INSTRUCTIONS

for Installing, Maintaining *and* Adjusting Nos. 41, 42, 43, 43-B and 53

LUCAS "Precision"

Horizontal Boring Machines

THE LUCAS MACHINE TOOL CO.

CLEVELAND, OHIO

Booklet A-69 **Printed in U. S. A.**

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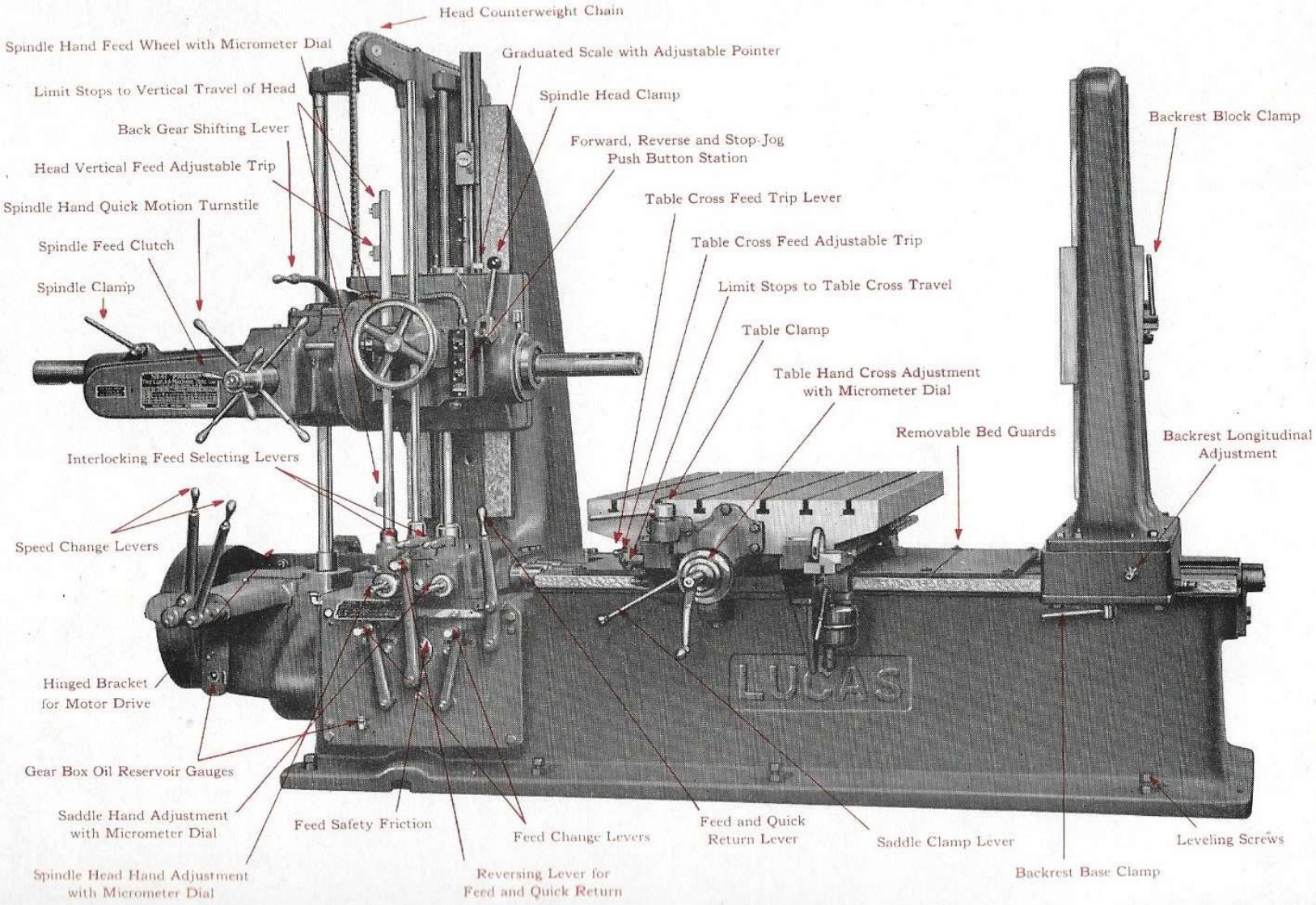
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FOREWORD

Every Lucas "PRECISION" Horizontal Boring, Drilling and Milling Machine is carefully built and tested for accuracy and alignment before it is shipped, all indicated tests with reference to alignments being recorded on a test sheet. Every machine is run under its own power, carefully adjusted and proved to be in proper working order throughout.

FOUNDATION

To obtain full advantage of the accuracy built into the machine, it should be set on a concrete foundation of adequate depth, according to the nature of the soil and size of the machine (ordinarily not less than three feet deep). Leveling screws are provided in the lower flange of the bed, which should bear on steel plates, approximately 6″ square x ½″ thick, previously grouted onto the foundation in corresponding positions as indicated on the Erection Diagram accompanying the machine, a copy of which is mailed also with the acknowledgment of each order. The machine should not be bolted down or grouted to the foundation.

REMOVAL OF SMALLER SIZE MACHINES FROM SKIDS

The skidded machine should first be rolled into the position it is to occupy over its foundation. The bolts fastening the bed to the skids at the four corners and the blocking timber at the right hand end of the skids should be removed.

If a flat steel bar 1¾″ thick by 8″ wide, about 12″ longer than the width of the skids is available, it can be slid across the skids in the space (D in Fig. 1) between the first and second cross planks (counting from the left hand end) and the head end of the machine can be lifted directly by two jacks under the ends of this steel bar.

Otherwise, the machine can be tilted and stepped up, with a single jack of the lever type, equipped with a foot lift which can be inserted under the arched lower flange at the right hand end of the bed. The right hand cross plank of the skid should be reinforced against the concentrated load imposed by the jack, by inserting a 4″ thick block between the floor and the underside of the plank at this point. (See A in Figures 1, 2 and 3).

The right hand end of the bed can then be raised the entire lift of the jack (making sure that the gear box or motor drive guard does not strike the floor or other obstruction). Then insert as thick blocking (B in Fig. 1) as will go between the skids and the bed, to the left of the balancing point which is approximately beneath the left hand end of the bed ways. Lowering the right hand end will tilt up the extreme left hand end of the bed, permitting its being blocked up at C in Fig. 2.

By repeating this procedure, the machine ultimately can be supported on two sound 6″ x 8″ OAK timbers, blocked up from the floor, just outside the skids which the timbers straddle, so the skids can be slid out endwise from under the machine. (See Fig. 3).

By reversing the tilting procedure, the machine can be stepped down onto the foundation plates. Safety blocking should be used under the

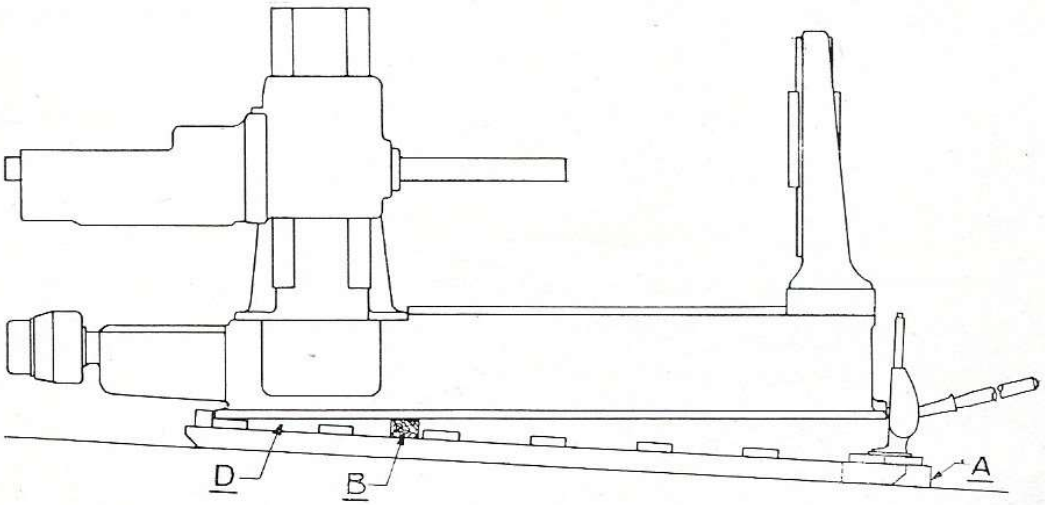

Fig. 1

bed while raising and lowering with the jack, to prevent any possibility of the machine dropping.

CLEANING

The machine should be carefully cleaned of all slush and dirt, with clean kerosene and wiping cloths free from grit (gasoline and waste are not recommended).

Warning:—Be sure not to draw the sliding spindle back into the spindle sleeve before it is absolutely clean and properly lubricated. Failure to observe this precaution might result in scoring and seizing, with most serious consequences. Clean the left hand end of the spindle as well as the right hand end.

Special attention should be given the corner where the spindle enters the spindle sleeve. After wiping the spindle all over again with a dry, clean cloth and the bare hand, the entire exposed surface of the sliding

spindle should be covered with clean, thin lubricating oil of high quality, before pulling the spindle back into the spindle sleeve.

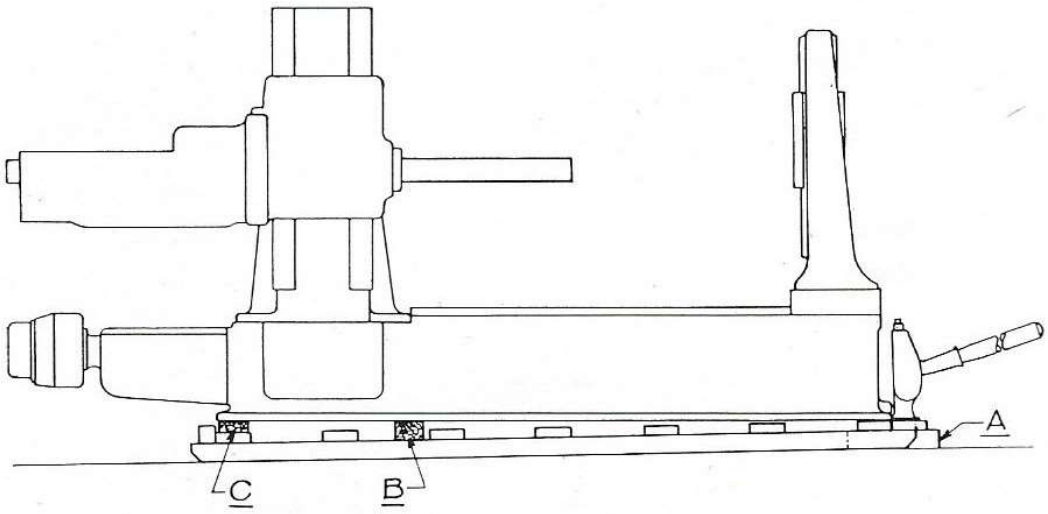

Fig. 2

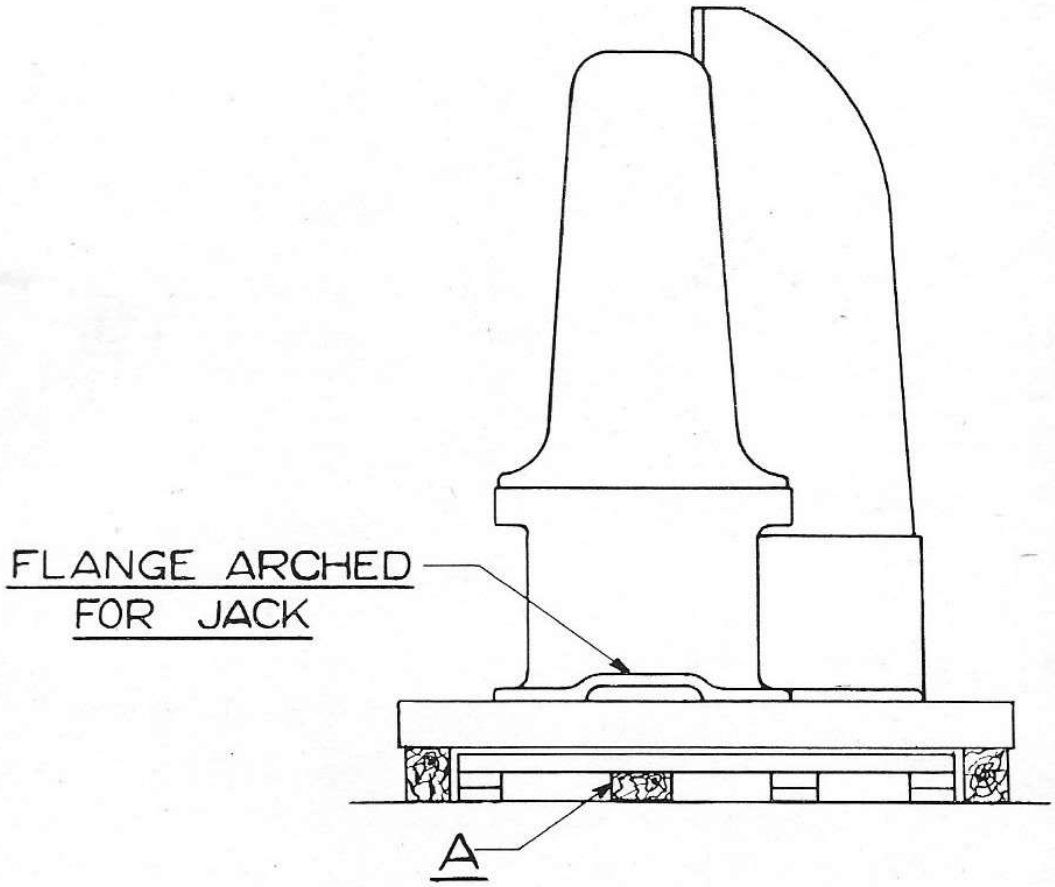

Fig. 3

OILING

The oil levels in the SPEED and FEED CHANGE GEAR BOXES, and the spindle head of machines with ring oiling bearing construction, should be maintained with high-grade lubricating (machine) oil such as Socony-Vacuum Oil Co.'s Vactra Heavy Medium X or equivalent. The oil level in the SPINDLE HEAD reservoir on early machines with ring oiling construction should not be brought up to the "High" line, or leakage may occur due to overflowing. The danger point from lack of oil is below the "Low" line. Later machines with Timken Bearing Spindle Construction have wick oilers on the head. When oil drips from the hollow drain plug at the bottom of the head, unscrew the plug to drain the accumulation from the wick oilers, catching the oil in a convenient clean container, for possible reuse. The feed change gear box should also be drained occasionally to the level of its filler fitting or gauge. The rest of the machine should be oiled thoroughly and at proper regular intervals through the wick or individual oilers, as the case may be.

In the earlier machines of the "40" series, as in the preceding models, oil should be introduced through marked holes in the top of the TABLE, when in position to register as indicated on the top of the way near the left hand front corner of the saddle, where this construction is used. Later machines have SADDLES provided with Centralized, Pressure Lubrication, by means of a hand operated plunger pump having a reservoir which should be kept filled with Socony-Vacuum Oil Co.'s VACTRA BBX oil, or equivalent, whose lubricating film is extra strong and lasting, which facilitates smooth indexing and feeding of the table crosswise and saddle longitudinally. The pump plunger or lever should be given a full stroke, every working half shift.

Collection of oil on the floor will result from excessive oiling of the MOTOR DRIVE SILENT CHAIN, through the opening in the side of the guard or sight feed oiler on the earlier No. 42 and No. 43 Machines, or from over-oiling of the driving pulley or sprocket by means of the sight feed oiler on the earlier No. 41 Machines (in place of which there is a grease cup on the larger No. 42 and No. 43 Machines and later No. 41 Machines, which have roller bearings at this point). Weekly oiling of the silent chain should be sufficient. Later machines are pro-

vided with a wick oiler for the chain, which should be filled daily. When the accumulation of oil overflows the cored opening in the bottom of the chain guard, the guard should be drained completely

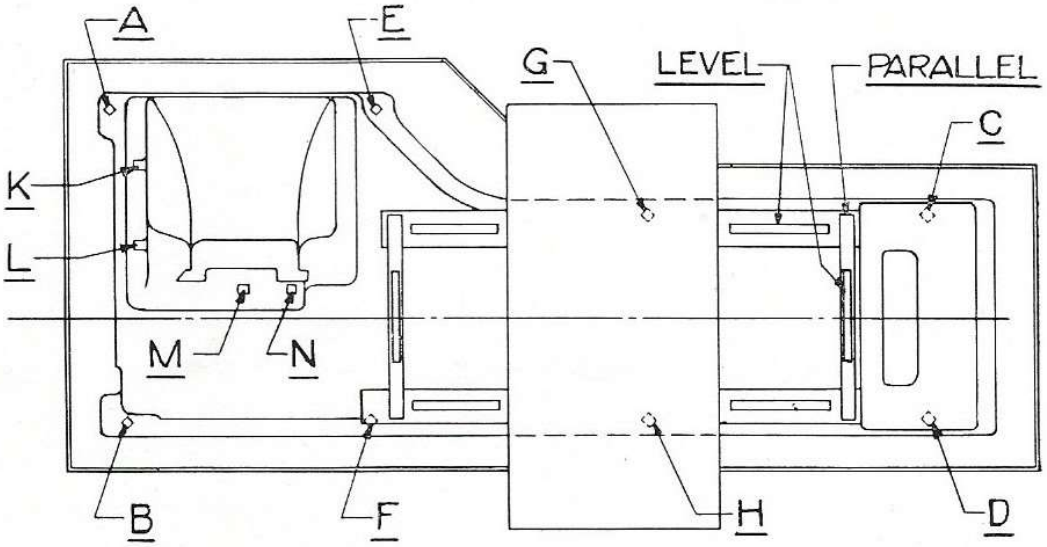

Fig. 4

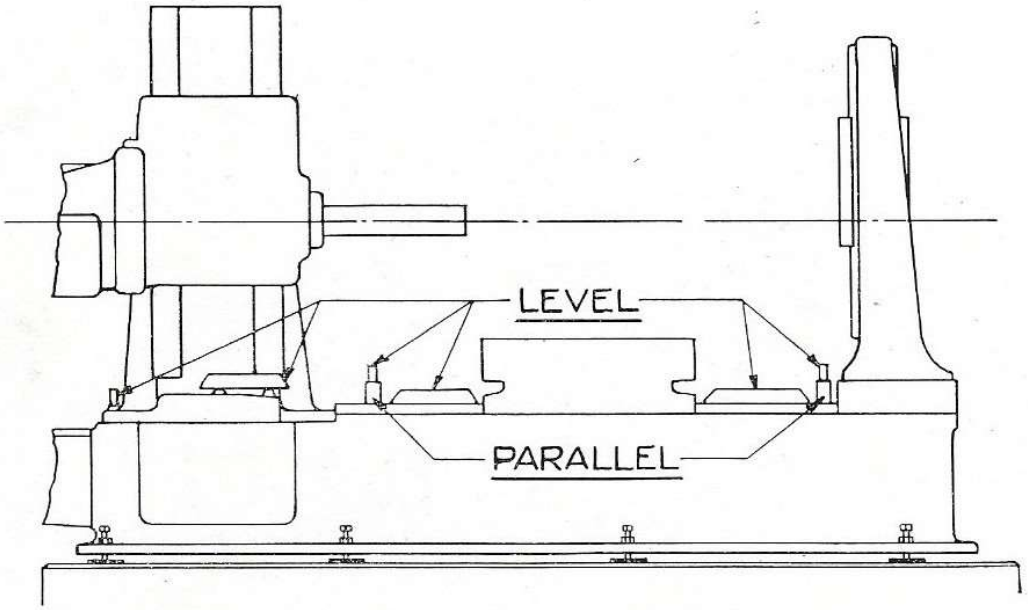

Fig. 5

through the drain cock provided. Still later machines have multiple V belt motor drive instead of silent chain and lubrication at this point is eliminated.

The GEARS in both the SPEED and FEED CHANGE GEAR BOXES run in oil. We recommend Socony-Vacuum Oil Co.'s VACTRA Heavy

Medium X oil or equivalent. The bearings of the feed change gear box should be oiled regularly each day, through the centralized oil tubes at the upper left hand corner of the front of the box in earlier machines. Later machines have wick oiling at this point and in the FEED DISTRIBUTING GEAR BOX above (served by two oilers at the left side) and should be oiled generously every day. The level of the oil in the feed change gear box, for the splash lubrication of the feed change gears, should be maintained near the top of the oil cup or elbow fitting at the front of the box and should be lowered to this level by opening the drain plug, if there is an excess accumulation from the wick oilers above. The proper level of the oil in the speed change gear box is indicated at the glass on the front side. A drain plug is provided at the bottom of the Spindle Feed Compensating Gear Box on the front of the head of certain machines provided with this feature. Drain if leakage develops. Oil in all gear boxes should be replaced annually.

UNBLOCKING COUNTERWEIGHT

The head counterweight blocking set screws should be removed from the front and right hand side of the column and the head can then be lowered by means of the hand crank operating the vertical adjusting screw, to take the slack out of the counterweight chain and raise the counterweight slightly, to permit removal of the rod extending through holes in the sides of the column, by which the counterweight is supported while in transit, to take the strain off the chain and prevent the counterweight bumping around inside the column.

3 BUTTON PUSH BUTTON STATION OPERATION ON LATE NO. 41 AND NO. 42 BORING MACHINES

Depressing the STOP button automatically drops the latch (below it) into the JOG position and then the motor will run in the forward or reverse direction only as long as the Forward or Reverse Button is held down.

Lifting the latch (⅛") results in Continuous Running in forward or reverse direction, after the corresponding button is depressed, until the STOP button is depressed the next time which again will trip the latch into position for jogging only.

On some machines, instead of a latch the STOP button has either a rotative locking ring or a pivoted locking bar with two positions marked RUN and JOG respectively.

Jogging is desirable to facilitate shifting of gears and locating the spindle in desired position of drift slot or of the cutter holding set screw in a supplementary boring bar. It is most convenient to jog around a partial revolution of the spindle, after which the latch or locking ring or bar can be set to permit continuous running.

If the motor does not respond to the push button controls, or stops while running, it would indicate that the temperature overload relay has tripped out due to an overload and heating up of the motor. This overload relay can be reset manually by depressing the reset button in the magnetic starter mounted on back of the column. Before depressing the reset button, allow approximately thirty seconds (after the motor has stopped) for the heating unit to cool off sufficiently to allow the reset to stay in. Heating of the overload relay may be caused by unusually frequent starting, stopping, or reversing, but if the relay refuses to stay in during ordinary operations, investigate for a possible short circuit.

Quick Stopping, on machines with electrical reverse, is provided by a Plugging Switch mounted on the motor. The plugging switch is adjusted for proper operation before shipping and should require no further immediate adjustments. Ultimate future adjustments can be made as follows:

On machines having a Euclid Electric plugging switch, if the Spindle drifts while stopping, decrease contact break or spring tension. If the Spindle stops too suddenly, increase contact break or spring tension. On machines having General Electric plugging switch, if the spindle drifts while stopping, increase spring tension. If the spindle stops too suddenly decrease spring tension. Adjustments are accessible on both makes of switches by removing of cover of plugging switch.

Fluttering of the reversing type starter contacts may be caused by excessive slack in the motor drive V belt tension, acting through the plugging switch. See later paragraph entitled MOTOR DRIVE CHAIN AND V BELT ADJUSTMENT. This is most likely to occur at the higher spindle speeds of machines with Auxiliary Hi-Speed Drive or Special 50%

Increased Spindle Speed construction, because of the greater momentum.

LEVELING

A precision level is essential to the accurate setting up of these machines, as well as many others of comparable size. An ordinary level is not good enough. We recommend a level with a sensitivity of ten seconds of arc, such as Pratt and Whitney's 15" precision level, having graduations one-tenth inch apart, which indicate one-half thousandth of an inch deviation in one foot of length.

An accurate parallel long enough to span the bed ways is also necessary in leveling the bed crosswise, which must be done in addition to leveling longitudinally along the bed ways. Accurately finished leveling pads (M & N and K & L in Fig. 4) are provided on the lower flange of the column at the front and left hand sides, as a means of determining that the bed is not being strained so as to force the column out of square with the bed ways.

Before leveling up the machine, all attachments should be removed, the backrest should be at the extreme right hand end of the bed and the saddle and table should be adjusted central on the bed, as shown.

Large size machines have an extra adjusting screw at the middle of the right hand end of the bed, for preliminary leveling on three points in connection with the two leveling screws at the left front and left rear corners respectively of the bed. On smaller size machines the two pairs of leveling screws (A & B and C & D in Fig. 4) next to the left and right hand ends respectively of the bed should be used alone at first, having the intermediate screws, E & F and G & H free, bringing the level readings as nearly alike as possible, after which the final leveling can be accomplished by use of the intermediate leveling screws, as well as the end screws which probably will require some readjustment, making sure that all the screws have a firm bearing. The level should read the same (that is, level) all along the bed ways, both longitudinally and crosswise and also on the leveling pads at the foot of the column, insuring the column being square with the bed ways. This leveling is important, requires some patience and judgment and the results obtainable fully warrant an hour or two of a skilled mechanic's time, to do it well.

As floors are bound to change and even foundations cannot be depended upon indefinitely, the leveling should be re-checked occasionally, particularly if there is any reason to suspect a change in alignment. Hence, our recommendation against bolting or grouting the machine to the foundation.

SAFETY FRICTION DEVICES

Safety friction devices are provided for both the feed and power rapid traverse, the feed safety friction consisting of a feed gear which is not keyed to its driving shaft, but is held between leather washers in early model machines, in which the clamping pressure and consequent driving friction are adjustable by means of a nut, plainly indicated on the front of the feed change gear box. As a protection to the mechanism, the friction is set up as follows:

The slowest spindle speed should be engaged, by shifting the speed change levers to the A-1 positions and the feed change levers should be put in the B-1 positions and the feed should be directed to the head elevating screw. With the head and backrest free (unclamped and not taking a cut), the feed safety friction nut should be tightened until the feed will just lift a weight of 30 lbs., hung on the hand crank furnished with the machine, placed on the end of the left hand shaft extending forward from the feed distributing gear box, by which the head is adjusted vertically by hand. The feed safety friction adjusting nut should then be locked in adjustment by means of the hollow set screw. The purpose of this device is to provide for slipping before any part of the feeding mechanism is damaged. The friction set as described above will transmit sufficient feeding power for the heaviest work that should be done on the machine.

In later machines, special asbestos composition friction discs are used as an improvement over the leather washers formerly employed and the adjustment of the pressure on them is fixed and maintained automatically, even though the discs wear from slippage, due to excessive feeding resistance, or to shock in overcoming inertia of a heavy slide as the power rapid traverse clutch is engaged suddenly. This automatic take-up is accomplished by a series of coil springs, put under predetermined compression by tightening the clamping nut firmly to a shoulder.

The power rapid traverse being engaged through an automatically releasing friction, controlled by hand, provides in itself a safety friction for the power quick motion drive.

Incorporated in the hand adjusting crank is a safety clutch, preventing the crank being left so it would be rotated by the shaft, under power feed or rapid traverse, unless the automatic spring release is tampered with (at the operator's own risk).

Automatic Adjustable Trips and Limit Stops are provided for the vertical travel of the head and cross travel of the table. Before the power motion or feed can be reconnected, it is necessary to adjust the head or table in the opposite direction far enough to clear the trip, by means of the hand crank. The spindle feed rack runs off its pinion at each end of the traverse, so there is no danger of jamming and on late machines a rugged, spring-operated, automatic re-engaging device is provided, the operation and adjustment of which is obvious.

TABLE

The table is of unusually stiff design, amply strong to withstand any strain which should be brought on it and the T slots are correspondingly deep. However, as in the use of any such machine, good judgment should be used in placing the straps or clamps for holding work so the bolts are close to the work, where reasonable tightening will hold it firmly, instead of having the bolts closer to the heel blocks, necessitating excessive tightening to get any effective pressure on the job, thereby tending to distort the table. Holding-down straps should not be depended upon to prevent work shifting under heavy milling or boring cuts, but the side thrust should be taken positively by stops having tongues fitting slots in the table. The underside of heavy work should have sufficient area in contact with the table to avoid highly concentrated pressure.

GIB ADJUSTMENT

The taper gibs and flat caps under the square lock ways for the slides should be kept in snug adjustment to prevent cocking or tilting, but should not be set up so tightly as to bind noticeably when the slide in question is moved by means of the hand crank.

The thick ends of the TAPER GIBS on the long narrow, guiding ways

have a coarse pitch, square thread hobbed into one side, with which there meshes a hollow adjusting screw. In earlier machines of this model, the gib adjusting screw is carried on a hexagon head cap screw which, when tightened after the adjustment, serves to lock the adjusting screw against end play and rotation. (See Fig. 6.)

This hexagon head cap screw should be loosened only enough for unclamping, to permit rotation of the adjusting screw by means of a pin inserted in one of the series of radially drilled holes in the shank of the adjusting screw. Loosening further will give end play of the adjusting screw, so the gib will tend to loosen by pulling out when the slide is moved in one direction and jam in on the taper when the

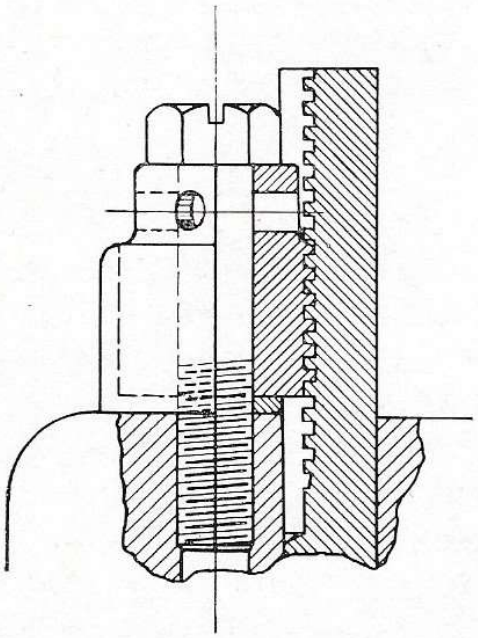

Fig. 6

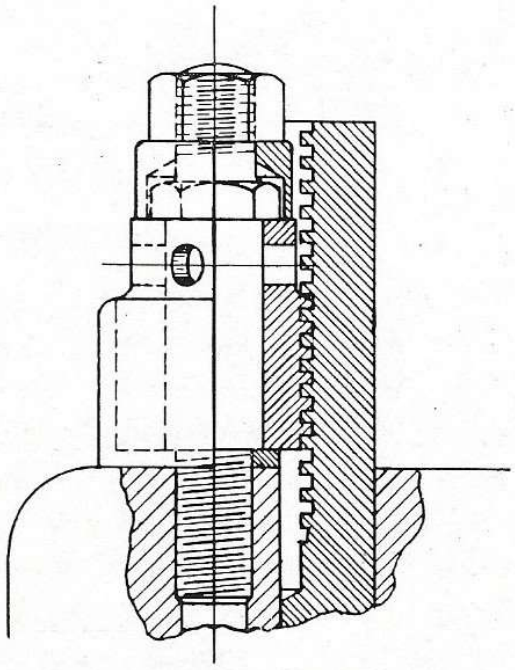

Fig. 7

slide is moved in the opposite direction. After proper adjustment, the hexagon head cap screw should be tightened again to hold the adjusting screw from rotating under vibration, destroying the gib adjustment.

This construction was improved on later machines, the cap screw being replaced by a shoulder stud, faced for a rotating fit of the hollow adjusting screw (with only a few thousandths of an inch end play) and a cupped washer and nut being mounted on an extension of the shoulder stud, threaded on the outer end, for clamping the adjusting screw against rotation, thereby locking the adjustment of the gib. (See Fig. 7.) A special socket wrench fitting the nut and the hexagon por-

tion of the stud is included with the standard equipment accompanying the machine.

The FLAT CAPS are scraped for a sliding fit with the cap screws tightened home. The ledges of the slides against which the caps seat are relieved in the center between the sides, so only a narrow strip of metal need be filed or scraped to let the cap up closer to the way, after the sliding fit has worn loose. Excessive looseness, particularly of the caps under the saddle and table which overhangs in the extreme forward and rear positions, would permit the table to sag, throwing it out of alignment so it would index long in the crosswise direction (this effect being accentuated, the higher up the holes are bored) and cause chatter under certain cuts.

CLAMPS

The tables of certain later machines are provided with two clamps binding the table cap under the ledge of the left hand way of the saddle. These clamps are not equalized, inasmuch as one of them is beyond the end of the saddle in the extreme positions of the table travel. These clamps are adjusted, by the round nuts on the fine pitch threaded lower ends of the clamping studs, to act equally when the tapped levers on the coarse pitch, square threaded upper ends of these clamp studs are at right angles with the side of the table, in the clamped position. This setting can be made by running the table clear back, clamping and noting the position of the clamping wrench on the hexagon nut at the front of the table and determining the effort required to obtain any movement of the table with the hand crank and then making a comparative test of the rear clamp with the table clear forward, adjusting the round nuts on the lower ends of the clamp studs as may be necessary. These round nuts are locked in position by hollow set screws. The hexagon clamp operating nut has been replaced on later machines by an eccentric, with a pointer to indicate whether clamped or unclamped, as the operating lever may be lifted out of engagement so as to be out of the operator's way. If for any reason the table cap and clamp studs should be removed from the table, care should be taken that the clamp studs are not run so far up into the tapped levers, that the squared middle section of the studs

would bottom against the underside of the table, when clamped. The adjustment should not be made too tight, or the thread studs may be broken by the great leverage provided to minimize the effort required for operating the clamp lever.

The Saddle is provided with automatically equalized clamps, binding the front and rear caps under the ledges of the bed ways. Two L shaped levers are pivoted on adjusting nuts on the lower ends of studs screwed into the underside of the saddle. The horizontal (or toe) portions of these levers bear against the caps and the vertical legs of the levers are spread apart by a screw floating between them, when tightened by means of the ratchet wrench at the front of the saddle. On later machines this ratchet wrench and screw have been replaced by a quick acting lever on a shaft carrying a cam with roller thrust bearing. With the clamps released, the adjusting nuts on the studs should be set so the L shaped levers stand vertical and bear against the caps. Both the table and saddle clamps are very efficient and lock the slides securely without excessive effort.

Do not try to move any slide by power while the clamps are tightened, for if the feed safety friction should fail to slip the bronze metal of the feed nut may be distorted under the excessive pressure, causing it to bind on the screw thereafter, the ways may be cut, or the traverse screw may be stretched or gearing may be damaged.

CLUTCH ADJUSTMENT

The main driving friction clutches of the earlier No. 41 Machines are of the cone type used in the preceding "30" series machines, which type is adjusted by means of a nut on the outer end of the shaft, which moves the finger carrier inward, so as to force the angular or beveled friction surfaces into tighter engagement.

The larger size Machines and later No. 41 Machines had clutches of the plate or disc type, faced with asbestos composition friction material and are adjusted by rotating the finger carrier, which is threaded on the clutch sleeve and held in adjustment by means of a spring plunger or pin engaging one of a series of holes, or spaces between internal gear teeth, in the outer driven plate of the clutch. The main driving clutch has been eliminated from still later machines in favor of Electrical Forward, Reverse and Stop-Jog Push Button Control.

Earlier machines with Auxiliary Hi-Speed Drive were provided with an additional multiple disc friction clutch for braking. This brake is located outside the main driving friction clutch and its means of adjustment is similar. If the fingers climb to the top of the rise of the operating wedges, the fork spool will move over to the left against the shoulder on the clutch plate driving member. This indicates need of adjustment. Do not tighten the adjusting nut so much that the brake clutch plates drag when the clutch lever is in the neutral position. Later machines with electrical reverse and plugging switch do not have (or need) this mechanical brake.

The Main Feed Engaging Clutch is of the multiple disc friction type in machines with Auxiliary Hi-Speed Drive, to avoid possible difficulty in engaging the regular jaw clutch when using a combination of the coarsest feed available and the fastest speed. This friction type feed clutch is adjustable for wear in a manner similar to that described for the main driving friction clutch, also of Twin Disc make. Access to the adjustment may be obtained by removal of a plate indicating its purpose, which covers a hole through the top of the bed, to the right of the feed distributing gear box.

Large size machines have power rapid traverse engaging clutches of similar Twin Disc type, made self-releasing (as is desirable in this place) by making the wedge so long that the fingers will not climb to the top, until the facings are worn considerably from long use. This may be compensated for by adjustment similar to that of the main driving clutch, access being obtained by removing the cover plate at the left hand end of the bed.

MOTOR DRIVE CHAIN OR V BELT ADJUSTMENT

The motor is arranged for "wall mounting", with the feet on the right looking at the projecting shaft, no base (or pulley) being required, as the motor is fastened to a vertical plate hinged at the bottom and with provision for adjustment of the silent chain or V belt tension, at the top of the bracket, which is fastened to the machined pads on the rear wall of the speed change gear box. This adjustment should not be set so tightly but that there is sufficient slack, so either the lower or upper (approximately horizontal) strand of the chain can be given a vertical

movement of at least ½", midway between the sprockets. In the earlier construction, the hinged plate carried a pair of adjusting screws extending through the stationary bracket, with nuts on both sides, to vary and lock the adjustment. As it was found that unwarranted tightening of the adjustment was made too easy, to the detriment of the chain, a more positive setting was provided on later machines with silent chain drive, consisting of hexagon head screws extending through the stationary bracket into tapped holes in the hinged plate, with spacer sleeves between the bracket and hinged plate, faced to give the correct tension of the chain originally. Stretch of the chain can be compensated for, by inserting thin washers or shims at either end of the spacer sleeves, removing one screw only at a time, to hold the motor up in position. Still later machines have multiple V belt motor drive and the hinged motor mounting plate is again provided with threaded adjustment to compensate for V belt stretch.

SPINDLE ADJUSTMENT

After years of service, the spindle bearings may be expected to show some looseness due to natural wear, affecting the quality of the work. Provision is made for compensating for wear in both the sliding and revolving bearings.

The hole in the spindle sleeve in earlier machines is lined, both front and rear, with bushings of special metal, making it possible to renew the fit when necessary, by regrinding the unhardened spindle to make it the same diameter its entire length and clean up any worn surfaces and by rebushing the sleeve with bronze to fit, finishing the bore of these new bushings in place. The Morse taper socket should be trued up after regrinding the spindle. Machines with double setting spindle construction require a new spindle feed sleeve, with undersize bore to fit the reduced diameter of the reground spindle. After pressing the bushings into the sleeve and pinning with brass pins long enough to fill the drilled holes completely, the bore should be finished by grinding, steady-resting the sleeve on its true outside diameter. The allowance for the sliding fit should be approximately .0005" for the 3" spindle, .0006" for the 4" spindle and .0007" for the 5" spindle. Great care should be used to have the hole straight, of uniform diameter and smooth.

Later machines have Hardened NITRALLOY spindles, employing the same material for the bushing at the front end of the spindle sleeve, long deferring if not altogether eliminating maintenance expense at this point. This construction may be applied by us to older machines, as a more lasting and satisfactory repair.

This construction insures the spindle running as true as possible and is considered superior to adjustable (split, tapered) bushings in this place, which have a tendency to cause the spindle to run out of true, permit dirt to be carried into the sliding bearing and, of course, cannot compensate for the unequal wear of various places along the sliding spindle itself.

In early machines having the plain bronze box construction for the rotating bearing of the spindle, play in the taper-bored, solid bronze box at the front or right hand end of the head, is taken up by reducing the thickness of the thrust ring or washer, between the outer end of this box and the flange of the spindle sleeve, thus letting the conical journal further into the box. Care should be exercised to keep the opposite faces of the thrust ring parallel. The box should be rescraped to give a good bearing all around, both inside the bore and at the end against the thrust washer. If this thrust ring is made too thin, the journal will wedge into the taper bearing, causing binding and heating. If the thrust washer is too thick, radial play of the spindle sleeve in the box will result. Under no circumstances should this box be removed from the head, as it must be fitted in place.

The left hand or rear journal of the spindle sleeve is cylindrical and the bronze box is tapered on the outside and split so it can be taken up by facing off the inner face of the flange of the box, thus letting the fillister head screws pull it further into its taper seat in the head, closing it in around the journal. This box also should be rescraped to give a good bearing, after such taking up. Of course, if the journals of the spindle sleeve are scored or worn out of round, they should be reground before refitting of the boxes. Rebushing is likely to distort the journals and necessitate regrinding them, likewise.

After reassembling the spindle sleeve in the head, with its thrust ring at the right hand end, the spindle driving key in place and driving gear at the left hand end, the end play of the spindle sleeve should

be adjusted by means of the large nut on the left hand end of the spindle sleeve, to .0025″ to .0035″, depending on the size machine and whether the spindle is usually run at a comparatively low or high speed. This amount of endplay, when the parts are cold, is necessary to allow for expansion under operating conditions. This endplay should be tested after the nut on the left hand end of the spindle sleeve is locked, as clamping around the V threads has a tendency to tighten the bearing adjustment further. This split nut has a fillister head screw to clamp it around the threads of the spindle sleeve and the clamping screw is locked by a headless screw, set against its end, accessible from the other side of the nut.

The endplay of the sleeve can be tested by having a Dial Indicator bear against the faceplate of the spindle sleeve. The spindle sleeve can be pulled to the left by means of a rod placed through the drift slot in the spindle, using the spindle hand feed wheel to apply pressure against the faceplate. Similarly, it can be moved to the right as far as possible, by having this rod strapped to the faceplate of the spindle sleeve, or on the larger Machines with double setting spindle construction, a clean two by four stick can be placed between the spindle feed slide and the left hand end of the sleeve.

In later machines with Timken Bearing Spindle Construction, the bearings are adjusted snugly so there is practically no endplay of the spindle sleeve (less than one quarter thousandth of an inch). This adjustment should not be tampered with. Takeup of these bearings is a simple matter of unlocking and tightening the ring shaped nut on the left hand end of the spindle sleeve. With the back gears slid out of mesh, slight drag or resistance to rotation of the spindle sleeve by hand should be felt, when the nut has been adjusted and clamped.

REMOVING BACKREST

When it is desired to remove the Backrest for long work, the method recommended to insure returning it later to proper alignment with the spindle is to proceed as follows:—With the hand crank raise these members until the top of the backrest block comes up to the zero line stamped on the front V of the Backrest and the index line on the collar near the lower end of the Backrest elevating screw and the one near

the right hand end of the horizontal connecting shaft in the top of the bed, match respectively zero marks on the bearings in which they revolve. When these marks all match, the top of the head will also match a mark on the right hand edge of the column way. After clamping the backrest block and removing the dowel pins and screws from the base, the backrest yoke can be lifted off. When replacing the backrest, it is only necessary to match all these marks in order to mesh the bevel gears properly, so as to get the Backrest Block back into line with the spindle.

RE-ALIGNING BACKREST BLOCK

After long use, particularly where the vertical feed of the head is used for face milling to a considerable extent, more or less unequal wear of the head and backrest elevating screw bronze nuts may necessitate re-alignment of the spindle with the hole in the Backrest Block. Re-aligning here will also be necessitated, should replacement of either of the bronze nuts on the elevating screws ever be required.

This alignment may be tested by indicating from an accurate parallel across the bed ways to a true Boring Bar in the spindle, or by reversing the Backrest Bushing, so it may extend part way from the left side of the Backrest Block and indicating to the underside of this bushing and the spindle, making allowance for the difference in radii by indexing vertically by means of the micrometer dial, between the respective readings of the indicator. However, it is more direct and therefore safer, to make a plug to fit the hole in the Backrest Block snugly, having this plug shouldered down to the exact same diameter as the spindle and indicate directly to this shouldered plug and the spindle without intermediate indexing.

This test should be made with the head about midway in its vertical travel on the column, with the backlash taken upward. A neutral point between the extremes of any slight runout of the spindle should be determined by a dial indicator and this point should be used (at the underside of the spindle) for indicating in this alignment test.

As changing the meshing of the bevel gears in the Backrest Base one tooth raises or lowers the Backrest Block approximately .007", the spindle may be brought within something less than .007" lower than

the hole in the Backrest Block, by shifting the meshing of these Bevel Gears. Final correction can be made by facing off the underside of the flange of the head nut, an amount equal to that which the spindle indicates lower than the Backrest Block, as the screws fastening the nut to the top of the head can then pull the spindle head up into exact alignment. It is well to have the Backrest Block about .001" higher than the spindle, on account of the necessary allowance for a running fit between the boring bar and bushing in the Backrest Block.

Changing the meshing of the bevel gears and refacing the head nut as described above for realignment necessitates remarking the index lines on the horizontal shaft at the right hand end of the bed and collar near the lower end of the backrest elevating screw, to facilitate replacement of the Backrest in correct alignment, after removal to accommodate long work, as described in a preceding paragraph.

REMOVING FEED CHANGE GEAR BOX

With the main driving friction clutch disengaged or the power shut off, the quick motion driving chain should be slid off the outer side of the driving sprocket, which can be reached through the opening in the rear wall of the bed, beneath the column.

The construction in the "40" series machines differs from the preceding model, in that before this unit can be removed from the front of the bed, the bearing and shaft extending through the left end of the bed, carrying the driving jaw clutch connection to the feed change gear box, must be removed first. This is a simple matter of taking out the screws holding the bearing flange against the machined outer side of the bed end wall, after removing the guard to give access.

To prevent the feed reverse lever catching in the cover of the feed distributing gear box above, it is safer to drive out the taper pin and remove this lever from the end of its shaft, extending from the center of the front of the feed change gear box.

After removing the dowel pins and screws holding it to the front of the bed, the feed change gear box can be slid out of the bed, the right hand side coming out somewhat ahead of the left hand side. In reassembling, the rear left corner should be started in ahead of the right hand side.

An interfering Lever is provided on the front of the feed change gear box to prevent reversal while the rapid traverse is engaged, or engagement of the rapid traverse friction except when the feed reverse clutch is in full engagement. This interlock should not be removed or tampered with. When a fine feed and slow speed are engaged, it sometimes is necessary to wait a few seconds for the clutch jaws to move into a position opposite corresponding spaces in the mating clutch, to permit engagement when the direction is being reversed.

RE-ASSEMBLING DISMANTLED MACHINES

Sometimes it is desirable to ship machines partly dismantled, to facilitate handling to upper floors or through small openings in the walls of the building.

No particular instructions are necessary in connection with the reassembling, except to make sure that there are no nicks, bruises, dirt, etc., present between the various joints or contacting surfaces and in dowel pin holes, which would affect alignment. Up-ending the column is a job requiring considerable caution, so it does not tip clear over and it should be arranged to come up onto blocks at either side of the gear on the lower end of the head screw, extending several inches below the bottom of the column, to prevent these parts being bent or broken off. It is necessary to remove the feed distributing gear box from the top of the bed before the column can be removed from or replaced on the bed, as the bevel gear on the lower end of the head elevating screw extends beneath its pinion in the feed distributing box.

When machines are boxed for export, the table crossfeed screw may be removed to conserve space. In running the screw back through the nut in the saddle, the feed engaging clutch members must be held up in line for the end of the screw to enter and a temporary shaft is used for this purpose. In the No. 41 Machine, having a keyway in the screw, care must be used in matching up with the key in the clutch bushing, when the splined screw passes through the nut and enters the clutch bushing. The clutch bushing can be rotated by means of the temporary shaft, which can be reached from the rear of the saddle, beneath the table.

SWIVELING TABLES

Square and Circular Swiveling Tables mounted on baseplates are provided with an elevating ball thrust bearing to facilitate swiveling. A flat lever extending forward from beneath the baseplate partially rotates a coarse thread screw which carries the ball thrust bearing, thereby lifting the swiveling table slightly off its flat scraped bearing on the top of the baseplate, thus reducing the friction of rotation to a minimum.

On the Swiveling Tables with Split Ring Clamp, this elevating ball thrust operating lever is interlocked with the split ring clamp operating bolt and the indexing lockbolt for four positions 90° apart. This interlocking is not practicable on the early circular tables with four individual clamps, so care should be exercised not to attempt to elevate the ball thrust bearing without first releasing the clamps and withdrawing the indexing lockbolt. Similarly, the table should not be clamped before lowering the ball thrust bearing. Otherwise, the threads of the nut of the elevating mechanism may be sprung so the table no longer can be lifted by the ball thrust bearing. In such event, it will be necessary to shim above the ball thrust bearing. The table should elevate about .007".

Too thick a shim should not be used, or the table cannot be lowered onto its flat bearing on the baseplate for clamping firmly. This sheet metal shim should have the same outside diameter as the ball bearing upper race and have a hole fitting the centering stud. Both Square and Circular Swiveling Tables mounted on baseplate should be clamped to the baseplate, before lifting to and from the main table or platen of the machine. This operation will be facilitated by a simple lifter, consisting of a square or flat bar of steel, having an eyebolt in the center and a hole near each end for bolts having the heads on the underside to fit the T slots in the Swiveling Table.

The Split Ring Clamp on the latest type Swiveling Table on baseplate is very efficient and comparatively little effort is required to clamp the table down securely against rotation. Clamping unnecessarily tight does no good and might result in expensive breakage.

If the clamp requires taking up, tighten the nut having the serrated

end, one notch only. If taken up too much, the clamp will not release far enough to prevent drag when the table is swiveled. In later machines this serrated construction has been eliminated, the six flat sides of the hexagon adjusting nut being sufficient to provide for adjustment and its locking. Do not remove the stop screw or pin (located in the side of the clamping bolt) in order to give the bolt more motion, as this stop keeps a groove in the bolt in proper relation with the interlocking mechanism referred to above.

DIAL INDICATOR INDEXING DEVICE

The Special DIAL INDICATOR INDEXING DEVICE, incorporated in machines only when so ordered, gives a means of accurately spacing holes, with measuring elements not subject to appreciable wear, the traverse screws being used merely to adjust the slides to position. Of course, if the extreme horizontal distance between the holes to be bored is as great or nearly as much as the maximum cross travel of the table of the machine, the job will have to be located on the table so the hole farthest toward the rear will line up with the spindle when the table is clear forward at the end of its adjustment. Otherwise the table may not have enough adjustment to reach the hole farthest toward the front.

When doing original work such as boring two or more holes in a jig, experimental work or parts of a special machine, the spindle is lined up with the work to bore the hole lowest down and farthest to the rear and combinations of $\frac{5}{8}''$ round standard end measuring rods (available in 1", 2", 3", 6" and 12" lengths) and inside micrometers, corresponding to the center distances to the holes highest and farthest forward are placed in the troughs or holders provided for them, so they will be in contact with each other and the fixed abutments on the top of the head and side of the saddle respectively. The indicator holders are then adjusted along the trough strips, so each dial indicator makes contact with its end measures and reads zero after the hand makes a partial revolution around the dial. On late model machines, adjustment is provided in the abutment pin in the bracket at the side of the saddle.

After boring the first hole, the combinations of end measuring rods and

inside micrometer settings should be changed an amount to correspond with the vertical and horizontal distances to the next hole and the head and table adjusted upward and toward the rear respectively, so the indicators again make contact and the hands read zero after making the same partial revolution, without changing the dial settings or unclamping the indicator holders.

In repetition work such as boring gear boxes on a production basis, a simple work holding fixture should be provided with a starting point to which the spindle can be set, using special length gages corresponding to the distances vertically and horizontally from this locating point to the centers of the various holes to be bored. A one inch diameter plug with a taper shank in the spindle can be brought into contact with vertical and horizontal surfaces or pads on the fixture, or a close fitting sleeve can be slid along the above mentioned plug so as to enter a snug fitting bored hole in the fixture, as a starting point.

SERIAL NUMBER

In ordering repair parts or corresponding about this machine, be sure to identify it by its serial number, which will be found stamped on the combination speed and name plate and also on the front edge of the bed, near the left hand end of the way.

THE LUCAS MACHINE TOOL CO.
Cleveland, Ohio U. S. A.

MEMORANDA

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