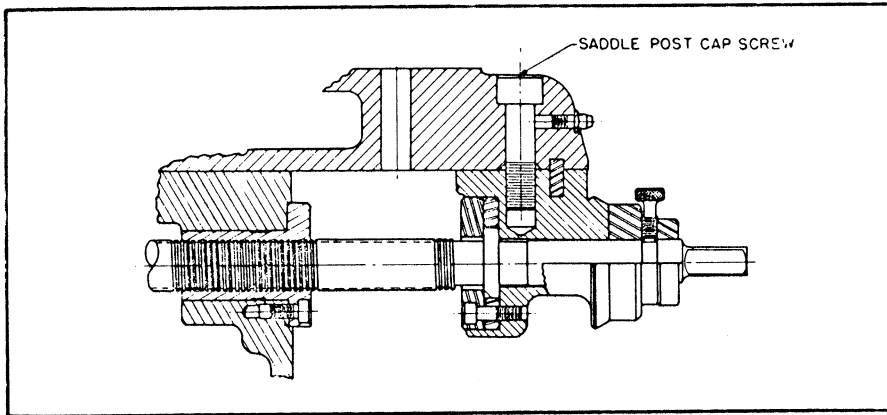
The only adjustment ever needed to the head rack is to place shims under the entire length of the rack to take up any looseness that may have developed between the rack and the segment. Before inserting shims, be sure the looseness is not local. If only the center of the rack is worn, the use of shims will correct the play in the center but will cause binding on the upper and lower ends of the rack. Care should be taken when reassembling the rack and segment to be sure that the teeth are properly engaged and that all the teeth in both the rack and the segment are in use.

Belt Tension

Remove the belt guard. A binder bolt will be found underneath the motor which goes through a slot in the motor bracket. By loosening this bolt, the motor may be rotated to either ease or tighten the belts; this unit has an adjustment range of $2\frac{1}{2}$ ". If more adjustment is necessary, loosen the motor ring screw and again rotate the motor. Because the axis of the output shaft is off center, this will give additional movement to the motor.

Saddle Screw

The saddle post cap screw must be tight at all times to assure accuracy of the entire saddle assembly. The line drawing shows the design and location of this important screw.



TRANSVERSE SCREW AND SADDLE POST

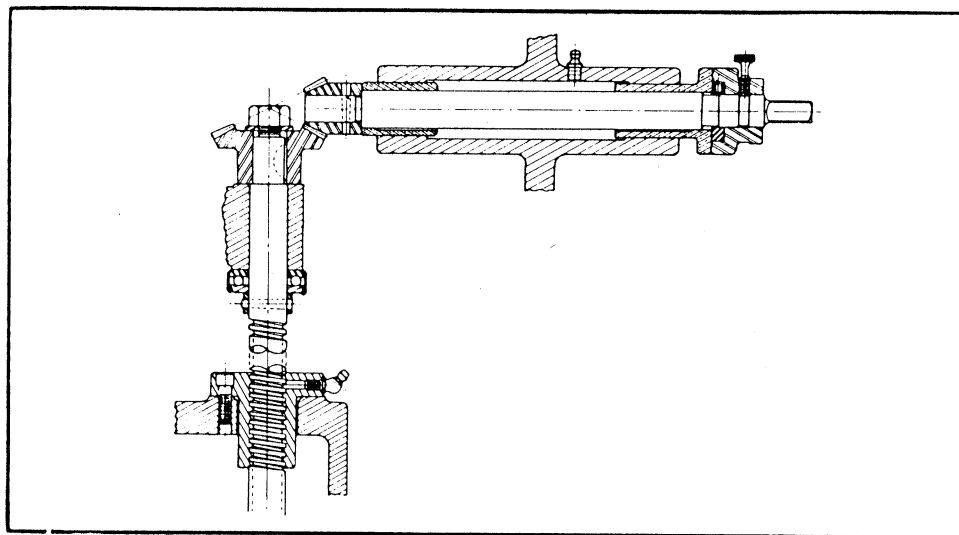
Elevating Screw Relacement

1. Remove right-hand table end cap and slide table off saddle.
2. Turn transverse screw all the way out and slide saddle off.
3. Raise head as high as possible. Raise knee until collar on elevating shaft is 12" above elevating nut. Tighten knee binding handle.
4. On older machines (Serial #7-P-4528 or older), remove set screw which locks elevating nut to base. Turn elevating crank counter-clockwise lifting elevating nut out of base. On later machines, the elevating nut is fastened to the base with three 5/16" socket head cap screws. Remove these and the elevating nut.
5. Lift knee 1 or 2" — place piece of wood between bottom of elevating screw and base.
6. Remove knee binder screw and 4 gib screws. Slide gib down and remove from bottom HOLDING KNEE SECURELY TO PREVENT ITS FALLING.

7. Remove knee and elevating screw.
8. Measure length of elevating screw bearing boss. Assemble collar, taper pin, thrust bearing and bevel gear on new screw and bring gear solidly against its seat by tightening nut. Check measurement between face of thrust bearing and bearing face of gear. This should not be more than .001" over the measurement of the bearing boss noted above. Face off shoulder on collar to accomplish this. No end play is permissible.

Then disassemble above parts from the elevating screw and proceed with its installation on the machine.

9. Installation on older machines. Press elevating nut into base, aligning flat around oil hole with oil hole in base. Spot through set screw hole into nut, and install set screw. On later machines, install the elevating nut with the grease fitting as shown on sketch below.



KNEE ELEVATING MECHANISM

ACCESSORIES

Arbors (see photograph, page 36)

Arbors furnished for Nichols Millers have #40 MMS taper with 7/16" — 14 tapped hole for the draw-bar and 9/16" diameter pilot to fit the overarm bracket.

The arbor most commonly used and for which the machine is designed is 5" working length available in $\frac{5}{8}$ ", $\frac{3}{4}$ ", $\frac{7}{8}$ ", 1" and 1 $\frac{1}{4}$ " diameter. Other arbors with diameters up to 1 $\frac{1}{2}$ " and lengths up to 10" working length are available, but should be used only for light work. When using arbors over 7" working length, an extra length overarm is required.

Cutters with 1 $\frac{1}{4}$ " or larger bores may be adapted to a 1" arbor by shouldering down a collar to fit. The collars supplied with the machine are soft so that they will grip the sides of the cutter better, and can be more easily machined if it is found necessary to reduce the diameters so they may clear fixtures, etc.

Nichols Vertical Milling Attachment

(see photograph, page 37)

The Nichols Vertical Milling Attachment is mounted on the spindle head on a T-slotted ring adapter and is driven by a splined adapter inserted in the taper of the main spindle and held by the arbor draw-in bar. Be sure to clean the mounting faces of the ring adapter and the Attachment before mounting. The Vertical Attachment spindle has the same #40 MMS taper as the main spindle and is furnished with draw-bar threaded 7/16" — 14 on one end and $\frac{5}{8}$ " — 11 on the other.

Speed of the vertical spindle is in 4:3 ratio with speed of the horizontal machine spindle. CAUTION: Do not run the Vertical Milling Attachment at speeds in excess of 2000 RPM. The operator should be especially cautioned as to this speed limit when using the vertical attachment on Nichols Millers having the intermediate (200-2800 RPM) and high spindle speed (250-3500 RPM) ranges. With the 4:3 ratio, the maximum permissible speed of the vertical spindle will be exceeded if the machine spindle is turning faster than 1500 RPM.

All Toolroom Millers from Serial #7-N-4108 and later, and all Millers beginning with Serial #8-T-5700, are equipped with the ring adapter on which the Ver-

tical Milling Attachment is mounted. Millers other than Toolroom Model from Serial #7-N-4108 through Serial #8-T-5699 are drilled to receive the adapter which can be installed according to the following instructions:

Remove pulley and key from spindle and the four screws from the rear bearing cap. Loosen 5/16" set screw in the spindle nut. Insert 5/16" screws in opposite tapped holes in the spindle nose and, with a bar between them, loosen the spindle nut with a spanner wrench or 5/16" pin in the hole provided. Remove the nut. Remove the four screws in the front bearing cap. With a lead hammer tap the rear end of the spindle to remove the bearings from their seats, and remove the spindle. Place the spindle, nose down, over a piece of 3 inch I.D. tubing and tap on the extension end until the front bearing is removed. Use care not to damage any parts in dis-assembly. Stone the face of the flinger and the front bearing lightly, to remove burrs, and clean all parts thoroughly.

Place the bearing cap and flinger on the spindle and tap the front bearing in place. Replace this assembly in the head, and install rear bearing. Tighten spindle nut tightly and rotate to seat the bearing rollers. Tap both ends of the spindle lightly. If too tight, make adjacent pencil marks on the spindle and nut, then back off nut until marks are 1/16" apart. Tap again, and try. Spindle should spin a few revolutions when turned by hand.

For information as to the adaptability of the Vertical Milling Attachment to millers prior to Serial #7-N-4108, inquiry should be made to the factory.

Swivel Base Vise (see photograph, page 36)

The Nichols Swivel Base Vise is 5¼" wide, with jaw opening 2⅞" x 1¼" deep. The swivel base is graduated with verniers which make possible very accurate angular settings. To read the quarter degree vernier, count

the number spaces on the vernier after the zero mark to the lines that match up. This will be the number of quarters of a degree above the reading of the regular scale, where the zero mark falls. Two large tension bolts run the full length of the vise body, from front to rear, terminating in the hardened steel end cap, and holding it securely in place. These bolts *preload* the entire vise, thus giving added rigidity and resisting deflection when holding the work. The extra large hardened feed screw has a $\frac{3}{4}$ " milled Acme thread revolving in a large bronze nut. The bearing for the feed screw in the end cap is hardened and ground, and is lubricated by a grease fitting.

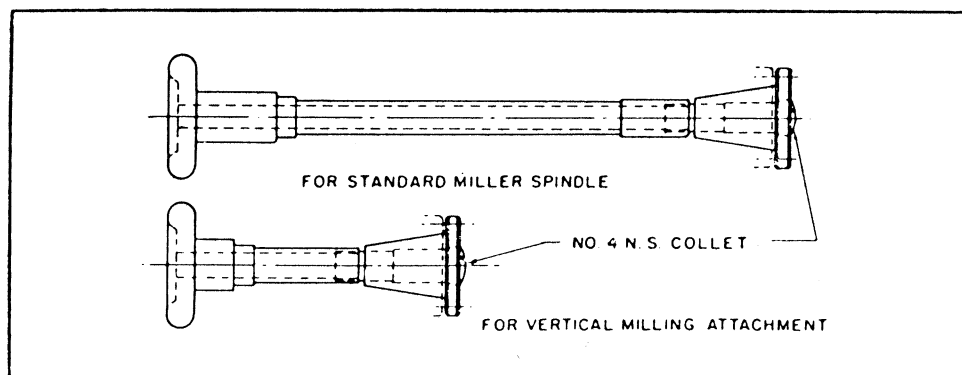
Upright Vises (see photograph, page 36)

Nichols Upright Vises are designed for holding cylindrical work. The smaller No. 1 Vise takes diameters up to $2\frac{5}{8}$ "; the No. 2 Vise takes diameters ranging from $2\frac{1}{2}$ " to 6". These vises are valuable as work holders for key seating set-ups and other applications which require the cutter to be brought into or through the work with the Nichols Miller sliding spindle head.

All three Nichols Vises are provided with slots or holes for hold-down bolts so that they may be securely attached to the work table.

Draw-in Collet Attachment (see photograph, page 37)

The Nichols draw-in collet attachment is available for either the main spindle or the Nichols Vertical



DRAW-IN COLLET ATTACHMENTS

Milling Attachment spindle and allows the use of conventional spring collets. The hardened and ground spring collet adapter bolts to the face of the spindle, and takes Hardinge No. 4 NS collets, or equivalent up to $\frac{5}{8}$ " capacity.

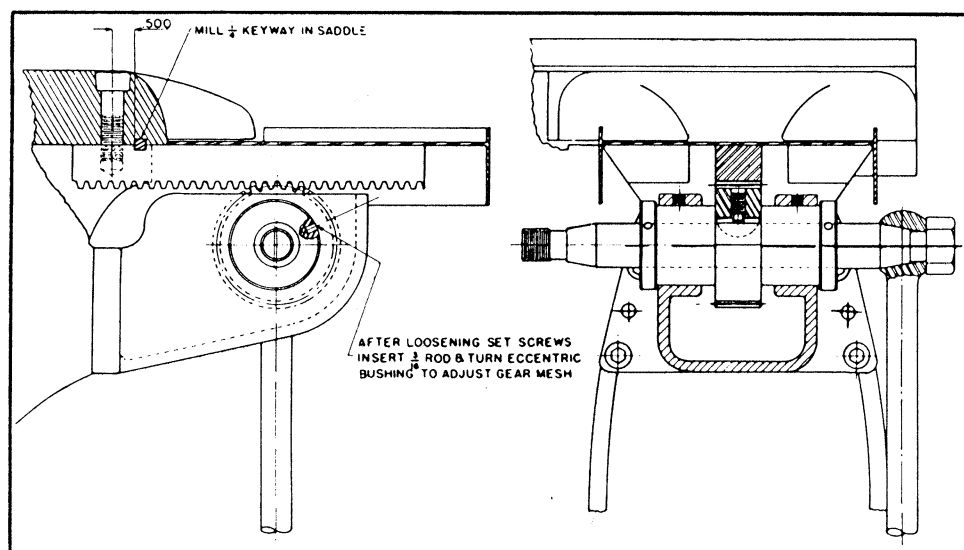
Adapters (see photograph, page 36)

No. 40 outside taper adapters are available with Nos. 2 and 3 Morse or Nos. 5, 7 or 9 Brown & Sharpe inside taper or with straight bores of any diameter from $\frac{1}{4}$ " to 1" by $\frac{1}{8}$ ths.

Lever Rack and Pinion Transverse Feed Attachment

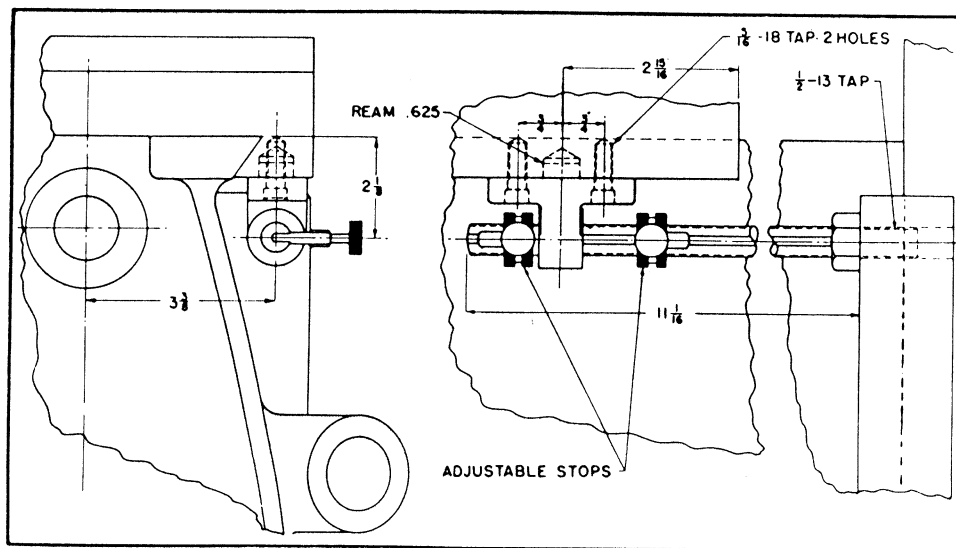
If your machine is serial No. 7-S-5168 or later, installation of this attachment (if not supplied as original equipment) may be made without removal of the saddle or knee, as all drilling has been done. For earlier machines, the following procedure is necessary:

1. Remove saddle and knee and saddle post from saddle.
2. Mill keyway $\frac{1}{4}$ " wide x $\frac{1}{8}$ " deep across the boss of the saddle that is the seat for the saddle post. (See sketch below).



SADDLE RACK AND PINION

3. Install rack on saddle.
4. Mill face of knee, to which pinion bracket is attached, square with slides.
5. Put saddle on knee so that rack extends $6\frac{1}{2}$ " beyond ends of knee and lock gib. With knee on bench, milled face up, place pinion bracket in position. Make sure that pinion is square and lines up with rack.
6. Transfer one hole from bracket to knee, remove saddle, and drill and tap $\frac{3}{8}$ " - 16.
7. Install bracket and tighten the screw. Square shaft by indicating from scraped surface of knee to shaft on either side of bracket. Spot the other 3 holes and drill and tap them.
8. Bolt on bracket, drill for $\frac{5}{16}$ " dowels, and install same.
9. Drill and tap $\frac{1}{2}$ " - 13 hole in knee for saddle stop screw. (See sketch below) Install saddle stop screw.



SADDLE STOP

10. Drill and tap the two $\frac{5}{16}$ " - 18 holes, drill and ream .625 hole for saddle stop bracket and install it. Check inside of saddle dovetail for possible distortion by these screws and correct it.
11. Replace knee and saddle. Before tightening gib on saddle, insert rods in holes provided and adjust eccentric bushings for proper pinion mesh with rack.

Longitudinal Feed Screw

Lever, rack and pinion longitudinal table feed is standard equipment on the Nichols Miller. However, a longitudinal feed screw is available at extra charge, except on the Toolroom model on which it is included as standard equipment in addition to the lever, rack and pinion longitudinal feed. This feed screw can be installed easily without further machining, if not supplied as original equipment, for it comes with all components complete and with drawings showing correct installation procedure. On the top of the saddle at the right, a *seat* is machined to receive a half-nut. To engage this table feed screw half-nut, first remove the $\frac{3}{8}$ " - 16 x 1" cap screw, clean the half-nut, and then fit the nut into the feed screw *with hub of the nut in seat provided in saddle*. In the sketch below, the screw "A" is the end shake adjusting screw which takes up the end play through an intermediate brass pad. Screw "B" locks the adjusting screw in position.

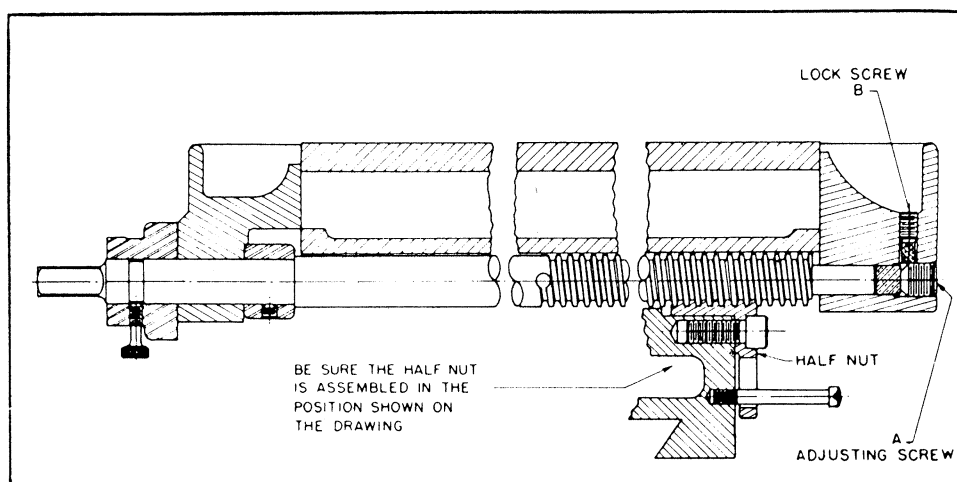
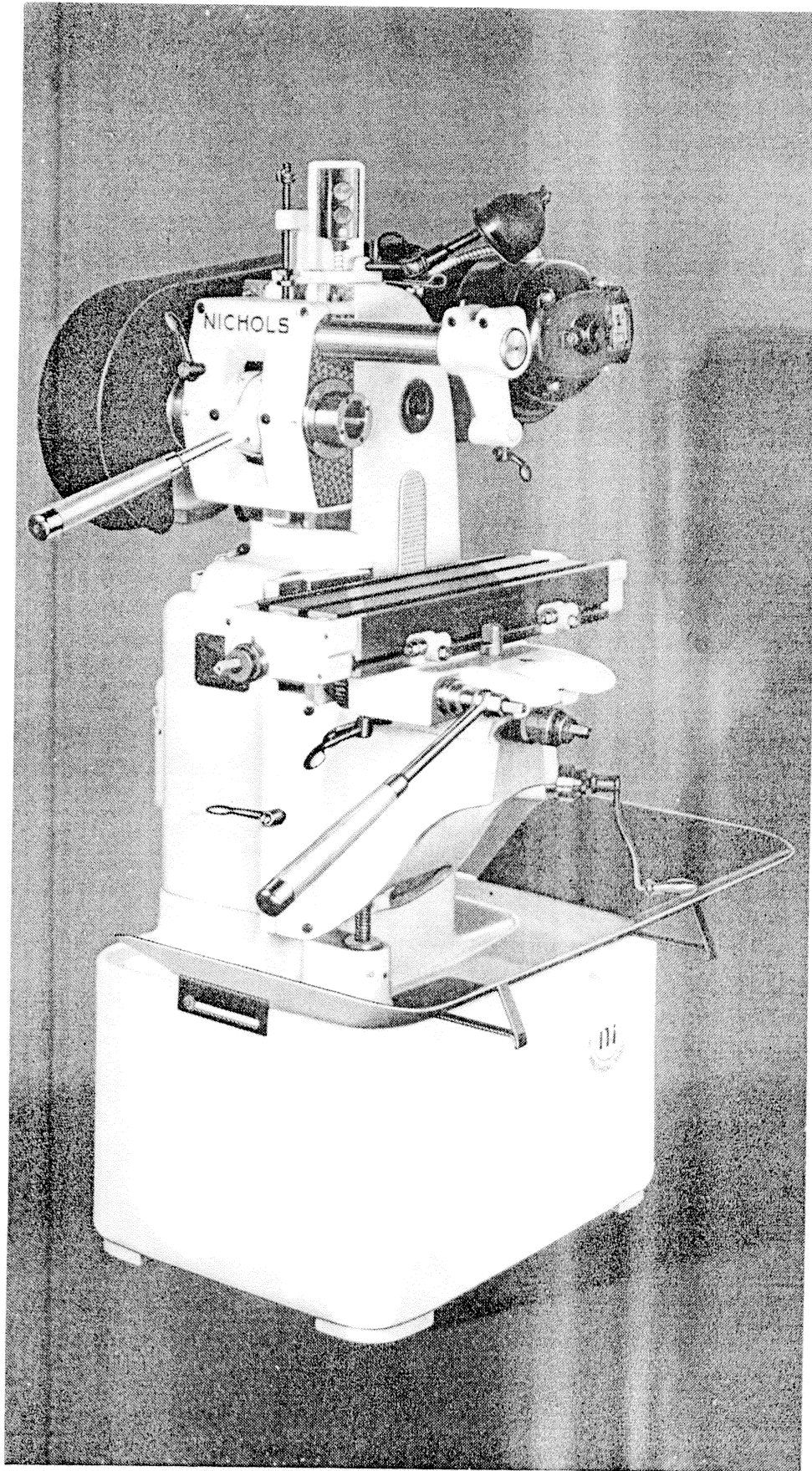
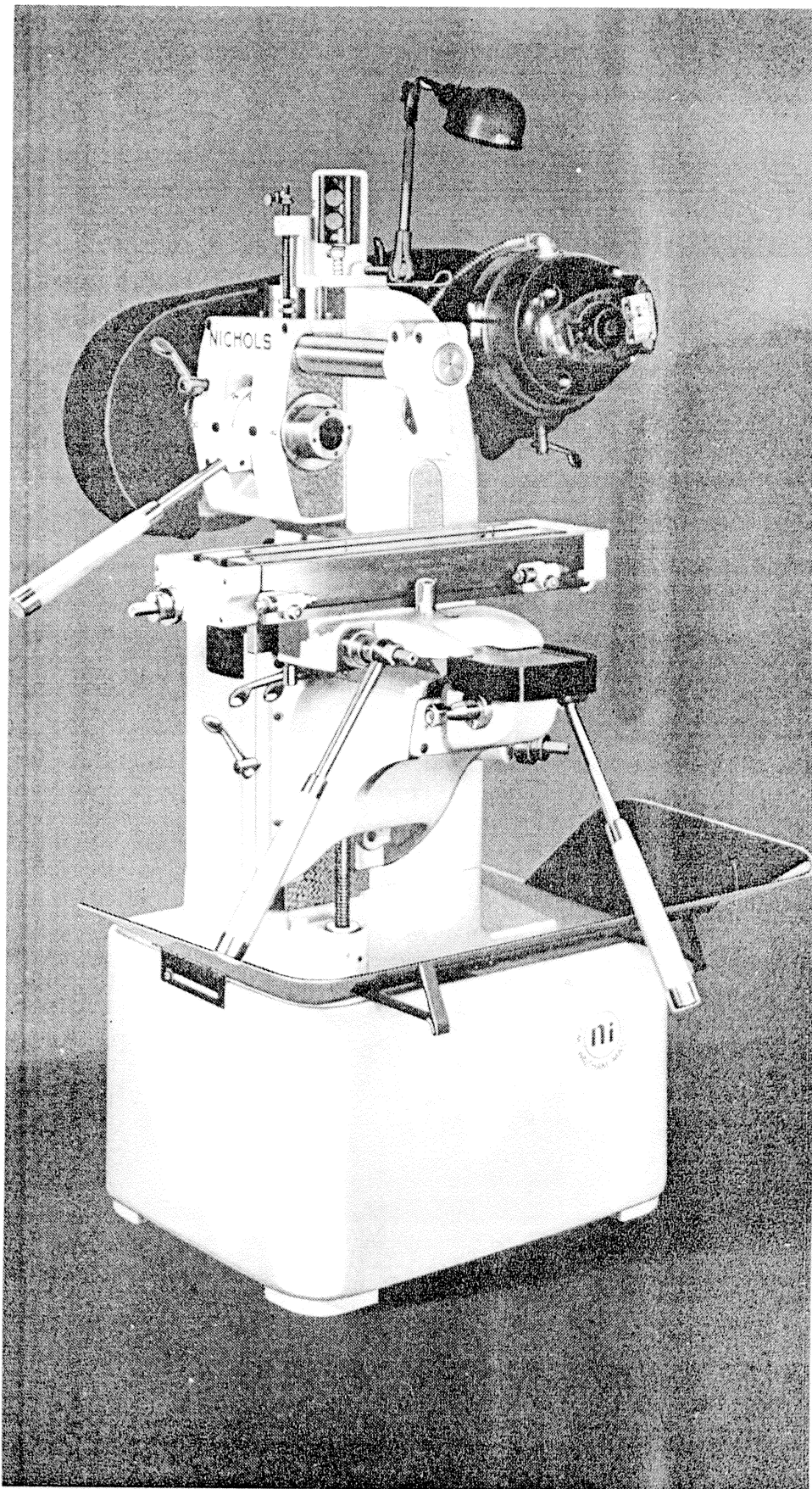


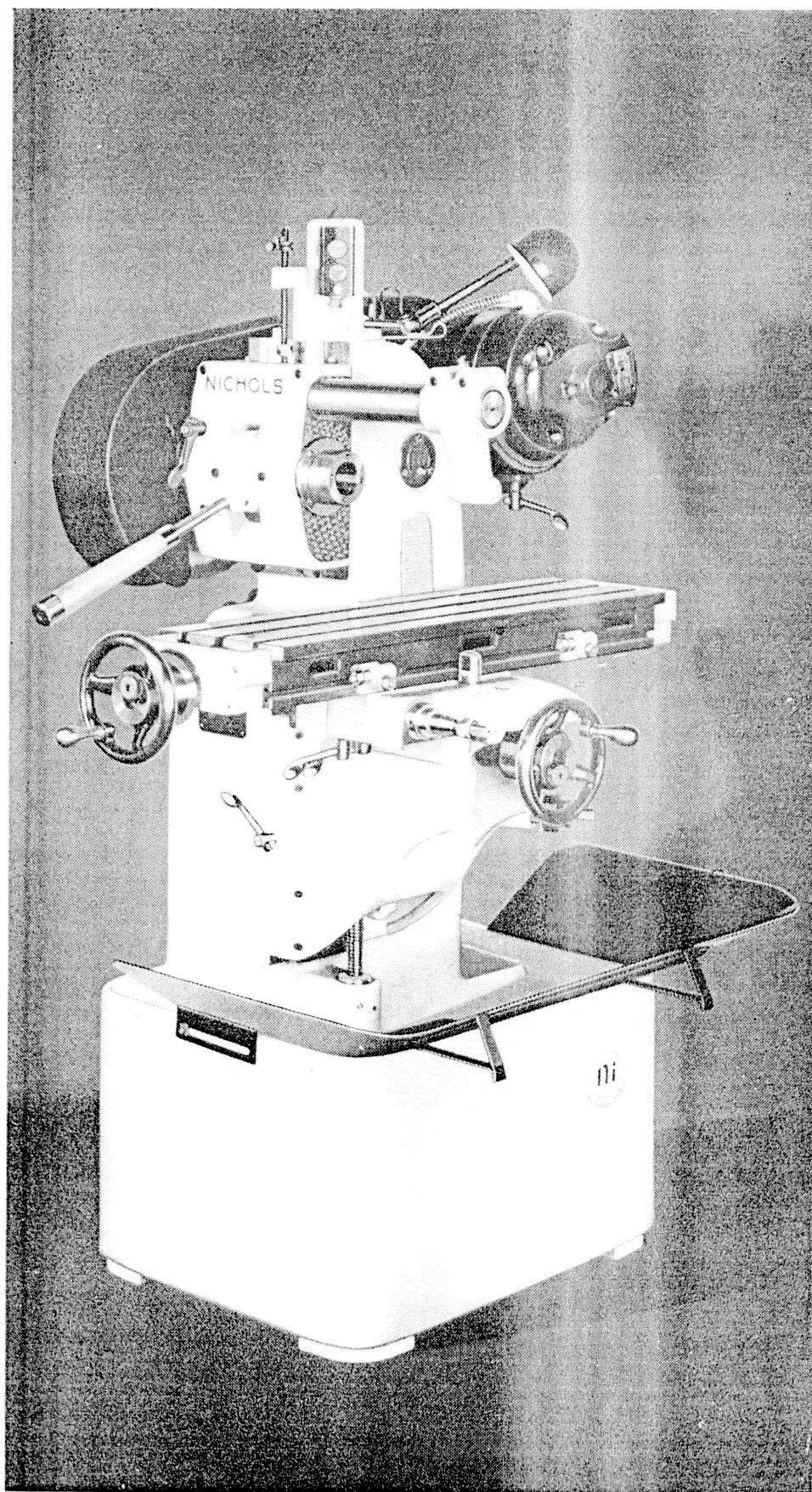
TABLE FEED SCREW



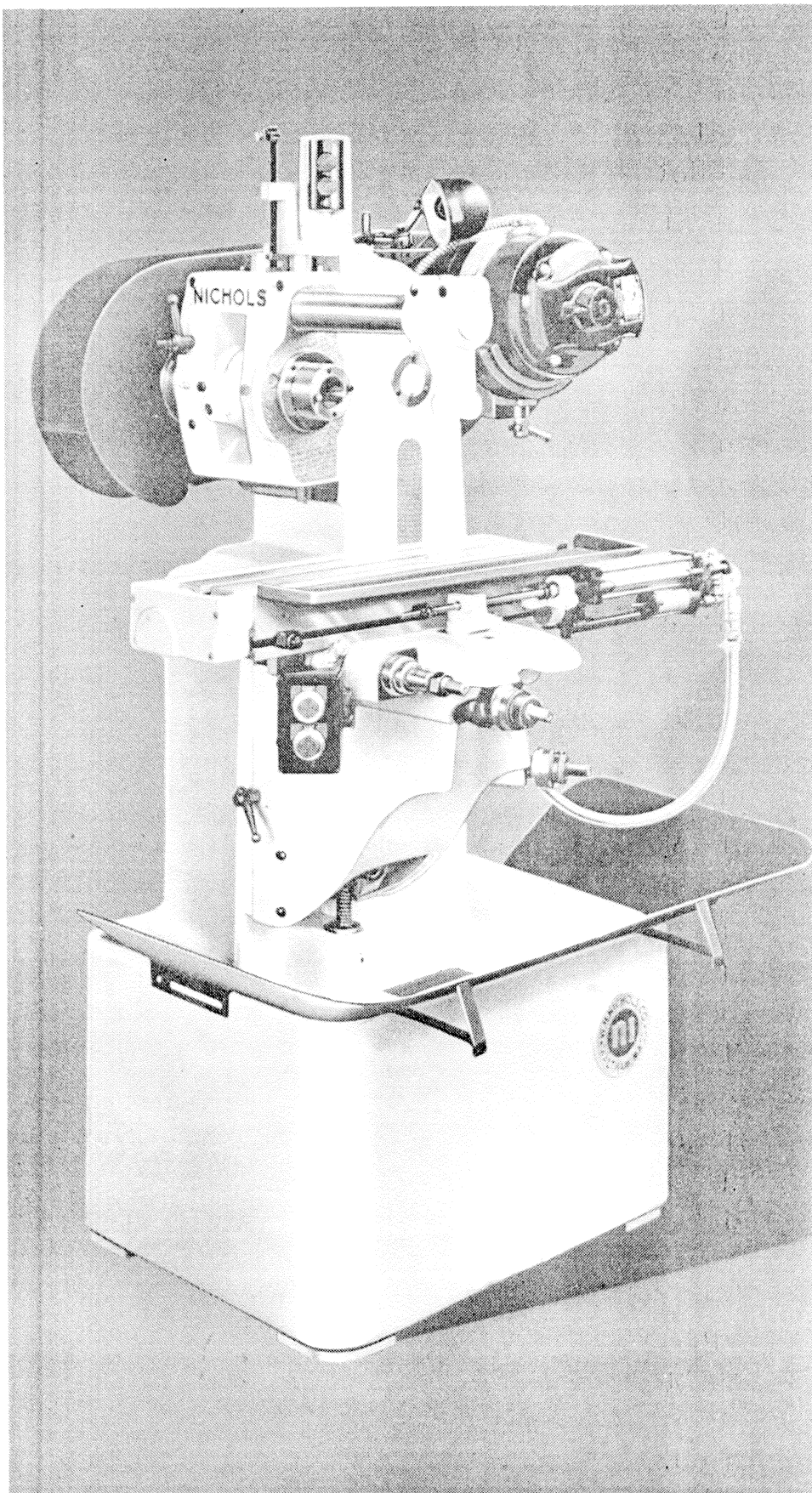
STANDARD NICHOLS HAND MILLER



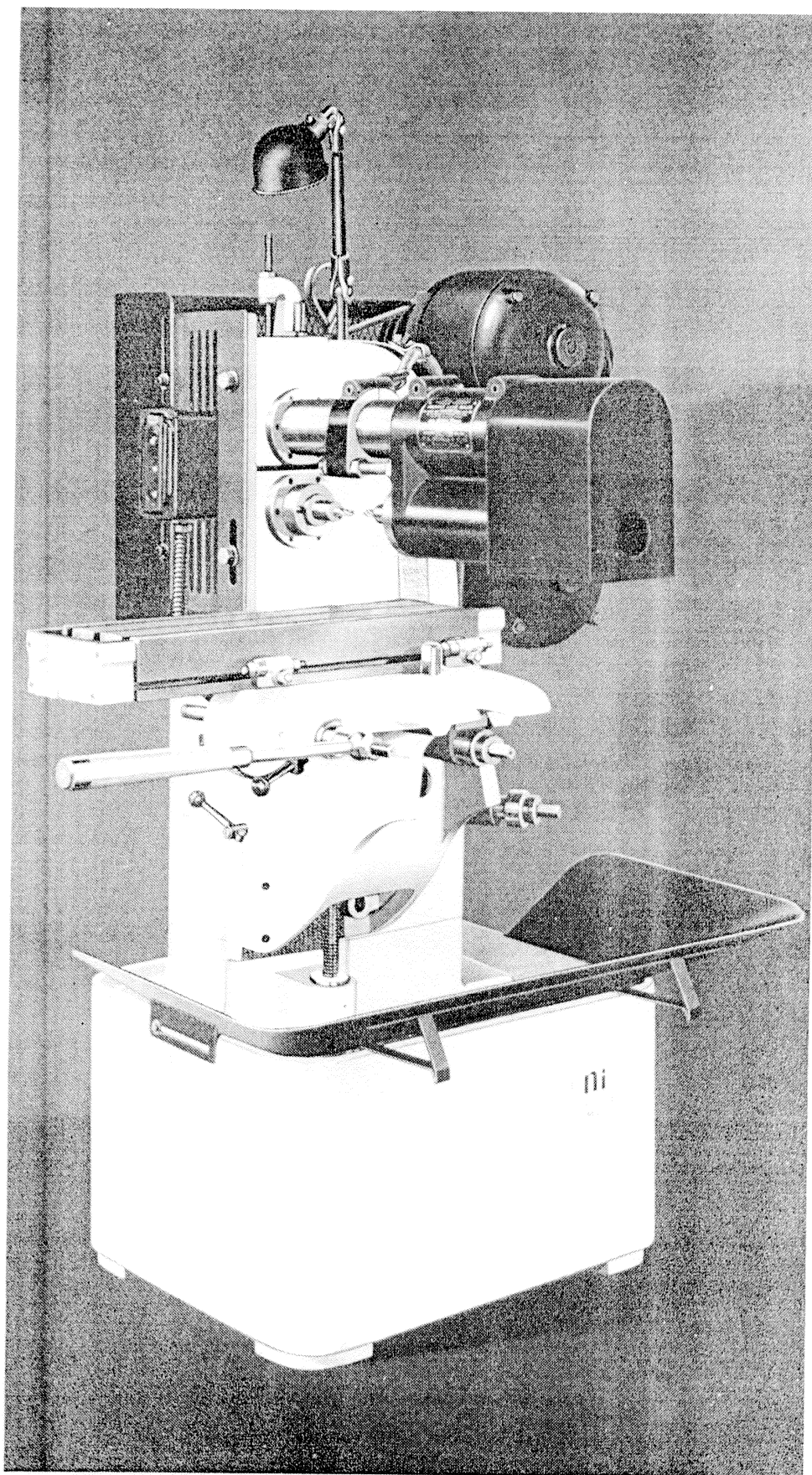
NICHOLS MILLER PRODUCTION MODEL



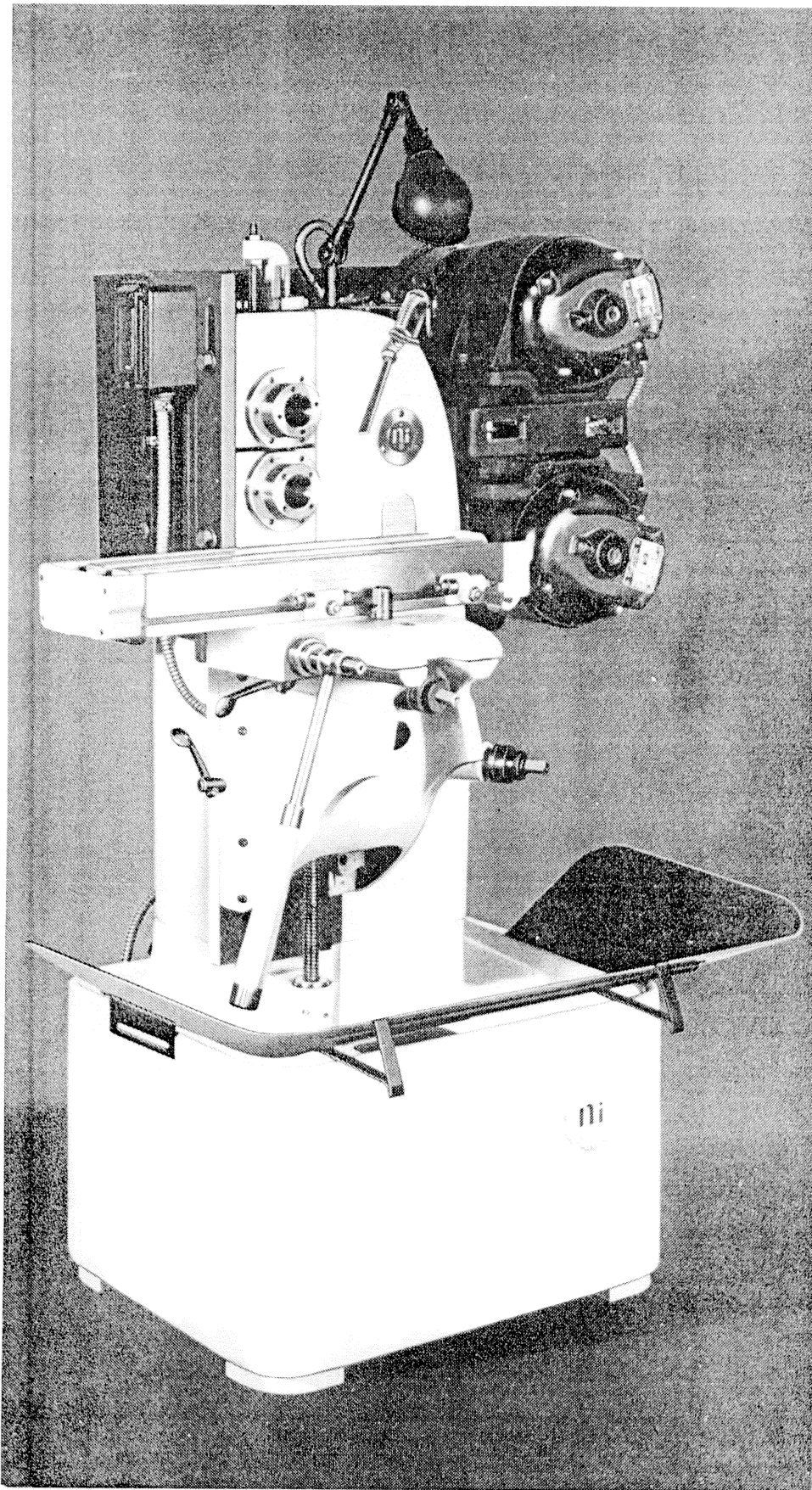
NICHOLS TOOL ROOM MILLER



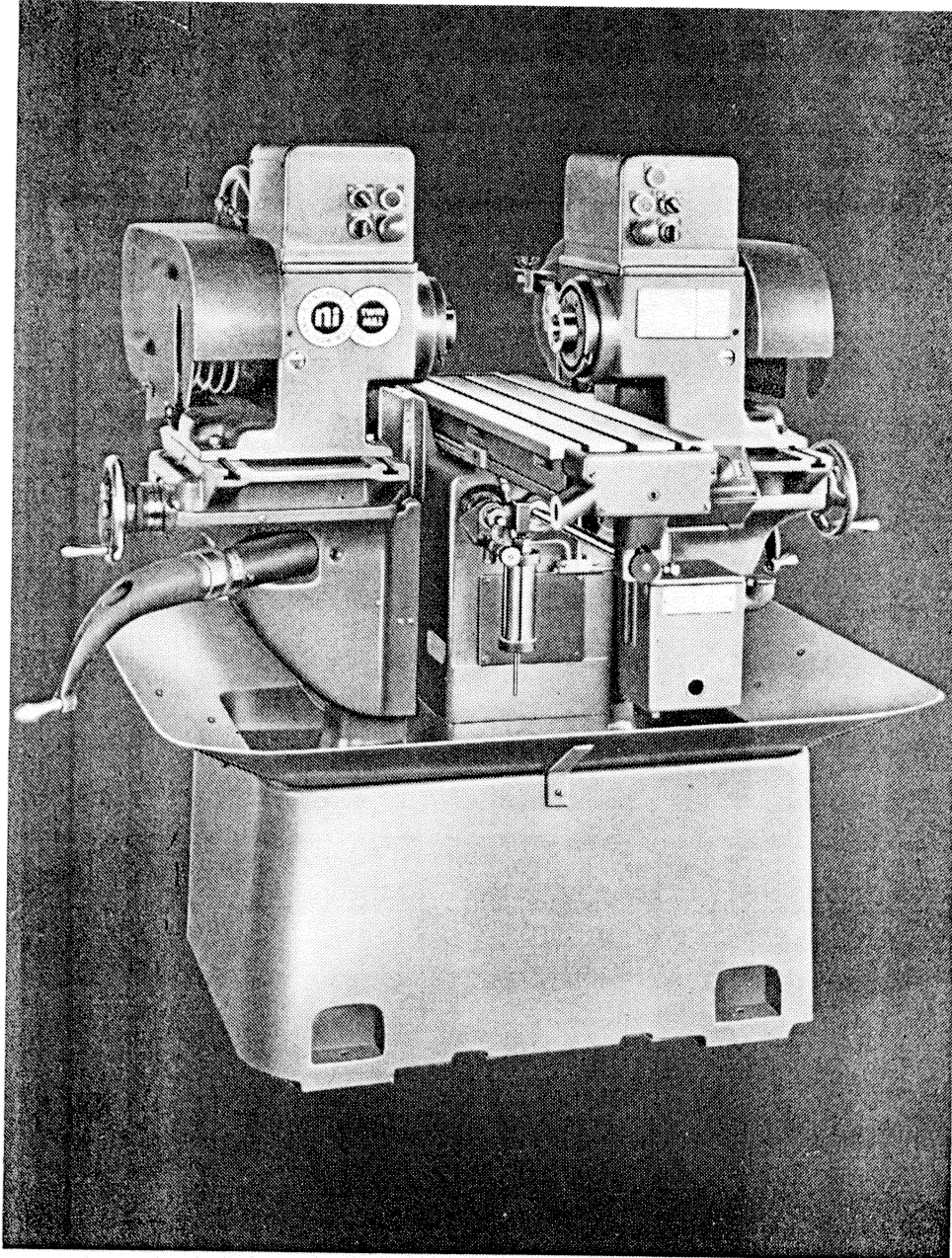
NICHOLS SEMI-AUTOMATIC MILLER



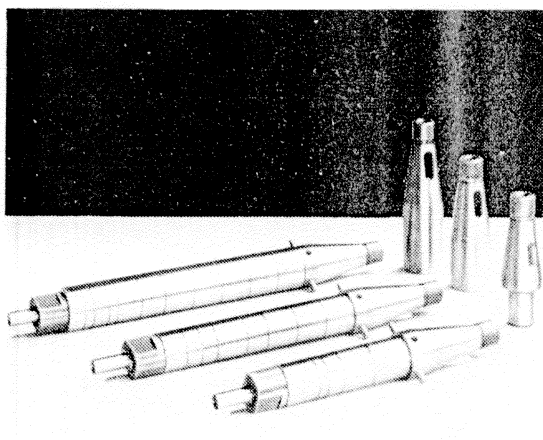
NICHOLS DUPLEX MILLER — OPPOSED SPINDLE TYPE



NICHOLS DUPLEX MILLER — DOUBLE DECKER TYPE

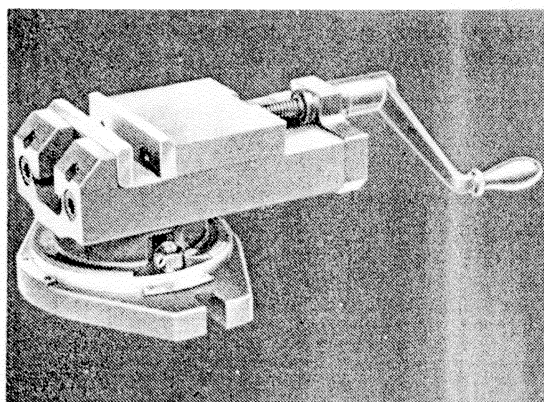
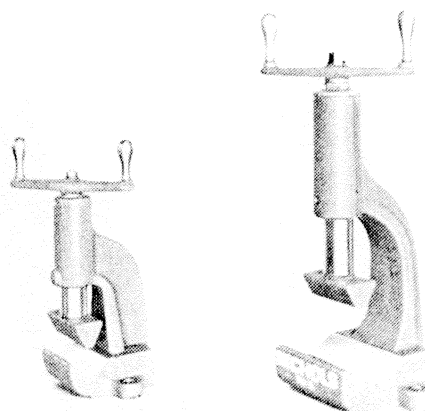


NICHOLS TWIN MILL



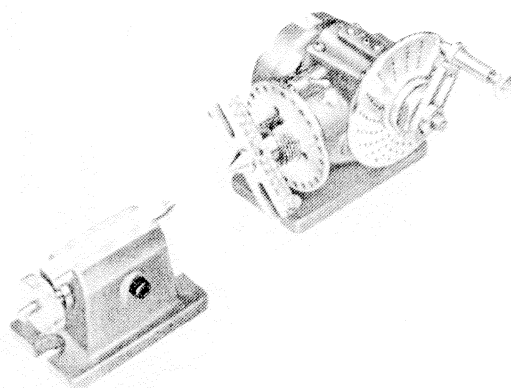
NICHOLS ARBORS
AND ADAPTERS

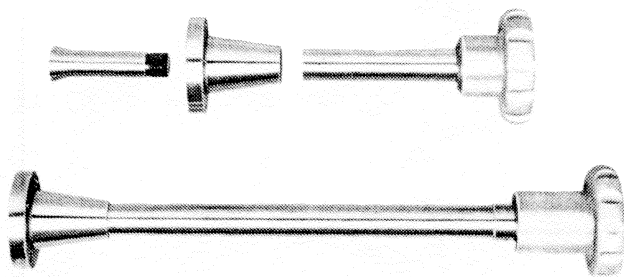
NICHOLS UPRIGHT VISES
NO. 1 and NO. 2



NICHOLS SWIVEL BASE VISE
— 5 1/4" JAWS

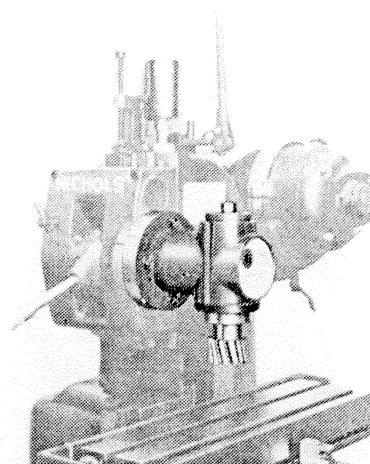
DIVIDING HEAD
WITH TAILSTOCK



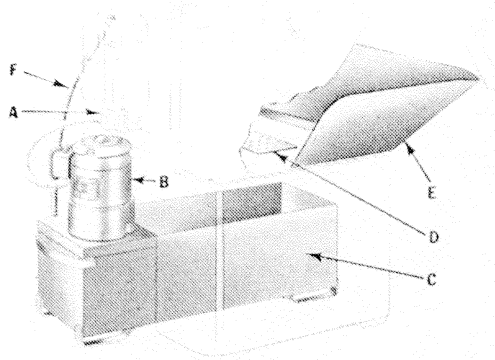


NICHOLS DRAW-IN COLLET
ATTACHMENTS FOR MAIN AND
VERTICAL SPINDLES

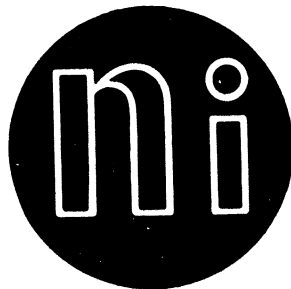
NICHOLS VERTICAL MILLING
ATTACHMENT



COOLANT PUMP WITH
SPLASH GUARD



- | | |
|-------------------------------|----------------------------|
| A... DISCONNECT PLUG | D COOLANT RETURN |
| B... MOTOR $\frac{1}{8}$ H.P. | E SPLASH GUARD (REMOVABLE) |
| C. 8 GALLON TANK | F FLEXIBLE HOSE |



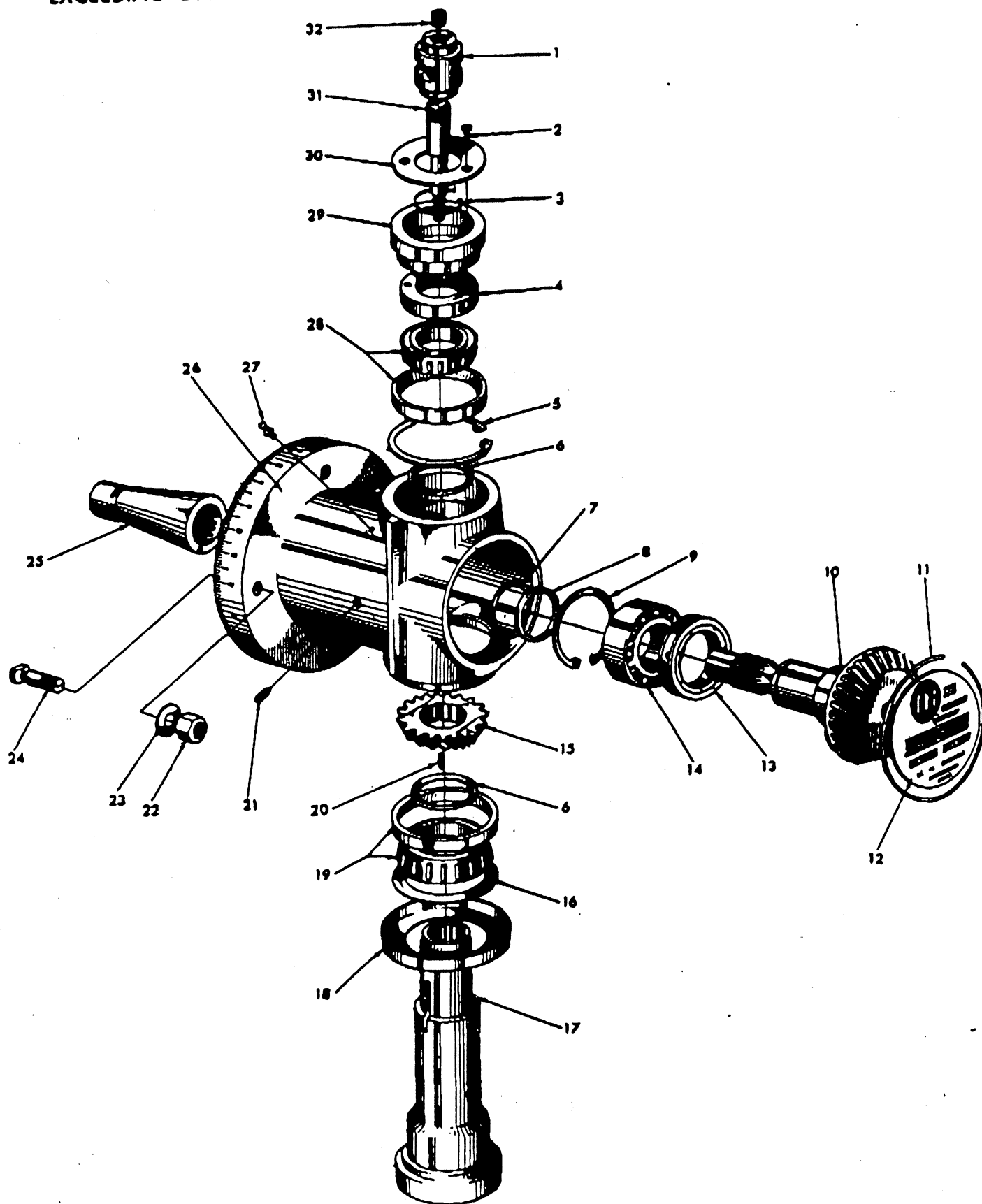
Trade-mark of the Nichols Miller

Manufactured by W. H. NICHOLS COMPANY

Waltham 54, Mass., U. S. A.

NOTE: LUBRICATE AT FITTINGS EVERY 8 HOURS OF RUNNING. USE LUBRICANT ESSO ANDOK C. OR EQUIVALENT.

SPINDLE SPEEDS AT THE VERTICAL ATTACHMENT ARE ONE-THIRD HIGHER (4:3 RATIO) THAN AVAILABLE HORIZONTAL SPINDLE SPEEDS. VERTICAL SPINDLE SPEEDS EXCEEDING 2000 R.P.M. ARE NOT RECOMMENDED.



WHEN ORDERING, GIVE MACHINE SERIAL NUMBER, VERTICAL MILLING ATTACHMENT SERIAL NUMBER, KEY NUMBER, PART NUMBER AND PART NAME

VERTICAL MILLING ATTACHMENT
(ASSEMBLY NUMBER 42-00103 0001-1)
 60000 -4

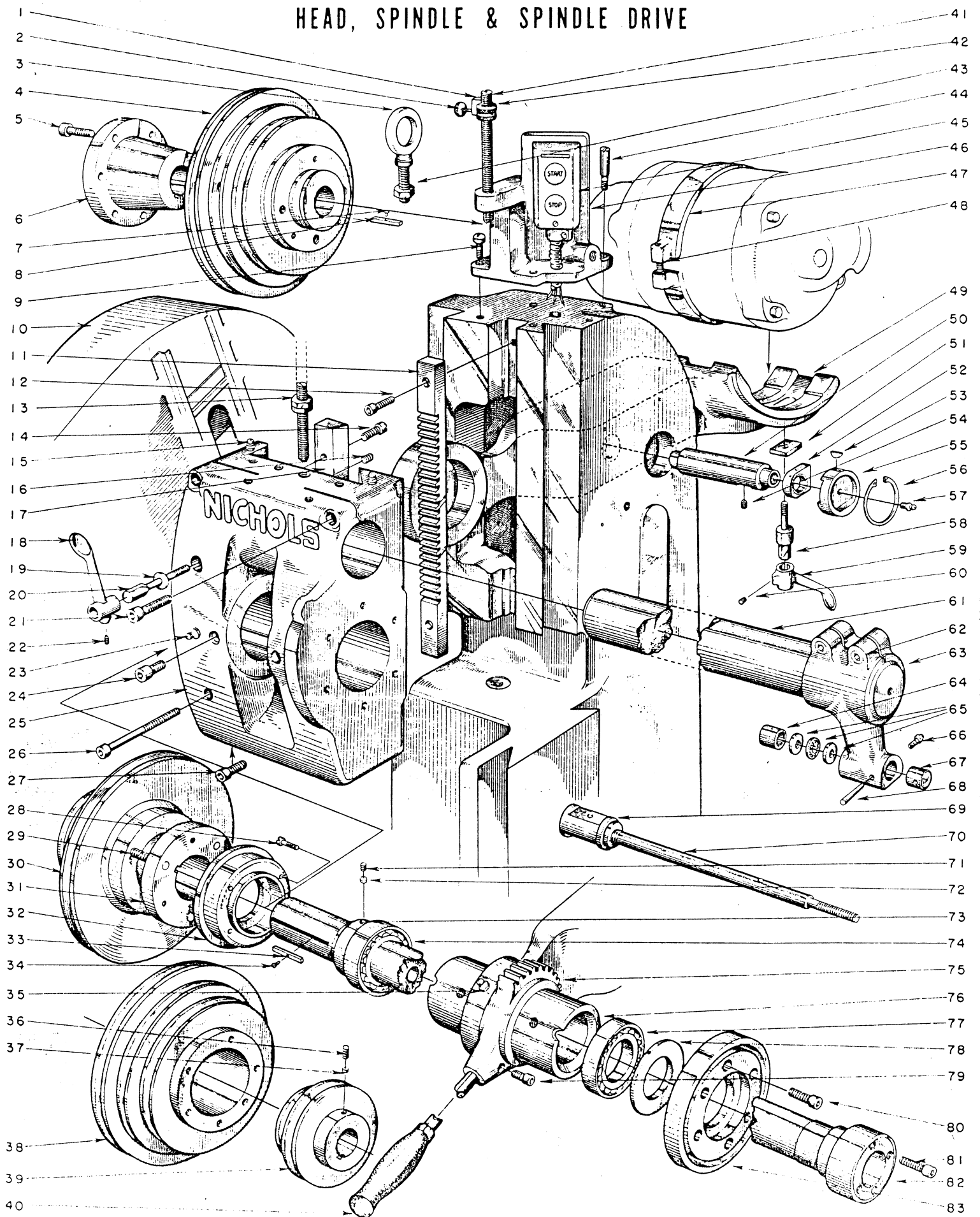
<u>Key No.</u>	<u>Part No.</u>	<u>No. Req.</u>	<u>Description</u>
1	45-59012-0001-1	1	Nut, draw in rod
2	48-90210-2018-2	3	Screw, Upper flinger
3	45-78510-0001-1	1	Ring, Snap
4	45-59008-0003-1	1	Nut, Spindle
5	48-18307-0001-1	1	Ring, Snap, Spindle Bore
6	45-80501-0003-1	2	Shim, Adjusting Gear and Bearing
7	48-18304-0003-1	1	Ring, Snap, Drive Gear
8	45-80501-0002-1	1	Washer, Drive Gear
9	48-18307-0002-1	1	Ring, Snap Drive, Shaft Bore
10	45-20006-0001-2	1	Gear, Drive
11	48-18303-0003-1	1	Ring, Snap, Name Plate
12	48-82006-0006-1	1	Name Plate
13	45-76608-0002-1	1	Ring, Clamp Drive Gear
14	48-04501-0004-1	1	Bearing, Drive Gear
15	45-20002-0001-1	1	Gear, Spindle
16	48-87501-0004-1	1	Flinger, Spindle Lower
17	45-81002-0001-2	1	Spindle
18	45-08508-0004-1	1	Cap, Dust Cover
19	[48-04506-0007-1 48-14506-0013-1]	[1 cup 1 cone]	Bearing, Spindle Lower
20	45-56015-0001-1	1	Key, Spindle Gear
21	48-92331-1020-2	3	Screw, Clamp
22	48-95003-1037-2	4	Nut, T Bolt
23	48-87510-0003-1	4	Washer, T Bolt
24	45-06503-0009-1	4	Bolt T
25	45-00507-0004-1	1	Adapter, Spindle
26	45-06006-0001-4	1	Frame
27	48-18901-0008-1	1	Fitting, Grease
28	[48-04506-0001-1 48-04506-0002-1]	[1 cup 1 cone]	Bearing, Spindle Upper
29	45-08512-0001-1	1	Cap, Dust Cover
30	45-87501-0006-1	1	Flinger, Spindle Upper
31	45-77502-0001-1	1	Rod, Draw In
32	45-78520-0002-1	1	Screw, Draw In Rod

Notes:

1. Lubricate at fittings every 8 hours of running. Use Lubricant Esso Andok C or equivalent.
2. Spindle speeds at the vertical attachment are one-third higher (4:3 ratio) than available horizontal spindle speeds. Vertical spindle speeds exceeding 2,000 RPM are not recommended.
3. A standard draw-in rod is furnished. A draw-in collet attachment is available at additional cost. (See back page for parts description).
4. Parts list applies to vertical milling attachments from serial number 1039.

WHEN ORDERING, GIVE MACHINE SERIAL NUMBER, VERTICAL MILLING ATTACHMENT SERIAL NUMBER, _____
 KEY NUMBER, PART NUMBER AND PART NAME

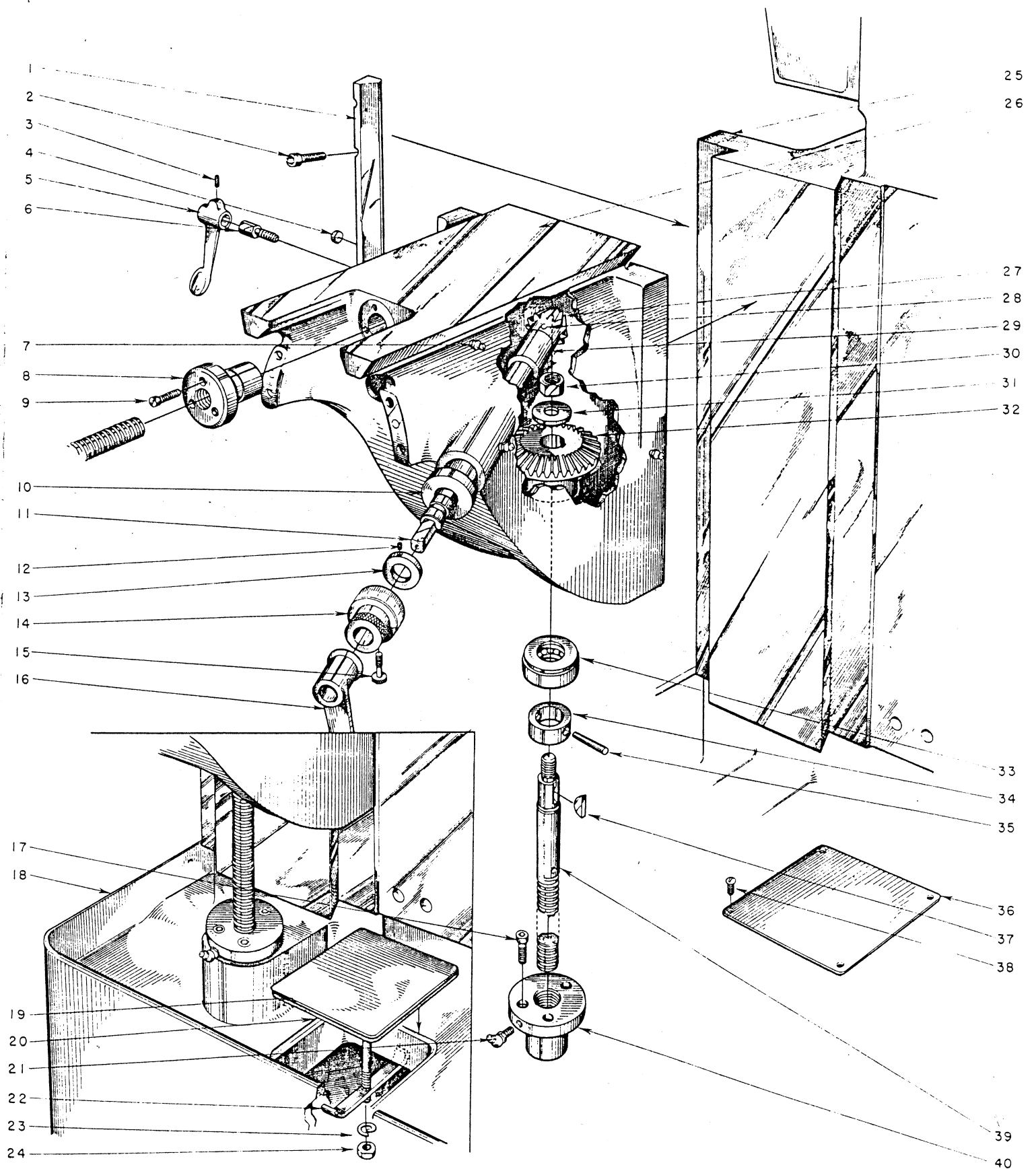
HEAD, SPINDLE & SPINDLE DRIVE



WHEN ORDERING GIVE PART NO. AND MACHINE SERIAL NUMBER

1	WA-54	1	C - Clamp
2	WL-47	1	Screw - C - Clamp Lock
3	WB-311	1	Eyebolt - Williams Eyebolt No. 27
4	WC-136	1	Pulley - 5 Step
5	WA-1360-616-20	3	Screw - Motor Pulley Mounting 3/8 - 16 x 1 1/4 Socket Head
6	WA-1299	1	Adapter - Pulley 1" Bore
7	WA-1363-6-6	1	Screw - Key 6 - 32 x 3/8 Fillister Head Machine
8	WA-346	1	Key - 1/4 Square
9	WA-1361-616-16	1	Screw - Head Stop Bracket 3/8 - 16 x 1 Fillister Head Cap
10	WC-217	2	Guard - Belt (Standard)
11	WB-20	1	Rack - Head
12	WA-1360-516-14	1	Screw - Rack 5/16 - 18 x 7/8 Socket Head Cap
13	WA-1424-816-J	2	Nut - Head Stop Screw Lock 1/2 - 13 Jam Nut - Heavy S.F.
14	WA-1361-616-16	1	Screw - Top - Head Gib 3/8 - 16 x 1 Fillister Head Cap
15	WA-243-01	2	Fitting - Grease Alemite No. 1652
16	WA-1371-416-4	1	Screw - Head Stop Screw Lock 1/4 - 20 x 1/4 Cup Point Socket Set
17	WB-131	1	Gib
18	WA-499	1	Handle - Binding Screw 1/4 - 20 x 5/16 Flat Point Socket Set
19	WA-339	1	Washer - Head Binding Screw
20	WA-698	1	Screw - Head Binding
21	WA-1360-716-28	1	Screw - Overarm Clamping 7/16 - 14 - 1 3/4 Socket Head Cap
22	WA-1369-416-5	2	Screw - Binding Handle Lock 1/4 - 20 x 5/16 Flat Point Socket Set
23	WA-243-07	2	Fitting - Spindle Bearing Grease Alemite No. 1610
24	WA-1369-716-12	2	Screw - Bearing Spacer 7/16 - 14 x 3/4 Socket Head Cap
25	WJ-17-3	1	Head - Timken Bearing
26	WA-1380-616-64	1	Head - Ball Bearing
27	WA-1360-616-16	1	Screw - Long - Head Gib 3/8 - 16 x 4 Socket Head Cap
28	WA-1361-416-20	1	Screw - Bottom Head Gib 3/8 - 16 x 1 Socket Head Cap
29	WA-1360-616-44	4	Screw - Rear Bearing Cap 1/4 - 20 x 1 1/4 Fillister Head Cap
30	WC-136	3	Screw - Spindle Pulley Mounting 3/8 - 16 x 2 3/4 Socket Head Cap
31	WA-500	1	Pulley - 5 Step
32	WA-494	1	Adapter - Spindle Pulley
33	WL-7	1	Cap - Rear Bearing - Timken Spindle
34	WA-346	1	Cap - Rear Bearing - Ball Bearing Spindle
35	WA-1363-6-6	1	Key - 1/4 Square
36	WA-243-01	2	Screw - Key 6 - 32 x 3/8 Fillister Head Machine
37	WA-1369-716-8	1	Fitting Grease Alemite No. 1652
38	WA-427	1	Screw - High Speed Pulley Lock 7/16 - 14 x 1/2 Flat Point Socket Set
39	WC-221	1	Pad - High Speed Pulley Lock Screw
40	WC-220	1	Pulley - Low Speed - 3 Step
41	WB-676	1	Pulley - High Speed - 2 Step
42	WA-56	1	Lever Assembly - Segment
43	WL-46	1	Screw - Head Stop
44	WA-1424-1016J	1	Nut - Head Stop
45	WA-38	1	Nut - Eyebolt Lock 5/8 - 11 Jam Nut - Heavy S.F.
46	WA-403	1	Stud - Oil Pot Bracket
47	WC-111	1	Enclosure - Push Button Allen-Bradley No. 2 S.A.
48	WK-1	1	Bracket - Head Stop
49	WA-1360-616-20	1	Ring - Motor Binding
50	WJ-6-03	1	Screw - Motor Binding Ring Clamp 3/8 - 16 x 1 1/4 Socket Head Cap
51	WJ-6-02	1	Bracket - Motor - Timken Bearing Head
52	WA-1358	1	Bracket - Motor - Ball Bearing Head
53	WL-36	1	Shaft - Pivot
54	WA-1359	2	Washer - Motor Binding
55	WA-546	1	Block - Pivot
56	WA-1369-716-8	1	Key - Pivot Cap Woodruff No. 5
57	WA-1305	1	Screw - Pivot Shaft Lock 7/16 - 14 x 1/2 Flat Point Socket Set
58	WA-1306	1	Cap - Front Pivot
59	WA-1414-1	1	Cap - Rear Pivot
60	WA-243-09	2	Ring - Pivot Cap Snap Waldes No. 5000 - 244
61	WA-701	1	Fitting - Pivot Cap Grease Alemite No. 1762-B
62	WA-499	1	Bolt - Motor Ring Positioning
63	WA-1369-416-5	1	Handle - Binding Screw
64	WL-38	1	Screw - Binding Handle Lock 1/4 - 20 x 5/16 Flat Point Socket Set
65	WB-176	1	Overarm - Standard (20 1/4")
66	WA-1360-716-12	2	Overarm - Long (24 1/2")
67	WB-5	1	Screw - Bearing Spacer
68	WA-241	1	Bracket - Overarm
69	WA-242	1	Bearing - Needle Torrington No. B-912
70	WA-243-02	1	Bearing - Thrust Boston Gear Works No. A - 09
71	WA-31	1	Fitting - Grease Alemite No. 1608
72	WA-256-02	1	Plug - Overarm Bracket
73	WB-314-02	1	Pin - No. 3 Taper
74	WA-1424-816	1	Nut - Draw-In Rod
75	WB-314-01	1	Nut - Draw-In Rod 1/2 - 13 Hex. Nut Heavy S.F.
76	WB-96	1	Rod - Draw-In
77	WA-1369-516-4	1	Rod - Draw-In
78	WA-1369-516-8	1	Screw - Spindle Nut Lock 5/16 - 18 x 1/4 Flat Point Socket Set
79	WA-52-02	1	Screw - Spindle Nut Lock 5/16 - 18 x 1/2 Flat Point Socket Set
80	WA-956	1	Pad - Spindle Nut Lock Screw (Timken Spindle)
81	WA-496	1	Pad - Spindle Nut Lock Screw (Ball Bearing Spindle)
82	WA-730	1	Nut - Spindle Bearing (Timken Spindle)
83	WA-167	1	Nut - Spindle Bearing (Ball Bearing Spindle)
84	WA-566	1	Nut - Spindle Bearing
85	WA-1353	1	Bearing - Rear - Timken Spindle No. 3 Precision Cone No. L 305649 - Cup No. L 305610
86	WA-421	1	Bearing - Rear Ball Bearing Spindle New Departure No. 3 L10T - 5CF
87	WA-715-1	1	Bearing - Rear Spindle New Departure No. 3208 PT - CF
88	WA-715-2	1	Segment - Gear - Timken Spindle
89	WA-495	1	Segment - Gear Ball Bearing Spindle
90	WB-256	1	Spacer - Timken Spindle
91	WB-257	1	Sleeve - Outer - Ball Bearing Spindle
92	WB-82	1	Sleeve - Inner - Ball Bearing Spindle
93	WA-566	1	Sleeve - inner
94	WA-420-01	1	Bearing - Front - Timken Spindle No. 3 Precision Cone No. L 305649 Cup No. L 305610
95	WA-420-02	1	Ball Bearing - Front Flanged New Departure No. QNOL10 - DBL5CF
96	WA-502	1	Ball Bearing - Front Plain New Departure No. QOL10-DBL5CF
97	WA-168	1	Flinger - Timken Bearing Spindle
98	WA-1360-516-14	1	Flinger - Ball Bearing Spindle
99	WA-1360-516-14	1	Screw - Segment Handle Lock 5/16 - 18 x 7/8 Socket Head Cap
100	WA-1360-516-8	6	Screw - Front Bearing Cap 5/16 - 18 x 7/8 Socket Head Cap
101	WC-134	2	Screw - Spindle Nose 5/16 - 18 x 1/2 Socket Head Cap
102	WC-179	1	Spindle - Timken Bearing
103	WC-46	1	Spindle - Ball Bearing
104	WB-295	1	Spindle - Ball Bearing
105	WB-557	1	Cap - Front Bearing - Timken Spindle
106	WA-169	1	Cap - Front Bearing - Ball Bearing Spindle
107		1	Cap - Front Bearing

BASE, COLUMN & KNEE

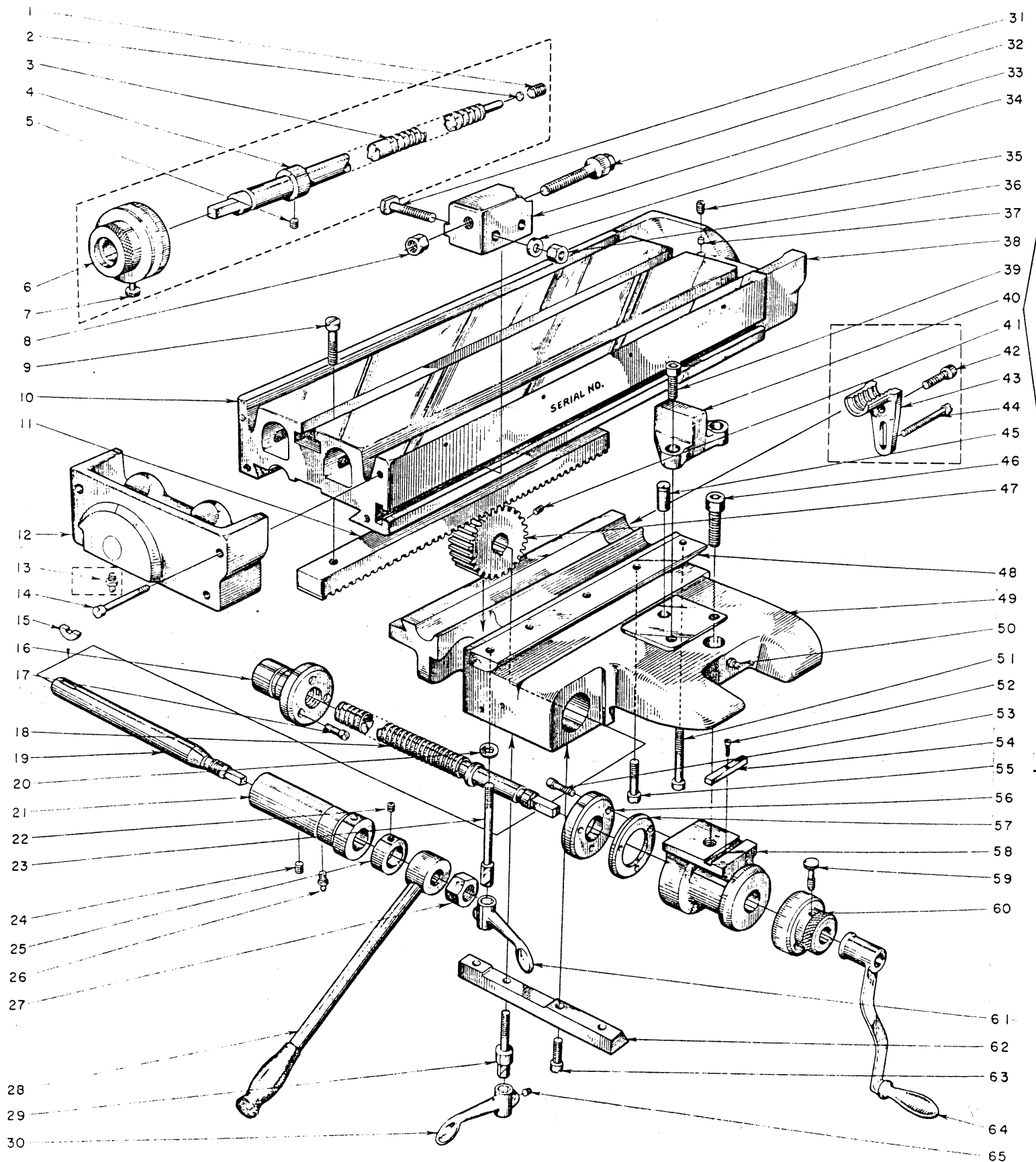


WHEN ORDERING GIVE PART NO. AND MACHINE SERIAL NUMBER

1	WB-19	1	Gib - Knee
2	WA-1360-616-24	4	Screw - Knee Gib 3/8 - 16 x 1 1/2 Socket Head Cap
3	WA-1369-416-5	1	Screw - Binding Handle Lock 1/4 - 20 x 5/16 Cup Point Socket Set
4	WA-1422-2	1	Pad - Knee Gib
5	WA-499	1	Handle - Binding
6	WA-781	1	Screw - Knee Binding
7	WA-243-01	3	Fitting - Grease Alemite No. 1652
8	WL-19	1	Nut - Transverse
9	WA-1361-416-8	3	Screw - Transverse Nut Mounting 1/4 - 20 x 1/2 Fillister Head Cap
10	WL-53	1	Bushing - Elevating Shaft Outer
11	WK-5	1	Shaft - Elevating
12	WA-1371-8-4	1	Screw - Elevating Shaft Collar Lock 8 - 32 x 1/4 Cup Point Socket Set
13	WA-1860	1	Collar - Elevating Shaft Thrust
14	WL-13-1	1	Dial No. 5 - Metric Watt Graduations
15	WL-12	1	Screw - Dial Lock
16	WB-6	1	Crank - Short
17	WA-1360-516-14	3	Screw - Elevating Nut Mounting 5/16 - 18 x 7/8 Socket Head Cap
18	WD-5	1	Base
19	WB-158	1	Cover - Base or WB-159 Strainer Base 1
20	WB-157	1	Gasket - Base Cover
21	WA-243-06	1	Fitting - Angle Grease Alemite No. 1636
22	WA-531	1	Clamp Cover
23	WA-1502-616	1	Washer - Base Cover Lock 3/8 Heavy
24	WA-1425-616	1	Nut - Cover Clamp 3/8 - 16 Hex. Nut - Reg. S.F.
25	WE-8	1	Column
26	WC-9	1	Knee
27	WA-2048	1	Gear - Small Bevel
28	WA-256-01	1	Pin - Taper No. 3
29	WL-55	1	Bushing - Elevating Shaft Inner
30	WA-1424-816	1	Nut - Elevating Gear 1/2 - 13 Hex. Nut - Heavy S.F.
31	WA-362	1	Washer 1/2" Hardened
32	WA-2049	1	Gear - Large Bevel
33	WA-240	1	Bearing - Elevating Screw Thrust Bantam No. 875
34	WL-29	1	Collar - Elevating Screw
35	WA-256-01	1	Pin - Taper No. 3
36	WA-1765	1	Plate - Reservoir Cover
37	WA-255	1	Key - Elevating Screw No. 7 Woodruff
38	WA-1364-10-5	4	Screw - Reservoir Cover Plate 10 - 24 x 5/16 Round Head Machine
39	WB-23	1	Screw - Elevating
40	WB-457	1	Nut - Elevating



SADDLE, TABLE & TABLE SCREW ATTACHMENT



WHEN ORDERING GIVE PART NUMBER AND MACHINE SERIAL NUMBER

KEY NO.	PART NO.	NO. REQ.	PART NAME
1	WA-1369-416-4	1	Screw - Feed Screw Adjusting 9/16 - 12 x 5/8 Flat Point Socket Set Screw
2	WA-1422-1	1	Pad - Feed Adjusting Screw
3	WK-4-1	1	Screw - 21" Table Feed - Inch Thread
	WK-4-2	1	Screw - 21" Table Feed - Metric Thread
	WB-164-1	1	Screw - 30" Table Feed - Inch Thread
	WB-164-2	1	Screw - 30" Table Feed - Metric Thread
4	WA-16	1	Collar - Table Screw
5	WA-1369-416-4	1	Screw - Collar Lock 1/4 - 20 x 1/4 Flat Point Socket Set Screw
31	WA-2300-1	1	Dial - 3" Dia. - Inch Graduations WL-13-2 Dial - No. 10 - 2" Dia. Inch Grad. WA-2300-2 Dial - 3" Dia. - Metric Graduations WL-13-4 No. 10 - 2" Dia. - Metric
32	WA-2291	1	Screw - Dial Lock
8	WA-1432-716	2	Nut - Micrometer Stop Screw - Inch Thread 7/16 - 20 Hex. Nut - Light S.F.
33	WA-2616	2	Nut - Micrometer Stop Screw - Metric Thread
9	WA-1361-616-22	3	Screw - Rack 3/8 - 16 x 1 3/8 Fillister Head Cap Screw
34	WA-1361-616-22	5	Screw - Rack 3/8 - 16 x 1 3/8 Fillister Head Cap Screw
10	WC-96	1	Table - 21" WC-109 Table - 30" - Single Slot
11	WB-29	1	Rack - 21" Table WB-299 Rack - 30" Table
12	WB-236	1	Cap-Left End
13	WA-243-02	2	Fitting - Drive Grease Alemite No. 1608
35	WA-1361-416-36	8	Screw - Table Cap 1/4 - 20 2 1/4 Fillister Head Cap
14	WL-50	1	Key - Table Pinion
15	WL-19	1	Nut - Transverse
36	WA-1361-416-8	3	Screw - Transverse Nut Mounting 1/4 - 20 x 1/2 Fillister Head Cap
16	WK-6	1	Screw - Transverse Feed
37	WK-12	1	Shaft - Table Pinion
17	WA-339	1	Washer - 3/8 Hardened
38	WL-49	1	Bushing - Table Pinion Eccentric
18	WA-1369-416-4	1	Screw - Collar Lock 1/4 - 20 x 1/4 Flat Point Socket Set
19	WA-702	1	Screw - Table Binding
39	WA-1369-516-6	1	Screw - Eccentric Bushing Lock 5/16 - 18 x 3/8 Flat Point Socket Set
20	WA-26	1	Collar - Table Pinion Shaft
40	WA-243-06	1	Fitting - Angle Grease Alemite No. 1636
21	WA-1432-1216	1	Nut - Pinion Shaft Handle 3/4 - 16 Hex. Nut - Light S.F.
41	WC-448	1	Lever Assembly - Table
22	WA-697-02	1	Screw - Saddle Binding
42	WA-499	1	Handle - Binding
23	WA-163	4	Tee Bolt - Micrometer Stop
43	WA-49-1	2	Screw - Micrometer Stop - Inch Thread WA-49-2 Screw - Micrometer Stop - Metric Thread
24	WA-214	1	Body - Micrometer Stop - L.H. WA-2149 Body - Micrometer Stop - R.H.
44	WA-339	4	Washer - 3/8 Hardened
25	WA-1369-516-10	1	Screw - Adjusting Screw Lock 5/16 - 18 x 5/8 Flat Point Socket Set
45	WA-1425-616	4	Nut - Micrometer Stop Tee Bolt 3/8 - 16 Hex. Nut - Reg. S.F.
26	WA-52-01	1	Pad - Feed Lock Screw
46	WC-110	1	Cap - Right End
27	WA-1360-616-16	2	Screw - Table Stop 3/8 - 16 x 1 Socket Head Cap Screw
47	WA-1586-1	1	Stop - Table - Hand Miller
28	WA-1366-516-10	1	Screw - Table Pinion Lock 5/16 - 18 x 5/8 Full Dog Point Socket Set
48	WA-1360-616-16	1	Screw - Half Nut Mounting 3/8 - 16 x 1 Socket Head Cap
29	WL-14	1	Nut - Half
49	WA-1361-416-36	1	Screw - Half Nut Lower 1/4 - 20 x 2 1/4 Fillister Head Cap
30	WA-1433-1	1	Dowel - Table Stop
50	WA-1360-816-24	1	Screw - Saddle Post 1/2 - 13 x 1 1/2 Socket Head Cap
51	WL-54	1	Pinion - Table
52	WB-67	1	Gib - Table
53	WJ-14	1	Saddle
54	WA-243-01	3	Fitting - Grease Alemite No. 1652 with Table Feed Screw Add;
55	WA-1361-616-44	2	Screw - Table Gib - Long 3/8 - 16 x 2 3/4 Fillister Head Cap
56	WA-1363-6-6	1	Screw - Key 6 - 32 x 3/8 Fillister Head Machine
57	WA-1360-416-12	3	Screw - Retainer 1/4 - 20 x 3/4 Socket Head Cap
58	WA-346	1	Key - Saddle Post
59	WA-1361-616-32	2	Screw - Table Gib - Short 3/8 - 16 x 2 Fillister Head Cap
60	WA-1248	1	Retainer - Saddle Screw
61	WA-1249	1	Spacer - Saddle Screw
62	WB-441	1	Post - Keyed Saddle - 2" Dial
63	WL-12	1	Screw - Dial Thumb
64	WL-13-01	1	Dial No. 5 Inch Graduations WL-13-03 Dial - No. 5 Metric Graduations
65	WA-499	1	Handle - Binding
66	WB-68	1	Gib - Saddle
67	WA-1361-616-22	3	Screw - Saddle Gib 3/8 - 16 x 1 3/8 Fillister Head Cap
68	WB-6	1	Crank - Short
69	WA-1369-416-5	2	Screw - Binding Handle Lock 1/4 - 20 x 5/16 Flat Point Socket Set
70	WB-19	1	Gib - Knee