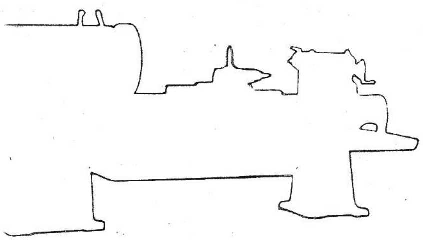
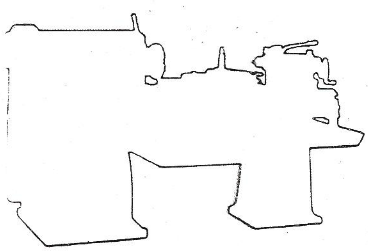
NB891 888-532-5663

# SERVICE MANUAL

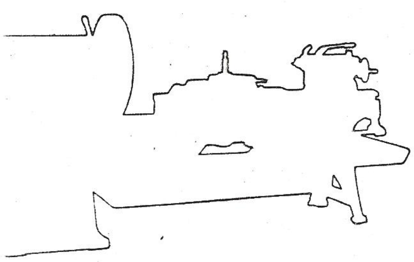
## LeBLOND
## 12" - 14" - 16" - 18"
## ENGINE LATHES



## TOOL ROOM LATHES



## GAP LATHES



★ *Installation*
★ *Maintenance*
★ *Operation*
★ *Repair Parts*

THE R. K. LeBLOND MACHINE TOOL CO.

CINCINNATI, OHIO, U. S. A.

# Service Manual

## Installation • Maintenance • Operation • Repair Parts

# LeBlond

## 12″ to 18″ Engine—Tool Room—Gap and 19″ x 38″ Sliding Bed Gap Lathes

### *Make the Acquaintance of . . .*

LeBlond Lathes

12″ . . . 14″ . . . 16″ . . . 18″ sizes

"Pleased to meet you" is the usual reply when one is introduced to a new acquaintance. But a LeBlond Lathe—even though it is your first one—is more than a new face in the shop. LeBlond Lathes are old friends in many shops. We hope they are or will be in yours.

"Pleased to Meet" one can be more than a brief formality. At least it should be. Here's how we feel about it, as concerns LeBlond Lathes:

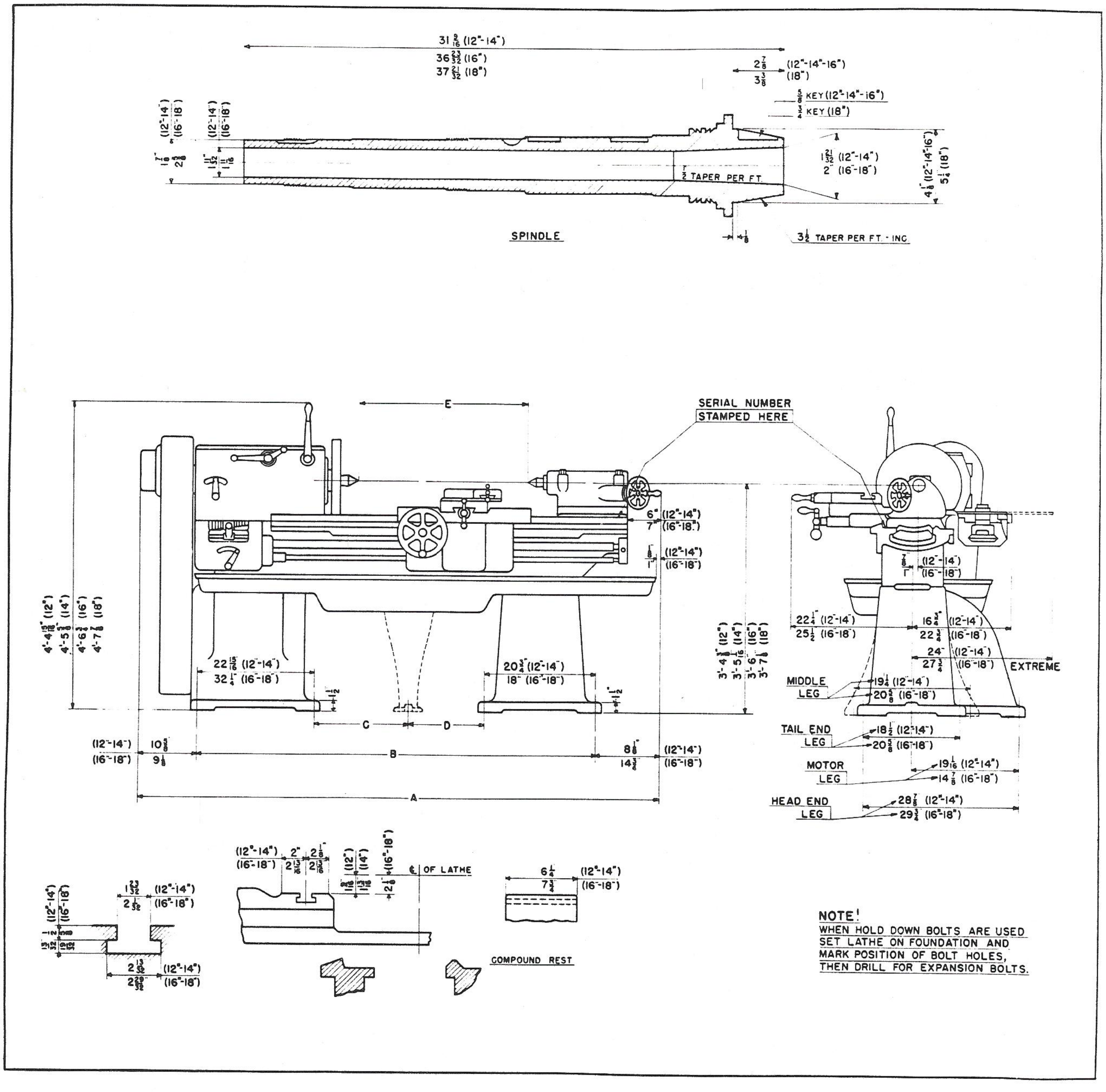
> They are good lathes. Not because we say so. Rather because they can prove it, themselves. But do you know that?
>
> They are built to precision standards by the largest manufacturer —LeBlond— of a complete line of lathes. Does that mean anything?
>
> Their *fluer-de-lis* (⚜) trade mark is internationally known and recognized. It is a mark of merit, to those who know. Do you?
>
> They are rugged, versatile, accurate, almost foolproof. Do any of these things mean anything?

We think NOT . . . unless, of course, you want them to mean something. We are not saying you should. But may we not suggest that you treat your new LeBlond with at least the same courtesy and respect that you would a new acquaintance. Who can tell, that new acquaintance, that new LeBlond Lathe, may turn out to be one of your best friends. We hope so. That's why we say again: "Make the Acquaintance of LeBlond Lathes."



The R. K. LeBlond Machine Tool Co.
CINCINNATI, OHIO, U. S. A.

# Dimensions of 12″-14″-16″-18″ Engine and Tool Room Lathes—Approximate Space Required




# CAPACITY

**12″-14″-16″-18″ Engine and Tool Room Lathes**

| Size of Lathe | 12″ | 14″ | 16″ | 18″ |
|---|---|---|---|---|
| Swing Over Ways | 14½″ | 16¼″ | 18¼″ | 20¼″ |
| Swing Over Compound Rest | 8 ¼″ | 9½″ | 11¼″ | 13½″ |
| Compound Rest Travel | 2⅞″ | 2⅞″ | 4″ | 4″ |
| Cross Slide Travel | 10 5/16″ | 10 5/16″ | 11⅞″ | 11⅞″ |
| Size of Tool | ½x⅞ | ⅝x1 | ⅝x1¼ | ⅝x1¼ |
| Steady Rest Capacity | 4½″ | 4½″ | 5½″ | 5½″ |
| Taper Att. Max. Taper per Ft. | 3″ | 3″ | 3½″ | 3½″ |
| Taper Att. Turns at One Setting—Max. Length | 15″ | 15″ | 18″ | 18″ |

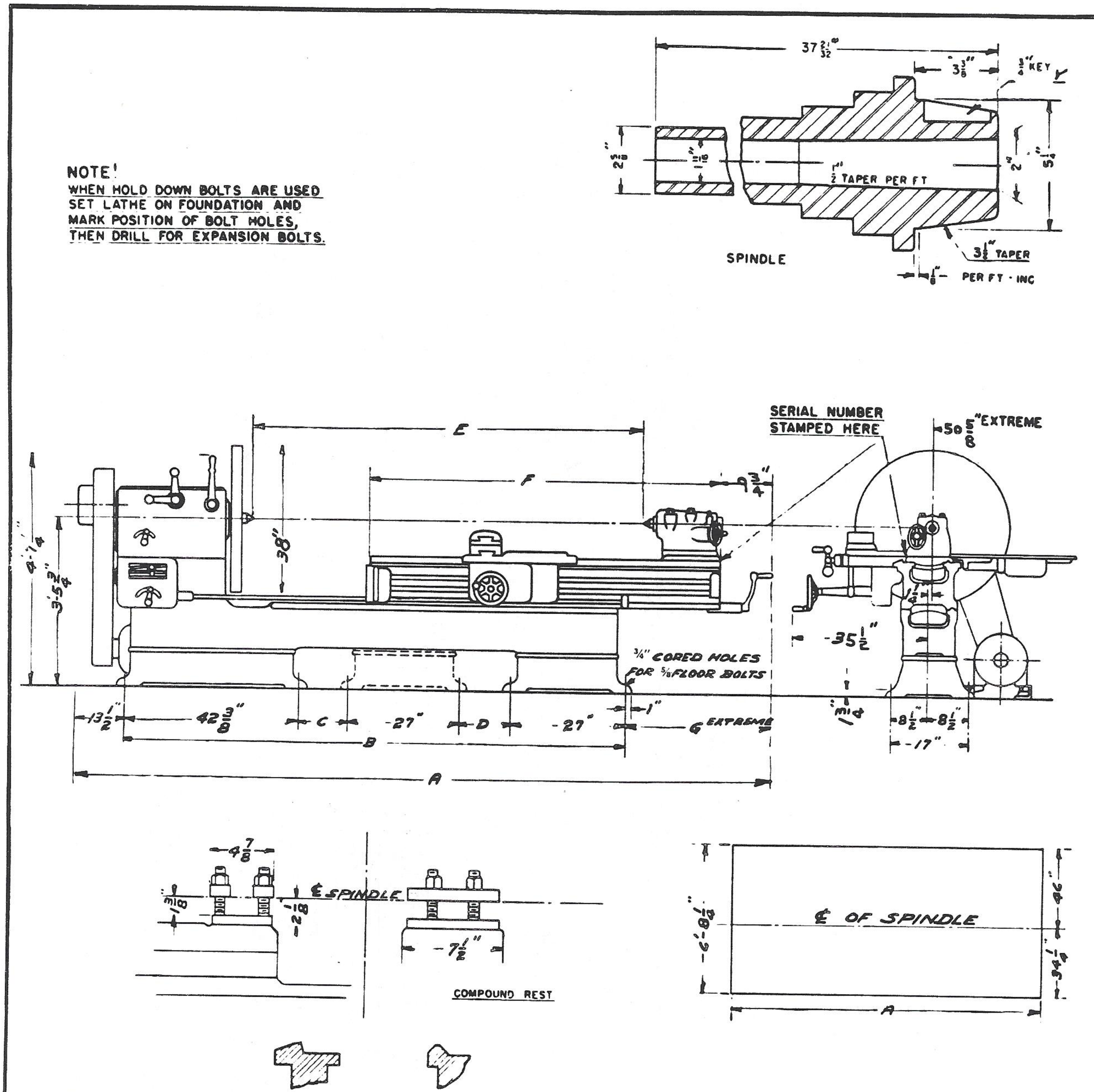
**12″-14″ Engine and Tool Room Lathes**

| DIMENSIONS | | | | | | Net Weight Less Motor | |
|---|---|---|---|---|---|---|---|
| Bed | A | B | C | D | E | 12″ | 14″ |
| 6′ 6″ | 7′ 10¾″ | 6′ 4″ | | | 30″ | 2970 | 3020 |
| 8′ 6″ | 9′ 10¾″ | 8′ 4″ | | | 54″ | 3205 | 3260 |
| 10′ 6″ | 11′ 10¾″ | 10′ 4″ | 38 9/16″ | 41¼″ | 78″ | 3440 | 3550 |
| 12′ 6″ | 13′ 10¾″ | 12′ 4″ | 50 9/16″ | 53¼″ | 102″ | 3675 | 3740 |
| 14′ 6″ | 15′ 10¾″ | 14′ 4″ | 62 9/16″ | 65¼″ | 126″ | 3910 | 3980 |
| 16′ 6″ | 17′ 10¾″ | 16′ 4″ | 74 9/16″ | 77¼″ | 150″ | 4145 | 4220 |

**16″-18″ Engine and Tool Room Lathes**

| DIMENSIONS | | | | | | Net Weight Less Motor | |
|---|---|---|---|---|---|---|---|
| Bed | A | B | C | D | E | 16″ | 18″ |
| 7′ 3″ | 8′ 9⅞″ | 6′ 10″ | | | 30″ | 4140 | 4250 |
| 9′ 3″ | 10′ 9⅞″ | 8′ 10″ | | | 54″ | 4415 | 4530 |
| 11′ 3″ | 12′ 9⅞″ | 10′ 10″ | 39½″ | 40¼″ | 78″ | 4690 | 4810 |
| 13′ 3″ | 14′ 9⅞″ | 12′ 10″ | 51½″ | 52¼″ | 102″ | 4965 | 5090 |
| 15′ 3″ | 16′ 9⅞ | 14′ 10″ | 63½″ | 64¼″ | 126″ | 5240 | 5370 |
| 17′ 3″ | 18′ 9⅞″ | 16′ 10″ | 75½″ | 76¼″ | 150″ | 5515 | 5650 |

# Dimensions of 19″-38″ Sliding Bed Gap Lathe
# Approximate Space Required

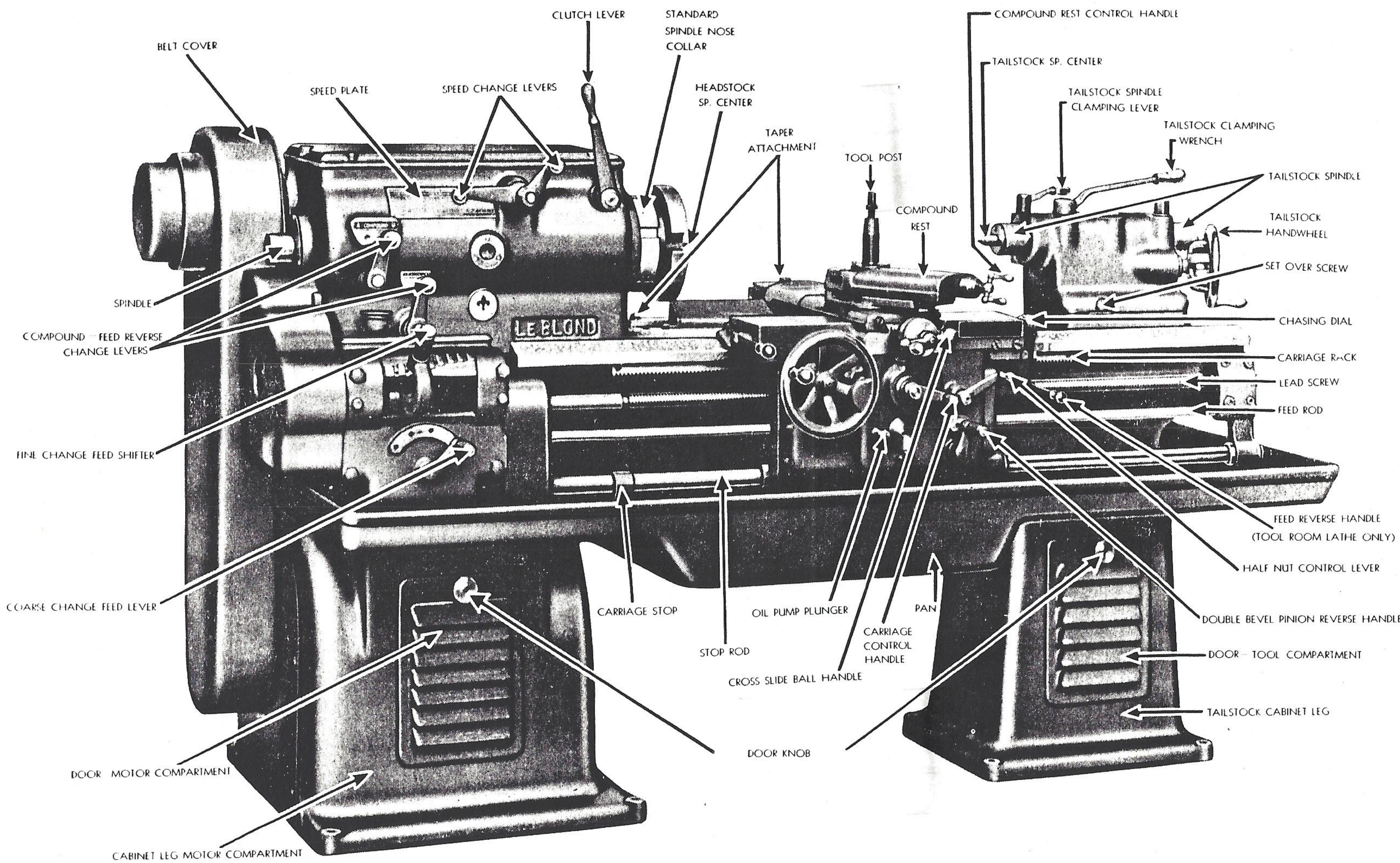



## CAPACITY

| 19″-38″ Sliding Bed Gap Lathe | |
|---|---|
| Swing Over Ways | 20½″ |
| Swing Over Gap | 40½″ |
| Swing Over Compound Rest | 13½″ |
| Compound Rest Travel | 4″ |
| Steady Rest Capacity | 5½″ Regular to 13″ Special |
| Distance Between Centers—Base Length Bed—Closed | 6′ 0″ |
| Distance Between Centers—Base Length Bed—Extended | 10′ 0″ |
| Size of Tool | 5/8″ x 1¼″ |

**19″-38″ Sliding Bed Gap Lathe DIMENSIONS**

| Bed | A | B | C | D | E Open | E Closed | F | G |
|---|---|---|---|---|---|---|---|---|
| 10′-9″ | 16′-7″ | 10′-9½″ | | | 120″ | 78″ | 7′-9″ | 4′-8″ |
| 12′-9″ | 19′-7″ | 12′-9½″ | | | 144″ | 102″ | 9′-9″ | 5′-8″ |
| 14′-9″ | 22′-7″ | 14′-9½″ | 3′-4 9/16″ | 3′-4 9/16″ | 168″ | 126″ | 11′-9″ | 6′-8″ |
| 16′-9″ | 25′-7″ | 16′-9½″ | 4′-4 9/16″ | 4′-4 9/16″ | 192″ | 150″ | 13′-9″ | 7′-8″ |
| 18′-9″ | 28′-7″ | 18′-9½″ | 5′-4 9/16″ | 5′-4 9/16″ | 216″ | 174″ | 15′-9″ | 8′-8″ |
| 20′-9″ | 31′-7″ | 20′-9½″ | 6′-4 9/16″ | 6′-4 9/16″ | 240″ | 198″ | 17′-9″ | 9′-8″ |




NOMENCLATURE 12" TO 18" LeBLOND ENGINE LATHES

# Service Manual

## 12"-14"-16"-18"Engine—Tool Room—Gap
## 19"-38" Sliding Bed Gap Lathes

## FIRST STEPS

*Unloading and Handling*

Before shipment from our plant, this machine was inspected for defects and subjected to rigid accuracy tests. Every machine element was adjusted, corrected, and put in alignment. At the conclusion of this inspection, all oil was drawn from lubrication reservoirs. All bright parts were heavily coated with slushing compound.

While in transit, the machine has been subjected to conditions beyond our control. The car may have been roughly handled in switching, thus subjecting the machine to injurious jolts and strains. These may have caused breakage or affected alignment and proper operation.

*Before Signing Delivery Receipt*

Upon arrival of car, inspect the machine carefully. If damaged in any way, the shipment should be conditionally accepted from the transportation company, subject to thorough inspection.

*Packing List*

The packing list itemizes all parts included in the shipment. The Receiving Clerk should check and account for each item on the list. Keep this packing list as a part of the permanent record of the machine.

*Important!*

Care of the lathe begins as soon as it gets inside your shop. The machine should be kept on its skids until moved into its final location. Before the lathe is handled by cranes, the slushing compound should be removed. The lathe should be oiled before handling, to avoid scoring or scratching any of the sliding units. It is generally necessary to move the carriage, steady rest and tailstock in order to place the sling around the lathe and to balance it when it is lifted. If the lathe is rolled into position, it can be cleaned after the skids are removed.

*Remove Slushing Compound*

The slushing compound, which is applied to all polished and unpainted surfaces to prevent rust, picks up grit and dirt. It can be removed easily by washing with a rag saturated in kerosene or benzine. A stiff brush will get into the corners. *Do not use an air hose.* Pressure will drive grit and dirt into bearing surfaces. Remove cross slide guards, clean screw and slides. Don't overlook feed and control rods. Remove the shear wipers and clean thoroughly. When all surfaces are wiped clean, rub over the bright or bearing parts with a rag saturated with clean oil to cover the parts with a protecting film.

# Leveling

VERY IMPORTANT

Before your lathe left the LeBlond plant, it was subjected to rigid accuracy tests. Extremely close tolerances have been established for these tests. Every machine must conform to these limits before it passes inspection. To secure the same results, the lathes must be erected under similar conditions in your plant. THE LATHE MUST BE LEVEL TO CONSISTENTLY PRODUCE ACCURATE WORK.

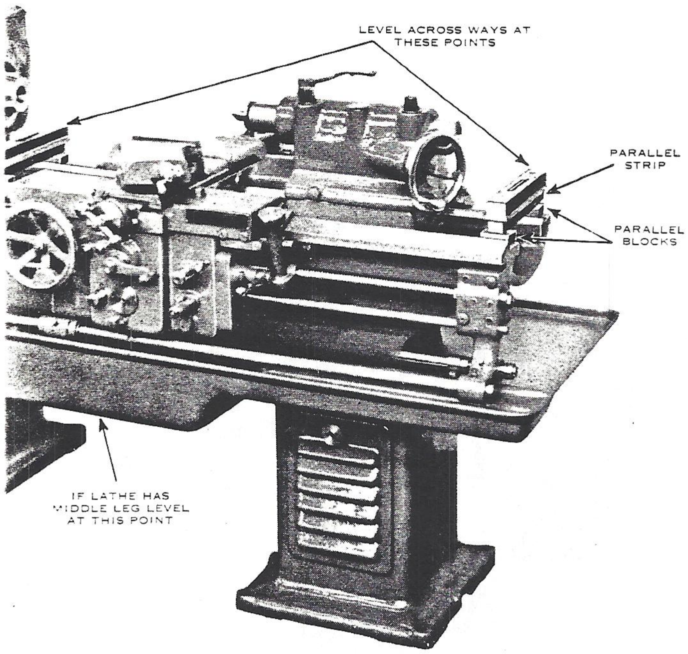
The lathe should be erected on a good solid floor that is free from vibration. It should be sufficiently rigid to support the weight of the lathe without deflection. A stone or concrete foundation is preferable.

When leveling, use only solid packing or wedges under the legs. LEVEL THE BED (see illustration), BOTH LENGTHWISE AND ACROSS THE WAYS, USING AN ACCURATE LEVEL.[⊕] It is highly important to have the level show the same reading when placed across the ways at both the head and tail of the bed. If the bed has a middle leg, take a reading over the center leg also, be sure it is accurately level across and between leg supports. If the level is too short to reach across the ways, place it on a good parallel strip, on blocks, as shown in the illustration. These blocks should rest on the flat surface of the front way and the rear flat surface of the rear way* but not on the flat surface adjacent to the inverted vee. Accurate work cannot be produced if the bed has a twist in it. This can be prevented only by careful leveling. If lag screws or bolts are used to hold the lathe to the floor foundation, tighten only enough to prevent the lathe from "walking" or shifting.

[⊕]In our plant we use an 18″ Queen level with graduated glass, made by Queen & Co., of Philadelphia, Pa. An ordinary machinists level is not accurate enough to get precision results.

*The rear flat way is $\frac{1}{16}$″ higher than the front flat way on the 12″ and 14″ sizes, and $\frac{1}{8}$″ higher on the 16″ and 18″ sizes.

# Leveling

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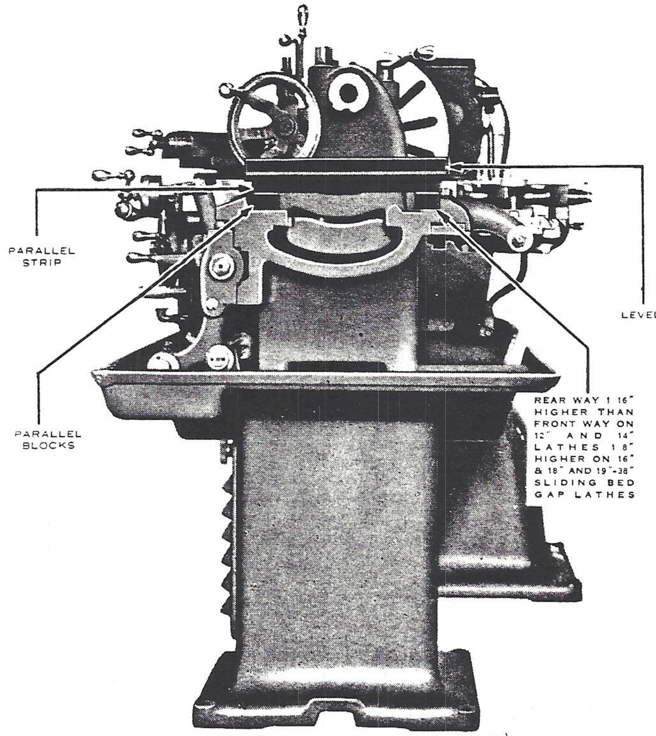


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# Musts

LeBlond machine tools, as they are now designed and built, do not require a lot of the operator's time for servicing and care. However, the things he should do are important. When a machine has been properly set up, there are but five "Musts" for the operator to keep the machine in producing form.

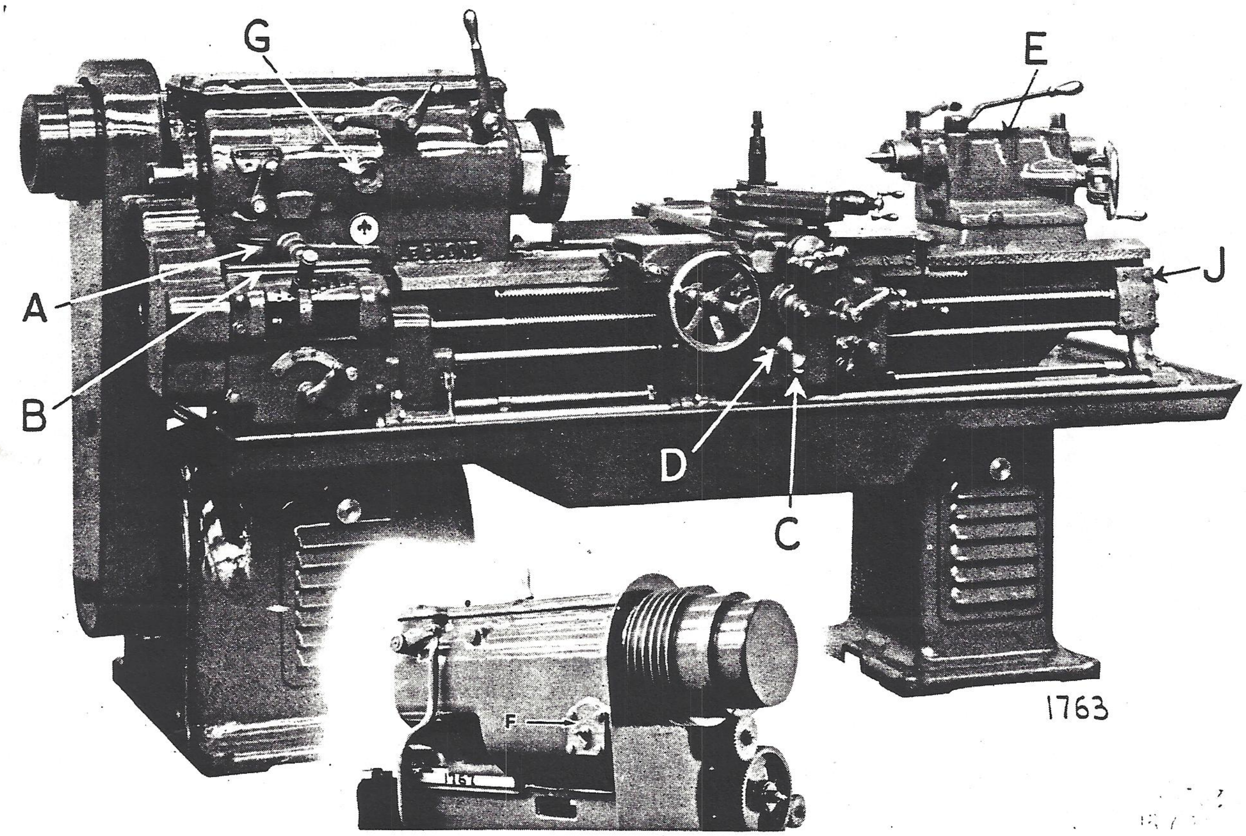
He Should:

1. Keep the machine clean. Read instructions below.
2. Keep it properly lubricated. See pages 8 and 9.
3. Keep it level. See pages 6 and 7.
4. Adjust clutch. See pages 35 to 39.
5. Adjust gibs to take up wear. See page 34.

*Cleaning*

A clean machine is conducive to more and better work. Periodic cleaning of the machine after installation is advisable. Permanent stains can be avoided by wiping off the machine once a week with a rag soaked in clean kerosene. Run over bright parts with an oil soaked rag when the machine is not being used.

# Lubrication




*Important—Check Daily*

The life of any machine, as well as the ease with which it can be operated, depends upon the care bestowed upon it. Each part should be kept clean and well lubricated.

*Note*—Before starting your lathe each morning, check the following:

Headstock: Keep the oil within one inch of top of intake (A).

Feed Box: Oil with can at (B).

Apron: You should be able to see oil in the intake (C). Work the plunger slowly back and forth three or four times (D), or until oil starts from telltale hole at right end of rear carriage wing.

Tailstock: Oil with a can (E).

Lead Screw and Feed Rod Bracket: Oil with a can at (J).

Motor: Follow instructions of the manufacturer.

# Details of Lubrication

*Headstock*—Whenever the spindle is running a submerged pump that needs no priming forces oil from reservoir in the head through a Cuno oil filter (F) to all bearings on the spindle, shafts and the multiple disc clutch and brake. This is accomplished through a system of piping to all bearings. A cascade of oil is sprayed over the entire gear train. The filter is on the rear of the head. A sight feed indicator (G) gives constant check on the oil flow.

Before starting the lathe fill the reservoir until the oil is about one inch from the top of the oil filler opening (A). A good grade of engine oil SAE 30 is recommended for the headstock lubrication.

About once a month turn the cross handle on the Cuno filter (F) two or three revolutions to scrape off foreign matter that may have accumulated on the oil filter.

*Apron*—A plunger pump on the apron forces oil to all bearings in the apron to the cross slide and to the front and rear bed ways. Work the plunger (D) slowly in and out three or four times. This should be done daily. Fill the reservoir through the intake on the front of the apron (C). The reservoir is full when the oil can be seen in the bottom of the intake. A good grade of machine oil SAE 30 is recommended.

*Quick Change Feed*—A covered trough (B) on the top of the feed box supplies oil through feeders to all the needle bearings in the housing. The filtering pad in the trough should be saturated daily.

*Tailstock*—The oil intake (E) for the tailstock is located on the top midway between the binding screws. Unscrew the top and saturate the felt filtering pad from an oil can daily.

*Lead Screw and Feed Rod*—The bracket (J) on the end of the lathe supporting the lead screw and the feed rod has a screw cap on the top of the bracket for lubricating purposes. A small amount of oil from an oil can daily is sufficient.

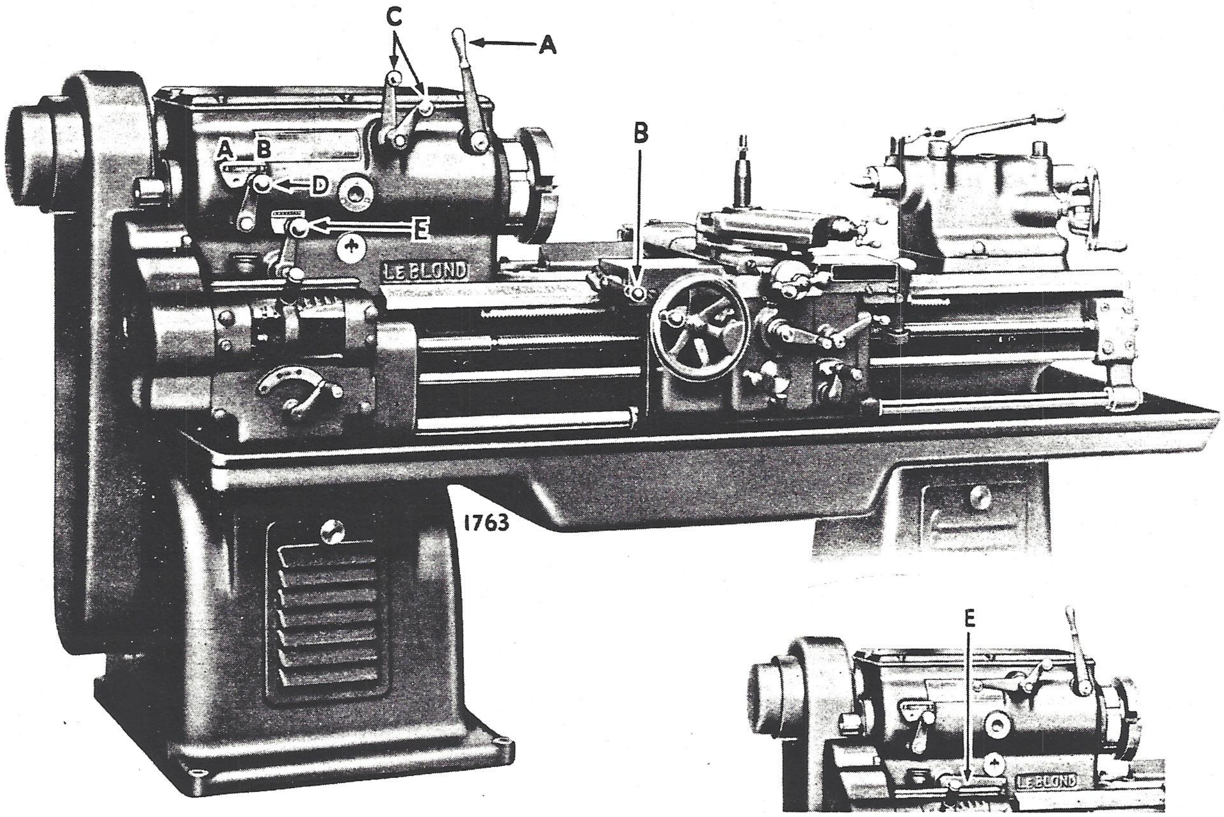
*General Practice*—Motors with ball bearings should be greased once or twice a year, depending on whether under continuous or intermittent operation and on the temperature of room. Sleeve bearing motors are oil lubricated. Use a good grade of light mineral oil SAE 10 or 20. Check oil level on sleeve bearing motors once a week.

# Re-Level

No lathe bed, irrespective of its manufacturer, is of sufficient strength to resist twisting, if it is not accurately leveled and its supporting members properly shimmed. The life of your lathe will be increased half again if this matter is given the proper attention. It is advisable to occasionally re-level the lathe after it has been in service. Frequency of re-levelling depends upon the condition of the floor or foundation. At LeBlond we use an 18-inch "Queen Level," to accurately level each lathe before testing and running off. An ordinary machinist's level is not sufficiently accurate to insure the best results.

**This is a highly accurate and sensitive metal level with graduated glass made by Queen & Co. of Philadelphia, Pa.

# To Operate Lathe




*Headstock*—The 12″ to 18″ lathes are regularly furnished with a multiple disc clutch and brake (see pages 35 to 39) incorporated in a driving pulley. The driving pulley is supported on large anti-friction bearings mounted on a bush bolted to the head, relieving the driving shaft of all strain and pull from the driving unit. The powerful multiple disc clutch when disengaged automatically engages a single plate brake.

To start the spindle you can use either the head or the apron control. With the head control pull the long handle (A) at top-front of the headstock toward you, when standing in the operating position, to disengaged push to the left; with the apron control (B) push the handle at the left end of carriage down, pull up to release. When the clutch is released it automatically applies a single disc brake.

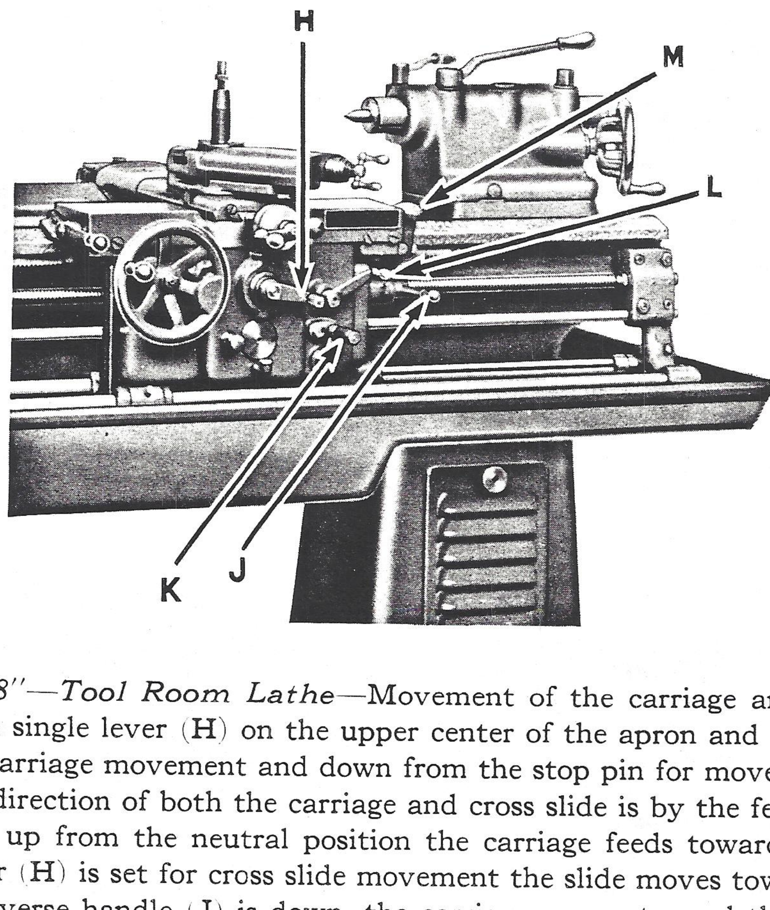
Do not change speeds with tools under cut. Always disengage the feed before changing speeds.

To change speed on any LeBlond lathe move one or both speed control handles (C) located at the left of the clutch handle into position indicated on the graphic speed plate (position of both handles are shown for all the speed changes) for the desired speed. The speed change handles will slide the gears into position easier if the clutch is engaged momentarily, just enough to start the gear train in motion.* The two handles (D and E) at the left side are the feed compounding and reversing controls. On the 12″ to 18″ Tool Room Lathe (E) is a

*Do not change speed with clutch engaged.

connecting link to the feed reverse control handle (J) on the carriage (below). Instruction for their use is dealt with under feed box and thread cutting below, and on pages 11 and 20.

*Apron 12" to 18"—Engine Lathe*—Movement of the carriage and the cross slide is controlled by a single lever (H) on the upper center of the apron and is moved up from the stop pin for carriage movement and down from the stop pin for movement of the cross slide. On the engine lathe the movements of the carriage and the cross slide can be reversed either by reversing the feed mechanism with the reverse handle (E) on the head or by shifting the double bevel pinion handle (K) on the lower right hand side of the apron. In explaining the movements of the carriage and the cross slide we will assume the reserve handle (E) on the head is in the left hand position, where it should be set to cut a right hand thread. Now with the apron double bevel pinion handle (K) in the left hand position the carriage will feed toward the headstock and the cross slide will feed toward the rear way of the bed. With the apron reverse handle (K) thrown to the right the carriage will feed toward the tailstock and the cross slide toward the operator.

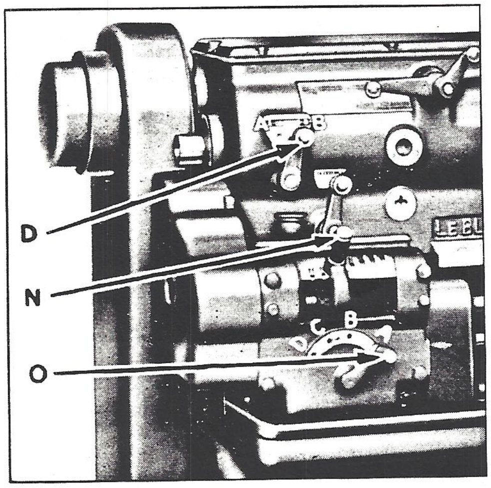


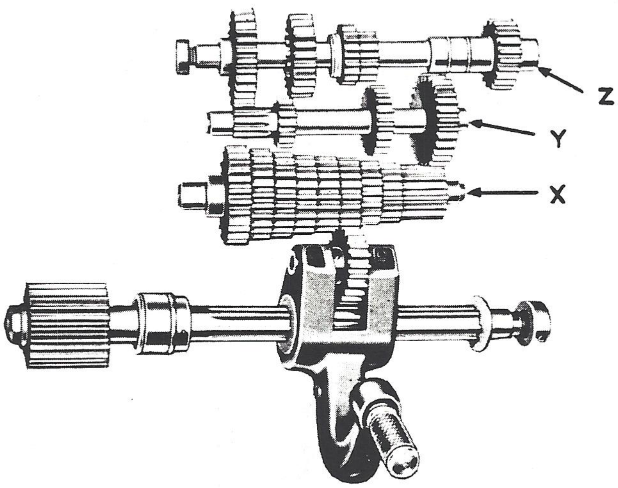

*Apron 12" to 18"—Tool Room Lathe*—Movement of the carriage and the cross slide is controlled by a single lever (H) on the upper center of the apron and is moved up from the stop pin for carriage movement and down from the stop pin for movement of the cross slide. Change of direction of both the carriage and cross slide is by the feed reverse handle (J); when pulled up from the neutral position the carriage feeds towards the head, or if apron clutch lever (H) is set for cross slide movement the slide moves toward the operator. When the feed reverse handle (J) is down, the carriage moves toward the tailstock or the cross slide feeds toward the rear way of lathe. The reverse lever (J) should only be used to change the direction of the feed and not to operate the carriage and cross slide.

Handle (K) is moved to center, neutral position when the lead screw is in use.

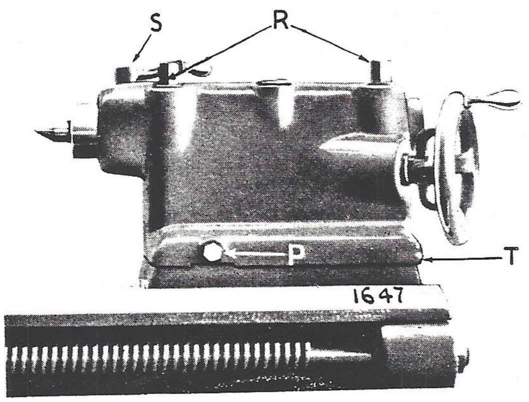
# To Operate Lathe

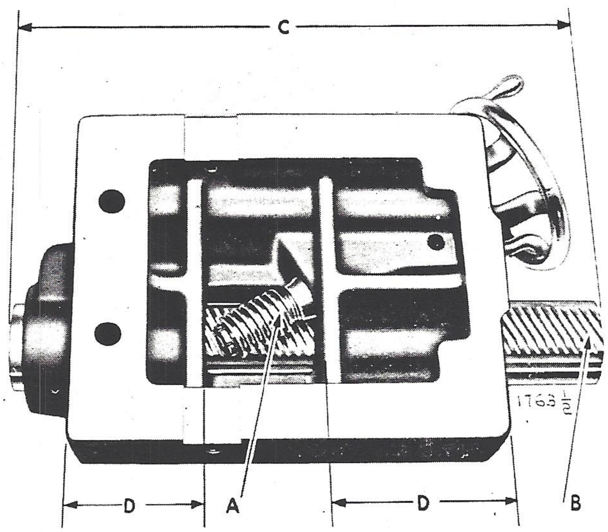
*Feed Box*—The feed and thread mechanism is simple and easy to operate. It consists of a cone of gears (X), an intermediate shaft (Y) and a set of sliding gears (Z). The fine change shifter (N) slides on a splined shaft and carries a tumbler gear which is dropped into engagement with a gear on the cone corresponding to the thread or feed selected on the index plate above it. For the course changes the lever (O) on the lower part of the box is moved into the (A, B, C and D) positions. To further change the range of feeds, a lever (D) on the head above the feed box is shifted into the (A and B) positions above the shifter, (A) giving the coarse range, (B) the fine range. This lever moves the sliding gear in the head into engagement as indicated by the (A and B) positions above the shifter with the resulting feeds and threads shown on the feed box plate.




*Tailstock*—The spindle movement of the tailstock is through rack (B) and worm (A) forming a positive lock to the spindle against backing out. The tailstock spindle (C) has a large area bearings (D) in both the front and rear of the tailstock even with the spindle

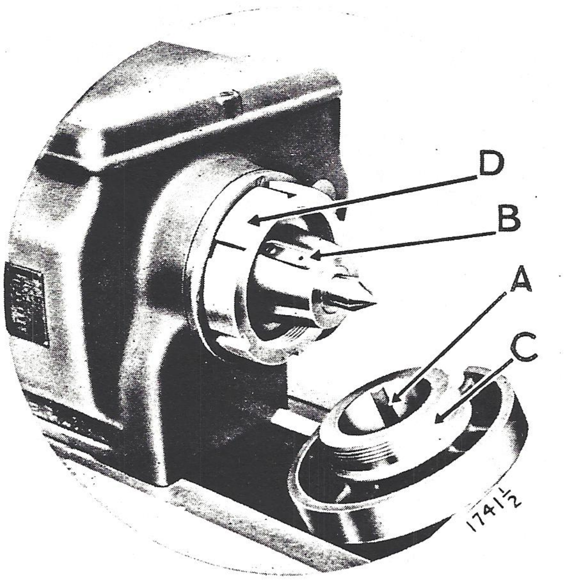



extended to the limit of its movement. The travel is greater than would ever be needed for a piece held between centers and adequate for most drilling and boring operations without reclamping the tailstock screws.

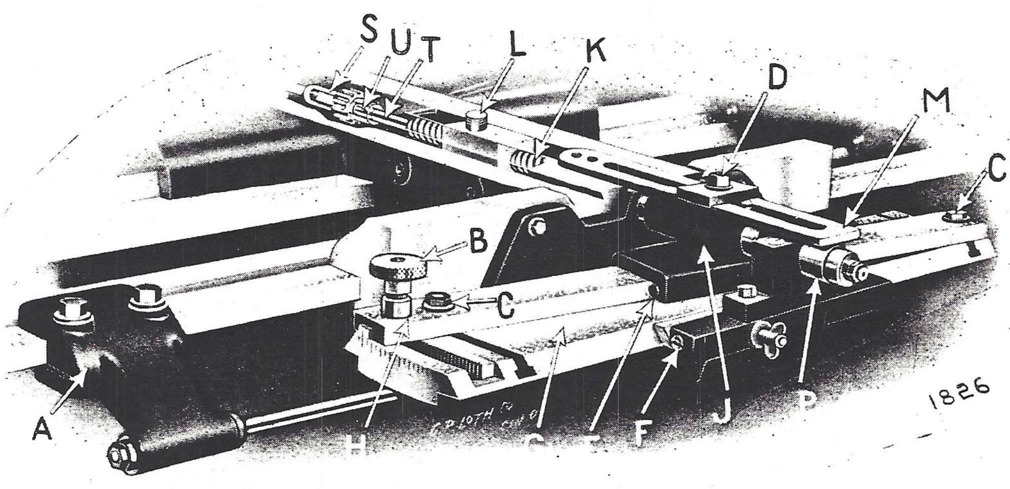
# To Operate Lathe

Two setover screws (P) move the tailstock top to any desired position on the accurately graduated scale on the end (T). The hand wheel sets at an angle with the spindle, is handy to operate and is arranged so that a bar can be used for hand feeding when drilling with the tailstock. A drill sleeve with a tang driver is furnished for holding drills. Heavy tailstock clamping bolts (R) securely clamp the tailstock in any position on the bed. The handle (S) securely clamps and holds the spindle in the desired positon.



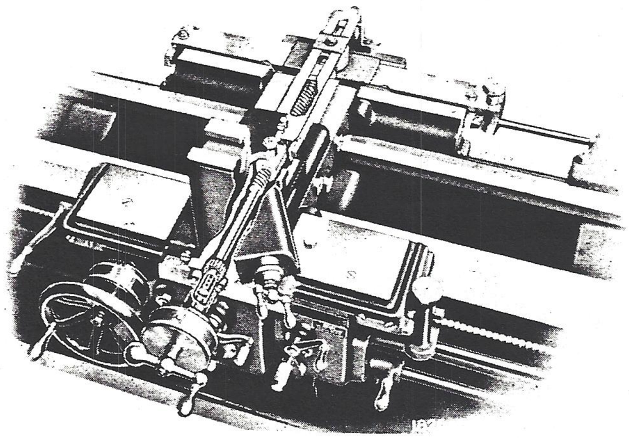

*Mounting Chucks and Face Plates* — Mounting chucks for face plates is simple on the new key drive spindle nose. Place the chuck or face plate keyway (A) on the key (B) in the spindle with the key on top. Next, slide it into position. This brings the thread (C) on the chuck into alignment with the threaded collar (D). Then, with both hands free, start the threaded collar (D)—tightening up with a spanner wrench. The chuck or face plate is then positively placed and will run true and accurate.

*Taper Attachment*—The LeBlond DUAL Performance Heavy Service Carriage Type Taper Attachment combines the convenience of a telescopic screw with the rigidity of the yoke type attachment. When the carriage is brought into position for the taper operation, the bracket (A) is tightened on the flat bed way. The swivel guide bar (H) is adjusted to




the selected taper, which is marked in inches on one end of the lower bar and in degrees on the other end of the bar.

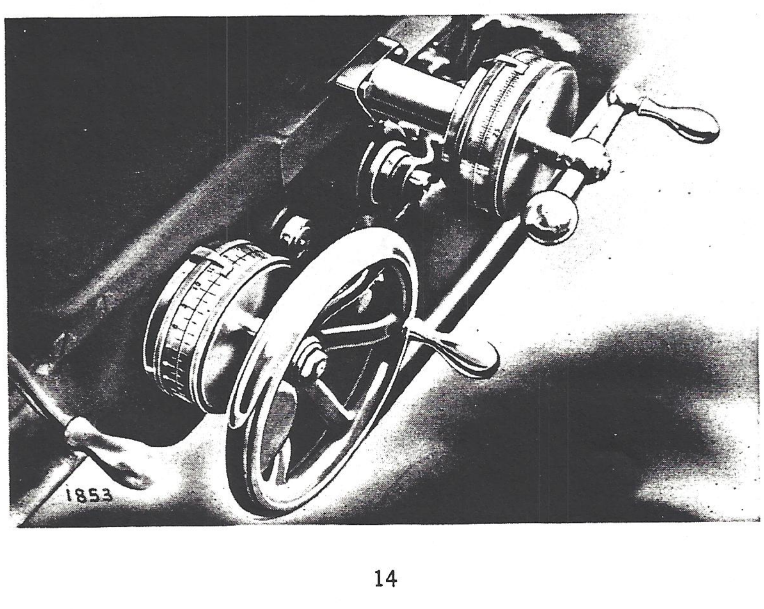
# To Operate Lathe



The adjustment is made by means of the set-over-knob (B) engaging the rack in the end of the taper bar, moving the swivel bar to the desired taper. It is held secure by the screws (C). Now, with the taper bar clamp screw (D) loose, and assuming that the shoe bracket gib (E) and the carriage bracket gib are properly adjusted, we are ready to chase taper threads or to finish taper turning, or finish boring. When the carriage feed is engaged the bracket (A) and its connecting rod hold the lower taper bar (G) and the adjustable swivel bar (H) in a fixed position with relation to the bed and the work. The movement of the carriage slides the gibbed shoe (J) along the taper bar (H) and the pull is on the cross feed screw (K) and nut (L) the end of the screw telescoping in the bush (S) allowing the slide to move in or out. The telescoping end of the screw is splined (T) and in this spline a key (U) in the telescoping bush slides, allowing movement of the tool at all times.

On heavy cuts, none of the pull is on the cross feed screw but on the draw bar (M) which is connected to the bottom slide of the tool rest. On heavy cuts the clamping screw (D) is tightened and the action of the sliding shoe is the same as on light cuts, except that the pull is on the draw bar (M) clamp plate, relieving the cross feed screw of all strain and pull and wear, thus insuring longer life and sustaining the original accuracy of the screw. Adjustment of the cut is made by loosening the nut (D) and setting the tool to the proper diameter and of course tightening the nut again after the adjustment is made, however, most adjustments of the tool are made by the compound rest and there is no necessity of adjusting the nut (D) after the taper is set.

*Direct Length Travel Reading Dials*—The direct length travel reading dial as the name indicates makes possible the accurate measurement of length cuts directly read from a



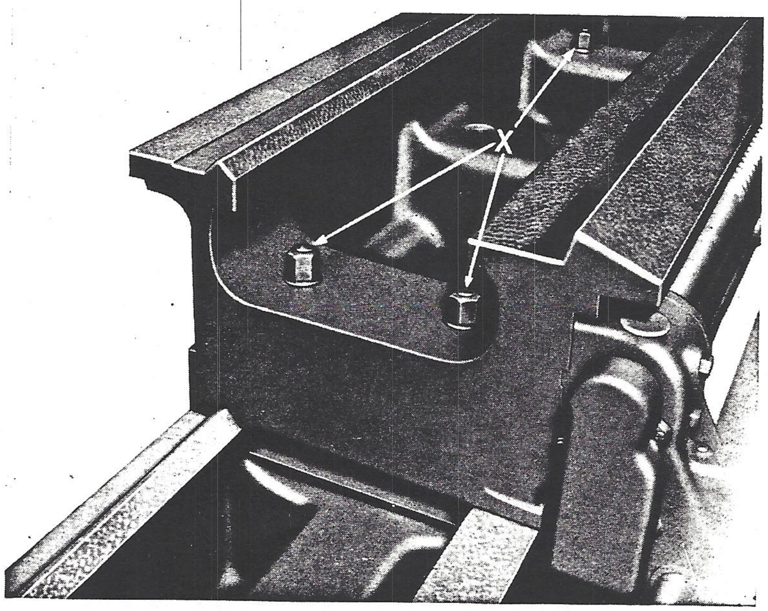
# To Operate Lathe

large dual dial located on the carriage hand wheel shaft. The dials are graduated both in inches ($\frac{1}{2}''$ marking) and fractions of an inch ($\frac{1}{64}''$ markings) and are moved into position by gripping the knurled portion of the dial. The carriage is moved one inch with one complete revolution of the outer dial. One complete turn of the inner dial moves the carriage 24″. To use the dial first set the turning tool for the diameter to be turned, then position the tool at the start of the cut. Now turn the dial that will give the desired length until the zero mark is directly under the pointer.

The length of cut can then be read directly from the dial, or it can be used to set the length feed stops where duplicate parts are to be machined.

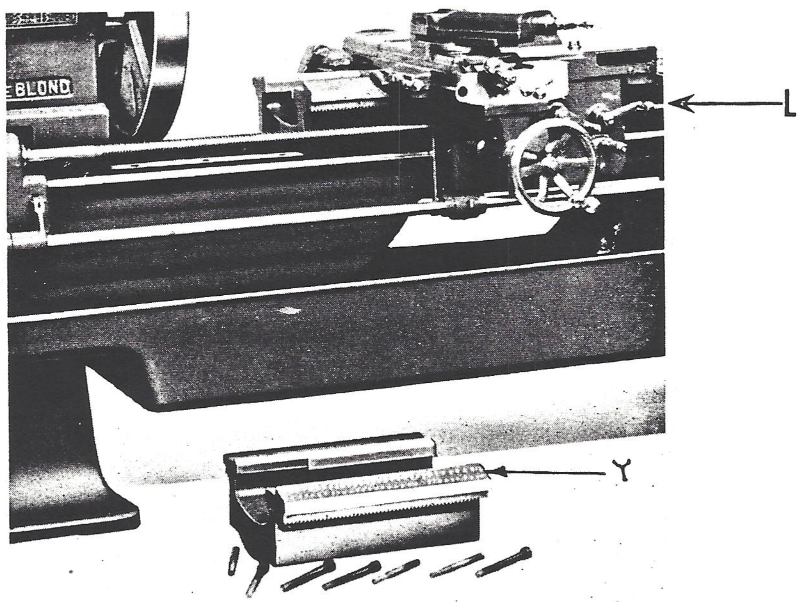
*Dual Crossfeed Diameter Dials*—The dual diameter dial saves time in tool setting as it eliminates the old cut and try method. The dial is directly behind the cross feed handle and is marked in both decimal and fractional inches. The outer dial is graduated in thousandths, one complete turn moves in .2 of an inch. The inner dial is marked in $\frac{1}{32}''$, one complete turn moves the cross slide 3″. First determine the size of the piece to be turned then bring the point of the tool into position so that it just touches the work. Then turn the dial until the zero mark is directly under the pointer. Subtract the diameter to be turned from the diameter of the stock and feed tool in one-half the amount. For example if the diameter of the stock is 2″ and the diameter to be turned $1\frac{1}{2}''$ the difference is $\frac{1}{2}''$ then feed the tool in $\frac{1}{4}''$ or .250″.

*Sliding Bed—Gap Lathes*—See engine lathe instructions on 18″ size for instructions on the units common to both. The bed is composed of two sections, the top bed being moveable



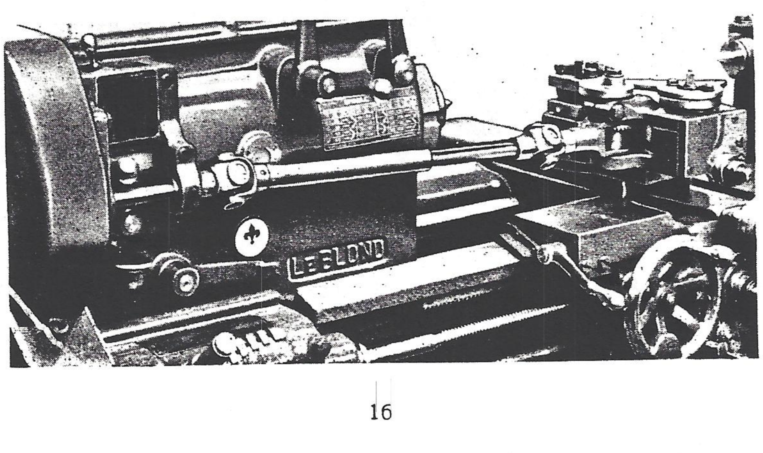

on the lower bed by means of a coarse pitch screw on the rear of the bed and operated by a crank at the end of the bed. To move the upper bed loosen the clamps that are held by screws (X) through two holes in each of the heavy cross girths of the upper bed. The clamps pull against finished surfaces under the ways of the lower bed. Move the bed into position desired and pull up clamp screws, tightening first the screw to the back of bed pulling the upper bed securely to the vee way on the back then tighten the front screws. Next place the jacks at the end of the overhanging bed. The jacks should be raised just enough to relieve the stain resulting from the unsupported load.

*Regular Gap Lathes*—Instruction on corresponding sizes of engine lathes also apply to gap lathes. The supplementary piece (Y) is accurately fitted in the gap and great care should be taken when it is removed to exert an even pull to avoid jamming it. The piece is held rigid in place by two locating pins and four screws.




*Relieving Attachment*

The fully Universal Relieving Attachment will cut any relief from zero to 1/4" with the use of only two cams. The change from external to internal or end relief is made without the addition of intermediate supporting blocks and additional knuckle joints. Spiral relief can also be taken care of by a simple adjustment of change gear combinations. The use of the taper it easily accomplished without any special brackets or connections.

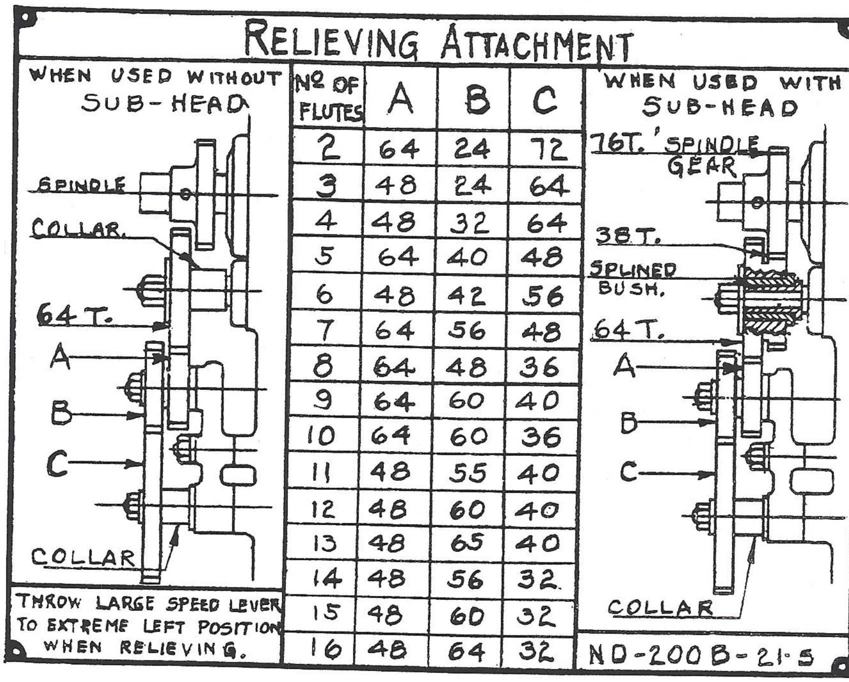


# To Operate Lathe

To connect the relieving attachment it is only necessary to remove the compound rest, place relieving attachment in position and connect telescopic shaft.

The adjustment of the follower cam is simple and can be accomplished quickly. A wrench on the square milled end of the vertical eccentric shaft moves it and the follower cam hub that is keyed to it. When the eccentric shaft is in position for the desired relief the nuts on two bolts in the tee slot milled in the follower cam hub are tightened, holding the follower cam securely in position.

The range of adjustment accomplishes a relief from zero to 1/16″ with the small follower cam and 1/16″ to 1/4″ with the larger follower cam. The graduations for both cams are on the follower cam hubs: zero to 1/16″ being on the side next to the tailstock and 1/16″ to 1/4″ side next to the headstock, in increments of 1/64″.




| Nº OF FLUTES | A | B | C |
|---|---|---|---|
| 2 | 64 | 24 | 72 |
| 3 | 48 | 24 | 64 |
| 4 | 48 | 32 | 64 |
| 5 | 64 | 40 | 48 |
| 6 | 48 | 42 | 56 |
| 7 | 64 | 56 | 48 |
| 8 | 64 | 48 | 36 |
| 9 | 64 | 60 | 40 |
| 10 | 64 | 60 | 36 |
| 11 | 48 | 55 | 40 |
| 12 | 48 | 60 | 40 |
| 13 | 48 | 65 | 40 |
| 14 | 48 | 56 | 32 |
| 15 | 48 | 60 | 32 |
| 16 | 48 | 64 | 32 |

*Pitch of Spiral Flutes*

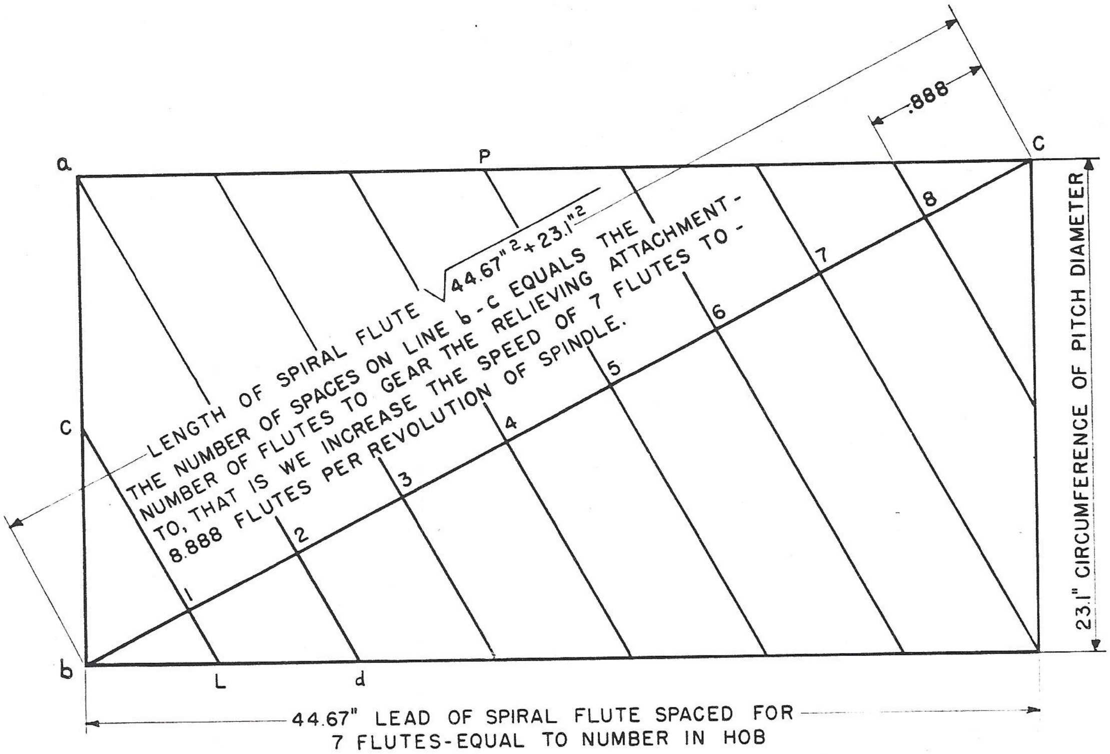
To obtain the correct pitch of spiral at right angles to the thread the following formula may be used:

C—Circumference of hob at pitch line
L—Lead of thread
P—Pitch of Spiral Flutes

Then $\frac{C^2}{L} = P$ The triangles bac and dba are similar and their corresponding sides are proportional. They are both right angle triangles and the angles b c a and b d a are equal. Therefore their corresponding sides are proportional and we have

a c : a b : : a b : b d $\quad ac = \frac{ab^2}{bd}$ or $\frac{C^2}{L} = P$

# To Operate Lathe




From the above sketch we note there is one more tooth on the spiral tooth than on the straight.

Therefore if M = number of teeth in straight flute

and if N = number of teeth in spiral flute

$$N = \frac{\text{Lead of spiral}}{\text{Lead of thread}} + 1$$

$$M = \frac{\text{Lead of spiral}}{\text{Lead of thread}}$$

$$\frac{N}{M} = \text{Ratio of Compensating Gears}$$

EXAMPLE: For double thread job with 7 spiral flutes, 3″ circular pitch, 7.353 pitch diameter

7.353 x Pi = 23.100 Circum.

23.1 x 23.1 = 533.61

533.61 ÷ 6 = 88.93 Lead of spiral

M = 88.93 ÷ 6 = 14.82

N = 14.82 + 1

$$\text{Ratio of Compensating Gears} = \frac{15.82}{14.82} = \frac{32}{30}$$

# To Operate Lathe

Referring to chart on page 17, gears used for 7 straight flutes are:

$$\frac{64\text{(idler)}}{64\ (A)} \qquad \frac{56\ (B)}{48\ (C)}$$

$$\text{Adding Compensating Gears to Train} = \frac{64}{64}\ \frac{56}{48}\ \frac{32}{30} = \frac{64}{64}\ \frac{56}{45}$$

EXAMPLE: For triple thread with 7 spiral flutes, 3″ circular pitch, 7.353 pitch diameter.

7.353 x Pi. = 23.100 Circumference
23.1 x 23.1 = 533.61
533.61 ÷ 9 = 59.290 Lead of spiral
59.290 ÷ 9 = 6.587

$$\text{Ratio of Compensating Gears} = \frac{7.587}{6.587} = \frac{35}{30}$$

$$\text{Gears used to relieve hob with 7 straight flutes are } \frac{64}{64} \quad \frac{56}{48}$$

$$\text{Adding compensating gears} = \frac{64}{64} \quad \frac{56}{48} \quad \frac{35}{30} = \frac{64}{64} \quad \frac{49}{36}$$

EXAMPLE: For quadruple thread hob with 7 spiral flutes, 3″ circular pitch, 7.353 Pitch diameter.

7.353 x Pi. = 23,100 Circumference
23.1 x 23.1 = 533.61
533.61 ÷ 12 = 44.467 Lead of Spiral
44.467 ÷ 12 = 3.7056

$$\text{Ratio of compensating gears} = \frac{4.7056}{3.7056} = \frac{47}{37}$$

$$\text{Gears used to relieve hob with 7 straight flutes are } \frac{64}{64} \quad \frac{56}{48}$$

$$\text{Adding compensating gears} = \frac{64}{64} \quad \frac{56}{48} \quad \frac{47}{37} = \frac{64}{64} \quad \frac{40}{27}$$

# To Operate Lathe

## CUTTING THREADS

A central position (feed control handle (H), page 11, against stop pin) holds the feed mechanism into a neutral position, releasing the dog that locks the half nuts out of engagement when the feed mechanism is used.

The lever (L) page 11, above the feed direction shifter engages the half nuts to chase threads. A downward movement of the handle engages the half nuts on the lead screw, pulled up the lead screw is released. Either the chasing dial (M) page 11, or the lead screw reverse (J) page 11, can be used to re-engage the tool in the thread being cut. The direction of the lead screw or feed rod is reversed by the handle (E) page 10, on all LeBlond engine lathes.

Since chasing requires a number of cuts and all must be in the same line of the cut of the thread, it is necessary either to keep the half-nut engaged on the lead screw at all times and return the carriage by reversing the lead screw, or to use an indicator which meshes with the lead screw and shows when the half nut can be engaged so that the tool will cut along the same thread; the device used for this purpose is called a chasing dial.

*Thread Indicator Method*—The thread chasing dial on right hand side of apron, page 8, comprises a worm wheel that meshes with the lead screw and a shaft connecting the worm with the indicator dial. The dial is marked from 1 to 4 equally spaced, that is 90 degrees apart with single graduations spaced between each number.

For all even number threads close half nut at any line on dial.
For all odd number threads close half nut at any numbered line.
For half threads close half nut at any half revolution.
For quarter threads close half nut any whole revolution.

*Lead Screw Reverse Method 12″ to 18″*—The use of the lead screw reverse on tool room lathes is particularly valuable in chasing odd threads that cannot be picked up with the thread dial; on short threading jobs; for chasing threads in blind holes or on threads stopping at a shoulder.

With the lead screw reverse you can change the direction of travel of the carriage with the use of either lead screw or feed rod without changing the direction of rotation of the spindle. The lever (J), page 11, on the right hand side of the apron shifts a single tooth clutch in the thread and feed gear train and controls the direction of rotation of the lead screw and feed rod.

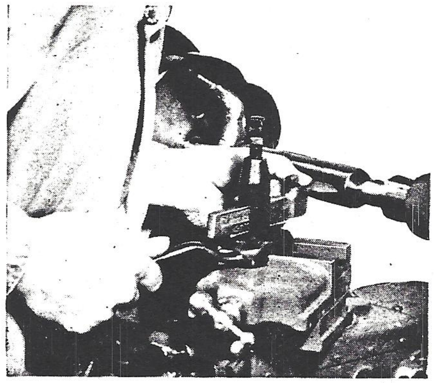
More accurate threads can be cut as the single tooth clutch insures the register between the lead screw and the lead being cut. Adjustable automatic stops are provided to disengage the feed mechanism in both directions.

When the stop disengages the lead screw at the end of the thread the tool should be backed out and the feed engaged to return the carriage to the starting point without releasing the half nuts on the return. Another dog disengages the mechanism, the tool is then set to the proper depth and the control handle engaged for another cut.

# To Operate Lathe

*Thread Cutting Data*

When cutting threads it is necessary to set the tools at a right angle to the piece to be chased; that is, the axis of the thread tool should be exactly 90 degrees from the axis of the work. This is accomplished by use of a thread setting gauge.



Next set the cutting edge of the tool exactly on the dead center. The depth of the thread and the thread angle will not be cut correctly if the tool is set in any other position. When cutting threads on cast-iron or brass no cutting lubricant is necessary, but on steel it should be used. A good quality of cutting oil should be applied to the tool, especially on the finish cuts; a smoother surface is thus obtained.

On threads of fine lead, about 30 and finer, the tool may be fed straight into the work in successive cuts. However, on coarser leads it is better to set the compound rest at one-half the included angle of the thread, and feed in along the side of the thread with the compound rest handle, so that the tool cuts on one side only during the roughing. On the last two or three cuts the tool should be fed straight in, by the cross slide handle, to remove all lines caused by feeding along the side of the thread.

When the lathe is ready for the first chasing cut and a chasing stop is not being used, proceed in the following manner. Bring up the point of the tool until it touches the diameter to be chased. Set the cross feed dial at zero and feed the compound slide in .005° and take a cut. At the end of the cut withdraw the tool by means of the cross slide handle and return the carriage to the starting point. Again run the tool in until the dial is on the established zero reading and again feed the compound slide in .005. Proceed in the same manner until the last two or three cuts are to be made, then feed straight in with the cross slide to clean up both sides of the thread.

The points just outlined are also true for taper and internal threading. We would again point out that the top edge of the tool should always be set on the lathe center line and the proper side and front clearance must be allowed to clear the sides of the threads.

The table following conveys some idea of the number of cuts necessary to chase vee threads that are in common use:

| No. of Threads per inch | No. of Chasing Cuts |
|---|---|
| 8 | 18 |
| 10 | 14 |
| 11 | 13 |
| 12 | 11 |
| 13 | 10 |
| 16 | 9 |
| 20 | 8 |

This table is based on .005″ per cut allowing an extra cut for finish which is the actual practice in our shop.

# To Operate Lathe

*Formula for Figuring Change Gears for Special Threads*

A limited number of threads in between those shown on the index plate on the 16″ and 18″ lathes can be cut by setting the feed box to cut the same number of threads as the number of teeth in the gear H (24 teeth) page 27, on end of the feed box, and by putting a gear in place of the gear H having the same number of teeth as the thread to be cut, for example, place a 21 teeth gear to cut 21 threads, a 27 teeth gear to cut 27 threads, etc.

Another simple method not requiring compound gears follows (see diagram on page 27):

On 12″ and 14″ Lathes—For Driving Gear F, use 36 teeth
For Driven Gear H, use 27 teeth
Lead Screw has 4 threads per inch
For 1:1 ratio set feed box to cut 3 threads

On 16″ and 18″ Lathes—For Driving Gear F, use 48 teeth
For Driven Gear H, use 24 teeth
Lead Screw has 2 threads per inch
For 1:1 ratio set feed box to cut 1 thread

Example to cut 6.4″ thread on 12″ lathe:

$$\frac{\text{Set box to cut 3 threads x (F) 36T}}{\text{Special thread to be cut x (H) 27T}} = \frac{3\text{x}36}{6.4\text{x}27} = \frac{3\text{x}4}{6.4\text{x}3} = \frac{12}{19.2} = \frac{45\text{T—F}}{72\text{T—H}}$$

There are a number of special leads* which may be obtained by replacing the gears F, G, and H. For example, suppose a lead of .759 was desired, we first select a thread plus or minus the lead desired and set feed box levers to chase this thread. We may select 2 threads which give us the lead of .500 or the following ratio $\frac{759}{500}$. The ratio established on the lathe between head and feed box by gears F and H, for example on the 12″ lathe is $\frac{36}{27}$ or $\frac{4}{3}$.

Taking the LCD□ of $\frac{759}{500}$ we have $\frac{3 \times 11 \times 23}{5 \times 5 \times 5 \times 2 \times 2}$ combining this we have

$$\frac{3 \times 11 \times 23 \times 4(\text{F})}{5 \times 5 \times 5 \times 2 \times 2 \times 3(\text{H})} \text{ or } \frac{69 \times 44 \text{ Pinions}}{50 \times 30 \text{ Gears}}$$

These gears are shown on the diagram as $\frac{F' \times G'}{G' \times H'}$. When it happens that the ratio cannot be divided into suitable Lowest Common Denominators that can be arranged for gears and pinions, it becomes necessary to try another ratio. To check the problem we have

$$\frac{69 \times 44}{50 \times 30} = \frac{3036}{1500} \div \frac{4}{3} = \frac{759}{500}$$

*The pitch of a screw thread is the distance from the center of one thread to the center of the next. The lead is the distance the nut will move forward on the screw when turned one full revolution. In a single thread the pitch and the lead are the same. In a double threaded screw the lead is equal to twice the pitch. In a triple thread, three times the pitch and so on.

□Lowest Common Denominator of a given number can be found in the various machinery hand books under Prime Numbers and Factors.

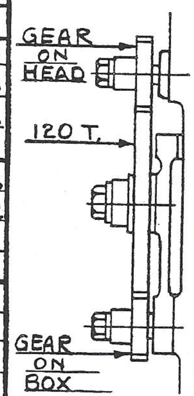
COARSE THREADING INDEX PLATE

| GEAR ON HEAD | GEAR ON BOX | LEVER ON BOX | LEAD IN INCHES — LEVER ON HEAD | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | B | A | B | A | B | A | B | A | B | A | B | A | B | A | B |
| 42 | 30 | A | | | | | | | | | 5¼ | | | | | | 7 | 7/8 |
| " | " | B | | | | | | | | | 2 5/8 | | | | | | 3½ | 7/16 |
| " | " | C | | | | | | | | | 1 5/16 | | | | | | 1¾ | 7/32 |
| " | " | D | | | | | | | | | 21/32 | | | | | | 7/8 | |
| 39 | 30 | A | | | | | | | | | | | | | | | 6½ | 13/16 |
| " | " | B | | | | | | | | | | | | | | | 3¼ | 13/32 |
| " | " | C | | | | | | | | | | | | | | | 1 5/8 | |
| " | " | D | | | | | | | | | | | | | | | 13/16 | |
| 38 | 30 | A | | | | | | | | | 4¾ | | | | | | | |
| " | " | B | | | | | | | | | 2 3/8 | | | | | | | |
| " | " | C | | | | | | | | | 1 3/16 | | | | | | | |
| " | " | D | | | | | | | | | 19/32 | | | | | | | |
| 36 | 30 | A | | | | | | | 4 | ½ | 4½ | 9/16 | | | | | 6 | ¾ |
| " | " | B | | | | | | | 2 | ¼ | 2¼ | 9/32 | | | | | 3 | 3/8 |
| " | " | C | | | | | | | 1 | | 1 1/8 | | | | | | 1½ | |
| " | " | D | | | | | | | ½ | | 9/16 | | | | | | ¾ | |
| 34 | 30 | A | | | | | | | | | 4¼ | | | | | | | |
| " | " | B | | | | | | | | | 2 1/8 | | | | | | | |
| " | " | C | | | | | | | | | 1 1/16 | | | | | | | |
| " | " | D | | | | | | | | | 17/32 | | | | | | | |
| 33 | 30 | A | | | | | | | | | | | | | | | 5½ | 11/16 |
| " | " | B | | | | | | | | | | | | | | | 2¾ | 11/32 |
| " | " | C | | | | | | | | | | | | | | | 1 3/8 | |
| " | " | D | | | | | | | | | | | | | | | 11/16 | |
| 27 | 27 | A | | | | | | | | | 3¾ | | | | | | 5 | 5/8 |
| " | " | B | | | | | | | | | 1 7/8 | | | | | | 2½ | 5/16 |
| " | " | C | | | | | | | | | 15/16 | | | | | | 1¼ | |
| " | " | D | | | | | | | | | 15/32 | | | | | | 5/8 | |

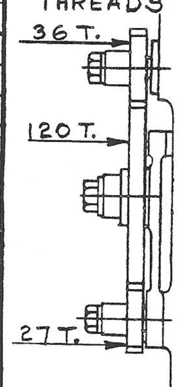
NOTE: THROW LARGE SPEED LEVER TO EXTREME LEFT POSITION WHEN COARSE THREADING

OIL, TUMBLER IN THIS POSITION

GEARS FOR COARSE THREADS




GEARS FOR STANDARD THREADS




NO NB-204B-10S

*Coarse Threading Attachment and Sub Head*

The Coarse threading attachment provides special leads without changing the gears on the end of the lathe.

The sub head is applied to furnish exceptionally low speeds for coarse worm cutting or chasing threads with exceptionally long leads and for use with the relieving attachment.

The diagram above shows the leads that can be cut with the coarse threading attachment on the 12" and 14" lathes. On the 16" and 18" the plates on pages 25 and 26 indicate the results of the coarse threading attachment used with the sub head and resulting leads and diametral pitches.

# To Operate Lathe

When selecting gears for special leads be sure that all gears clear and that the standard quadrant is used if possible. However, there are a number of cases where special quadrants with idler gears are necessary. To cut any lead not listed use the following formula to calculate special change gears for head and box:

Explanation of $R = \frac{6 \times ST}{L}$

| Desired Gear Ratio | Gear on Box / Gear on Head | Coarse Thread Ratio in Head | Feed Lever Ratio in Head | Tumbler Ratio in Box | Lever Ratio in Box | Feed Rod to Lead Screw | Lead of Screw |
|---|---|---|---|---|---|---|---|
| R | $\frac{GB}{GH}$ | $\frac{12}{1}$ | $\frac{2}{1}$ | $\frac{T}{1}$ | $\frac{S}{1}$ | $\frac{1}{2}$ | $\frac{1}{2}$ |

$$R = \frac{GB}{GH} = \frac{\frac{12}{1} \times \frac{2}{1} \times \frac{T}{1} \times \frac{S}{1} \times \frac{1}{2} \times \frac{1}{2}}{L} = \frac{6\,TS}{L}$$

(L = Lead to be Cut)

*Example Illustrating Method of Computing Gears for any Lead*

Let "L" = 1.782 in. nearest values fall in third row on coarse thread index plate opposite page, so lever on box will be at "C" and lever on head at "A". S = .25.

Substituting: $R = \frac{6 \times .25}{1.782} \times T = .8417508 \times T.$

For first tumbler position: R = .8417508 x .5333333 = .4489338.

From gear-ratio table: $\frac{22}{49}$ = .4489796. This leaves an error in ratio of .0000458.

Tabulating all 9 values.

| T | R | Closest Gears | Ratio of Closest Gears | Ratio Error | |
|---|---|---|---|---|---|
| .5333333 | .4489338 | 22 49 | .4489796 | .0000458 | Best |
| .5714285 | .4810004 | 38 79 | .4810127 | .0000123 | GH too big |
| .6153846 | .5180005 | 43 83 | .5180723 | .0000718 | GH too big |
| .6666667 | .5611672 | 55 98 | .5612245 | .0000573 | GH too big |
| .6956521 | .5855657 | 65 111 | .5855856 | .0000199 | GH too big |
| .7272727 | .6121824 | 30 49 | .6122449 | .0000625 | 2nd best |
| .8000000 | .6734006 | 33 49 | .6734694 | .0000688 | 3rd best |
| .8888889 | .7482229 | 89 119 | .7478992 | .0003237 | GH too big |
| 1.0000000 | .8417508 | 101 120 | .8416667 | .0000840 | GH too big |

Proof: $L = \frac{6 \times .025 \times .5333333}{.4489796} = 1.7818181.$ Error in lead is .0001819 or .000102 per in.

As this error is considerable, the computations should be made for compounding:

Formula for use with 113T and 71T Compound Gears:

$R = \frac{GH}{113} \times \frac{71}{GB} = \frac{L}{6\,ST}$ combining terms $R = \frac{GH}{GB} = 2652582 \; \frac{L}{ST}$

Substituting desired lead in this formula for compound gears,

$R = \frac{.2652582 \times 1.782}{1 \times T}$ Where S = 1, as nearest values fall in first row of diametral pitch plate.

Repeating above procedure, a pair $\frac{GH}{GB} = \frac{53}{69}$ gives a lead of 1.781987, an error of .000013, or .000007 per in. This is O. K., but cover will have to be removed if it is used.

TO OBTAIN ANY LEAD NOT LISTED, CHANGE GEAR ON HEAD AND GEAR ON BOX AS FOLLOWS:
$G_H$ = Nº OF TEETH IN GEAR ON HEAD. (NOT OVER 57 TO CLEAR RELIEVING ATT. GEAR. NOT OVER 66 TO CLEAR SPINDLE)
$G_B$ = Nº OF TEETH IN GEAR ON BOX. (NOT OVER 67 TO CLEAR COVER. NOT UNDER 57 WHEN COMPOUNDING).
L = LEAD DESIRED. S = LEVER RATIO (SHOWN BELOW). T = TUMBLER RATIO (SHOWN AT BOTTOM OF PLATE)
RATIO OF CHANGE GEARS DESIRED: $R = \frac{G_B}{G_H} = \frac{6ST}{L}$. (WITHOUT COMPOUNDING).
CHOOSE "S" FROM LEVER SETTING THAT SHOWS VALUES ON COARSE THREAD INDEX PLATE NEAREST TO DESIRED LEAD.
CALCULATE R FOR ALL 9 TUMBLER POSITIONS, AND SELECT NEAREST PRACTICAL PAIR OF GEARS FROM A GEAR-RATIO TABLE.
TO CHECK FOR ERROR, SUBSTITUTE ACTUAL GEAR RATIO SELECTED, IN FOLLOWING FORMULA:
ACTUAL LEAD $L = \frac{6ST}{R}$. ACTUAL LEAD MUST BE WITHIN LIMIT OF ERROR PERMISSIBLE.

FORMULA FOR USE WITH 113T AND 71T. COMPOUND GEARS: $R = \frac{G_H}{G_B} = .2652582 \frac{L}{ST}$
CHOOSE "S" FROM LEVER SETTING THAT GIVES VALUES ON DIAMETRAL PITCH INDEX PLATE NEAREST TO DESIRED LEAD.
TO CHECK FOR ERROR— ACTUAL LEAD L = 3.7699115 RST.

| LEVER ON BOX AT → | A | B | C | D |
|---|---|---|---|---|
| LEVER ON HEAD AT A | S = 1 | S = .5 | S = .25 | S = .125 |
| " " " " B | S = .125 | S = .0625 | S = .03125 | S = .015625 |

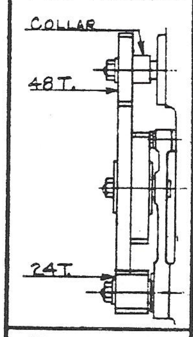
ND-120A-4-S

NOT TO BE USED WITH SUB-HEAD

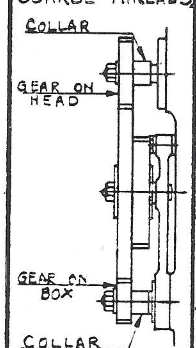
## COARSE THREAD INDEX PLATE

THE R.K. LEBLOND M.T. CO. CINCINNATI, OHIO, U.S.A.

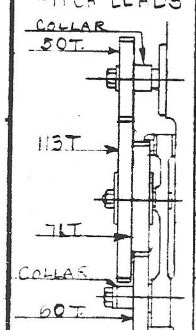
GEARS FOR FINE THREADS




GEARS FOR COARSE THREADS




GEARS FOR DIAMETRAL PITCH LEADS




| GEAR ON HEAD | GEAR ON BOX | LEVER ON BOX | LEAD IN INCHES — LEVER ON HEAD: A | B | A | B | A | B | A | B | A | B | A | B | A | B | A' | B | A | B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 48 | 24 | A | 6.400 | .800 | 6.857 | .857 | 7.385 | .923 | 8.000 | 1.000 | 8.348 | 1.043 | 8.727 | 1.091 | 9.600 | 1.200 | 10.667 | 1.333 | 12 | $1\frac{1}{2}$ |
| | | B | 3.200 | .400 | 3.429 | .429 | 3.692 | .462 | 4.000 | .500 | 4.174 | .522 | 4.364 | .545 | 4.800 | .600 | 5.333 | .667 | 6 | $\frac{3}{4}$ |
| | | C | 1.600 | .200 | 1.714 | .214 | 1.846 | .231 | 2.000 | .250 | 2.087 | .261 | 2.182 | .273 | 2.400 | .300 | 2.667 | .333 | 3 | $\frac{3}{8}$ |
| 44 | 24 | A | 5.867 | .733 | 6.286 | .786 | 6.769 | .846 | 7.333 | .917 | 7.652 | .957 | 8.000 | 1.000 | 8.800 | 1.100 | 9.778 | 1.222 | 11 | $1\frac{3}{8}$ |
| | | B | 2.933 | .367 | 3.143 | .393 | 3.385 | .423 | 3.667 | .458 | 3.826 | .478 | 4.000 | .500 | 4.400 | .550 | 4.889 | .611 | $5\frac{1}{2}$ | $\frac{11}{16}$ |
| | | C | 1.467 | .183 | 1.571 | .196 | 1.692 | .212 | 1.833 | .229 | 1.913 | .239 | 2.000 | .250 | 2.200 | .275 | 2.444 | .306 | $2\frac{3}{4}$ | $\frac{11}{32}$ |
| 40 | 24 | A | 5.333 | .667 | 5.714 | .714 | 6.154 | .769 | 6.667 | .833 | 6.957 | .870 | 7.273 | .909 | 8.000 | 1.000 | 8.889 | 1.111 | 10 | $1\frac{1}{4}$ |
| | | B | 2.667 | .333 | 2.857 | .357 | 3.077 | .385 | 3.333 | .417 | 3.478 | .435 | 3.636 | .455 | 4.000 | .500 | 4.444 | .556 | 5 | $\frac{5}{8}$ |
| | | C | 1.333 | .167 | 1.429 | .179 | 1.538 | .192 | 1.667 | .208 | 1.739 | .217 | 1.818 | .227 | 2.000 | .250 | 2.222 | .278 | $2\frac{1}{2}$ | $\frac{5}{16}$ |
| 36 | 24 | A | 4.800 | .600 | 5.143 | .643 | 5.538 | .692 | 6.000 | .750 | 6.261 | .783 | 6.545 | .818 | 7.200 | .900 | 8.000 | 1.000 | 9 | $1\frac{1}{8}$ |
| | | B | 2.400 | .300 | 2.571 | .321 | 2.769 | .346 | 3.000 | .375 | 3.130 | .391 | 3.273 | .409 | 3.600 | .450 | 4.000 | .500 | $4\frac{1}{2}$ | $\frac{9}{16}$ |
| | | C | 1.200 | .150 | 1.286 | .161 | 1.385 | .173 | 1.500 | .188 | 1.565 | .196 | 1.636 | .205 | 1.800 | .225 | 2.000 | .250 | $2\frac{1}{4}$ | $\frac{9}{32}$ |
| 32 | 24 | A | 4.267 | .533 | 4.571 | .571 | 4.923 | .615 | 5.333 | .667 | 5.565 | .696 | 5.818 | .727 | 6.400 | .800 | 7.111 | .889 | 8 | 1 |
| | | B | 2.133 | .267 | 2.286 | .286 | 2.462 | .308 | 2.667 | .333 | 2.783 | .348 | 2.909 | .364 | 3.200 | .400 | 3.556 | .444 | 4 | $\frac{1}{2}$ |
| | | C | 1.067 | .133 | 1.143 | .143 | 1.231 | .154 | 1.333 | .167 | 1.391 | .174 | 1.455 | .182 | 1.600 | .200 | 1.778 | .222 | 2 | $\frac{1}{4}$ |
| 30 | 24 | A | 4.000 | .500 | 4.286 | .536 | 4.615 | .577 | 5.000 | .625 | 5.217 | .652 | 5.455 | .682 | 6.000 | .750 | 6.667 | .833 | $7\frac{1}{2}$ | $\frac{15}{16}$ |
| | | B | 2.000 | .250 | 2.143 | .268 | 2.308 | .288 | 2.500 | .313 | 2.609 | .326 | 2.727 | .341 | 3.000 | .375 | 3.333 | .417 | $3\frac{3}{4}$ | $\frac{15}{32}$ |
| | | C | 1.000 | | 1.071 | | 1.154 | | 1.250 | | 1.304 | | 1.364 | | 1.500 | | 1.667 | | $1\frac{7}{8}$ | |
| 28 | 24 | A | 3.733 | .467 | 4.000 | .500 | 4.308 | .538 | 4.667 | .583 | 4.870 | .609 | 5.091 | .636 | 5.600 | .700 | 6.222 | .778 | 7 | $\frac{7}{8}$ |
| | | B | 1.867 | .233 | 2.000 | .250 | 2.154 | .269 | 2.333 | .292 | 2.435 | .304 | 2.545 | .318 | 2.800 | .350 | 3.111 | .389 | $3\frac{1}{2}$ | $\frac{7}{16}$ |
| | | C | .933 | | 1.000 | | 1.077 | | 1.167 | | 1.217 | | 1.273 | | 1.400 | | 1.556 | | $1\frac{3}{4}$ | |
| 26 | 24 | A | 3.467 | .433 | 3.714 | .464 | 4.000 | .500 | 4.333 | .542 | 4.522 | .565 | 4.727 | .591 | 5.200 | .650 | 5.778 | .722 | $6\frac{1}{2}$ | $\frac{13}{16}$ |
| | | B | 1.733 | .217 | 1.857 | .232 | 2.000 | .250 | 2.167 | .271 | 2.261 | .283 | 2.364 | .295 | 2.600 | .325 | 2.889 | .361 | $3\frac{1}{4}$ | $\frac{13}{32}$ |
| | | C | .867 | | .929 | | 1.000 | | 1.083 | | 1.130 | | 1.182 | | 1.300 | | 1.444 | | $1\frac{5}{8}$ | |

### DIAMETRAL PITCH LEADS

| LEVER ON BOX | LEVER ON HEAD | LEAD | PITCH | LEAD | PITCH | LEAD | PITCH | LEAD | PITCH | LEAD | PITCH | LEAD | PITCH | LEAD | PITCH | LEAD | PITCH | LEAD | PITCH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | A | 1.676 | | 1.795 | | 1.933 | | $\frac{2\pi}{3}$ | $1\frac{1}{2}$P. | 2.185 | | 2.285 | | $\frac{4\pi}{5}$ | $1\frac{1}{4}$P. | 2.793 | | $\pi$ | 1P. |
| B | A | .838 | | .898 | | .967 | | $\frac{\pi}{3}$ | 3P. | 1.093 | | 1.142 | | $\frac{2\pi}{5}$ | $2\frac{1}{2}$P. | 1.396 | | $\frac{\pi}{2}$ | 2P. |
| C | A | .419 | | $\frac{\pi}{7}$ | 7P. | .483 | | $\frac{\pi}{6}$ | 6P. | .546 | | .571 | | $\frac{\pi}{5}$ | 5P. | .698 | | $\frac{\pi}{4}$ | 4P. |
| A | B | $\frac{\pi}{15}$ | 15P. | $\frac{\pi}{14}$ | 14P. | $\frac{\pi}{13}$ | 13P. | $\frac{\pi}{12}$ | 12P. | .273 | | $\frac{\pi}{11}$ | 11P. | $\frac{\pi}{10}$ | 10P. | $\frac{\pi}{9}$ | 9P. | $\frac{\pi}{8}$ | 8P. |
| B | B | $\frac{\pi}{30}$ | 30P. | $\frac{\pi}{28}$ | 28P. | $\frac{\pi}{26}$ | 26P. | $\frac{\pi}{24}$ | 24P. | $\frac{\pi}{23}$ | 23P. | $\frac{\pi}{22}$ | 22P. | $\frac{\pi}{20}$ | 20P. | $\frac{\pi}{18}$ | 18P. | $\frac{\pi}{16}$ | 16P. |
| C | B | $\frac{\pi}{60}$ | 60P. | $\frac{\pi}{56}$ | 56P. | $\frac{\pi}{52}$ | 52P. | $\frac{\pi}{48}$ | 48P. | $\frac{\pi}{46}$ | 46P. | $\frac{\pi}{44}$ | 44P. | $\frac{\pi}{40}$ | 40P. | $\frac{\pi}{36}$ | 36P. | $\frac{\pi}{32}$ | 32P. |

NOTE. WHEN USING ABOVE LEADS, THROW LARGE SPEED LEVER TO EXTREME LEFT POSITION.
SET SELECTOR LEVER FOR COARSE THREADS.


OIL TUMBLER IN THIS POSITION

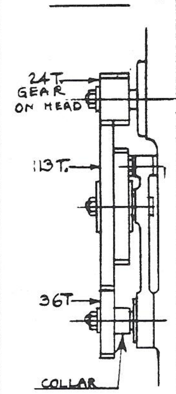
| TUMBLER RATIO (T) | .5333333 | .5714285 | 6153846 | .6666667 | .6956521 | .7272727 | .8000000 | .8888889 | 1.0000000 |
|---|---|---|---|---|---|---|---|---|---|

# To Operate Lathe

| VALUES FOR $R=\frac{GH}{GB}$, TO USE IN COMPUTING CHANGE GEARS FOR ANY LEAD (SEE COARSE-THREADING INDEX PLATE) | | | | |
|---|---|---|---|---|
| SELECTOR LEVER → | FINE THREADS | | COARSE THREADS | |
| NOT COMPOUNDING | $R=.333333\frac{L}{ST}$ | $L=3\ RST$ | $R=02777778\frac{L}{ST}$ | $L=36\ RST$ |
| COMPOUNDING. $\left(\frac{113\times}{71\ 71}\right)$ | $R=.5305164\frac{L}{ST}$ | $L=1.8849557\ RST$ | $R=.0442097\frac{L}{ST}$ | $L=22.619469\ RST$ |

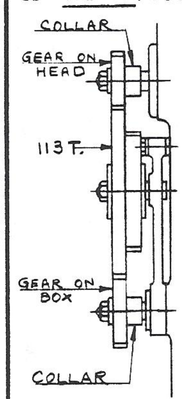
THE R. K. LEBLOND M. T. CO. — INDEX PLATE TO BE USED WITH SUB-HEAD — CINCINNATI, OHIO, U. S. A.

GEARS FOR FINE THREADS




| LEVER ON BOX | LEVER ON HEAD | FINE THREADS (THREADS PER INCH) | | | | | | | | | | | | | | SET SELECTOR LEVER FOR FINE THREADS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | TH'DS | FEEDS | TH'DS | FEEDS | TH'DS | FEEDS | TH'DS | FEEDS | TH'DS | FEEDS | TH'DS | FEEDS | TH'DS | FEEDS | TH'DS | FEEDS | TH'DS | FEEDS |
| A | A | $\frac{15}{16}$ | .355 | $\frac{7}{8}$ | .381 | $\frac{13}{16}$ | .410 | $\frac{3}{4}$ | .444 | $\frac{23}{32}$ | .463 | $\frac{11}{16}$ | .485 | $\frac{5}{8}$ | .533 | $\frac{9}{16}$ | .593 | $\frac{1}{2}$ | .667 |
| B | A | $1\frac{7}{8}$ | .177 | $1\frac{3}{4}$ | .190 | $1\frac{5}{8}$ | .205 | $1\frac{1}{2}$ | .222 | $1\frac{7}{16}$ | .231 | $1\frac{3}{8}$ | .242 | $1\frac{1}{4}$ | .267 | $1\frac{1}{8}$ | .296 | 1 | .333 |
| C | A | $3\frac{3}{4}$ | .088 | $3\frac{1}{2}$ | .095 | $3\frac{1}{4}$ | .102 | 3 | .111 | $2\frac{7}{8}$ | .115 | $2\frac{3}{4}$ | .121 | $2\frac{1}{2}$ | .133 | $2\frac{1}{4}$ | .148 | 2 | .167 |
| A | B | $7\frac{1}{2}$ | .044 | 7 | .047 | $6\frac{1}{2}$ | .051 | 6 | .055 | $5\frac{3}{4}$ | .057 | $5\frac{1}{2}$ | .960 | 5 | .067 | $4\frac{1}{2}$ | .074 | 4 | .083 |
| B | B | 15 | .022 | 14 | .023 | 13 | .025 | 12 | .028 | $11\frac{1}{2}$ | .029 | 11 | .030 | 10 | .033 | 9 | .037 | 8 | .041 |
| C | B | 30 | .011 | 28 | .012 | 26 | .013 | 24 | .014 | 23 | .015 | 22 | .015 | 20 | .016 | 18 | .018 | 16 | .020 |
| D | B | 60 | .0055 | 56 | .0059 | 52 | .0064 | 48 | .0069 | 46 | .0072 | 44 | .0075 | 40 | .008 | 36 | .009 | 32 | .010 |

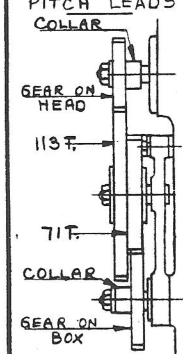
GEARS FOR COARSE THREADS




COARSE THREADS (LEAD IN INCHES) — SET SELECTOR LEVER FOR COARSE THREADS

| GEAR ON HEAD | GEAR ON BOX | LEVER ON BOX | LEVER ON HEAD: A | B | A | B | A | B | A | B | A | B | A | B | A | B | A | B | A | B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | 36 | B | | | | | | | | | | | | | | | | | 12 | $1\frac{1}{2}$ |
| | | C | | | | | | | | | | | | | | | | | 6 | $\frac{3}{4}$ |
| | | D | | | | | | | | | | | | | | | | | 3 | $\frac{3}{8}$ |
| 44 | 36 | B | | | | | | | | | | | | | | | | | | $2\frac{3}{4}$ |
| | | C | | | | | | | | | | | | | | | | | 11 | $1\frac{3}{8}$ |
| | | D | | | | | | | | | | | | | | | | | $5\frac{1}{2}$ | $\frac{11}{16}$ |
| 40 | 36 | B | | | | | | | | | | | | | | | | | | $2\frac{1}{2}$ |
| | | C | | | | | | | | | | | | | | | | | 10 | $1\frac{1}{4}$ |
| | | D | | | | | | | | | | | | | | | | | 5 | $\frac{5}{8}$ |
| 36 | 36 | B | | | | | | | | | | | | | | | | | | $2\frac{1}{4}$ |
| | | C | | | | | | | | | | | | | | | | | 9 | $1\frac{1}{8}$ |
| | | D | | | | | | | | | | | | | | | | | $4\frac{1}{2}$ | $\frac{9}{16}$ |
| 32 | 36 | B | | | | | | | | | | | | | | | | | | 2 |
| | | C | | | | | | | | | | | | | | | | | 8 | 1 |
| | | D | | | | | | | | | | | | | | | | | 4 | $\frac{1}{2}$ |
| 30 | 36 | B | | | | | | | | | | | | | | | | | | $1\frac{7}{8}$ |
| | | C | | | | | | | | | | | | | | | | | $7\frac{1}{2}$ | $\frac{15}{16}$ |
| | | D | | | | | | | | | | | | | | | | | $3\frac{3}{4}$ | $\frac{15}{32}$ |
| 28 | 36 | B | | | | | | | | | | | | | | | | | | $1\frac{3}{4}$ |
| | | C | | | | | | | | | | | | | | | | | 7 | $\frac{7}{8}$ |
| | | D | | | | | | | | | | | | | | | | | $3\frac{1}{2}$ | $\frac{7}{16}$ |
| 26 | 36 | B | | | | | | | | | | | | | | | | | | $1\frac{5}{8}$ |
| | | C | | | | | | | | | | | | | | | | | $6\frac{1}{2}$ | $\frac{13}{16}$ |
| | | D | | | | | | | | | | | | | | | | | $3\frac{1}{4}$ | $\frac{13}{32}$ |

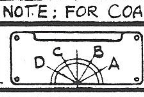
GEARS FOR DIAMETRAL PITCH LEADS




DIAMETRAL PITCH LEADS

| GEAR ON HEAD | GEAR ON BOX | LEVER ON BOX | LEVER ON HEAD | LEAD | PITCH | LEAD | PITCH | LEAD | PITCH | LEAD | PITCH | LEAD | PITCH | LEAD | PITCH | LEAD | PITCH | LEAD | PITCH | LEAD | PITCH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | SELECTOR LEVER SET FOR FINE THREADS. | | | | | | | | | | | | | | | | | |
| 50 | 60 | A | A | | | | | | | $\frac{\pi}{3}$ | 3P. | | | | | $\frac{2\pi}{5}$ | $2\frac{1}{2}$P. | | | $\frac{\pi}{2}$ | 2P. |
| | | B | A | | | $\frac{\pi}{7}$ | 7P | | | $\frac{\pi}{6}$ | 6P. | | | | | $\frac{\pi}{5}$ | 5P. | | | $\frac{\pi}{4}$ | 4P. |
| | | C | A | $\frac{\pi}{15}$ | 15P. | $\frac{\pi}{14}$ | 14 P. | $\frac{\pi}{13}$ | 13P. | $\frac{\pi}{12}$ | 12P. | | | $\frac{\pi}{11}$ | 11P. | $\frac{\pi}{10}$ | 10P. | $\frac{\pi}{9}$ | 9P. | $\frac{\pi}{8}$ | 8P. |
| | | A | B | $\frac{\pi}{30}$ | 30P. | $\frac{\pi}{28}$ | 28P. | $\frac{\pi}{26}$ | 26P. | $\frac{\pi}{24}$ | 24P. | $\frac{\pi}{23}$ | 23P. | $\frac{\pi}{22}$ | 22P. | $\frac{\pi}{20}$ | 20P. | $\frac{\pi}{18}$ | 18P. | $\frac{\pi}{16}$ | 16P. |
| | | B | B | $\frac{\pi}{60}$ | 60P. | $\frac{\pi}{56}$ | 56P. | $\frac{\pi}{52}$ | 52P. | $\frac{\pi}{48}$ | 48P. | $\frac{\pi}{46}$ | 46P. | $\frac{\pi}{44}$ | 44P. | $\frac{\pi}{40}$ | 40P. | $\frac{\pi}{36}$ | 36P. | $\frac{\pi}{32}$ | 32P. |
| | | | | SELECTOR LEVER SET FOR COARSE THREADS. | | | | | | | | | | | | | | | | | |
| 35 | 63 | A | A | | | | | | | $\frac{8\pi}{3}$ | $\frac{3}{8}$P. | | | | | $\frac{16\pi}{5}$ | $\frac{5}{16}$P. | | | $4\pi$ | $\frac{1}{4}$P. |
| | | B | A | | | | | | | $\frac{4\pi}{3}$ | $\frac{3}{4}$P. | | | | | $\frac{8\pi}{5}$ | $\frac{5}{8}$P. | | | $2\pi$ | $\frac{1}{2}$P. |
| | | C | A | | | | | | | $\frac{2\pi}{3}$ | $1\frac{1}{2}$P. | | | | | $\frac{4\pi}{5}$ | $1\frac{1}{4}$P. | | | $\pi$ | 1P. |
| | | A | B | | | | | | | $\frac{\pi}{3}$ | 3P. | | | | | $\frac{2\pi}{5}$ | $2\frac{1}{2}$P. | | | $\frac{\pi}{2}$ | 2P. |
| | | B | B | | | $\frac{\pi}{7}$ | 7P. | | | $\frac{\pi}{6}$ | 6P. | | | | | $\frac{\pi}{5}$ | 5P. | | | $\frac{\pi}{4}$ | 4P. |
| | | C | B | $\frac{\pi}{15}$ | 15P. | $\frac{\pi}{14}$ | 14 P. | $\frac{\pi}{13}$ | 13P. | $\frac{\pi}{12}$ | 12P. | | | $\frac{\pi}{11}$ | 11P. | $\frac{\pi}{10}$ | 10P. | $\frac{\pi}{9}$ | 9P. | $\frac{\pi}{8}$ | 8P. |
| | | D | B | $\frac{\pi}{30}$ | 30P. | $\frac{\pi}{28}$ | 28P. | $\frac{\pi}{26}$ | 26P. | $\frac{\pi}{24}$ | 24P. | $\frac{\pi}{23}$ | 23P. | $\frac{\pi}{22}$ | 22P. | $\frac{\pi}{20}$ | 20P. | $\frac{\pi}{18}$ | 18P. | $\frac{\pi}{16}$ | 16P. |

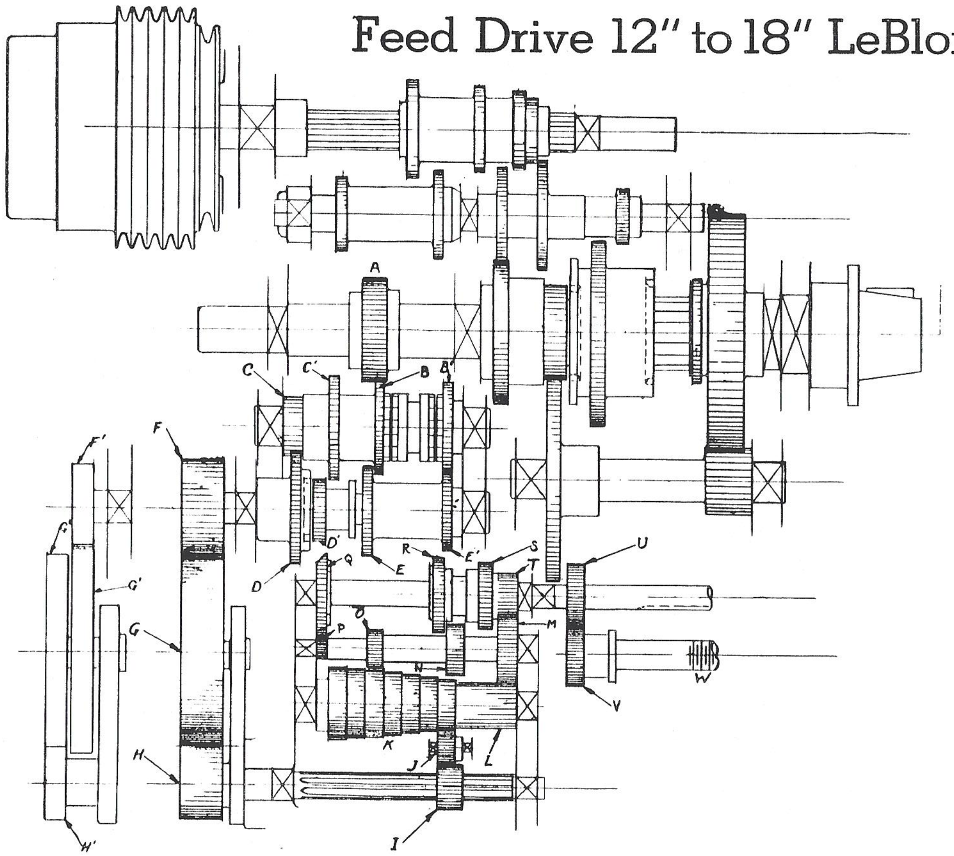
NOTE: FOR COARSE THREADS AND DIAMETRAL PITCH LEADS, THROW LARGE SPEED LEVER TO EXTREME LEFT POSITION.

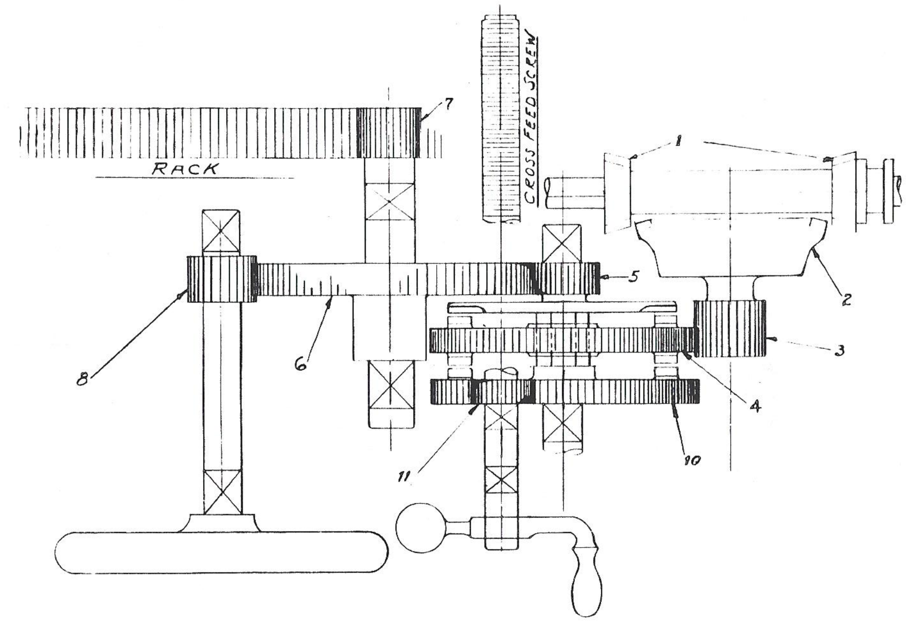



OIL TUMBLER IN THIS POSITION

ND-120A-5-S

# Feed Drive 12" to 18" LeBlond Heavy Duty Engine Lathe




*Feed Drive*

The LeBlond Heavy Duty Engine Lathes are equipped with gear drive from headstock to quick change box. The gear A on the spindle drives the feed reverse gears B—B′. From this shaft the feed comes through compound mechanism D—D′—E—E′. This is controlled by compound shifter lever on the head and is specified on the feed plate in the right hand column as A and B. At this point the feed drive comes from the head through the quadrant idler to the feed box, namely F, G, H. The feed drive enters the feed box through a splined shaft with a sliding tumbler gear and pinion I and J engaging in cone gears K. The lever on the box with the positions A, B, C and D controls the feed through gears Q, R, S and T which drive the feed rod. The gear U on the feed rod drives the sliding gear V on the lead screw.

From the quick change box the power is transmitted to the apron by either the lead screw (for chasing threads only) or the feed rod. Engaging the feed rod the bevel pinions No. 1 reverse the travel of the carriage or cross slide when engaged with the bevel gear No. 2. The pinion No. 3 drives the clutch gear No. 4 which can be engaged to drive cross feed gear No. 10 or the longitudinal gear No. 5, the latter driving gear No. 6 which is mounted on the rack stud with rack pinion No. 7.

Cross feed pinion No. 11 is pressed on the cross feed screw and is engaged with gear No. 10 for power movement of the cross slide. The gear No. 8 is mounted on the handwheel shaft and drives through No. 6 to the rack wheel pinion for manual longitudinal feed.

# Cutting Speeds

*Cutting speed for turning or boring is the speed and feed per minute at which the surface of the work passes the cutting tool*

For efficient operation of your lathe, the proper surface speed of work being machined must be maintained. If the speed is too slow, the job takes longer than necessary and oftentimes the work produced is unsatisfactory. On the other hand, if the speed is too great, the tool edge will be worn down too rapidly. Frequent grinding will be necessary, which is also wasteful. For ordinary production work the speed should be as great as the tool will stand without requiring sharpening more often than every two or three hours when cutting continuously.

## APPROXIMATE CUTTING SPEEDS

For Turning and Boring with "High-Speed" Steels

| MATERIAL | Roughing Cutting Speed, Feet per Minute | Finishing Cutting Speed, Feet per Minute |
|---|---|---|
| Cast Iron | 60 | 120 |
| Mild Machine Steel | 80 | 150 |
| Alloy Steel* | 50 | 90 |
| Bronze | 100 | 150 |
| Brass | 200 | 300 |
| Aluminum | 250 | 400 |

*Data for average alloy steel annealed.

The above table gives the approximate cutting speeds which can be maintained with various materials for rough and finish cuts. The surface speed is found by multiplying the length of the periphery in feet by the revolutions per minute of the work. Thus, the cutting speed for a 4″ diameter rotating at 60 R.P.M. will be $\frac{4 \times 3.1416}{12}$ x 60, or 62.83′ per minute. The formula for surface speed is diameter in inches times "$\pi$" (3.1416) times the R.P.M. divided by twelve inches, giving the answer in feet per minute.

To save time, a chart can be made that will give the cutting speed for a number of diameters at varying speeds. Even better is the use of an instrument called a "cut-meter" which is applied to a rotating part to show the cutting speed in feet per minute. This is similar to the well-known tachometer or revolution counter, but is arranged to show the cutting speed in feet per minute.

The cutting speeds possible are greatly affected by the use or absence of a suitable cutting fluid. Thus steel, which can be rough turned dry at 60′ per minute, can be rough turned at about 80′ or 90′ per minute when flooded with a good cutting lubricant.

When roughing parts down to size, use the greatest depth of cut and feed per revolution that the work, the machine and the tool will stand at the highest practicable speed. On

# Cutting Speeds

many pieces where tool failure is the limiting factor in the size of roughing cut, it is usually possible to slightly reduce the speed and increase the feed to a point where the metal removed is much greater with longer tool life.

For example: Where the depth of cut is 1/4″, the feed 20 thousandths of an inch per revolution and the speed 80 feet per minute. If the tool will not permit additional feed at this speed, it is usually possible to drop the speed to 60′ per minute and increase the feed to about 40 thousandths of an inch per revolution without having tool trouble.

In this case, the speed is reduced 25% but the feed increased 100%, so that the actual time required to complete the work is less.

To find the time in minutes for taking a cut, divide the total length of the cut, in inches, by the revolutions per minute times the feed per revolution, in inches. Thus a 12″ length of a turned surface at a lathe speed of 60 R.P.M. and the feed per work revolution set at .050 inch; would be figured as follows:

$$\text{Time for cut} = \frac{12}{60 \times 0.050} = 4 \text{ minutes.}$$

Tests have demonstrated that a depth of cut equal to 8 times the feed is a desirable ratio in taking rough cuts. The depth varies for different conditions from 5 to 10 times the feed.

On the finish turning operation, a very light cut is taken since most of the excess stock has been removed on the roughing cut. Due to requirements of the finish, a fine feed can usually be used and still make it possible to run at a high surface speed. A 50% increase in speed over the roughing speed is commonly used. In particular cases the finishing speed may be twice the roughing speed. In any event to secure the maximum speed in this operation the work should be run as fast as the tool will properly allow. A sharp tool should be used when finish turning. The tool should be rewhetted to a keen edge if the same tool is used for roughing and finishing.

# Tantalum and Tungsten Carbide Tools

With the increasing use of carbide alloys, this additional data for their use is important. The following table has been added as a guide.

Tantalum-carbide tools were used for materials marked with asterisks (*), Column 2. Tungsten carbide was used for all other examples. These speeds and feeds are intended as a general guide only. The rigidity of the machine and tool support, interrupted cuts and other factors result in wide variation in practice.

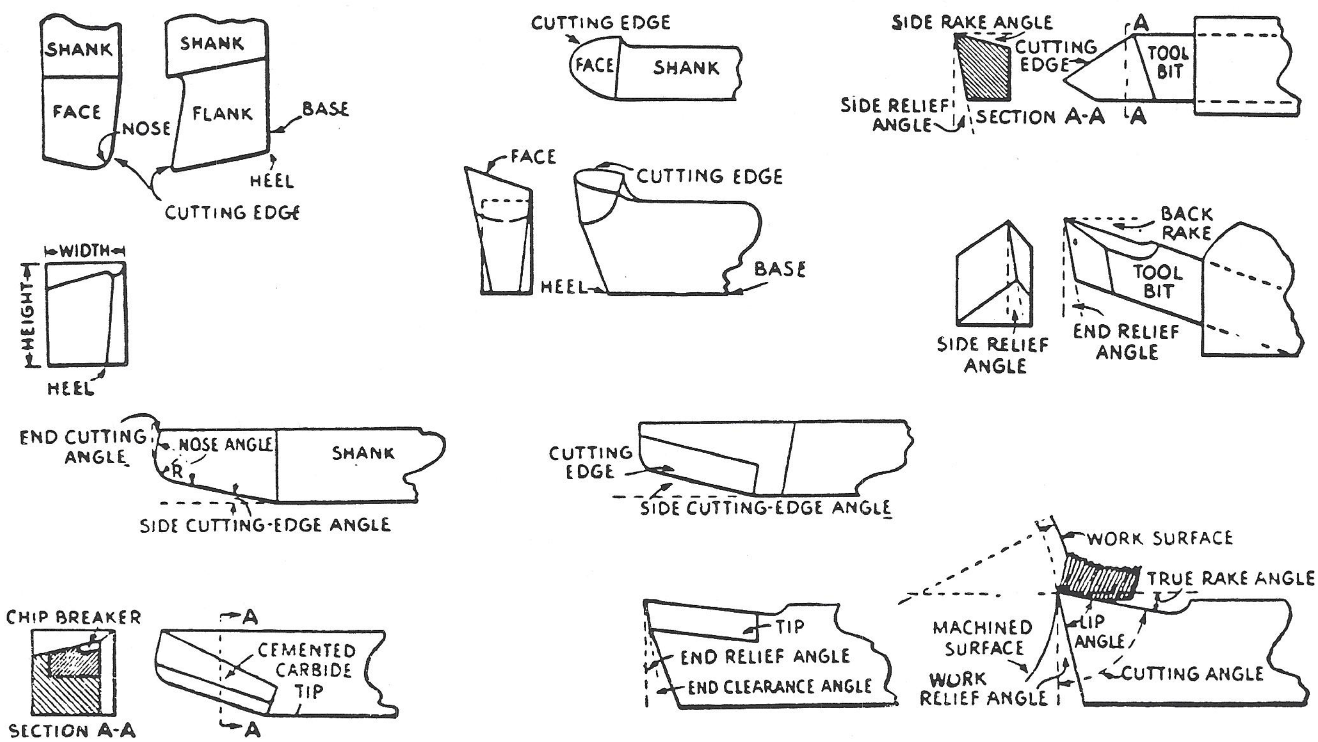
# Cutting Speeds

## CUTTING SPEEDS AND FEEDS FOR CEMENTED-CARBIDE TOOLS

| Machining Operation | Kinds of Material | Cutting Speed, Ft. per Minute | Depth of Cut, Inch | Rate of Feed Per Rev. |
|---|---|---|---|---|
| Turning | Cast Iron | 250 | 1/4 | 0.070 |
| | Cast Iron | 210 | 3/8 | 0.062 |
| | Cast Iron (1) | 260 | 3/16 | 0.015 |
| | Cast Iron (2) | 150 | 1/4—3/4 | 0.050 |
| | Semi-Steel (3) | 280 | 1/8 | 0.012 |
| | Semi-Steel | 300 | .... | .... |
| | *Semi-Steel | 225 | .... | 0.028 |
| | *Semi-Steel | 286 | 5/32 | 0.015 |
| | *Chilled C. I. | 62 | 3/8 | .... |
| | *S. A. E. 52100 | 185 | 1/8—5/16 | 0.020 |
| | *Tool Steel 1.10% | 140 | 1/2 | 0.020 |
| | Silicon Steel | 500 | .... | .... |
| | Carbon Steel, 0.90% | 500 | .... | .... |
| | Bronze | 400 | .... | 0.020 |
| | Bronze | 425 | 3/16 | 0.024 |
| | Bronze | 550 | 1/8 | 0.031 |
| | Brass Casting (4) | 458 | 3/32 | 0.108 |
| | Cast Aluminum | 1000 | .... | .... |
| | Aluminum Alloy | 570 | 1/8 | 0.031 |
| Boring | Cast Iron | 250 | .... | .... |
| | Brass | 350 | .... | .... |
| | Aluminum | 1500 | .... | .... |

(1) Interrupted cut.
(2) Much higher speed possible for lighter cut.
(3) 9 to 17 hours between tool grindings.
(4) Six days between tool grindings.

# Nomenclature of Lathe Tools



# Sharpening Lathe Tools

The successful operation of a lathe and the class of work turned out depend to a great extent on the skill of the operator in grinding his tools. Dull and improperly ground tools throw a heavy strain on the feed mechanism, cause the work to spring and the lathe to chatter.

Lathe tools are made of carbon steel, high-speed steel and alloys such as stellite and cemented carbide. The stellite and cemented carbide tools are becoming more generally used as their cost is reduced. There are but few carbon steel tools used, the general practice is to use high-speed steel tool bits in holders. Determine the kind of tool you are grinding, as carbon and high-speed steel require different treatment. Tools should be marked to show the kind of material from which they are made. A quick and simple way to tell whether a tool is carbon or high-speed steel is to grind the end and watch the sparks. If carbon steel, the wheel will throw a light colored spark and if high-speed steel, the sparks will be a dark red.

Single-point cutting tools used on lathes, boring mills and planers can be ground by hand (offhand) or by machine. Offhand grinding is generally done on double end bench or pedestal grinders. Wet grinders and special tool grinders designed primarily for sharpening cemented carbide tools are sometimes used for high speed and stellite tools.

In machine grinding, the tool is supported rigidly in a chuck or holder and ground semi-automatically to the desired rake and relief or clearance angles. Tool grinders of this class are of two distinct types—those designed for grinding on the periphery of the wheel and those for grinding on the side of a cup or cylinder wheel.

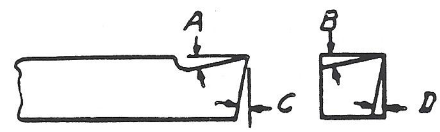
In grinding offhand, the tool should be supported on the work rest and moved with a rocking motion back and forth across the entire face of the grinding heel. This distributes the wear on the wheel and prevents the burning of the tool. Tools used for fine finishing or for cutting soft metals should be stoned lightly with an India oil stone before using and occasionally between grinds. The finish of the work is largely dependent upon the keenness of the tool edge. For roughing cuts on steel, this is not necessary.

The accuracy of a tool ground offhand depends almost entirely on the skill of the operator. In machine grinding, the precise rake and relief angles desired are reproduced by means of dial settings on the grinder. The tool is clamped in a universal adjustable holder and traversed across the face of the grinding wheel, generally by hand. Thus a keen cutting edge is restored with a minimum of grinding and at the same time the original angles of the tool are maintained. Machine grinding is done under a liberal flow of coolant directed at the point of grinding to prevent burning of the tool and to permit the use of harder, more economical wheels.

### *Tool Angles and Shapes*

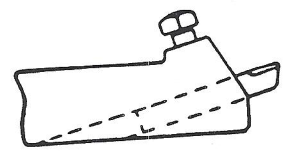
To cut free, a tool or cutter bit must be ground with correct angles on the top face (rake angles) and sides (relief or clearance angles). The shape of the tool, as well as the proper rake and relief angles, depends upon a large number of factors, such as the specific operation, the material to be cut and the material from which the tool is made.

The top rake "A" (127) and page 14, the side rake "B", the front clearance "C" and the side clearance "D".



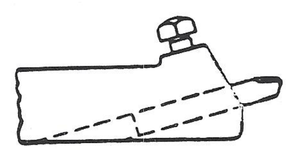

127

The top rake is usually provided for in the tool holder by the tool being set on an angle (128), which is correct for the machining of steel and cast-iron. On solid steel tools it is necessary to grind the top rake in the tool. By adjusting the tool in the tool post through wedge or rocker, this top rake can be varied somewhat to suit the material being turned. The softer the material the less the top rake should be as there is a tendency for the tool to dig in if the rake is too great.



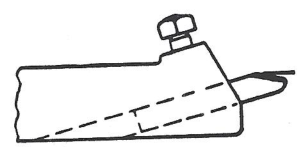
128

For turning brass, there should be no top rake (129) and the cutting edge of the tool should be about horizontal. For turning soft copper, babbitt, and some die casting alloys, a negative rake (130) is often used.

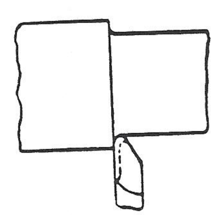


129

The side rake"B"(127) also varies with the material being machined. If this angle is made great enough, the tool will drag the carriage along by feeding into the work of its own accord, especially if the material is soft. On the other hand, without side rake, the tool would not cut and the feed mechanism would be under excessive strain. The proper angle is from 6 degrees for soft material to 15 degrees for steel.



130

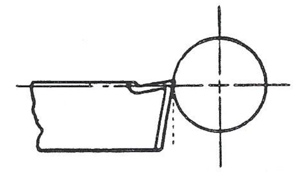


131

The front clearance "C"(127) depends on the diameter work to be turned. To turn cast-iron or steel it is advisable to set the tool above center. If the tool was ground square without any front clearance, it would not cut, but would rub on the material, to be

# Sharpening Lathe Tools

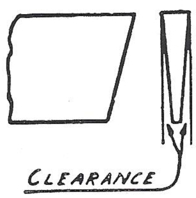
turned, below the cutting edge of the tool (132). The front clearance should be less for small diameters than for large diameters, ranging from 8 to 15 degrees. Do not grind more front clearance than is necessary as this takes away the support from the cutting edge of the tool.



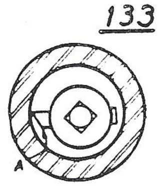
132

The tool is ground with the side clearance "D" (127) to take care of the advance and to prevent the dragging of the tool on the shoulder formed by the cut (131). This angle is usually about 6 degrees from the vertical and is constant.

Tool bits can be ground best in their own holders. To prevent grinding the holder, extend the tool beyond its regular cutting position.

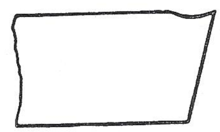



133




135

After a tool has been ground on the emery wheel, it will produce better work and last longer if the cutting edge is stoned with an oil stone. This takes out the wheel marks and gives a smooth cutting edge. Care must be taken in grinding cut-off tools to see that both sides of the tool have the necessary side clearance (133). A tool of this kind also cuts better if a lip is ground back of the cutting edge to curl the chip as it comes off the piece (134).



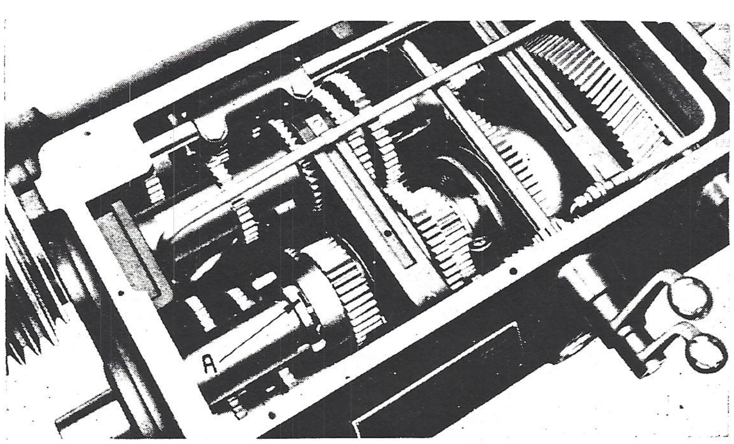
134

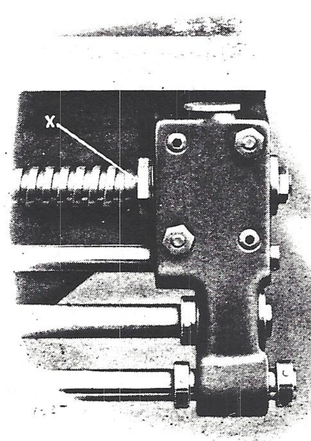
In grinding boring tools, see that the front clearance is sufficient to prevent the tool from rubbing in the hole and dragging at the point "A" (135).

# Adjustments

*Spindle*

In time the roller bearings on the spindle will need adjustment. Straighten leg of the spider washer that is bent into wrench slot of the adjusting nut (A). Then, with a spanner wrench in position on the nut with the hook in one of the slots, tap the wrench handle until you can feel a slight drag on the spindle when you pull the small face plate around by hand. When properly adjusted, bend the leg of spider washer that lines up with a wrench slot.

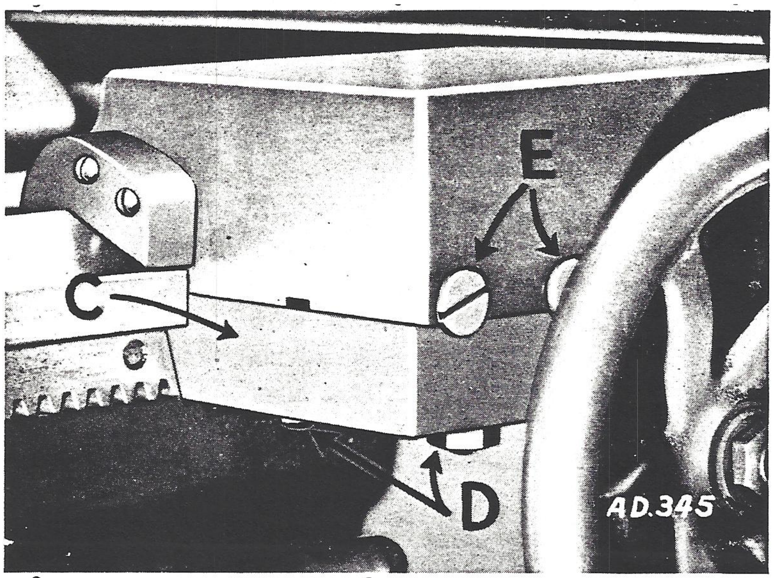


# Adjustments

*Adjustment of the Lead Screw*

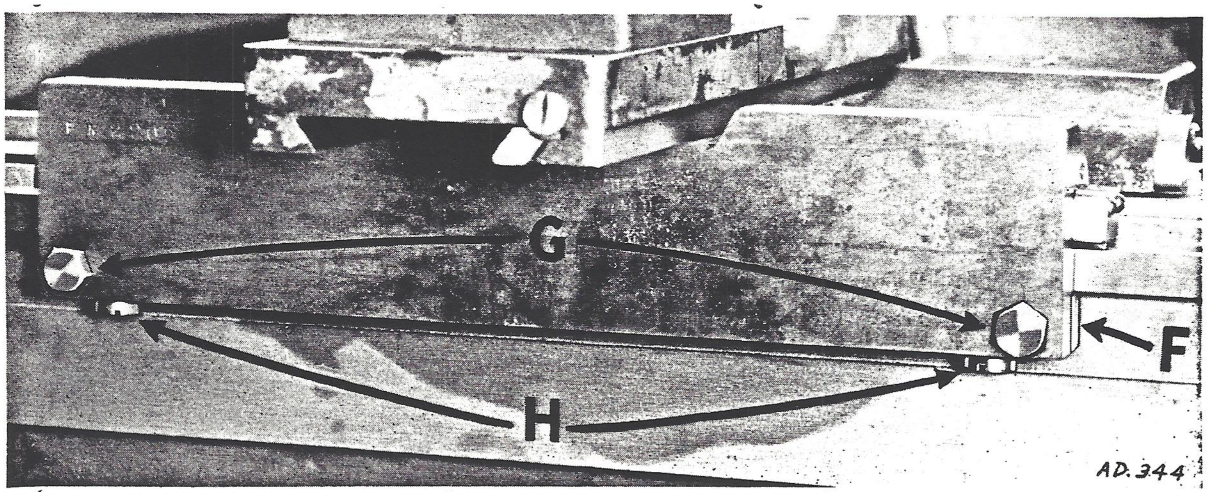
The lead screw is in tension and to maintain its accuracy it must be kept that way. Turn the nut (X) to the right until it is tight, then loosen until screw can be turned by hand. The nut on the end of the screw holds a collar against a shoulder on the screw. The collar is also a stop for the ball thrust bearing. The adjusting nut moves a bush against the ball race.




*Carriage Gibs*

Each of the two front gibs (C) on the carriage are held against the underside of the vee way with two cap screws (D) and against the side of the way with two adjusting set screws (E). To adjust, loosen cap screws (D) on the underside and tighten the two adjusting screws (E) on the side until you can feel a slight pressure of the gib against the side of the way. Proceed in the same manner with the second front gib, then tighten the cap screws in both gibs.

The long straight gib (F) on the rear of the carriage is adjusted in the same manner as the front gibs. Loosen the two cap screws (G) on the back side of carriage and tighten the adjusting screws (H) on the underside of carriage until you feel a slight drag on the gibs. Tighten the cap screws to hold the gibs in position.



# Adjustments

*Clutch and Brake*

This multiple disc clutch is equipped with automatic cone brake. Moving the clutch control handle to the left compresses the clutch driving discs to set the lathe driving shaft in motion. To disengage the clutch, move the clutch control handle to the right. The clutch driving discs then automatically separate and the brake takes hold to stop the lathe driving shaft with a smooth, quick stop, holding it rigid for ease in locking work in chuck or other operations requiring a fixed spindle. When necessary to turn the spindle by hand, it may be entirely disconnected from the driving shaft by throwing the lathe's regular gearshift handles into their neutral position. The speed with which the brake will stop the lathe is affected by the weight of the work piece that is in the lathe. When the spindle is driving a heavy load it will come to a slower stop than when it is without work or driving a lighter piece. Both the clutch clamping discs and the brake run continuously in oil to provide smooth starting, running and stopping. All working surfaces are given excessive area to insure oil-smooth operation for a long period of time with a minimum of adjustment. There are but two simple adjustments: 1 ... the pull pressure of the clutch discs; 2 ... the working clearance of the clutch discs.

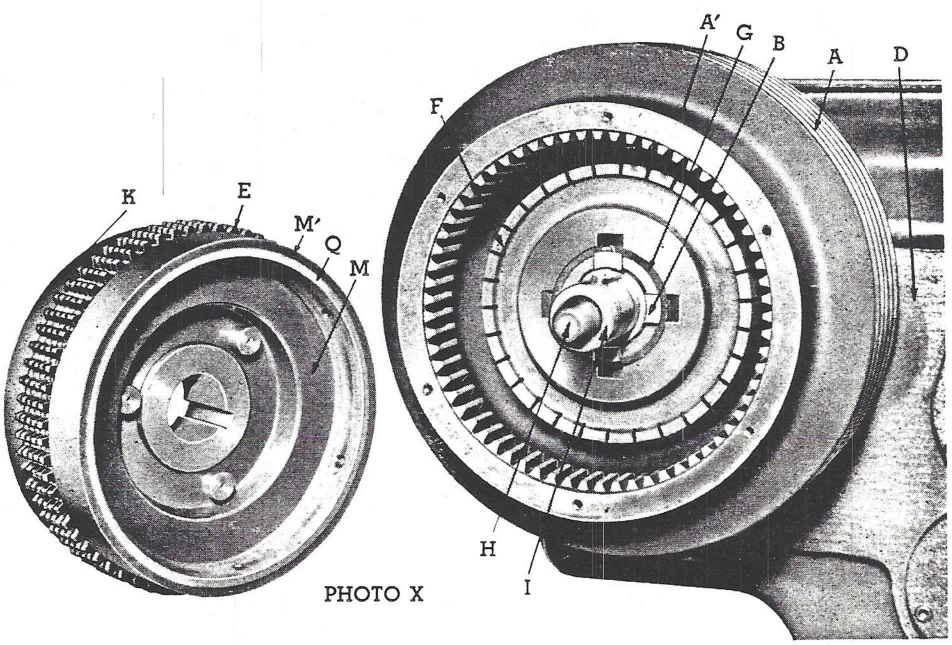



PHOTO X

*Chart "W" and Photos "X-Y-Z" Illustrate the Style F Clutch, 1D Series*

The driving pulley (A) is mounted on a pair of tapered roller bearings (C and C') supported on the pulley bushing (B), chart (W), page 39, which is rigidly bolted to the head of the lathe (D). The driving pulley is extended at the cover to form the clutch housing (A′). The gear teeth cut on the inside diameter of the housing (A′), completely engage the teeth on the outside diameter of the driving discs (E). This is the driving portion of the clutch. The brake shoe (F) is keyed securely to the end of the pulley support bushing and held in position by the snap ring (G). This is the stationary portion of the brake.

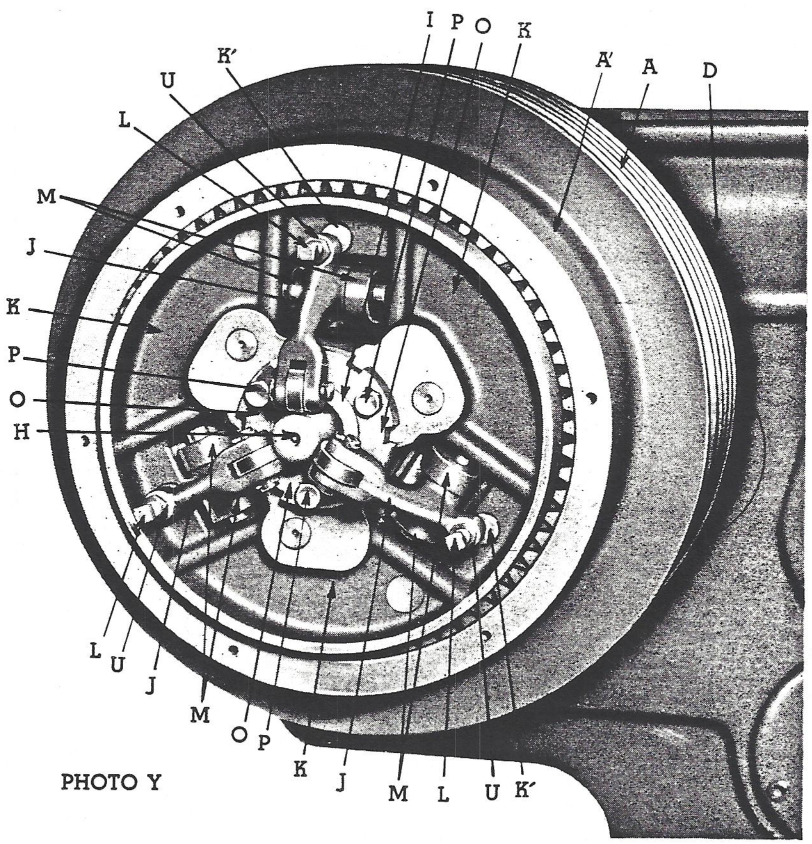



PHOTO Y

The operative portion of the clutch and the brake is controlled by the clutch control handle on the upper front of the lathe which operates the push rod (H) sliding freely in the center of the lathe driving shaft (I). To engage the clutch the push rod is forced out between the clutch fingers (J) which are levers having their fulcrum against pin (K′) in the clutch hub (K) by means of their adjusting screws (L). The clutch fingers (J) are pivotally connected to the driving plate (M) so that the spreading of the fingers pulls the driving plate (M) toward the clutch hub (K), compressing the intermediate clutch discs (N) between them, these are keyed to the central portion of the clutch hub and ride alternately between the driving clutch discs (E). This compressing movement locks the operative and driving clutch parts together to drive the clutch hub and the lathe drive shaft (I) to which the hub is splined. The nut (O) on the drive shaft and the three screws (P) secure the clutch hub to the drive shaft in its properly adjusted position.

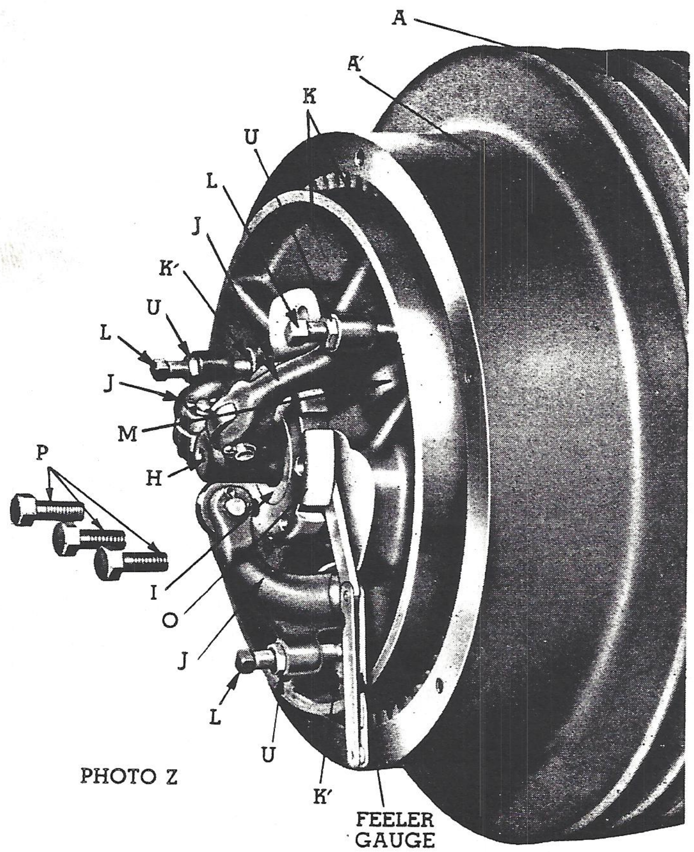



PHOTO Z

The brake (Q) is set into the flange (M′) extending from the reverse side of the driving plate (M). Three springs (R) separate the driving plate (M) and the clutch hub (K) when the push rod is withdrawn from between the clutch fingers by moving the clutch control handle to disengage the clutch. These springs instantly free the clutch discs to avoid any drag between them. They automatically apply the brake (Q) to the brake shoe (F) stopping the lathe driving shaft (I).

# Adjustments

*Adjustments*

There are two adjustments on the LeBlond 1D, Style F Clutch (identical on all three sizes: 3DC, 6DC, 9DC): The first is to set the proper pull of the clutch. The second to set the proper clearance of the clutch discs.

*Checking*

There are also two places where the clutch should be checked:

(1) If the chuck fails to stop in a reasonable time, the loaded heights of the springs should be checked as follows:

Clutch 3 DC 70 lbs. @ $1\frac{5}{16}$" high
Clutch 6 DC 110 lbs. @ $1\frac{1}{4}$" high
Clutch 9 DC 200 lbs. @ $1\frac{13}{32}$" high

(2) Overheating of the oil due to lack of clearance. Oil is circulated through the clutch all the time the driving shaft (I) is running. This circulation stops when the clutch is disengaged leaving sufficient oil in driving pulley to run idle. When the clutch runs idle for a long period, the oil in which the clutch plates run will warm up to possibly 130 to 140 degrees F. If the temperature should go beyond this range, it indicates there is not enough clearance between the clutch plates, and the clutch should be adjusted.

*First Adjustment,* (for pull only)

Adjust or check clutch for pull only. Drain the oil from the clutch (V) and remove the cover (S) by removing screws (T). Put clutch control lever in engaged position. Loosen nuts (U) on the three clutch fingers (J). To increase pull, turn each screw (L) to the right (turn each screw the same amount to keep in balance). Tighten these screws to the point where the belt will begin to slip when the clutch is engaged while the spindle is blocked or held so it cannot turn, or when it requires a pull of about 30 lbs. at the clutch control handle to force the push rod into the engaged position. If even adjustment of the three screws has been made, the end of the push rod will run perfectly central when the clutch is engaged. For best results, balance the screw adjustment so the push rod will run central. When adjustment is correct, tighten the lock nuts (U).

*Second Adjustment,* (for clearance)

Adjust clutch for clearance (after the pull adjustment has been made or found correct). With the oil drained and cover removed, put the clutch control handle in the engaged position. Remove the three screws (P) and tighten nut (O), turning to the right with a spanner wrench, to force the clutch assembly back into the clutch housing, or pulley as far as it will go. Now back off the nut (O) just enough so the screw holes are properly aligned for the screws (P) into the hub. Next, make the proper clearance adjustments as follows:

Clutch 3DC back off nut (O) 5-6 turns.
Clutch 6DC back off nut (O) 1 turn
Clutch 9DC back off nut (O) $1\frac{1}{2}$ turns

This should leave clearance approximately .050, .060, and .090 inches respectively between the clutch hub and the adjusting nut or determined by a feeler gauge. This shows the clearance that will be provided for the clutch plates when the clutch is disengaged. Replacing the screws (P) will draw clutch assembly tight against the nut in its proper operating position.

# Adjustments

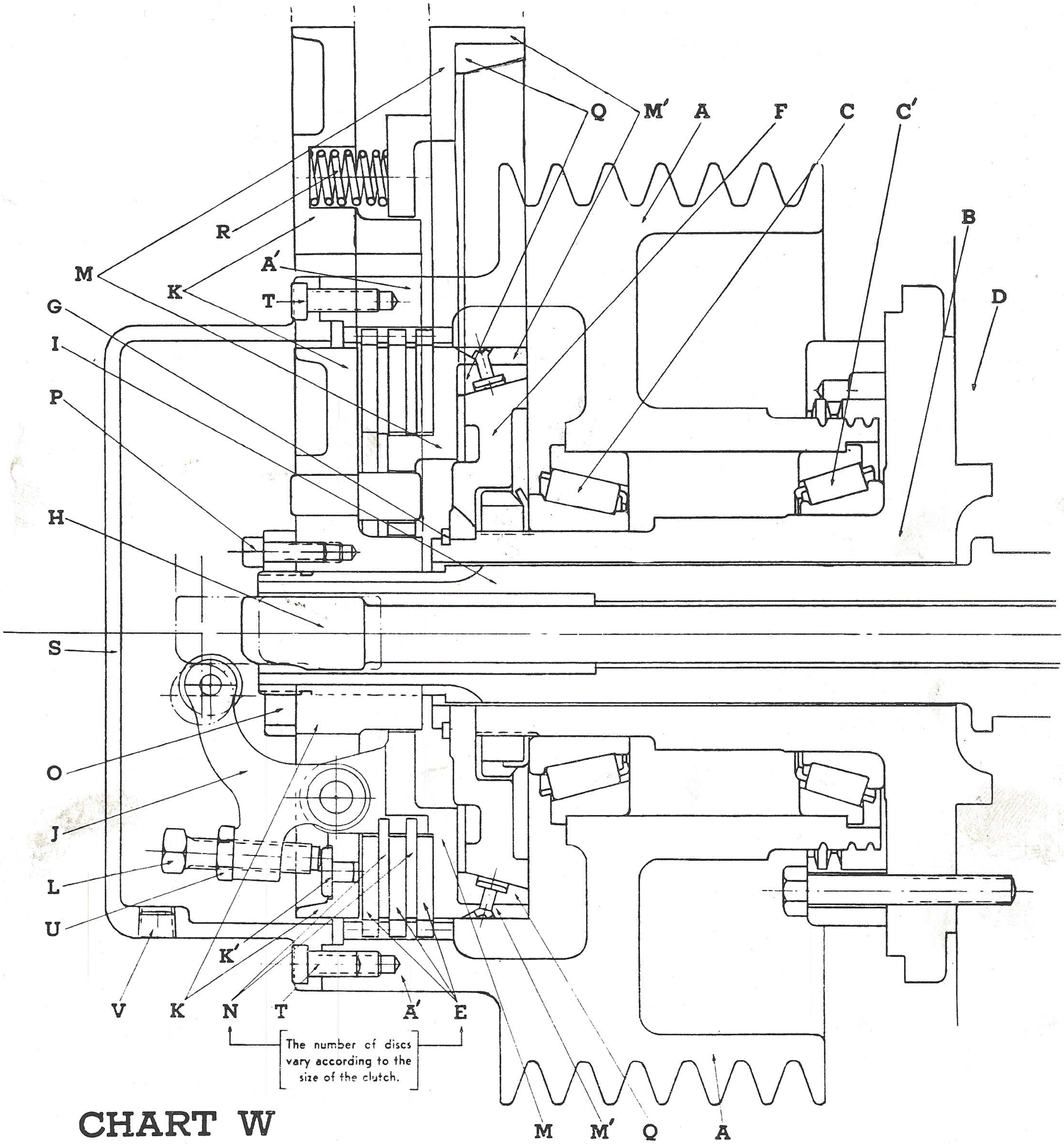



CHART W

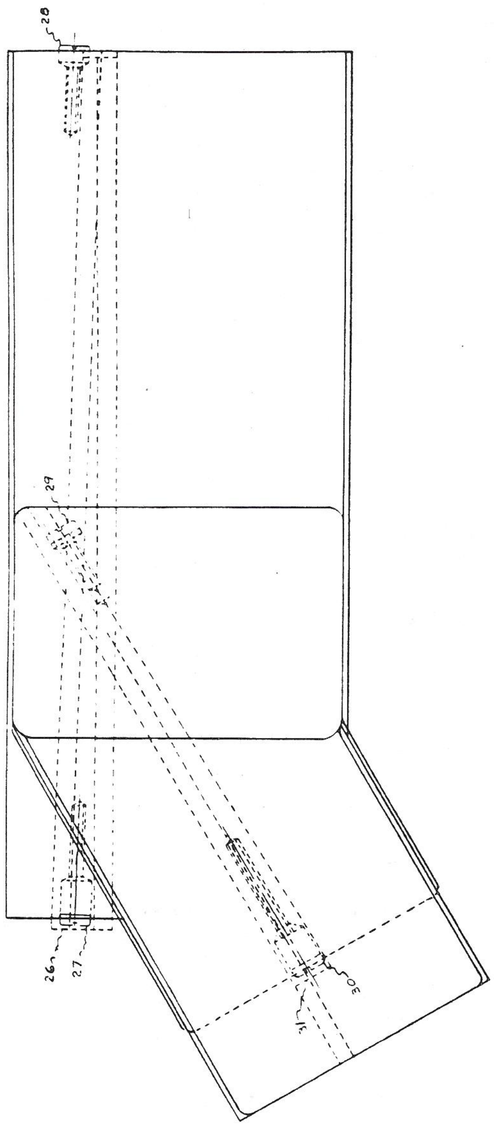
# Repair Parts Section

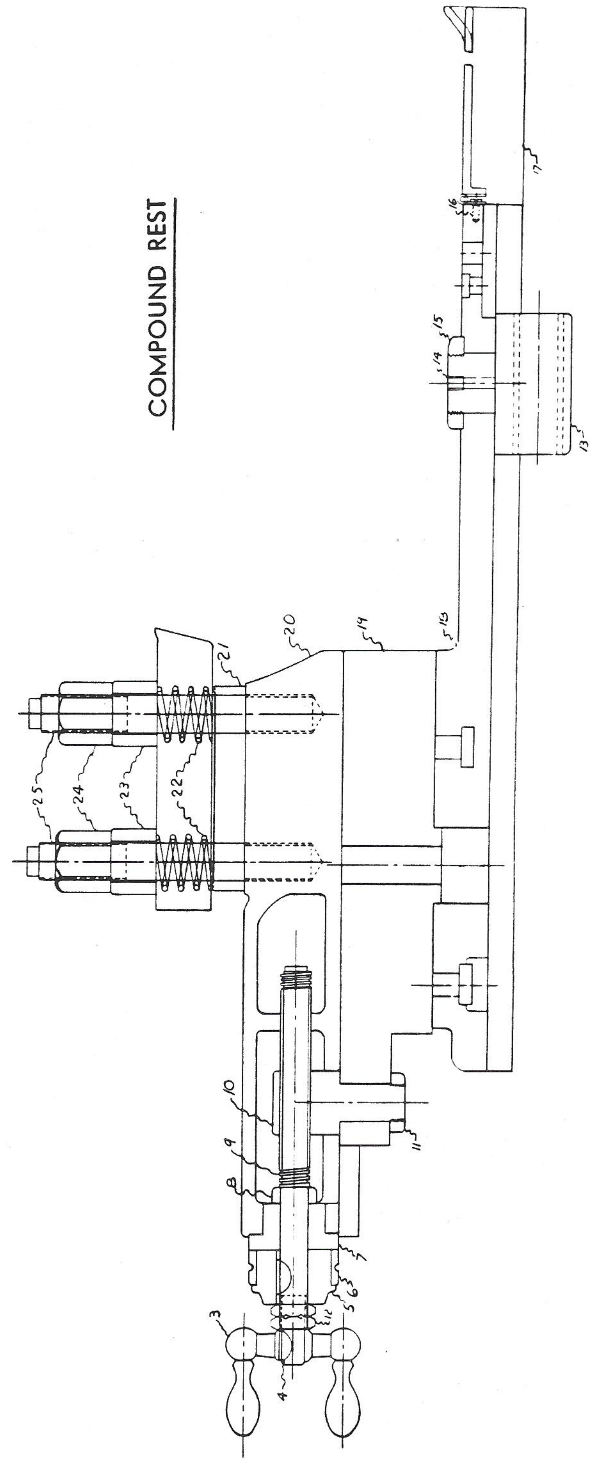
When ordering repair parts it is IMPORTANT for *prompt service* to give the following information in your order:

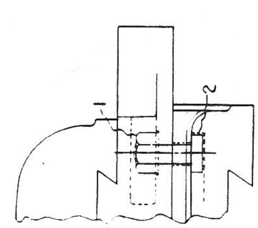
1. Size of lathe.
2. Serial number.
3. Number of part as listed.
4. Quantity wanted.

The serial number is absolutely necessary. It is stamped on the flat surface on the front way at the tailstock end of the bed. The numbers indicating the parts are *not* stock numbers, therefore, the information requested is of prime importance for the prompt handling of your order.

# COMPOUND REST




WHEN ORDERING PARTS, SPECIFY THE LATHE SERIAL NUMBER. THE SERIAL NUMBER IS STAMPED ON THE FRONT WAY ABOUT 2" FROM THE TAILSTOCK END—ALSO GIVE THE CATALOG No. OF THIS PAGE.

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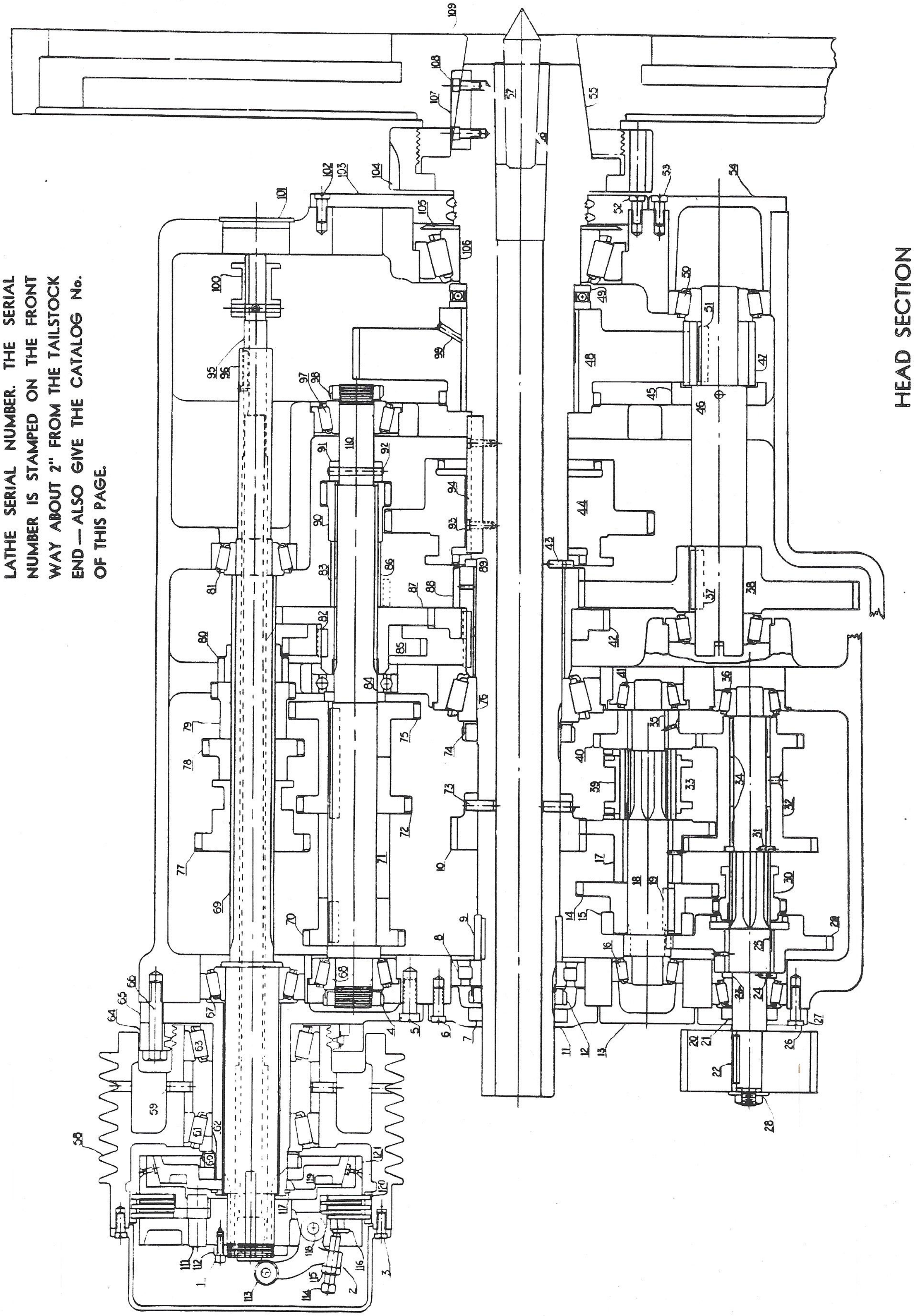
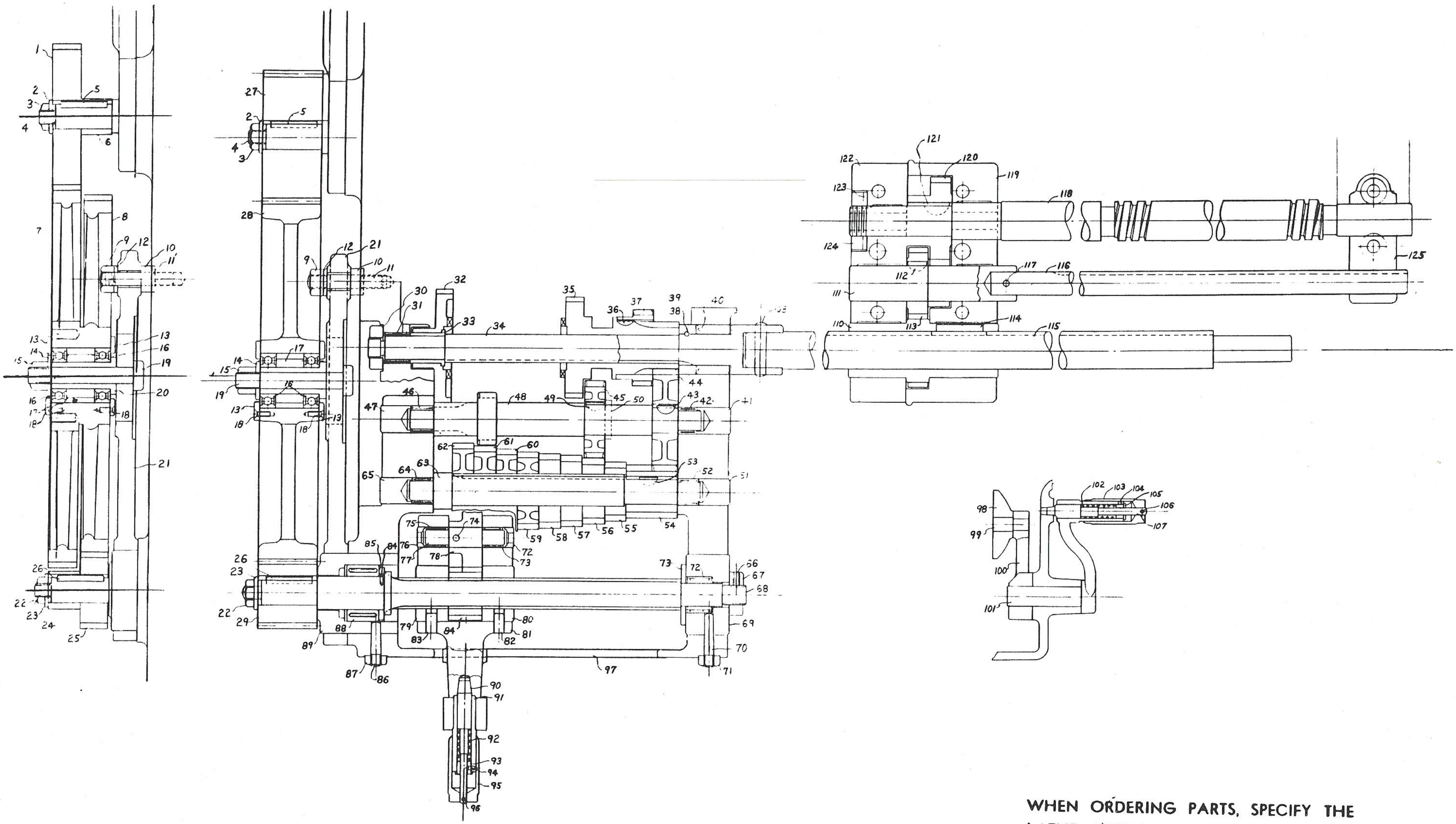


HEAD SECTION

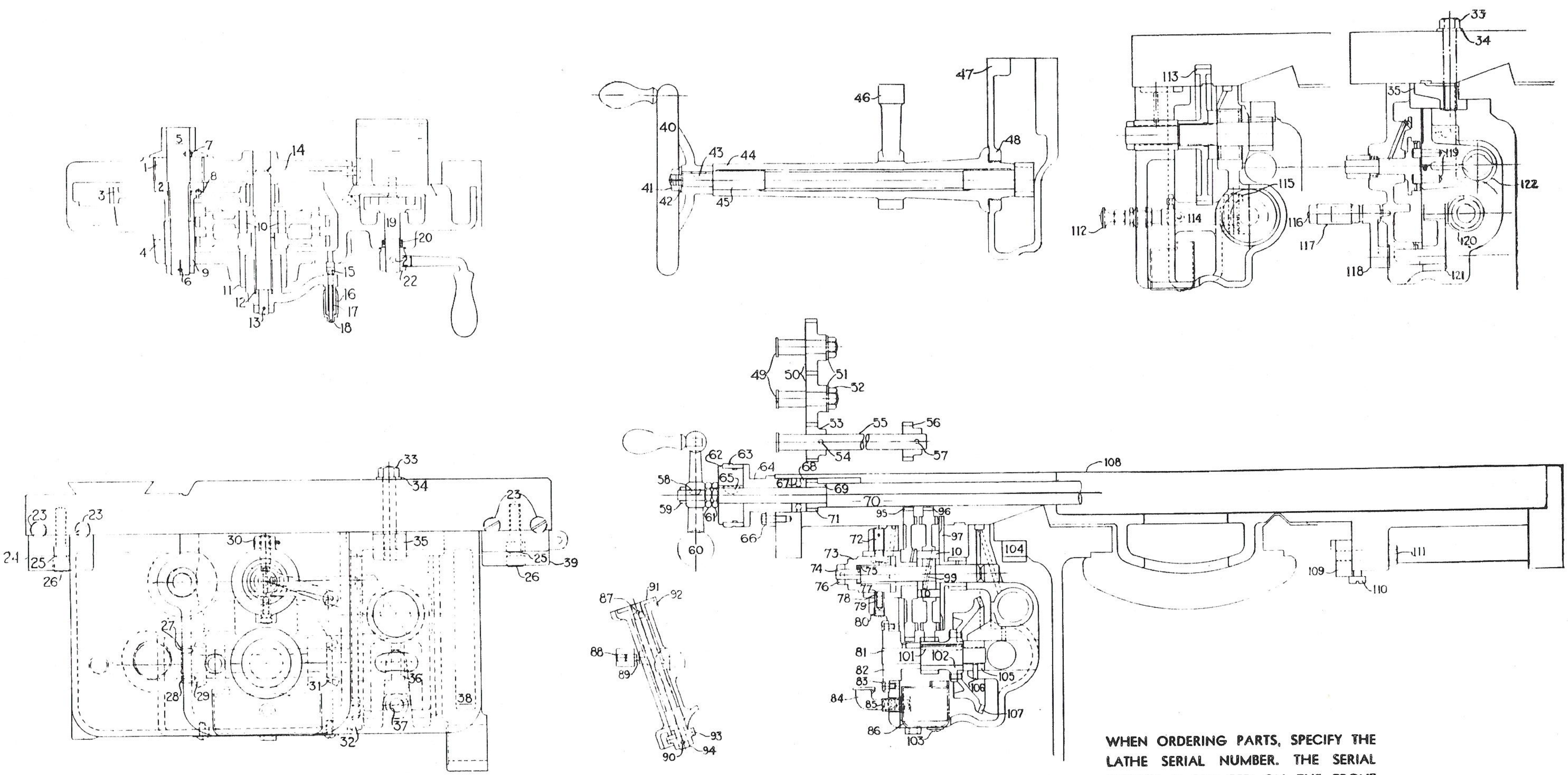
LeBLOND 19"-38" SLIDING BED GAP LATHE

CAT. 311



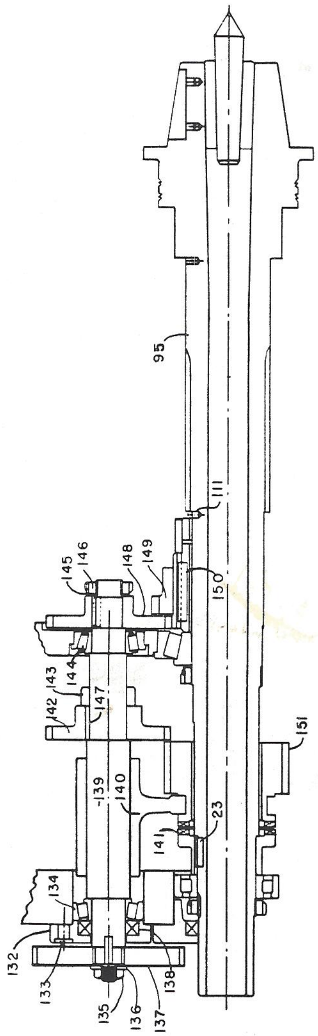
QUICK CHANGE FEED BOX

WHEN ORDERING PARTS, SPECIFY THE LATHE SERIAL NUMBER. THE SERIAL NUMBER IS STAMPED ON THE FRONT WAY ABOUT 2" FROM THE TAILSTOCK END — ALSO GIVE THE CATALOG No. OF THIS PAGE.

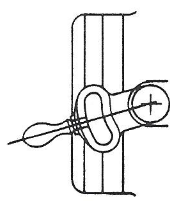


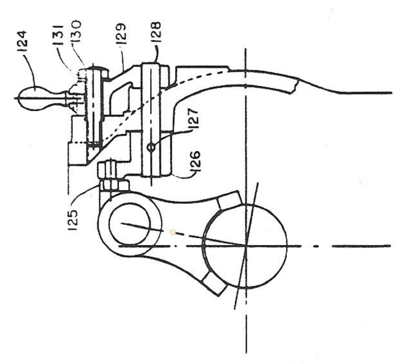
WHEN ORDERING PARTS, SPECIFY THE LATHE SERIAL NUMBER. THE SERIAL NUMBER IS STAMPED ON THE FRONT WAY ABOUT 2" FROM THE TAILSTOCK END — ALSO GIVE THE CATALOG No. OF THIS PAGE.

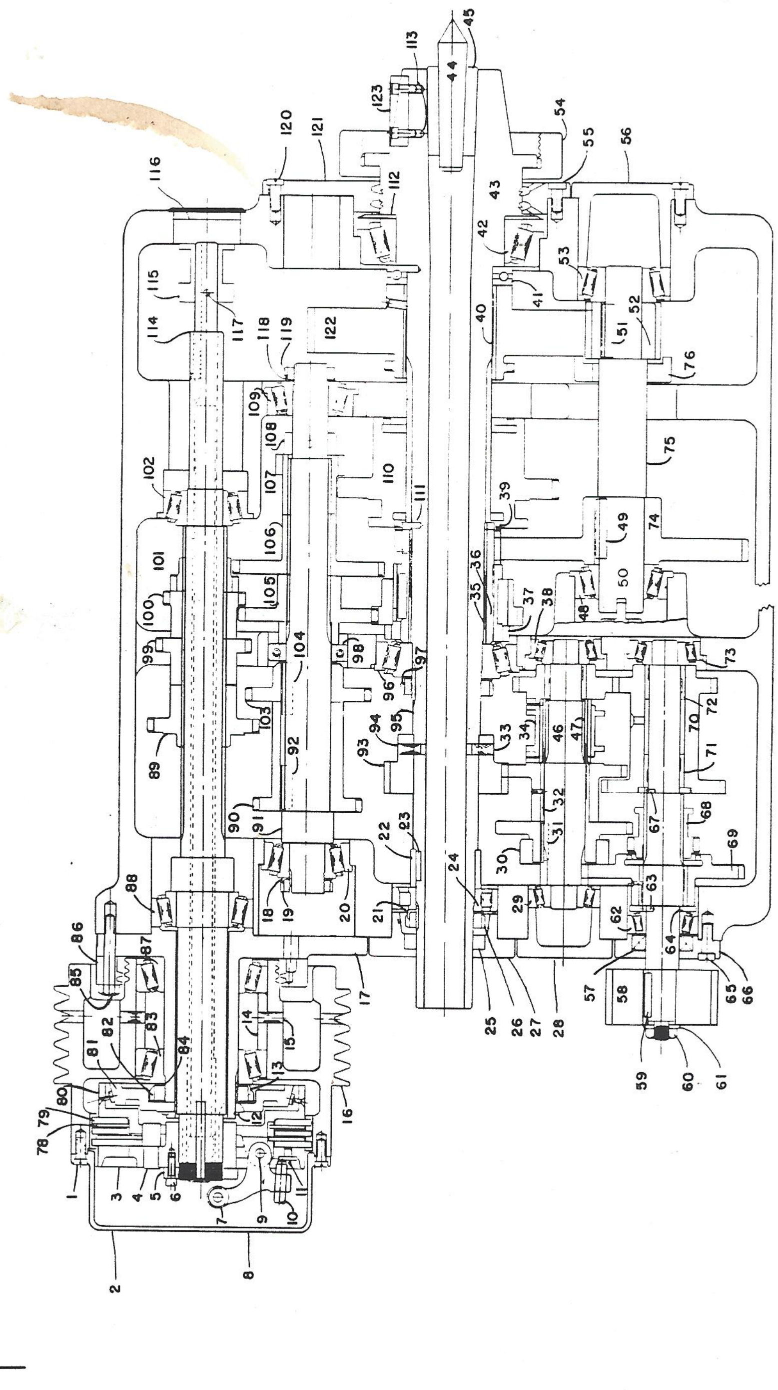
## APRON AND CARRIAGE



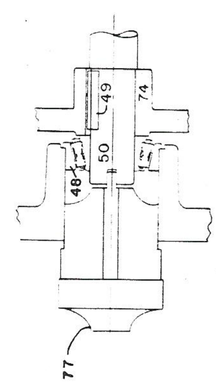
14"-16"-18"- RELIEVING ATTACHMENT DRIVE







HEAD SECTION



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# HEAD SHIFTERS

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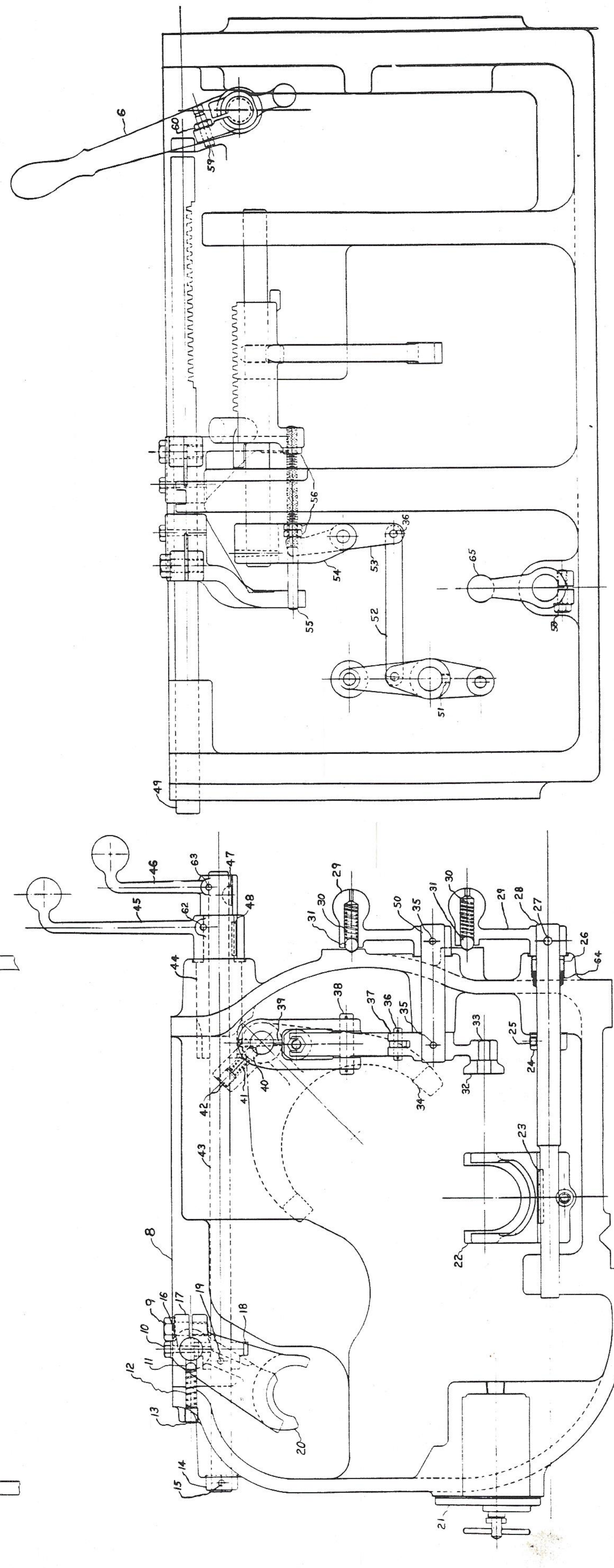

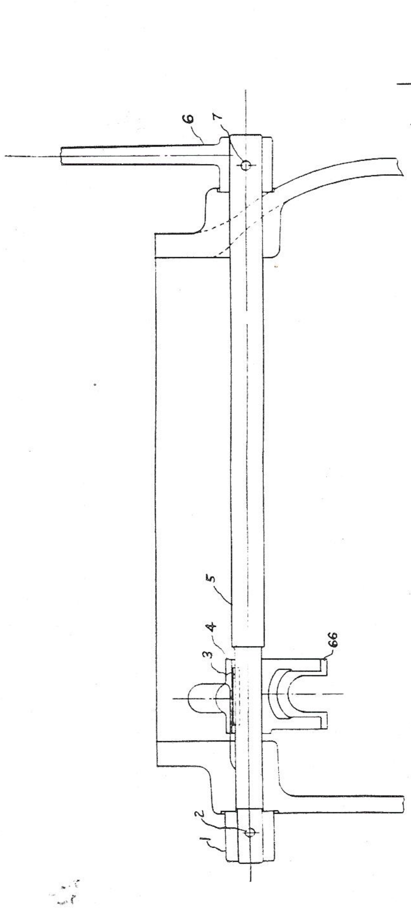

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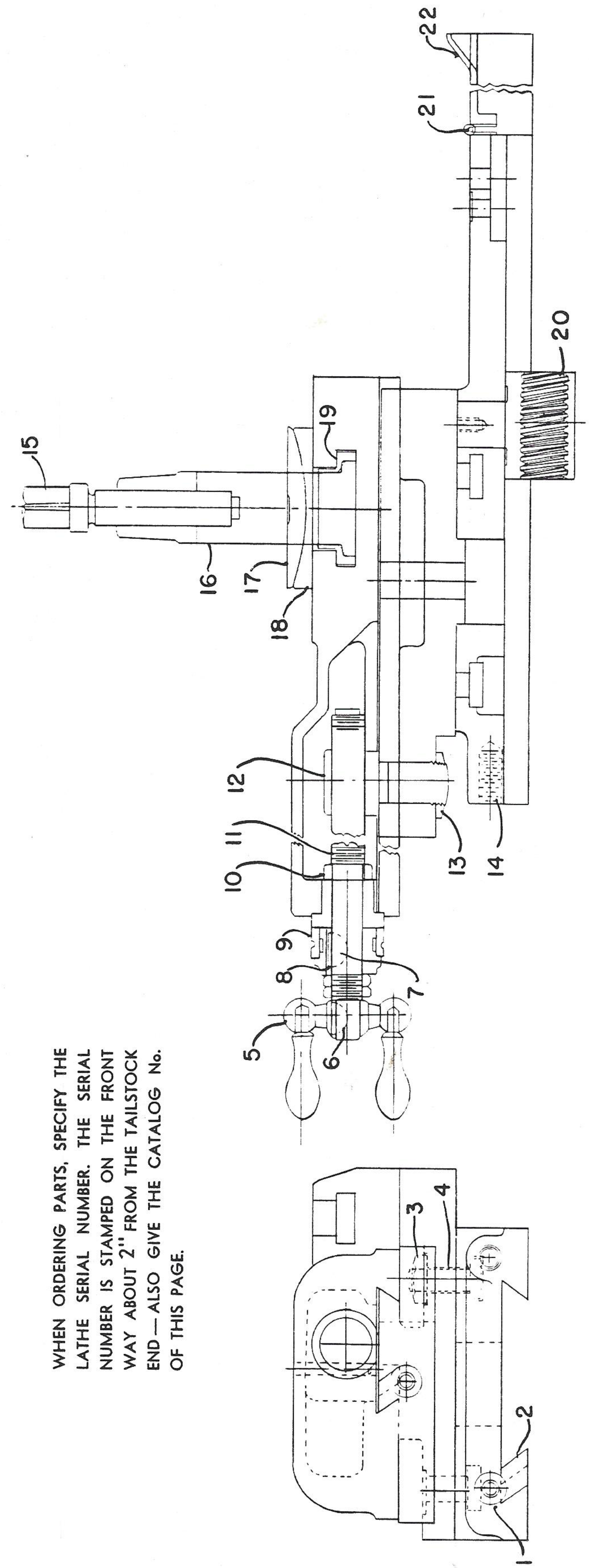
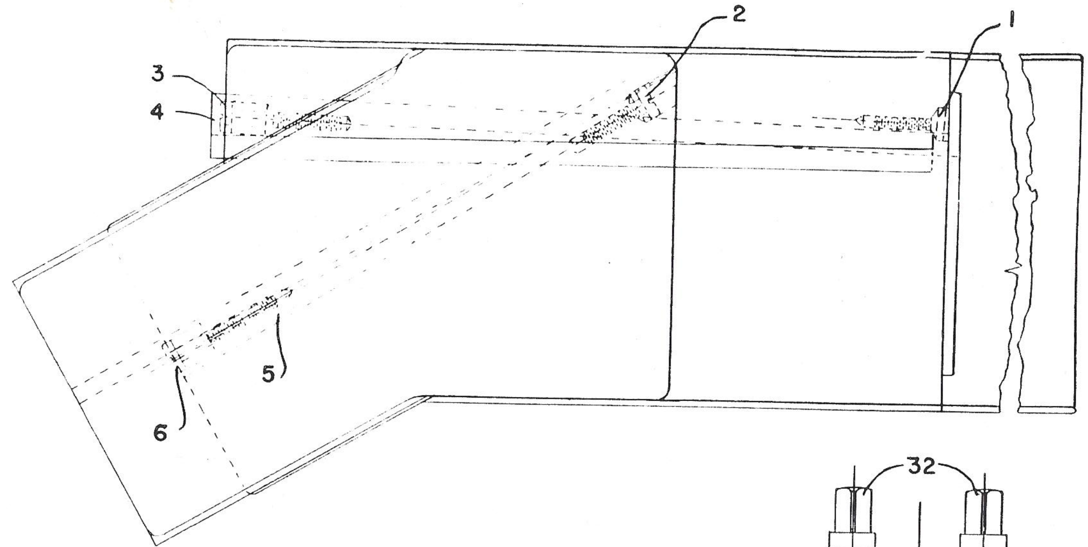
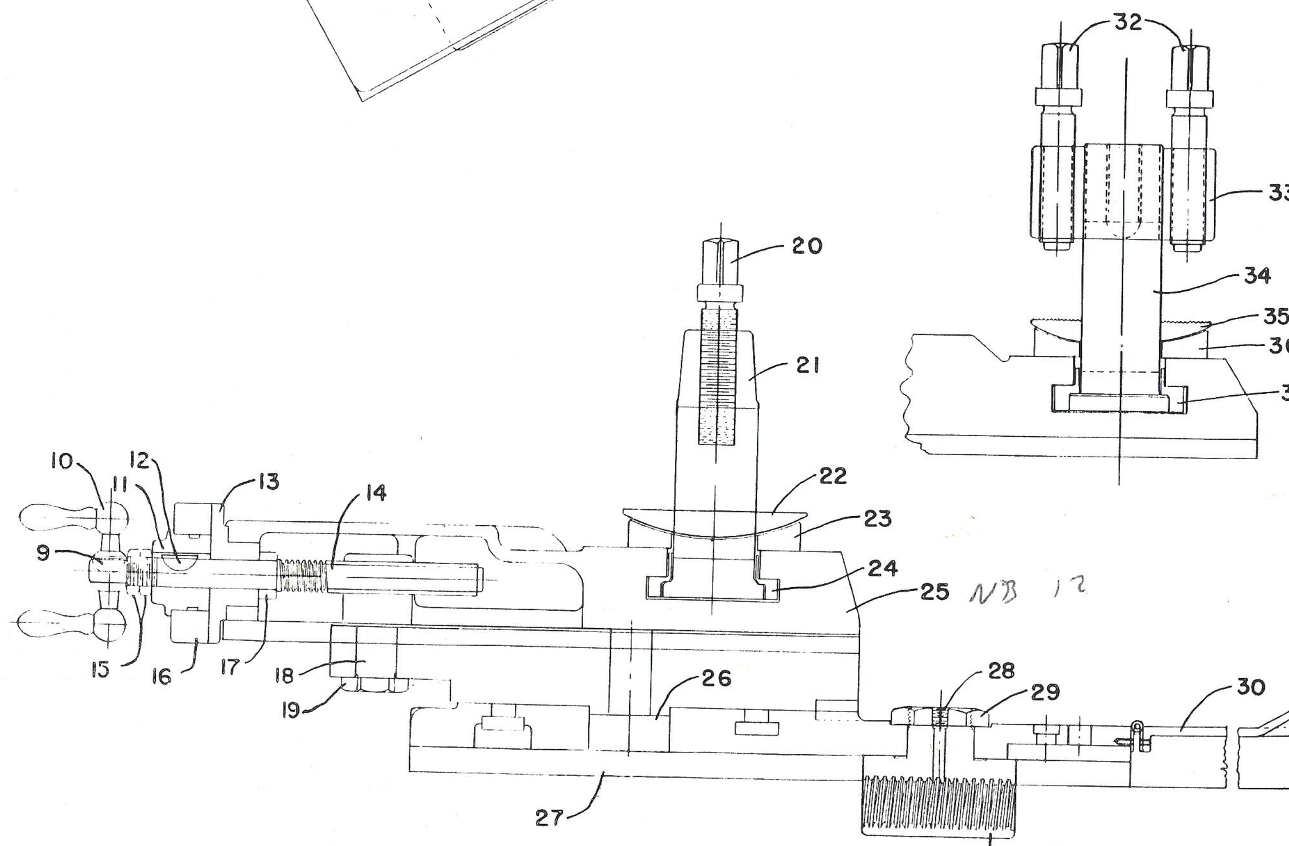


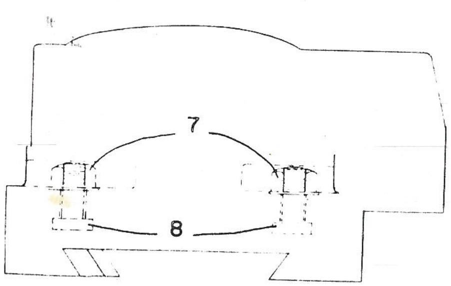

COMPOUND REST (STRAIGHT—12" AND 14")

WHEN ORDERING PARTS, SPECIFY THE LATHE SERIAL NUMBER. THE SERIAL NUMBER IS STAMPED ON THE FRONT WAY ABOUT 2" FROM THE TAILSTOCK END — ALSO GIVE THE CATALOG No. OF THIS PAGE.

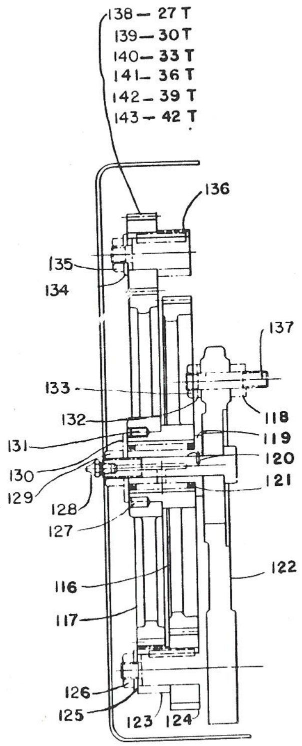


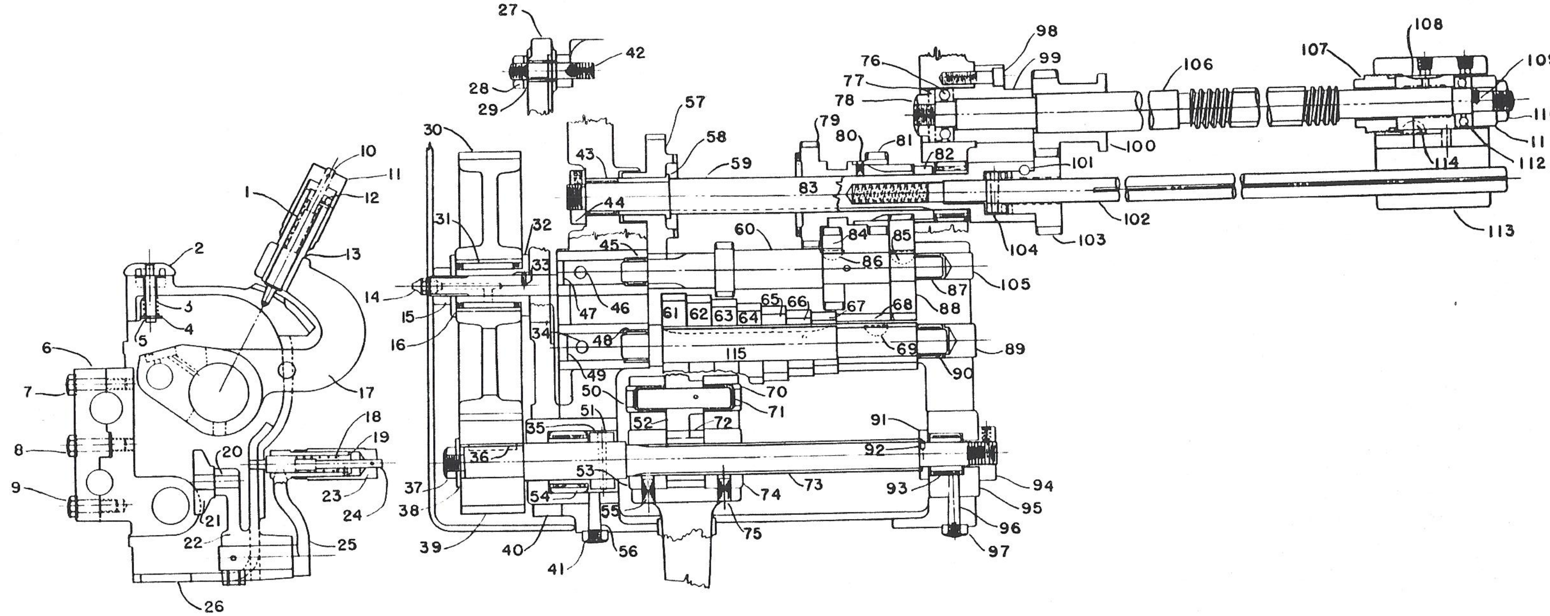




COMPOUND REST (OFFSET—16"-18")

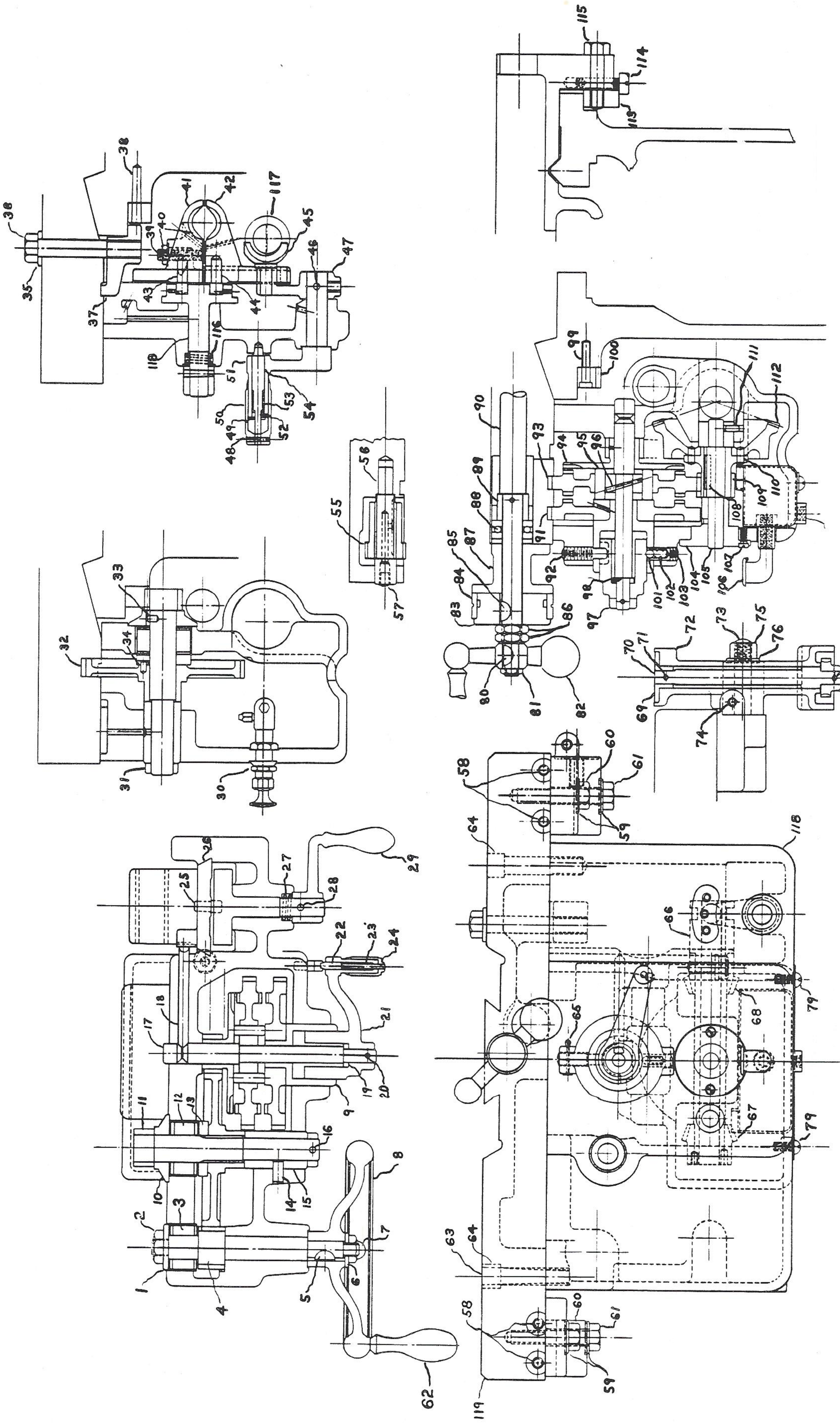


WHEN ORDERING PARTS, SPECIFY THE LATHE SERIAL NUMBER. THE SERIAL NUMBER IS STAMPED ON THE FRONT WAY ABOUT 2" FROM THE TAILSTOCK END — ALSO GIVE THE CATALOG No. OF THIS PAGE.



FEED BOX AND TRANSLATING GEARS



## APRON AND CARRIAGE

WHEN ORDERING PARTS, SPECIFY THE LATHE SERIAL NUMBER. THE SERIAL NUMBER IS STAMPED ON THE FRONT WAY ABOUT 2" FROM THE TAILSTOCK END — ALSO GIVE THE CATALOG No. OF THIS PAGE.

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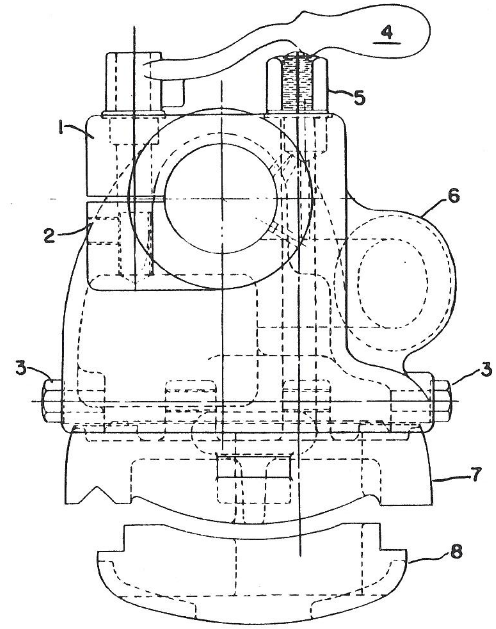
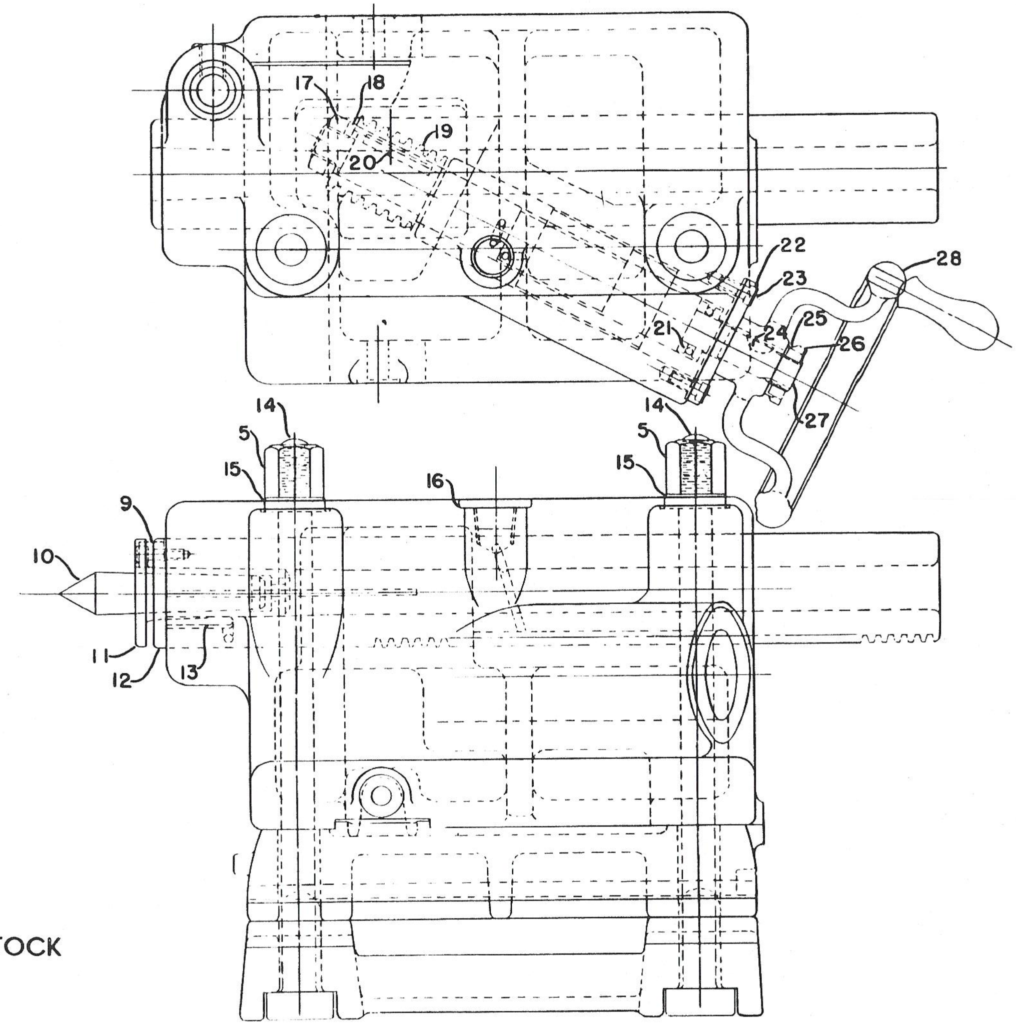
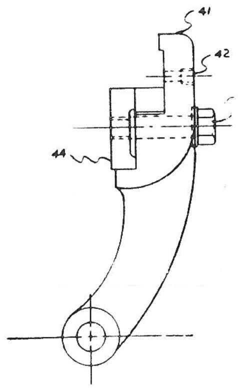
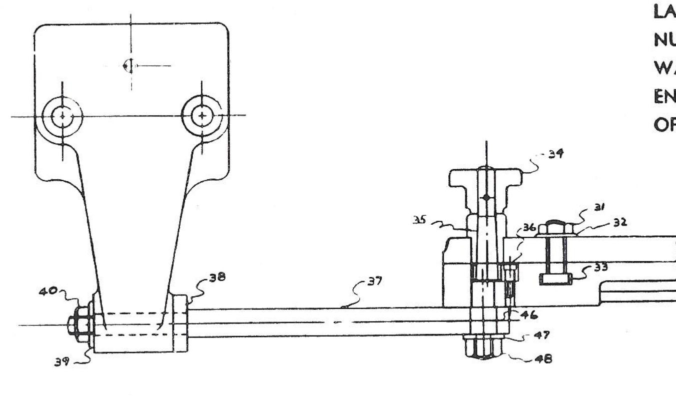


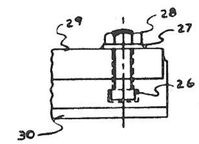



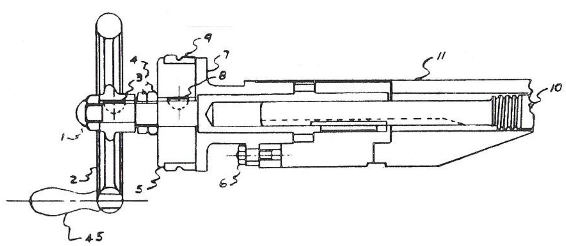

TAILSTOCK

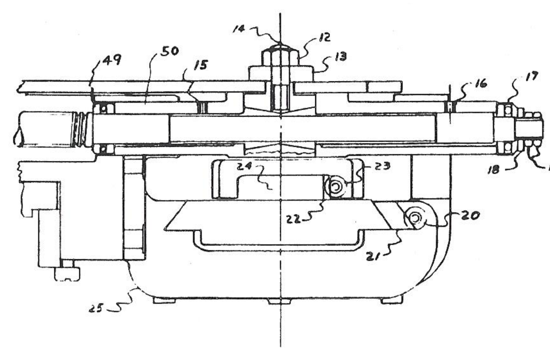
WHEN ORDERING PARTS, SPECIFY THE LATHE SERIAL NUMBER. THE SERIAL NUMBER IS STAMPED ON THE FRONT WAY ABOUT 2" FROM THE TAILSTOCK END — ALSO GIVE THE CATALOG No. OF THIS PAGE.



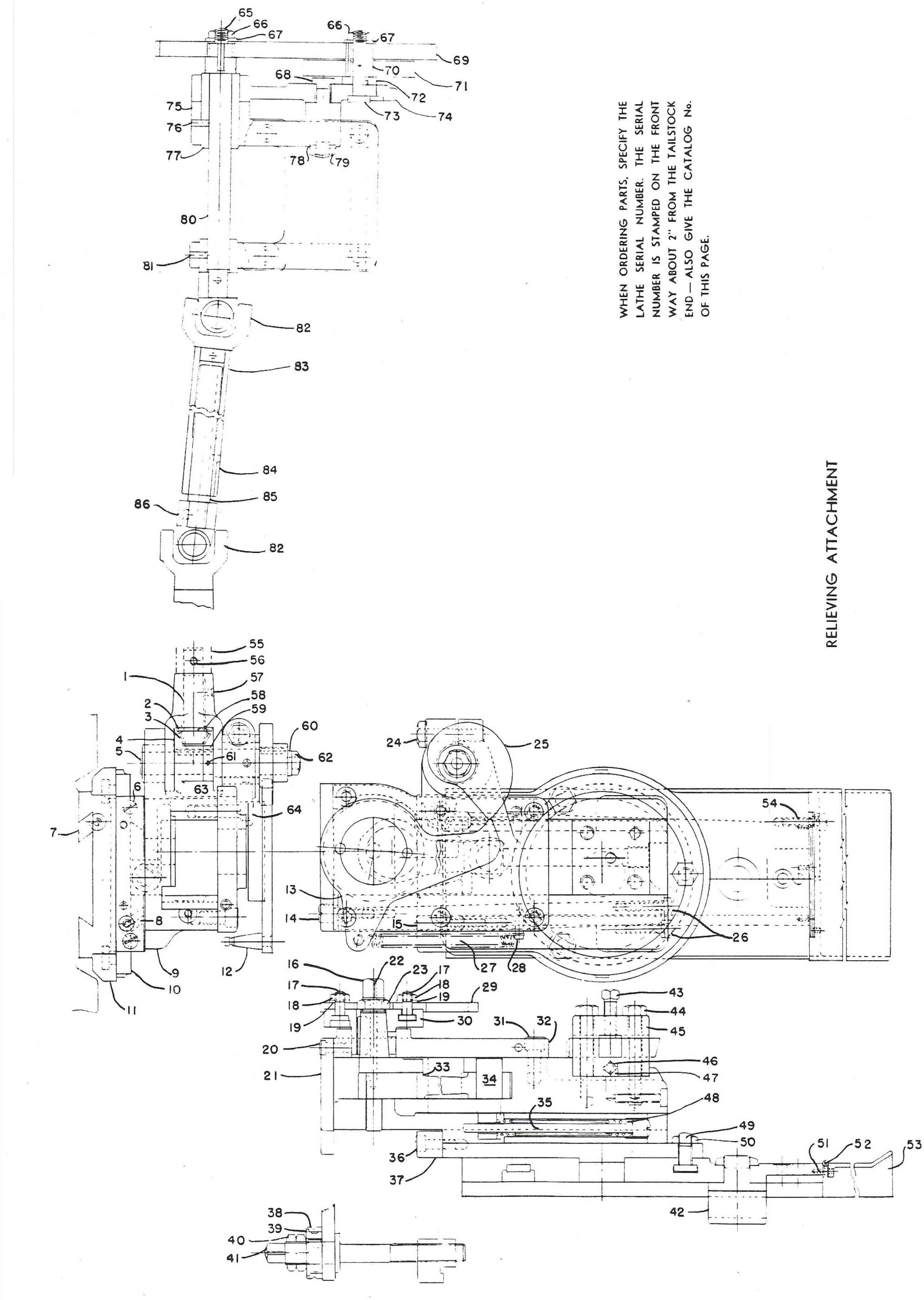




TAPER ATTACHMENT

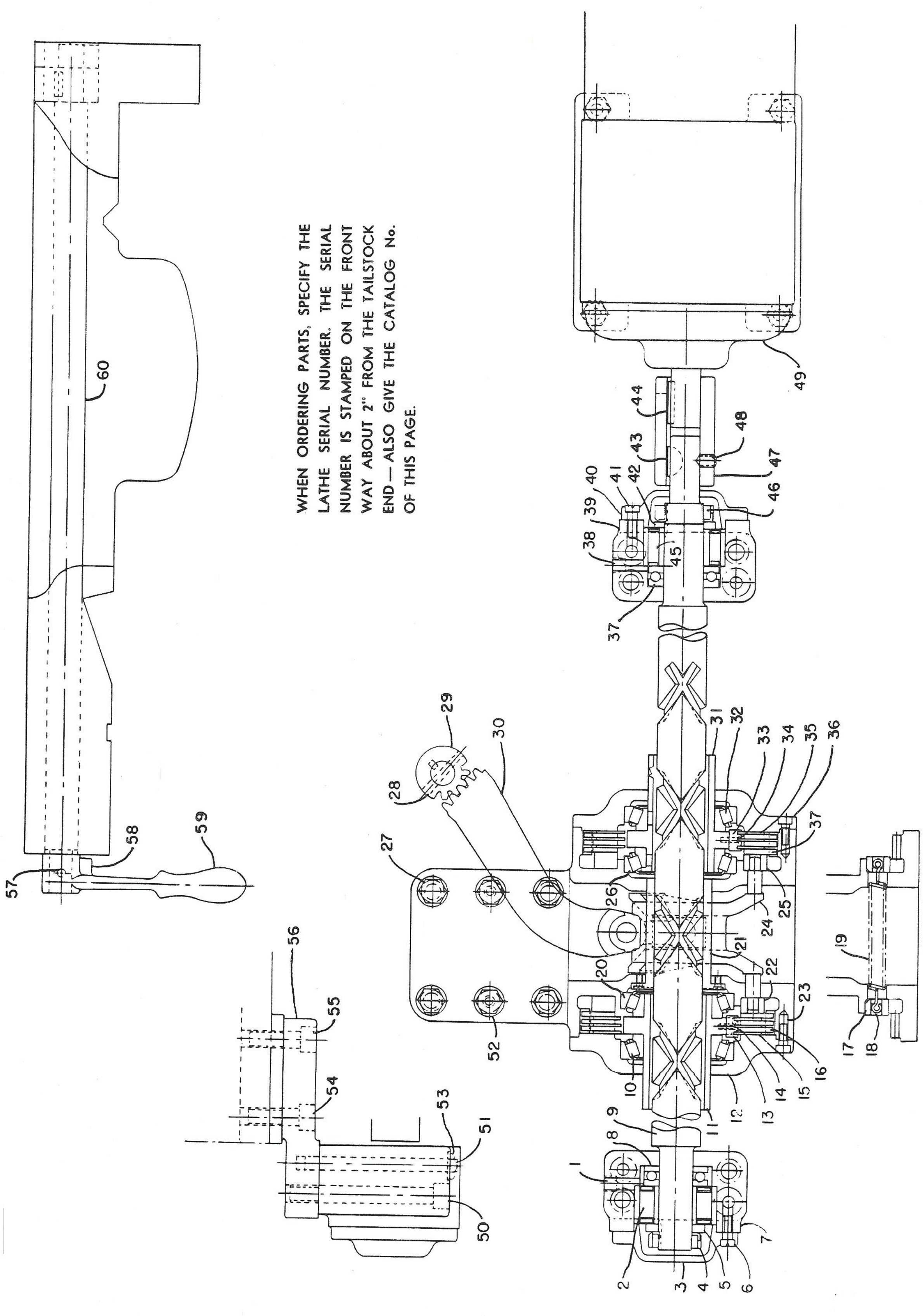


## RELIEVING ATTACHMENT

WHEN ORDERING PARTS, SPECIFY THE LATHE SERIAL NUMBER. THE SERIAL NUMBER IS STAMPED ON THE FRONT WAY ABOUT 2" FROM THE TAILSTOCK END — ALSO GIVE THE CATALOG No. OF THIS PAGE.

RAPID TRAVERSE

WHEN ORDERING PARTS, SPECIFY THE LATHE SERIAL NUMBER. THE SERIAL NUMBER IS STAMPED ON THE FRONT WAY ABOUT 2" FROM THE TAILSTOCK END—ALSO GIVE THE CATALOG No. OF THIS PAGE.



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