MODELS 1H AND 2HL
MILWAUKEE MILLING MACHINES
-Plain and Universal-

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K E A R N E Y & T R E C K E R
Corporation

Milwaukee Wisconsin

OPERATION
LUBRICATION & ADJUSTMENT

UNCRATING Carefully remove protective crating and skids so that the machine and parts are not marred, scratched or impaired. In the event of damage in transit, communicate at once with our representative and the transportation company making delivery.

SHORTAGES Check shipment carefully against the itemized packing list which is included in the parts box. When two or more boxes are necessary the parts list will be found in the one marked "PACKING LIST INSIDE THIS BOX". In case of shortages, report them immediately to the representative from whom the machine was purchased, indicating parts not received which have been checked on the packing list.

HOISTING DO NOT USE CHAIN OR CABLE - BE CERTAIN ROPE IS OF SUFFICIENT STRENGTH - Take extreme care when hoisting machine, balancing on rope before raising. Thoroughly protect all contact with machine by ample use of soft wood blocks, burlap, or equivalent.

Horizontal Machines - Place spliced rope in U fashion under rear end of overarms, passing rope through crane hook, continue rope double under front end of overarms and attach to crane hook.

PLACING ON SOLID FOUNDATION Milwaukee Milling Machines are extremely rigid and accurate. The column is cast in one piece and machined on the bottom to insure level installation when resting on a flat surface. Where a concrete foundation is used, it is advisable to apply grouting to eliminate any unevenness, thus providing a solid base at all points. When erecting machine on an upper floor select, where possible, a position over a girder, near a wall or some other suitable place where building vibration is at a minimum. A carefully prepared foundation will greatly improve the machine's efficiency.

LEVELING MACHINES The milling machine's work table is the index to proper leveling. Center the saddle on the knee and the table on the saddle. Prepare the machine for accurate installation by crosswise and lengthwise level readings of the table after the machine has been supported on taper wedges at each of the four corners. After obtaining a level position insert additional wedges around entire base. Use lag screws to secure machine solidly to foundation.

CLEANING — Thoroughly clean slush and grit accumulated in transit with either kerosene or gasoline. Do not move any part of machine until all exposed surfaces have been well cleaned and lubricated. Then by hand, move table, saddle, and knee, to limit stop in one direction. Clean and lubricate newly exposed surfaces, then move each unit by hand to extreme opposite limits to clean and lubricate exposed surface.

LUBRICATING OVERARMS — Clean exposed ends of overarms and lubricate, then unclamp and move arms in and out to clean and oil center of arms for ease of movement as well as preventing corrosion inside of the column bores.

SPEED OF PULLEY SHEAVE AND DIRECTION OF ROTATION — All machines equipped for motor-in-base drive. The correct r.p.m. is cast on the hub of sheave or main drive pulley together with an arrow indicating direction of rotation. It is essential that the R.P.M. and the direction of rotation be followed.

SETTING MOTOR — Place motor on base plate in column. A motor cooling fan is pressed onto hub of motor sheave - place sheave on armature shaft with fan toward motor. V-belts must have accurate vertical and horizontal alignment to insure long belt life.

V-BELT — Distance from center of outer grooves to side faces of both small and large sheaves are alike. To allow for end play of armature on sleeve bearing motors, set alignment by using a straight edge against side of sheaves. When properly aligned, lay out motor feet holes on motor plate, drill and tap holes in plate and attach motor.

PLACING AND ADJUSTING BELTS — Release lock screw located at right of motor sheave to permit full movement of motor plate. Raise motor plate to top limit with adjustment of lock screw at left rear of motor plate. Place V-belts from groove to groove of sheaves until all have been applied. To adjust belts to proper driving tension, lower motor plate with adjusting screws located at right and left rear of plate, both screw ends making contact to fasten plate securely. Lock both adjusting screws with lock nuts furnished to hold plate firm and secure.

To avoid unnecessary pressure on the motor bearing, the tension on the V-belt should be less than the tension required for a flat leather belt.

LUBRICATION — Do not operate machine until it has been properly lubricated. (Refer to numbers on illustrations.)

COLUMN LUBRICATION — The mechanism in the column is lubricated from a central lubricant reservoir directly above motor compartment. A high grade and perfectly clean machine oil should be applied (viscosity 300 to 325, saybolt at 100°) fill reservoir through cap opening at rear center of column until lubricant meets arrow line on sight gauge (No. 8). Approximately 3 gallons of oil are necessary. From this main reservoir, the entire mechanism in the column, pulley bracket and speed drive unit are flooded with lubricant.

On all sizes of machines - when motor is started, oil from the reservoir is automatically pumped (gear pump mounted to pulley drive mechanism) through a pipe line with perforated outlets, distributing a large volume and constant flow of oil over all gears, shafts, and bearings.

NOTE: The lubricant level should be inspected frequently and kept to correspond with line on lubricant gauge (No. 8). To prevent overflow, do not add oil while motor is running. An oil flow gauge (No. 3) is provided on all machines.

KNEE LUBRICATION — Fill lubricant reservoir in knee through filler cap located above gauge (No. 15) using a good grade machine oil (Viscosity 300 to 325, Saybolt 100°).

This lubricant gauge (No. 15) is a combination oil level and flow gauge. It indicates the height of oil level and shows whether or not the oil is circulating in knee. A gear driven pump supplies oil in large volume, and lubricates all unit mechanisms bolted to knee as well as the column ways, vertical screw and all running parts in the knee immediately when power is applied, or motor is started in operation.

NOTE: This lubricant level should be inspected frequently and kept to correspond with line on lubricant gauge (No. 15). Reservoir capacity 1 to 1-1/2 gallons of oil corresponding with line.

CLEANING LUBRICANT RESERVOIRS — With daily machine operation, drain column and knee reservoirs approximately every four months and fill with fresh oil. Column lubricant reservoir drain plug (No. 48) is located inside sheave and belt cover. Knee lubricant reservoir drain plug is located at rear underside of knee (No. 41).

After draining oil, reservoirs should be filled with kerosene and with machine in operation for five minutes to flush pumps, piping, and all mechanism, then kerosene should be removed, and reservoir filled with fresh oil. (The necessity of periodically flushing out the old lubricant from column and knee cannot be over-emphasized.)

SADDLE LUBRICATION — Fill saddle lubricant pocket (No. 13) located at front center daily, through oil plug opening. Copper tube enclosed wicks, which provide a continual flow of filtered oil from this pocket, lead lubricant to table drive mechanism, table feed screw and nut, crossfeed screw and nut, table drive shaft and the sliding way bearing surfaces on saddle and table.

TABLE THRUST BEARING LUBRICATION — Fill lubricant cups daily located at each end of table to properly lubricate bearings at ends of table feed screw.

LUBRICATION OF OVERARMS — The overarms should be kept clean and lubricated with a thin film of oil for ease of movement as well as for the prevention of corrosion inside the column. Cleaning and oiling overarms will also prevent marring when applying arbor supports.

ARBOR SUPPORT LUBRICATION — Arbor supports (No. 17) are equipped with lubricant reservoir and sight gauge which provides automatic lubrication for the support bushing.

MOTOR LUBRICATION — Have motor bearing lubrication cups filled at all times. Large doors are provided at each side of column for easy access to motor bearings, another advantage of the cross-mounted motors.

BALL BEARING MOTOR LUBRICATION — About every six months supply grease lubricant.

MOTOR COOLING — Fresh air is constantly circulated through motor compartment by a safety fan mounted on armature shaft directly behind motor sheave.

COOLANT RESERVOIR — The coolant reservoir is located in the base of the machine; to fill the reservoir, remove the screen cover plates (No. 16) in base and fill until level meets screen. Coolant capacity - 5 gallons.

CLEANING CUTTER COOLANT PASSAGES AND RESERVOIR — The rear longitudinal pocket in the milling machine table is provided with a fine mesh screen to prevent chips entering and clogging the coolant return channels. This screen can readily be removed in order that the table pocket channel can be cleaned of the fine grit deposited by the coolant as it returns to the reservoir. If this fine grit is not removed, it will accumulate into a caked mass and prevent the return of the coolant from the table to the reservoir.

To clean the coolant reservoir in the base of machine, remove the screens under the circular plates (No. 16). The coolant and any accumulation of sludge can be removed through these two openings as the telescopic tube is purposely located near one of these openings to facilitate cleaning any grit that deposits at this point.

CUTTER COOLANT PUMP — Cutter coolant pump is of the geared type. It is located at machine base (No. 51) inside of sheave and belt cover door. When milling cast iron or other material not requiring cutter coolant, the pump should be disengaged by disconnecting pump drive clutch (No. 50) located at the bottom of vertical splined feed shaft.

CUTTER COOLANT FLOW — The amount of cutter coolant flow is regulated at both outlet nozzles (No. 44) which can be swiveled to properly distribute coolant to cutters of all diameters. Each nozzle has two swivel joints and the outlet unit is mounted on a bracket which can be clamped to either overarm by means of a split circular clamp.

The stopping of the machine spindle stops the coolant flow and likewise when the spindle rotates, the coolant flow starts automatically when pump driving clutch is engaged and mounted on feed spline shaft, (No. 50).

When continuous coolant flow is desired, remove four screws and reverse pump cover (No. 51) and place pump drive clutch to rapid traverse vertical spline drive shaft. With machine motor in operation and machine spindle stopped, a cleaning hose can be tapped into coolant line at joint of flexible tube for washing grit and chips from fixtures, vises and machine table or regular coolant valves can be operated as desired.

SPINDLE SPEED SETTING

It is important that spindle speed changes be made only when the starting lever (No. 1) is disengaged. The three spindle speed change gear levers (No. 4) (No. 5), (No. 6), located on the left side of column, are used for the selecting of any of the sixteen speed changes. When the lever (No. 4) is set in the vertical (or neutral) position, all gear contacts with the spindle are disengaged, permitting ease of spindle rotation by hand for accurate cutter setup, whenever this method of accurate cutter setting is desired.

SPINDLE REVERSE

The spindle reverse is of the built-in mechanical type and is easily operated by plunger knob (No. 7) located at left side of column. The reversing of spindle is easily accomplished by disengaging starting lever (No. 1) and applying pressure in either pushing or pulling of knob (No. 7) before spindle train gears come to a full stop. The reverse of this spindle has no effect on the direction of the feed.

CAUTION: Spindle reverse should only be made with starting lever (No. 1) disengaged and speed range lever (No. 4) placed in slow position.

REMOVING ARBORS

With speed range lever (No. 4) set in "SLOW" position, release adjusting nut on draw-in rod several threads. Tap outer nut face of draw-in bolt lightly with wrench to release arbor from spindle taper. Rotate draw-in rod to disengage threaded end from tapped end of arbor and then remove arbor.

NOTE: Due to the standardized steep angle non-sticking taper in the spindle (3-1/2" per foot), it is always necessary to hold the arbor firmly in the taper hole in the spindle when engaging or disengaging draw-in rod.

FEED CHANGES

Desired feed is obtainable by with-drawing feed change lever handle (No. 31) and revolving in either direction until desired feed corresponds with arrow. For ease of operation feed changes should be made with spindle running. The feed can be stepped up or stepped down without disengaging the starting lever (No. 1) when milling cuts are light, feed changes can be made without disengaging either the table, cross or vertical feed levers. The feed box is of the sliding gear transmission type and mounted integral with feed distribution unit attached to front of knee.

All feed gears are heat-treated and hardened, mounted on splined shafts and run in oil which is supplied by a geared pump mounted in feed and rapid traverse unit at right side of knee. Like the column lubricating pump, with machine motor running the knee lubricating pump is operating and entirely independent of the drive clutch controlled by starting lever (No. 1). With this construction the oil is always in circulation and it is not necessary to engage the main drive clutch or any of the feed levers to obtain the proper lubrication for all mechanism in knee as well as units attached. The column face and sliding rear face of knee are automatically lubricated including the vertical screw from this centralized geared pump.

FEED MOVEMENT

When engaging the longitudinal, the cross, and the vertical feed levers for movement of either the table, saddle or knee it is desirable to have the spindle rotating. The longitudinal movement of the table is controlled by feed engaging lever (No. 35). The cross feed movement is controlled by feed engaging lever (No. 27) and the vertical feed movement is controlled by feed engaging lever (No. 28). To engage cross feed to saddle or vertical feed to knee, withdraw handwheel or crank, then engage cross or vertical control levers for cross or vertical feed directional movements as indicated at front of knee. The handcrank (No. 9) on left hand end of table screw is spring actuated and this crank automatically disengages when hand pressure is released.

NOTE: The power rapid traverse for table movement is independent of the main drive clutch and can be operated in moving table either right or left with table feed lever (No. 35) engaged and applying rapid traverse lever (No. 39). No. 1H or 2HL Machines are not equipped with power rapid traverse for saddle and knee movements.

TABLE FEED LEVER IS RE-ENGAGING TYPE

The table feed engaging lever (No. 35) is directional and is so constructed that by raising the handle it is possible to escape preset trip and continue past it as the operator desires. Thus, the workpiece can be rapid traversed up close to the cutter and table movement stopped instantly by tripping table lever to neutral with adjustable preset trip dog. The operator can then raise the feed lever and re-engage the feed into the cut. This exclusive feature facilitates a wider and more efficient use of power rapid traverse with absolute safety to machine, cutter and workpiece.

After the cut is finished and it is desired to return the table to the starting position then it is only necessary for the operator to reverse the feed lever which will then automatically pass the set feed trip dog and bring the table to the original position for unloading and loading a duplicate workpiece. Tripping to a starting position is accomplished by another trip block which is adjustable and can be placed at will to stop the table travel at any point in relation to the distance from the revolving cutter to permit changing of workpieces in perfect safety without stopping spindle. The tilting table feed engagement lever offers a skip-stop arrangement to the table feed and rapid traverse movements that is entirely under the control of the operator at all times. This re-engaging type of table feed lever is the most convenient feed lever ever placed on a milling machine, and it is well to study the possibilities of this feature so as to get the maximum productive results from the machine.

DIRECTIONAL FEED LEVERS

On all milling machines, regardless of age or make, the following hand movements have always been standard; turn the table handcrank (No. 9) to the right and table will move from left to right; revolve cross handwheel to the right and saddle moves "IN"; turn the elevating crank to the right and knee moves "UP". Feed levers (No. 27) and (No. 28) have identical directional movements. Engage lever (No. 35) to the left and table feeds to the left; move lever (No. 27) to the left and saddle travels "OUT"; move lever (No. 28) to the left and knee moves "DOWN".

SAFETY TYPE HANDWHEELS AND CRANKS

All handwheels and cranks are provided with means for safety and efficiency. They are interlocked, positive and foolproof. Handcranks and handwheels cannot be

left attached or engaged, and accidentally revolve when power is engaged. The operator is always completely protected regardless of where he is located in operating machine.

ADJUSTABLE AND POSITIVE SAFETY LIMIT STOPS

Both type stops provide tripping movement to table, cross and vertical feeds which are disengaged automatically, four adjustable trip blocks are provided on the table, two on the saddle and two on the knee. These adjustable trip blocks can be set so that the power to table, saddle, and knee movements can be tripped out at any desired point. Fixed limit blocks are provided on each end of the table, the saddle and knee and a positive safety in preventing damage to either of the screws or bearing bracket members.

CLAMPING TABLE, SADDLE AND KNEE

When milling work with table movement, it is advisable to clamp (No. 14) the knee to the column and the saddle (No. 12) to the knee to add rigidity to these members and provide for heavier cuts with greater feeds without vibration.

The table locking lever (No. 11) is located in the center at the front of the saddle. The saddle clamping lever (No. 12) is located at the left side of saddle, and should always be clamped when cross movement is not required. The knee clamping levers (No. 14) are located at rear left end of knee, both these levers should be drawn downward to clamp the knee to column solidly when vertical movement is not required.

The cross handwheel (No. 29) and vertical handcrank (No. 30) are interlocking and as an added safety to machine and operator both crank and wheel can be placed in a neutral position with knee or saddle clamped; interference rings are cast integral in the cross and vertical feed control levers and cannot be engaged accidentally or otherwise when handwheel or crank are positioned in neutral. These same interference rings obstruct the engagement of power feed when hand feed is in use and in like manner they obstruct the engagement of hand feed when power feeds are desired.

Both handwheel and handcrank have three positions and detent controlled - pull handwheel or crank all the way out and power feed can be accomplished, push either half way in for the neutral position, and when all the way in hand movements of saddle and knee can be made.

CAUTION: Be sure to release respective clamps before attempting to operate power longitudinal, cross or vertical movements, as neglecting in doing this may result in damage to the ways.

FEED SAFETY SLIP CLUTCH

There is a safety slip clutch in the knee located in the feed drive mechanism and adjusted to carry a 100% overload. This clutch provides safety to the longitudinal, cross and vertical feeds, the power to table, saddle and knee is transmitted through this feed safety clutch which is properly tested and set at the factory and is purposely constructed without any means for adjustment. When overload is imposed, movement of the table, saddle or knee stops automatically and a series of successive clicks will be heard, warning that movement has met with obstruction or that the feed used is beyond the capacity of the machine.

ADJUSTING THE MAIN DRIVE CLUTCH

The main drive clutch for speed and feed movements is built in the center of the large drive pulley (No. 46).

This clutch is of the single plate dry disc type, used for years and proven as superior by the automotive industry. By opening the sheave and belt door (No. 47) the clutch becomes accessible and adjustment is made without the use of any tools. To adjust or tighten this clutch, pull out the spring plunger lock pin (No. 46) which is located between two of the clutch fingers, and turn the clutch finger ring to the right for taking up clutch, or to the left for loosening. In making this adjustment take up one notch at a time and then check adjustment with the starting lever (No. 1). When full engagement of starting lever can be made in the ordinary way and clutch cone contacts fingers to compress drive plate for machine operation, then clutch is properly adjusted.

CAUTION: Do not set clutch too tight - a great amount of pressure in engaging starting lever places a tremendous strain on clutch fingers and may result in breakage.

RAPID TRAVERSE SAFETY SLIP CLUTCH

This safety clutch is mounted to drive gear mechanism of rapid traverse line and located in feed and rapid traverse take-off unit bolted to column on inner side of main drive pulley. This safety clutch prevents damage to rapid traverse drive mechanism on rapid table movements.

CAUTION: Be certain table lock is unclamped before applying rapid movement as scoring of table dovetail may result.

POWER RAPID TRAVERSE FRICTION CLUTCH

This clutch is of the multiple disc type and is located in the rapid traverse drive bracket on the right hand side of knee. It is controlled by lever (No. 39) located at right front of knee. Clutch is accessible for adjustment after removal of plate marked "Remove to adjust clutch". The adjustment of this clutch is similar to the adjustment of the main drive friction clutch. To adjust, disengage lock plunger pin in adjusting nut and turn to the right or left to adjust clutch to proper driving tension.

Proper adjustment for rapid traverse clutch is determined by instant movement of table when lightly engaging rapid traverse clutch lever (No. 39). When releasing rapid traverse lever from rapid to automatic feed movement, the table should not float or bind. If floating or binding takes place, proper adjustment to table gib is necessary.

NOTE: Always engage rapid traverse clutch gently as a safety precaution against interference when using this fast rate of travel. Undue wear to clutch mechanism is the result of jerking or applying a great amount of pressure in engagement of rapid traverse lever (No. 39).

ADJUSTMENT OF SPINDLE BEARINGS

Spindles are properly adjusted at factory and should run for a long period without further adjustment. However, if it ever becomes necessary to adjust the spindle, speed range lever (No. 4) should be placed in a vertical or neutral position allowing spindle to be turned freely by hand.

The spindle adjusting collar nut is at rear exterior end of spindle. Loosen both headless set screws - and tap screws lightly to loosen bronze shoes which contact spindle threads under headless screws of adjusting nut, hold spindle firmly with a flat bar between driving tongues at front face and turn collar nut to the right to take up on spindle. After taking up on adjusting nut tap each end of spindle lightly, using lead hammer, to remove all possible looseness in the collar and spindle bearings, then again draw up on nut and lock firmly. Great care should be exercised not to adjust the spindle too tightly. Proper adjustment is determined by grasping the spindle at both ends and revolve by hand. Should you desire to adjust the spindle with an indicator, permit about .0003" end play. A spindle properly adjusted will produce fine finishes with large diameter cutters regardless of depth of cut and will still be free enough to run continuously for a considerable period at the higher speeds without excessive heating and undue wear.

BREATHER PLATES — Plate (No. 45) is attached to right side of column and prevents condensation inside of column. Plate (No. 37) at right side of knee prevents condensation inside of knee.

ADJUSTMENT OF TABLE SCREW THRUST BEARINGS — The table screw is mounted in brackets at each end of the table; the bearing in the left hand bracket is of the radial type and the right hand bracket is provided with two anti-friction bearings to permit for takeup adjustment. Removing the cover from right end of table screw exposes the adjusting collar nut. This nut collar is provided with a lock washer arranged with a series of lugs or ears, one of which is always in position to be bent into one of the notches of this adjusting collar to prevent vibration loosening nut after proper adjustment to taper bearings has been made.

ADJUSTMENT OF CROSS FEED SCREW BEARINGS — To adjust the bearings on the cross feed screw, remove the handwheel, (No. 29) power feed lever (No. 27) and graduated dial. An adjusting nut and serrated lock washer are then exposed. Withdraw the serrated lock nut half-way and turn the nut to make the necessary adjustment to tapered roller bearings replacing the lock nut after correct adjustment has been made.

VERTICAL SCREW — No provision is made for vertical feed screw adjustment. This unit is properly adjusted at factory, and requires no further attention. The weight of knee prevents lash between screw, nut and driving members. Automatic lubrication is provided for vertical screw.

ADJUSTMENT OF TABLE GIB — The table is provided with a full length taper gib located at front dovetail of saddle and has an adjusting screw at both ends of gib. To take up gib, loosen screw at small end of gib 1/8 turn and bring up screw at large end the same amount, backing up the screw at the large end a least bit to make certain a bow has not been placed in gib. Repeat until a very slight "drag" is felt when moving the table by hand.

ADJUSTMENT OF SADDLE GIB — The left side dovetail of saddle is provided with a full length taper gib with adjusting screws at each end of gib. To make adjustment, loosen screw at small end of

gib 1/8 turn and bring up screw at large end the same amount, backing up on screw at large end the least bit to make certain a bow has not been placed in the gib. Repeat until a very slight "drag" is felt when moving the saddle by hand.

ADJUSTMENT OF KNEE GIB — A straight full length gib bolted to left rear of knee makes contact with column dovetail. For proper gib adjustment a series of screws is provided for parallel take up. After correct adjustment is made the knee should travel full distance without binding to insure accuracy of movement. Even tension on screws will permit smoothness of knee movement, checked by placing hand at top of gib where it makes contact with column dovetail.

NOTE: Gib adjustments to table saddle and knee are of vital importance in maintaining machine accuracy - loose gibs cause chatter, vibration and poor finishes to work as well as undue wear to machine ways which impair accuracy of sliding members. All gibs should be gone over quite frequently and properly adjusted whenever necessary.

ADJUSTMENT OF KNEE CLAMPS — Knee clamp levers (No. 14) are for the purpose of securely clamping knee to column. To adjust clamp levers, it is merely necessary to loosen lock screw contacting clamp bolt, unlock clamping levers and with screw driver tighten clamp bolt 180° and contact set screw to flat on opposite side of clamp bolt.

DOUBLE OVERARMS — The overarms consist of two parallel round steel bars which are laced together by broad triangular arbor supports, insuring positive alignment of the arbor. The overarms are clamped in solid metal all the way around the bars and regardless of whether front or rear self-equalizing clamp block is tightened first, the alignment remains unchanged. The overarms are clamped by means of two clamp nuts at top of column (No. 2).

ARBOR SUPPORTS — When applying or removing arbor supports (No. 17) always extend one overarm beyond the other, this procedure provides the convenience of one single arm for handling supports with ease and speed. It is not necessary to remove arbor support for cutter or arbor change, merely extend one overarm several inches beyond the other to act as a swivel point, withdraw support to end of extended overarm and swing support upward to rest on second bar.

NOTE: Before moving overarms or applying arbor supports, be certain exposed surfaces of overarms are clean and covered with a film of oil.

The arbor supports (No. 17) have a lubricant reservoir provided (No. 18) with a sight gauge for automatic lubrication for arbor bearing and support bushing. If the work to be milled permits only one arbor support and that support is a considerable distance from the column, additional rigidity can be had by mounting one arbor support upside down on overarms at a central point between column and support in use. When more than

one support is needed place them in position before clamping to overarms.

NOTE: Always tighten and loosen arbor nuts with arbor support in place on arbor. All arbor supports are equipped with adjustable bushings (No. 19) which should be adjusted properly at all times to insure a true running arbor and prevent chatter, vibration and poor finish on milled work.

OVERARM BRACES

On heavy milling cuts it is good practice to apply the overarm brace (No. 26) to tie the knee and overarms together. Set up the job to be milled. Then move overarms to the desired position being certain that the front face of each overarm is flush with the outer support. Apply overarm brace to knee, forming contact of inner face of brace with arbor support. Lock brace firmly to knee and bolt to arbor support. Be certain to eliminate all twists as brace must be parallel when bolted to prevent springing of arbor. Arm brace is adjustable along the knee as reducing the distance from column to brace materially increases rigidity to the set-up.

CUTTERS ARBORS COLLETS, ETC.

All Milwaukee Milling Machines are equipped with standardized spindles, the taper being 3-1/2" per foot. On these small machines the No. 40 National Standard Spindle taper apply. On larger machines the No. 50 taper spindles are standard. For maximum production use our high grade line of standard arbors which are extremely accurate and properly heat-treated to meet the maximum requirements of milling. We manufacture arbors, collets, centering plugs, etc., as well as inserted blade face mill cutters, with high-speed, stellite and tipped tungsten carbide, these cutters in sizes from three inches in diameter and up to 24" will fit any make of machine in proportionate size with the No. 40 and No. 50 standardized spindle end. We will gladly furnish our arbor and cutter literature upon request.

GENERAL HELPFUL POINTERS

To attach an arbor to the machine, see that both the taper hole in the spindle and taper arbor shank are perfectly clean. Turn the spindle until the driving keys are in a horizontal position. The notches in the arbor flange will then catch on the driving keys to support the arbor until it can be caught by the draw-in rod. Due to the steep non-sticking angle of arbor tapers and to avoid the possibility of the arbor dropping or falling and marring the machine, the arbor should always be held by hand, until the threads of the draw-in rod have started in the arbor. When placing collars on arbors, be sure to clean the ends as dirt or other foreign matter will cause the arbor to spring. This same procedure should also be followed when attaching cutters. After cutters and collars have been properly placed, tighten the arbor nut by hand after which the arbor support should be put in place and secured. Then tighten the arbor nut with a wrench which can be done without danger of straining or springing the arbor.

When collets, plugs or face milling cutters are attached to machine spindle, the same care should be taken to see that the taper hole and face of spindle as well as the shank of the collet, plug, arbor or cutter, is clean and free from burrs and nicks. Standard collets, plugs and arbors of any type are drawn into the taper hole of the spindle by the draw-in rod.

MODEL H WORMWHEEL TYPE
SPIRAL UNIVERSAL DIVIDING HEAD

40 to 1 Ratio

THE MEANING OF OIL FILM FLOAT

The Model H Wormwheel Type Dividing Head is, like the Hypoid Type Dividing Head, a practical, rugged instrument developed for the requirements of the toolroom, inspection department or laboratory, and its ruggedness will absorb continuous heavy duty performance on all work within its range. The Model H Head is new, not salvaged from older designs, and is capable of the superior performance and accuracy built into every Model H and K Milwaukee Milling Machine.

In every plain bearing dividing head spindle there must be an oil film or the spindle could not be revolved. Even though the oil film is thin, it is one of the greatest destroyers of dividing accuracy. Without any load, the plain bearing spindle will show an "apparent accuracy" that measures up to general requirements. Place that same plain bearing spindle under the load of average cutting pressures, and the oil film is squeezed to one side, with the result that "performance accuracy" (that is, accuracy of the work produced) does not measure up to the "apparent accuracy" of the plain bearing dividing head when idle.

OIL FILM FLOAT HAS BEEN OVERCOME

Realizing the inaccuracy caused by oil film float, this new and practical dividing head was developed in which there is no oil film on the spindle to float. Instead of ordinary plain bearings, the rugged spindle is mounted on oversize and matched precision anti-friction bearings that are preloaded at the factory to several hundred pounds pressure. This gives a metal to metal bearing contact with no oil film and consequently no oil film float. For the first time, heavy load "performance accuracy" equals no load "apparent accuracy."

A PRACTICAL SPINDLE MOUNTING

It is practical to have anti-friction bearings on the spindle of a dividing head, as it is to have anti-friction bearings on the spindle of a modern milling machine.

STANDARDIZED SPINDLE END

The hardened and ground head spindle has a No. 40 standardized spindle with a non-sticking taper 3-1/2" per foot. Any arbors or special plugs arranged with No. 40 spindle end and that fit in the spindle of any milling machine arranged with No. 40 spindle end, are now interchangeable with this dividing head. An expanding key in the spindle end gives a metal to metal positive drive to any arbor, work driver, etc. Size of hole through spindle is 1".

DIVIDING HEAD CHUCK

The chuck is mounted direct to spindle end by three hardened screws. A positive lock is provided to hold chuck firmly in position when operating head on indexing or spiral cutting in either direction. Remove expanding key adjustment screw when applying chuck.

INDEX PLATES

Index plates are the single plate self-cleaning type with holes drilled clear through. Three index plates are regularly furnished with dividing head. An additional set of four high number index plates, when used with the three plates regularly furnished, will divide in sequence all numbers from 2 to 100 and many beyond.

8" - 10" WORMWHEEL DIVIDING HEADS

Two sizes of Model H Dividing Heads are available. Maximum diameter of work - mounted between centers of these dividing heads with spindle, in a horizontal position, is 8" - 10".

This range of 8" as standard was determined only after exhaustive study and research which proved at least 99% of all dividing head work done on this size machine can capably be handled by a dividing head having an 8" diameter swing. When facts proved the 8" size was practical, this rugged and compact head was designed.

A 10" head can be purchased at an extra cost for that unusual job. This 10" head is similar excepting the height from base to spindle center.

LARGE WORMWHEEL AND NEW TWO-PIECE WORM INCREASES ACCURACY

Instead of the customary flimsy type of wormwheel, both size heads have a bronze wormwheel 4-5/8" in diameter. Meshing with this wormwheel is a patented two-piece worm (1-5/16" diameter) which eliminates the customary cam or eccentrics for taking up wear between worm and wormwheel. This new worm is made in two sections, clutched together and separated 1/16" in assembly. Adjustment for wear is accomplished by merely bringing the two sections closer together without disturbing their fixed axis of rotation. In this manner the accuracy of the worm and wormwheel is never destroyed. The tooth contact relation remains unchanged and actually improves with service. This two-piece worm is adjusted by releasing the slotted screw at rear top of dividing head which permits turning an adjustable nut (No. 57) provided with a series of small holes for adjustment in eliminating lash between worm and wheel.

LUBRICATION

To properly lubricate head when in use add a few drops of oil daily through cap openings at top and side of head. When shipped from the factory the dividing head is filled with anti-rust lubricating oil (Stanorust #0 as made by Standard Oil Company) to a level permitting the wormwheel to dip into this oil as it revolves. When necessary add oil through cap opening on wormwheel housing. This reservoir oil level can be checked by the slotted plug in the small cover to the left of the index plate. The head is provided with oil seals to prevent oil leakage when spindle is in a vertical position. Although anti-rust oil is recommended and is far more satisfactory for long life, a good grade of machine oil, Viscosity 300 to 325 Saybolt at 100°, can be used, if desired.

CLAMPING

Large diameter clamp rings, of the floating type, the type that does not create any distortion, firmly grip all the way around the wormwheel, spindle block, and the index plate. The spindle is clamped by the square head set screw (No. 52).

NOTE: Before applying power feed or rapid traverse to the dividing head, get into the habit of first checking this spindle clamp screw.

POWER RAPID TRAVERSE TO DIVIDING HEAD — When the machine is set up for and has cut a lead, and it is desired to return to the starting point, without disturbing the setup, power rapid traverse can generally be used as follows:

(1) On machines equipped with "LOW LEAD ATTACHMENT", power rapid traverse can be used on any lead when that lead is set up as specified in the Lead Book supplied with this Low Lead Attachment. That is, when leads below 8" are driven by the auxiliary shaft under the machine table, and leads above 8" are driven directly from the table screw.

(2) On machines equipped with "CONVENTIONAL LEAD ATTACHMENT", with direct drive from table screw, rapid traverse can be used on leads above 10" only.

NOTE: When power rapid traverse is used on the dividing head, it should be engaged exactly as it is engaged when used to move the table, that is, it should be engaged GENTLY, to avoid damage if an error has been made in setting up the leads.

LOW LEAD ATTACHMENT — This attachment is equipped with change gears and worm sets that will give 40,362 distinct leads by power, ranging from .022 to 240 feet. It is also used for driving Rotary Tables, Right Angle Drive Bracket, Cam Milling Slide, etc. Power Rapid Traverse can be used on all leads and power drives obtained through this attachment, when the leads are set up as specified in the Lead Book which is supplied with this attachment.

CUTTING LEADS BELOW 8" USING LOW LEAD ATTACHMENT — For all leads below 8" lock the table feed lever (No. 35) in neutral, using the knurled screw provided in the lever for locking purposes. Table direction lever (No. 69) replaces feed lever (No. 35) for all leads below 8"; lever (No. 69) is directional and moved to the left for left hand feeds and to the right for right hand feeds. Plunger lever (No. 68) is also directional and operates the lead reverse clutch for changing the hand of the spiral. Lever (No. 69) operates in conjunction with plunger lever (No. 68) and when lever (No. 69) is shifted to the left, lever (No. 68) should also be moved to the left. When lever (No. 69) is moved to the right, lever (No. 68) should also be moved to the right. Place the index plunger pin in any hole in the outside row. Loosen knurled nut (No. 65) that clamps the index plate. Loosen the square head set screw (No. 52) that clamps the spindle. Place hand crank on square end inside the lead box and check the setup by hand, before applying power (No. 54) on all leads under 8".

For tripping table movement automatically on low leads up to 8", attach feed trip rod (No. 61) to front of table and connect rod to slot at shaft end of table direction lever (No. 69) set adjustable trip blocks along rod to any desired position contacting locked directional table feed lever (No. 35). In this way tripping of table is accomplished on low leads to desired limit movement on spiral work.

NOTE: When it is desired to rotate dividing head or rotary table by feed or rapid traverse (using Low Lead Attachment) and not transmit any movement to the milling machine table (for cutting "dwells" etc.) lock table feed

lever (No. 35). In this way tripping of table is accomplished on low leads to desired limit movement on spiral work.

NOTE: When it is desired to rotate dividing head or rotary table by feed or rapid traverse (Using Low Lead Attachment) and not transmit any movement to the milling machine table (for cutting "dwells" etc.) lock table feed lever (No. 35) in neutral, disconnect worm or worm wheel from table screw in low lead box, and engage levers (Nos. 68 and 69).

CUTTING LEADS ABOVE 8" USING LOW LEAD ATTACHMENT

For all leads above 8", the drive is taken direct from the table screw and the auxiliary drive shaft is entirely disconnected. Table direction lever (No. 69) on low lead box is locked in neutral using the knurled screw (No. 70) in this lever provided for that purpose. All feeds and power are now applied through table feed lever (No. 35) for cutting leads above 8".

CONVENTIONAL LEAD ATTACHMENT

This attachment is equipped with change gears for cutting leads by power from 2-1/2" to 149". The auxiliary drive shaft is omitted and power is taken directly from the table screw. Before applying power, check all setups by hand, using the hand crank (No. 9) on the left end of table screw.

Power rapid traverse can only be used on leads greater than 10".

NOTE: Do not engage rapid traverse (No. 39) on any lead set-up under 10" while driving dividing head with conventional lead attachment.

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1) Adjustable starting lever with built-in push button control

2) Equalizing clamps, firmly grip both overarms without springing column

3) Sight oil flow gauge tells instantly all gears and bearings are getting oil

4) Speed range change lever

5) Speed change lever

6) Speed change selection lever

7) Built-in mechanical spindle reverse; does not reverse feeds

8) Column reservoir oil lever gauge

9) Table crank; disengages when hand pressure is released

10) Cross mounted motor - easy to get at

11) Table clamp lever for boring operations

12) Saddle clamp lever

13) Cap opening for saddle lubrication; fill daily

14) Two separate adjustable knee to column clamp levers

15) Knee combination oil level and flow gauge

16) Coolant screen covers

17) Non-distorting arbor support clamps

18) Arbor support oil level gauge

19) Arbor supports have adjustable bronze bushings

20) Adjustable tail center

21) Adjustable center rest for supporting long shafts

22) Knurled nut locking ring for index plate

23) Clamp ring for locking lead unit to head; box adjustment bolt inside

24) Table limit stops

25) Adjustable table trip dogs

26) Adjustable arm brace

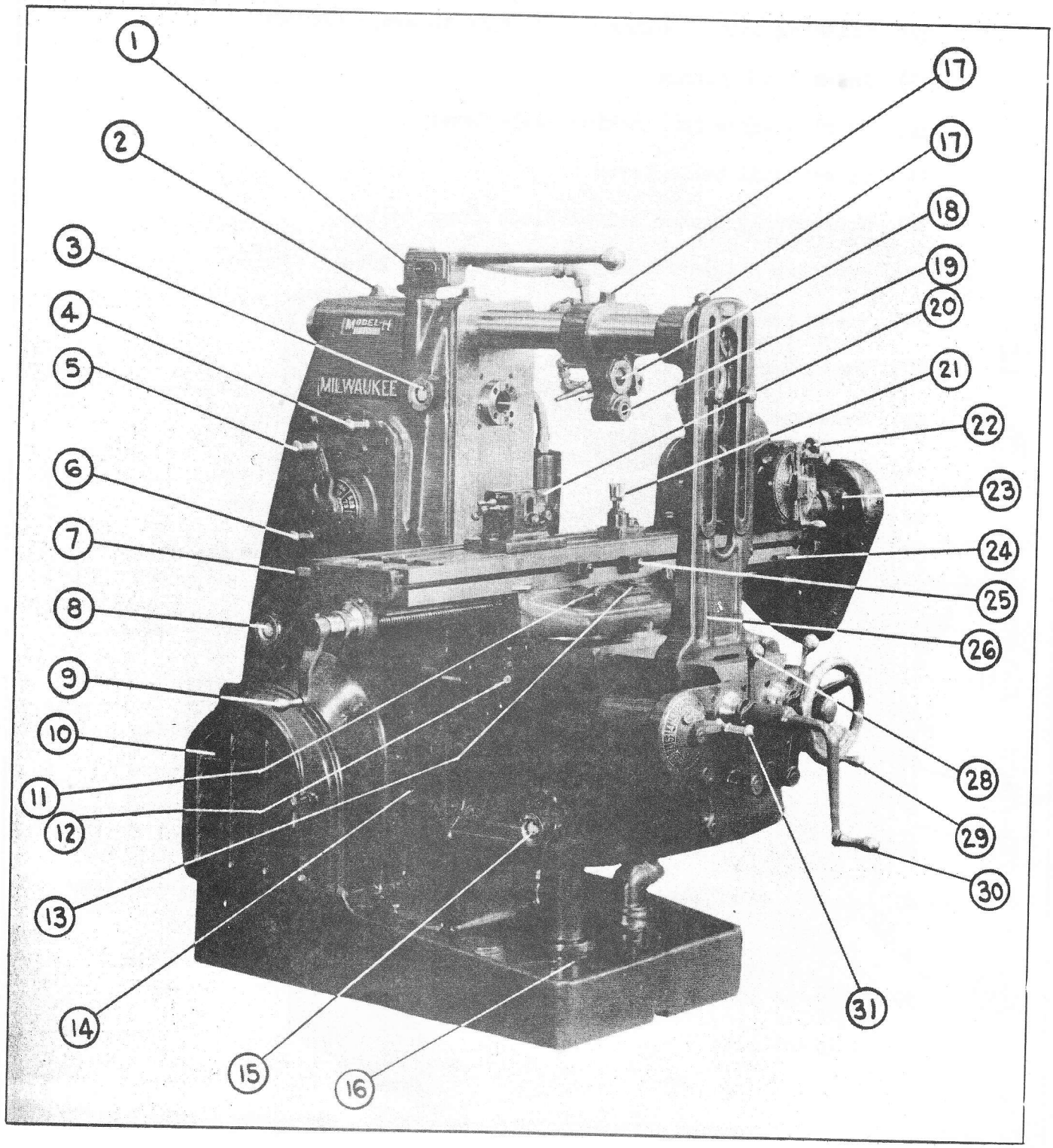
27) Directional cross feed lever

28) Directional vertical feed lever

29) Cross handwheel

30) Vertical hand crank

31) Feed change lever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MODEL 4

32) Clamping bolts locking outer brace to arbor support

33) Index crank plunger

34) Knurled screw for locking table lever

35) Directional table lever

36) Four evenly spaced swivel block clamp bolts

37) Breather plate prevents condensation in knee

38) Cover plate for rapid traverse clutch

39) Rapid traverse lever for fast table travel

40) Telescopic coolant return

41) Knee reservoir oil drain plug

42) Adjustable coolant clamp ring; mount on either overarm

43) Machine model and serial number; use to identify machine when requesting information

44) Adjustable coolant valves; double joint outlets

45) Air breather plate prevents condensation in column

46) Drive clutch adjustment lock pin

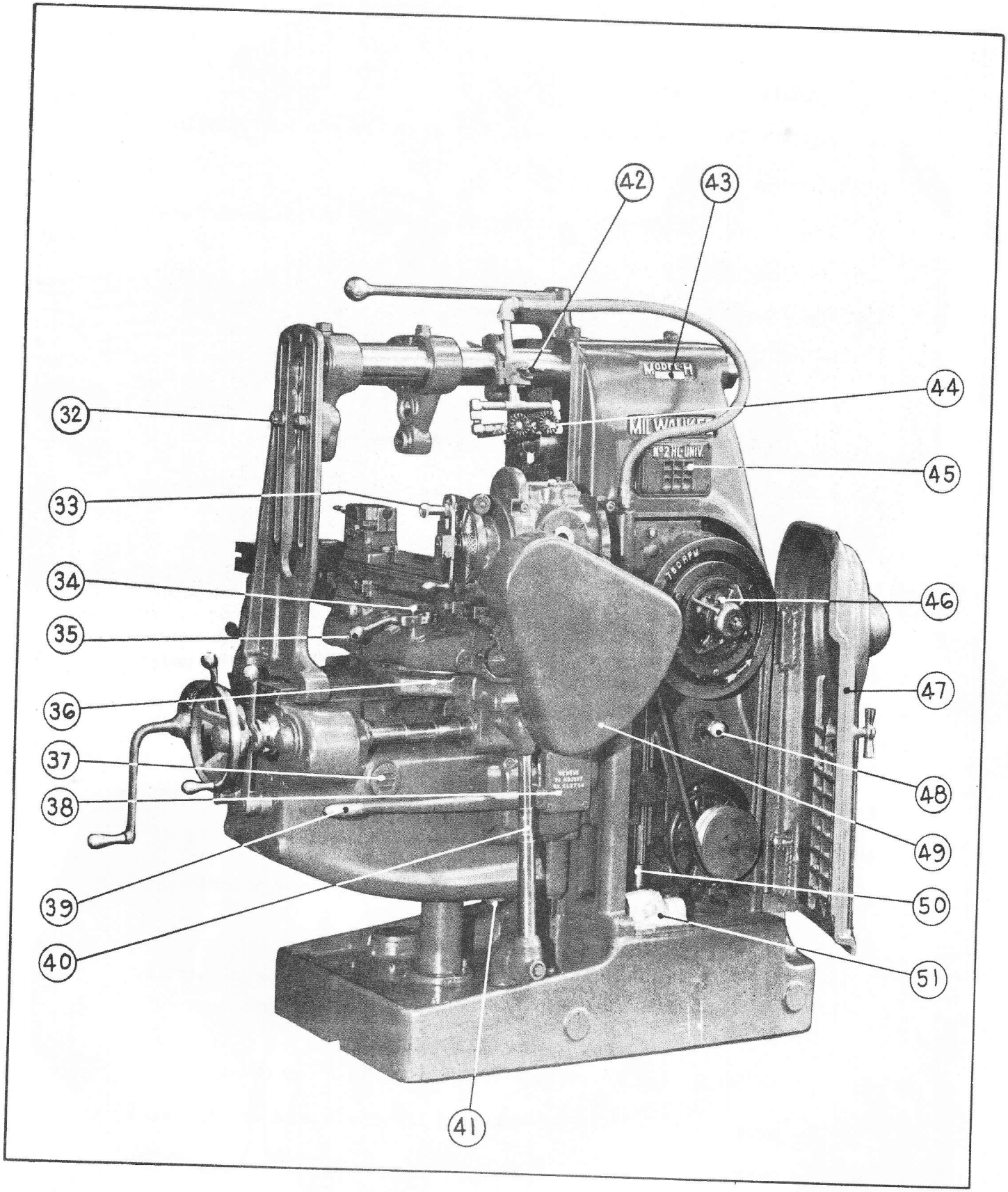
47) Door covers drive

48) Pipe cap for draining column reservoir

49) Covered lead gear unit - conventional - range of leads 2½" to 149" Power

50) Coolant pump drive clutch; snaps on

51) Coolant pump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52) Spindle clamp screw

53) Adjustable collar - graduated in minutes for spacing cams in degrees etc.

54) Hand crank end permits checking all leads 8" and under before applying power

55) Interchangeable and reversible worm gears - three sets

56) Clamp bolts for spindle block adjustment in degrees

57) Take up nut for spindle worm adjustment

58) Direct table screw drive for leads 8" or over

59) Adjustable drive tongue - for removing lash to arbor, driver and chuck

60) No. 40 National Standard taper spindle - same as machine spindle

61) Feed trip rod - used on leads 8" or under

62) Knurled screw for locking table lever on all leads 8" or under

63) Directional table feed lever - used on leads 8" or over

64) Auxiliary power drive shaft on leads 8" or under

65) Knurled nut for locking index plate clamp ring

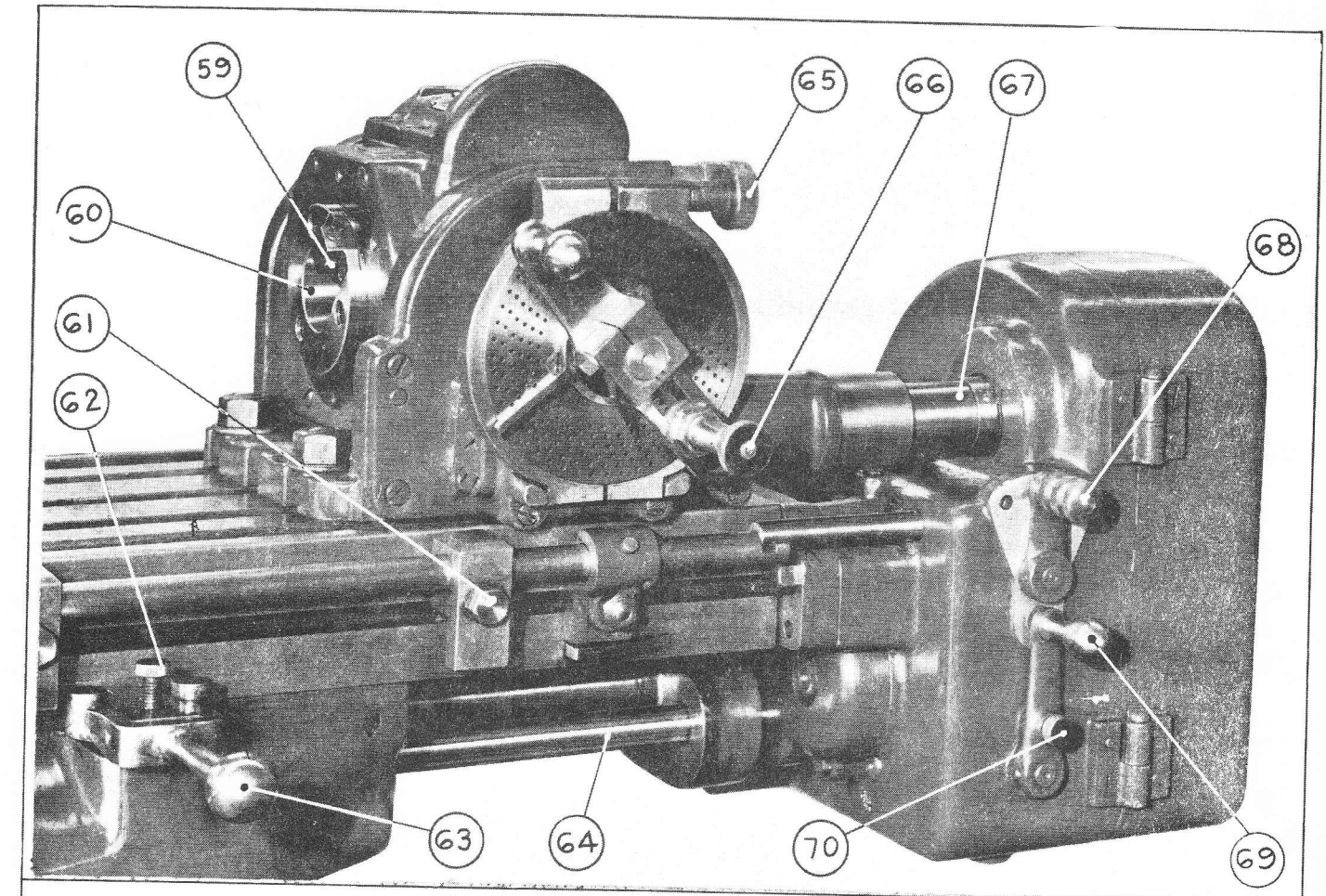
66) Index crank plunger

67) Telescopic extension shaft - permits setting head toward center of table for short work

68) Reverse lever for changing hand of spiral - also disconnecting drive to head

69) Directional feed lever - used on all leads 8" or under

70) Locking screw for directional feed lever - locked on all leads 8" or over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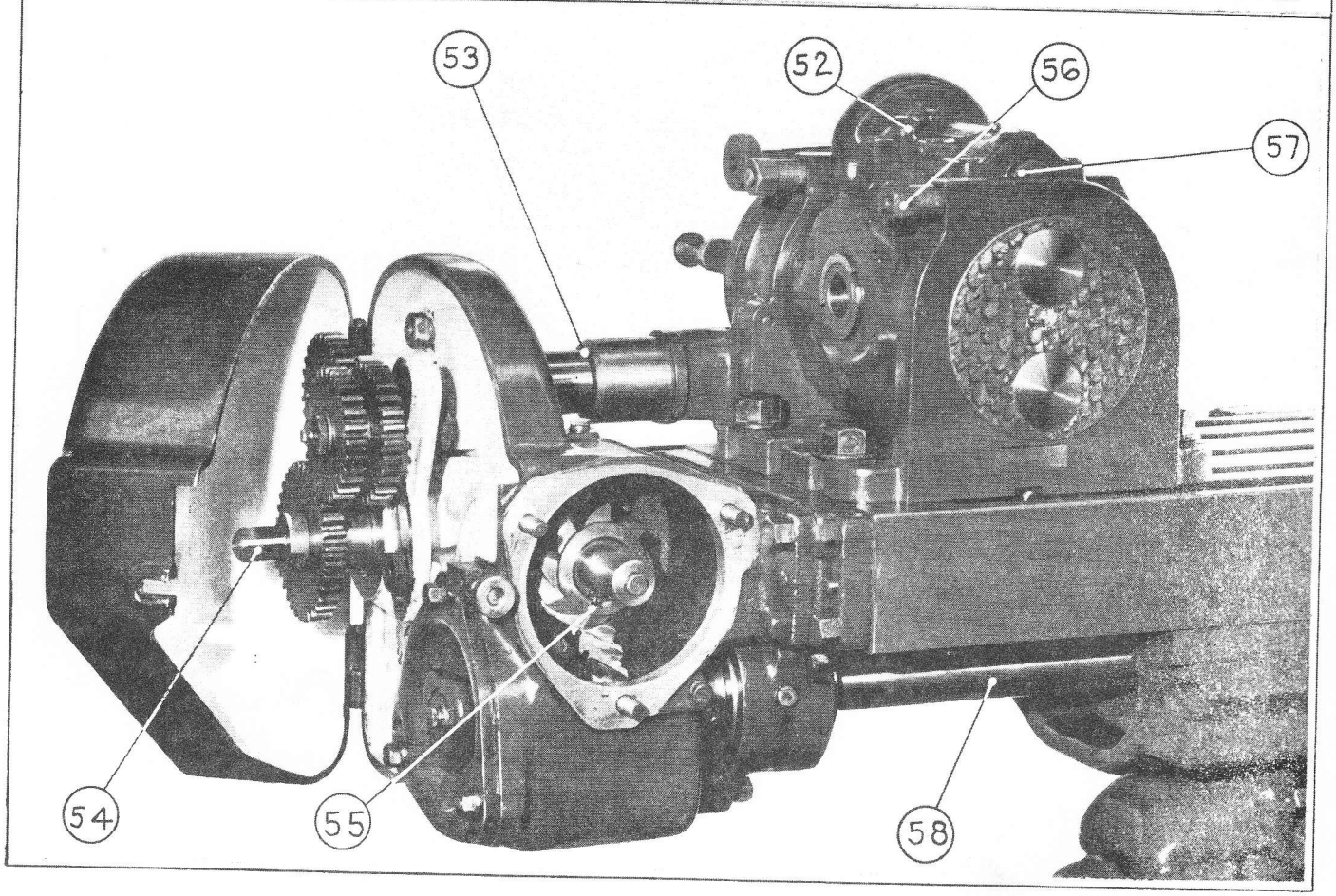
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