Wadkin BURSGREEN
T: 0116 2769111
F: 0116 2598138

DIMENSIONS AND CAPACITIES

Maximum length of Spar	3 - Bed Machine	30' - 0"
" " " "	4 - Bed Machine	44' - 0"
" " " "	5 - Bed Machine	58' - 0"
Maximum travel of Cutter Spindle	3 - Bed Machine	33' - 0"
" " " " "	4 - Bed Machine	47' - 0"
" " " " "	5 - Bed Machine	61' - 0"
Maximum diameter of Cutter		16"
Main Spindle Speeds	275 R. P. M. - 2500 R. P. M. Infinitely variable	
Auxiliary Spindle Speeds	137 R. P. M. - 1250 R. P. M. Infinitely variable	
H. P. of Spindle Motor	$12\frac{1}{2}$: 40 : 75	
Feed Speeds using standard pick off gears		$2\frac{1}{2}$" to 60" per min.
" " " alternate pick off gears		5" to 120" per min.
Quick return using standard pick off gears		8ft. per min.
" " " alternate pick off gears		16ft. per min.
Rise and fall of Spindle		$17\frac{5}{8}$" (Hydraulic)
Cross traverse		8"
Width of table		20"
Main and auxiliary spindle end	No. 50 International 5. 1/16" outside diam. 2. 3/4" dia. $3\frac{1}{2}$" taper/ft.	
Diameter of arbor (standard)	3" dia.	
Floor space	3 - Bed Machine	51' x 10'
" "	4 - Bed Machine	65' x 10'
" "	5 - Bed Machine	79' x 10'
Weight	3 - Bed Machine	32 tons
"	4 - Bed Machine	39 tons
"	5 - Bed Machine	46 tons

Diagrams 1 and 2 illustrate the principal capacities.

INSTALLATION. The machine is broken down into convenient sections for transporting in such a manner as to reduce re-assembly time to a minimum. All the larger members are provided with lifting eyebolts or have cored lifting holes. It is essential that a suitable concrete foundation be constructed as suggested on our foundation plan drawing No. LZ8512 supplied with all machines. Great care must be taken to ensure that the bed sections are accurately laid and that the beds themselves, which are marked at each end, are butted to their mating bed section. This is most important since all the bed sections are planed to a master template and each pair of beds are then keyed to each other at one setting to ensure perfect alignment. Generally speaking all parts which are dismantled for shipping are numbered to simplify re-assembly and arrangement drawings are supplied with all machines.

WIRING. The dismantling for shipping is so arranged as to reduce the breaking of electrical connections to a minimum. All broken connections are numbered and a wiring diagram is supplied with all machines.

SWARF EXTRACTION EQUIPMENT. The customer should consider which method of swarf extraction or collection is best suited to his needs before installing a machine, since this may considerably affect the space required to install the machine. We have, in conjunction with Messrs. Dallow Lambert & Co. Ltd. developed two types of extractor, details of which will be supplied on request.

THE CONTROLS. The push button station is grouped on a plate built into the overhung arm at the front of the machine (see Diagram 3). The control handwheels for varying the spindle speed and feed speeds are mounted on the large control panel on the left, which also houses the spindle tachometer, feed tachometer, and ammeter. The low range, medium range and high range spindle speed selector switch is also mounted on the front control panel. The various push buttons are interlocked so as to prevent any serious misuse of the controls. To start the spindle, press spindle start button, this also starts the suds pump and the hydraulic pump motor which controls the rise and fall of the headstock. When the spindle has reached its preset speed, then the forward feed may be started, but if the hydraulic copying equipment is in use, then the head must be allowed to come down until the tracer mechanism contacts the copy bar.

1. The spindle is started as described above. The spindle speed is selected by means of the spindle speed selector switch on the front control arm (see Diagram 3) and is controlled by means of the Capstan handwheel on the large control panel. The spindle speeds are indicated on the upper tachometer. The current taken is shown on the ammeter.

2. The feed can only be started after the spindle is up to full preset speed. The feed is infinitely variable and is regulated by the Capstan handwheel on the left of the control panel. Two ranges of feed speed are available and are selected from the switch (FSS) on the cubicle at the rear. The fast feed button gives maximum feed speeds dependent upon the setting of feed selector switch (FSS), irrespective of the preset feed, but is an inch operation only, and the feed stops when the button is released.

3. THE RETURN. Pressing the return button stops the spindle, hydraulic and suds pump motors and returns the carriage at full speed irrespective of the preset forward feed speed. The return feed, however, is arranged so that it is inoperative unless the headstock has been raised to a given height to clear the work on the return stroke. The height to which the head must be raised before the return feed can be operated, is determined by the setting of the cams on the rear slide of the headstock (see Diagram 7).

THE FEED.

PUSH BUTTON CONTROL. If the spindle is running all forward feed controls are operative and control the machine as described previously.

SLOW FEED POSITION. This feature can be used as a slow approach and will only operate while forward feed button is depressed. The return feed cannot be operated with the switch in 'Slow Feed Position'.

INCH POSITION. As push button control, but the feed will only proceed at preset feed whilst the feed button is pressed, and will stop when the button is released. This feature is used for setting up.

AUTOMATIC POSITION. When the operating switch is set at 'AUTO' and a copy bar has been fitted for form milling and the instructions under the method of setting the hydraulic tracer have been followed, the tracer valve operating knob set at 'TRACE'. By pressing the start spindle button, the following cycle takes place.

1. The spindle, hydraulic pump and suds pump motors start. The head lowers until the tracer roller reaches the copy bar.

2. When the spindle has reached full preset speed, fast feed horizontal movement takes place, and takes the spindle to the commence cut position, and then changes over either to preset feed or slow feed into the work piece, by means of the fast and slow dogs attached to the copy bars.

3. During cutting, fast, slow, and preset feeds are introduced as required, by means of cams or rollers on the sides of the copy bars (see more detailed description of copy bars Page 8).

4. At the end of the forward movement, a final ramp on the copy bar takes the head up to the top limit of the hydraulic movement. This movement is determined as described on Page 10, by the setting of the limit switch dogs on the rear slide of the vertical head, when the limit switch 'B' is reached the spindle stops, as well as the forward feed and all auxiliaries, excepting the bed lubricating pump motor; and the return feed then starts. The return feed continues until the carriage operates the return limit and switch 'RLS'. This is a completely automatic cycle, and to repeat it, it is only necessary to press the start spindle button.

LUBRICATION.

THE SADDLE. The saddle is automatically lubricated at six points, three on each face, by motorised oil pump. The pump should be topped up at least once a day with machine oil. A sight glass is provided and visual rising drop indicators are fitted to the oil pump. The pick-off gears are housed in a totally enclosed case inside the headstock frame. This case should be kept topped up with medium gear oil. To change the pick-off gears remove the back steel panel and the pick-off gear case cover. The feed pinion is mounted on taper roller bearings, and one parallel roller bearing all grease lubricated (see Diagram 9 & 10). The taper bearings are lubricated by a Stauffer grease cup at the base of the gear housing, and the parallel bearings by a nipple on the top end of the top cap.

GREASE EVERY THREE MONTHS.

1. Two ball bearing nipples on the feed motor spindle.
2. Two ball bearing nipples on the layshaft.
3. One ball bearing nipple on the jockey pulley.
4. One turn of the Stauffer grease cap on the tachometer.
5. One grease nipple on the top end cap of the feed pinion shaft.
6. One grease nipple at the base of the gear housing, lubricating the taper roller bearings.

OIL WEEKLY. Two oil cups on the hand traverse spindle. The worm shaft bearings are lubricated automatically by the splash from the gearbox sump. The wormwheel box forms a sump for lubricating the worm and wheel. The height of the oil is indicated on a dip stick on the top of the box behind the layshaft housing, and the filler cap is adjacent. Good quality ball bearing grease should be used in all the grease nipples, and medium gear oil in the worm box housing and the pick-off gear case.

LUBRICATION. General. The foregoing diagrams and texts give instructions for lubricating the principal points on the machine. There are several other grease nipples fitted at various obvious points on the machine to lubricate such things as handwheels, shafts, links, levers etc. which should be greased periodically.

CONSTRUCTION.

INTERMEDIATE SLIDE AND VERTICAL SLIDE. The intermediate slide is mounted on the headstock and carries the gear box. It is hydraulically operated over 17.5/8" total rise and fall. Lubrication for the slideways is provided by hand feed oil pump charged with medium machine oil, mounted on the rear of the intermediate slide (see Diagram 7). The pump should be used at least once per shift to lubricate the four points on the horizontal slide faces, and the train of spur gears from the cross traverse screw.

HEADSTOCK GEARBOX. The headstock is a self-contained gearbox with a $12\frac{1}{2}/40/75$ H. P. variable D. C. motor mounted on top, the motor is mounted on anti-vibration mountings. There is only one pair of reduction gears in the box as shown in Diagram 8. The main spindle is direct driven from a vee rope drive using eight Fenner vee ropes No. 105C, and when the main spindle only is being used the auxiliary spindle is out of mesh. The auxiliary spindle is driven by a pair of spur gears and is arranged for approximately half the spindle speeds on the main spindle. This gear should not be engaged under any circumstances whilst the headstock is running.

SPINDLE BEARINGS. Both the main spindle and the auxiliary spindles are mounted on Timken Taper roller bearings, clearances in which are pre-set before the machine leaves our Works, and should require no further adjustment over a long period. If, however, adjustment should be found necessary access to the spindle bearing adjusting locknuts (see Diagram 8) can be obtained by removing the large cover on the underside of the spindle headstock gearbox, and adjusting these two locknuts which are provided with 5/16" diameter tommy holes, (see Diagram 8)for further details. The lubrication of the spindle bearings is fully detailed on Diagram 5.

VEE BELT TENSIONING. The vee belt drive should not require any further adjustment over a long period. If, however, adjustment is found necessary this may be effected by adjusting the hexagon nuts on the support screws carrying the motor platform. Care should be taken to see that all four hexagon nuts are adjusted equally to maintain correct alignment of the driving motor. (See Diagram 8).

TAPER GIBS. The intermediate slide and the vertical slide are both fitted with taper gib wearstrips each of which are provided with adjustment to take up wear.

DRAW BOLT. Both the main spindle and the auxiliary spindle are bored to take a draw bolt and a large Capstan draw bolt spanner is supplied.

STEADY ARM. The outboard ball bearing steady is carried on two substantial round arms from the gearbox and a screw adjustment is provided to facilitate cutter changing.

GEAR CHANGE LEVER. A large gear change lever on the front cover of the gearbox is fitted with a safety plunger so that the auxiliary spindle gear may be locked in or out as required.

TACHOMETER. A tachometer driven direct from the main spindle indicates the actual spindle speed in R. P. M. on the main control panel.

CROSS ADJUSTMENT. The headstock has approximately 8" of cross adjustment on the intermediate slide by hand. A large Capstan handwheel is provided.

CONSTRUCTION (Cont.)

THE VERTICAL COLUMN. The headstock and intermediate slide are mounted on to a heavy vertical column which also houses the balance weight system. The balance weight cradle is carried on heavy roller chain over ball bearing guide rollers, which are grease packed and require no further lubrication. On the rear of the vertical column is carried the electrical cubicle containing the rectifiers and contactor gear for all the electrical equipment of the machine. This cubicle is removed before despatch. On the end of the vertical column is carried the feed motor, and on the front of the vertical column is carried the main control panel and the overhung arm carries the hydraulic profiling tracer valve. The whole column is mounted on a large saddle which traverses along the bed carrying the complete headstock feed works and electrical equipment. The saddle is traversed by rotating pinion engaging a continuous rack secured to the bed. It is powered by a variable speed D. C. motor through a vee belt drive and countershaft, pick-off gears, and worm wheel (see arrangement drawings Diagrams 9 & 10). There are no clutches in the mechanism, the forward feed being operated by varying the speed of the D. C. feed motor, and the return feed is operated by reversing the direction of rotation of the feed motor. The feed motor is arranged with electrical braking to reduce the over run to a minimum.

PICK-OFF GEARS. The machine is supplied with two pairs of pick-off gears giving feed speeds of $2\frac{1}{2}$" to 60" per minute, or 5" to 120" per minute.

TO CHANGE PICK-OFF GEARS. To change pick-off gears remove the cover plate on the rear side of the vertical column extension, and then the pick-off gear case cover (see Diagram 10). Release the hexagon nuts on the layshaft and the worm shaft and remove the pick-off gears. Fit pick-off gears required and replace covers.

HAND TRAVERSE. A hand traverse Capstan is fitted and this is spring loaded so that it automatically disengages when not in use.

VEE DRIVE. Feed motor and the layshaft are coupled by six 75A Fenner vee ropes, and are tensioned by a ball bearing jockey pulley.

FEED SPEED TACHOMETER. The tachometer generator is fitted to the feed mechanism and is driven from a layshaft spindle, the feed speed in inches per minute being indicated on the main control panel.

THE SADDLE. The saddle is mounted on to the bed, and retained by keep plates and two taper gib strips, each provided with 1. 1/2" of adjustment. Locking plates are fitted to the taper gib strips and must be removed before adjustments can be made.

The headstock is hydraulically operated on the rise and fall motion by a large diameter hydraulic cylinder, mounted on the hydraulic tank on top of the vertical column.

THE TANK UNIT. The tank unit comprises a constant delivery, high pressure pump, direct coupled to a 3 H. P. squirrel cage flange mounted pump motor, variable pressure control valve, oil filter and internal piping. The oil tank is provided with an inspection cover, filler cap, and oil level sight glass indicator, and carries the main cylinder and damper plungers, the whole unit being mounted directly on top of the vertical column.

THE TRACER VALVE. The hydraulic tracer valve is carried on a vertical square steel slide, with 18" of adjustment, and is carried from the headstock gearbox. The tracer valve engages on a cam bar (or a fixed bracket for parallel work) on the front of the machine table. The tracer valve is adjustable by means of the vertical adjustment handwheel (see Diagram 4) and thus the heavy headstock can be raised or lowered by hand without effort by virtue of the hydraulic ram and servo control system.

THE RAISE HEAD LEVER. The raise head lever (see Diagram 4) is used for raising the head up to its top position when the operation is complete, and the rate of lift is approximately 35" per minute. When the raise head lever is in the TRACE position, the head will lower at 35" a minute until the tracer valve roller reaches the cam bar, or the fixed bracket. The relative position of the tracer valve to the cutterspindle can be adjusted over the complete 17. 5/8" of vertical rise and fall.

HYDRAULIC COPYING. The tracer valve is arranged to engage copy bars carried on the brackets on the front of the machine throughout the complete traverse of the machine for copying any desired profile. The copy bars are arranged with fast and slow cams which vary the feed speed as required throughout the profiling operation (for further details see page 8).

THE HYDRAULIC TRACER VALVE. The hydraulic tracer valve is a very sensitive mechanism which responds to a deflection of .0005" and is correctly adjusted and tested before the machine leaves our Works. It is strongly recommended that no attempt be made by the customer to re-adjust or interfere with the setting of the valve. It is important that the tank be kept topped up to the sight glass level with hydraulic oil, Gargoyle D. T. E. light.

OIL FILTER. A purolater oil filter is fitted in the hydraulic tank, this should be removed every six months and immersed in petrol. Allow the surplus petrol to evaporate and replace the cover. Diagram 13 shows the filler cap, oil sight, pump motor, pressure release valve and the access cover over the oil filter.

THE HYDRAULIC COPY BARS.

A typical layout of hydraulic copy bars is illustrated on Diagram 11. The copy bars are arranged on the front of the machine table on the adjustable brackets, which are provided with setting screws to facilitate the alignment of the cam bar sections. Copy bars are manufactured from 1/4" thick mild steel plate and are made in sections, the length of each section being made to suit the particular contour required.

FAST AND SLOW CAMS. Fast and slow cams are fitted to the sides of the copy bars to engage limit switches on the travelling arm, in order to select FAST and SLOW feeds throughout the profiling operation.

DESIGN OF COPY BARS. The travel of the cutterspindle is 33ft. for a three bed machine, 47ft. for a four bed machine and 61ft. for a five bed machine, and the relative position of the cutterspindle to the table is shown on Diagram 1. The copy roller is 11" to the left of the cutter, and the fast and slow limit switches are 25. 1/4" to the left of the cutter (when viewed from the front of the machine). This should be remembered when designing copy bars, for positioning the FAST and SLOW feed cams. A parallel land should be provided starting from the START TRAVERSE position to the COMMENCE CUT position. The profile is then introduced, and at the end of the profile a 45° ramp should be introduced, which will take the copy roller up high enough to clear all obstacles on the return stroke. This ramp should be followed by parallel land of 18" approximately. In practice this parallel land should never be reached, but is provided so that it can be used in conjunction with the ultimate limit switch (R. L. S. Diagram 7) at the back of the machine, if the copy roller is not ramped up high enough to cut out the forward travel, i. e. limit switch 'B' is not reached (see Diagram 7). It is essential that a slow feed dog be engaged just prior to climbing the final ramp. This is particularly essential in the AUTOMATIC POSITION, since if too high a feed speed were employed climbing the final ramp, the action of reversing the feed motor from fast forward feed to fast return feed would cause excessive load on the feed motor, when limit switch 'B' is operated. A fast feed cam should be fitted to the cam bar and so arranged that the fast feed switch is depressed at the start traverse position, and continues to be depressed until the commence cut position is reached. FAST and SLOW feeds can be introduced at any point throughout the cycle. In the case of all sinking operations the incline of the copy bar should not exceed 45°, and if the step down is more than $\frac{1}{2}$" then a slow feed cam should be introduced during the sinking operation. As in the case of the final ramping operation, a slow feed cam should be introduced at any other rapid lifts throughout the profiling operation. In general it should be borne in mind that the maximum rate of travel of the hydraulic raise and lower is 35" per minute, therefore horizontal travel at all points of sudden changes in profile must always be carried out at a slow feed, if the preset feed would prevent this profile being followed. Any attempt to employ too fast a feed for a given rise would result in the delicate mechanism of the tracer valve being damaged. The maximum amount of hydraulic movement is 17. 5/8", the maximum incline of sink or climb should not exceed 45° to the horizontal under normal conditions. Inclines of 60°, however, can be copied provided a very slow forward feed is employed. It is recommended that the hand traverse forward feed be used should a climb of 60° be required.

METHOD OF SETTING THE HYDRAULIC TRACER.

1. Fit the copy bars to the brackets on the front of the machine table in the correct position.

2. With headstock carriage at the extreme left hand of the bed and the head in its top position adjust the vertical adjustment handwheel (Diagram 4) to lower the tracer valve until the roller is 4" to 5" clear of the copy bar.

METHOD OF SETTING HYDRAULIC TRACER (Cont.)

3. Select the spindle speed range as previously described on Page 2 and with the selector switch at PUSH BUTTON CONTROL position press spindle start button. The hydraulic pump and suds pump motors start automatically with the spindle, causing the head to lower (with raise head lever Diagram 4 in TRACE position) until the copy roller comes to rest on the parallel portion of the copy bar at the START TRAVERSE position (Diagram 11).

4. With the spindle and the hydraulic and suds pump motors still running adjust handwheel to lower the spindle to the correct depth of cut. The graduated slide bar on which the copy roller is carried, indicates the approximate centre height of the spindle above the table top, assuming that the parallel portion of the cam bar is arranged to be half an inch below the table top at the setting position. Final setting of the spindle height is obtained by adjustment of the handwheel, which is provided with a large dial graduated in .001".

5. Press FORWARD FEED BUTTON and adjust Capstan handwheel on the control panel as described on Page 2, until the feed speed tachometer reads the desired feed rate. It is recommended that a trial run over a complete cam bar be taken at this stage, without a spar on the table to check that all fast and slow dogs are operating correctly. At the end of this trial run the copy roller should be allowed to climb the final ramp (see Diagram 11) and when the copy roller is approximately $\frac{1}{2}$" from the top of this ramp the forward feed should be stopped. It is now possible to set the operating dog for limit switch 'B', see Diagram 7.

6. Press RETURN FEED BUTTON and return the carriage to the extreme left hand end of the bed.

7. The machine can now be operated under any of the four conditions as described on Page 3.

8. It should be borne in mind that the machine is arranged so as to prevent any electrical operation being performed without the hydraulic pump motor running, and since the hydraulic pump is electrically interlocked to the spindle motor contactors, this means that the spindle must be running before any power adjustments or traverses can be used.

9. A fixed bracket (see Diagram 4) is supplied with each machine for straight milling operations which do not require the use of a copy bar. If, however, the machine is required to operate with automatic, fast, slow and re-set feeds, then it will be necessary to fit plain or parallel copy bar, fitted with the appropriate fast and slow dogs.

SETTING THE LIMIT SWITCHES.

Limit switches are fitted to the cubicle, to limit the horizontal travel of the travelling headstock along the bed. They are operated by dogs or cams fixed to the bed. The dog at the right hand end of the bed looking on the rear of the machine is fixed and requires no further adjustment. The ultimate limit switch dog at the left hand end of the machine is also fixed and requires no adjustment. An adjustable cam fixed on a short cast iron slide is fitted at various positions along the bed and can be set to suit the length of spar being milled. Diagram 15 illustrates the horizontal limit switches.

THE VERTICAL LIMIT SWITCHES.

Two vertical limit switches are fitted to the cubicle and engage cams fixed on the rear slide keep plate of the vertical slide see Diagram 7. The lower limit switch 'B' is engaged by the lower cam and is set in such a position as to trip limit switch 'B' when the headstock is high enough to clear all obstacles on the return stroke. The upper limit switch R. L. S. is an ultimate limit switch and is arranged to stop the forward feed should limit switch 'B' be incorrectly set or fail for any other reason. The upper cam should be set so as to operate limit switch R. L. S. when the headstock is approximately $\frac{1}{2}$" below its top position, and left permanently at this setting.

FAST AND SLOW SWITCHES.

Two switches are mounted on the overhung arm on the travelling headstock which are engaged by cams or rollers mounted on the copy bars (see Diagram 12). The front switch controls the fast feed and the rear switch controls the slow feed. Cam plates are fitted to the copy bars to operate the switches as required.

NOTE: When it is required to change over from fast feed to the pre-set feed, it is necessary to momentarily contact the slow feed switch by means of a disc attached to the fast feed cam, see Diagram 11.

ELECTRICAL INSTRUCTIONS.

INSTALLATION. The whole of the cabling between motors and control gear is carried out by WADKIN LTD., but it is necessary to make certain disconnections in order that the machine can be dismantled for despatch. To put the machine into service it is necessary to remake all connections which have been broken for transit. (This is done by WADKIN LTD. at time of erection on site). Bring line supply cables which should be capable of carrying 120 amps. on a 400 volt 3 phase 50 cycle supply to the main isolating switch which is situated on the extreme left of the machine when viewed from the controls.

IMPORTANT. Before attempting to operate the machine the following procedure must be carried out.

1. Close main isolating switch. Red lamp on front of the isolating switch indicates that the supply is available.

2. Ensure that the direction of rotation of the cooling fan which is situated in the upper half of the main control cubicle is correct, the fan should rotate in a counter clockwise direction looking directly at the fan.

3. Ensure that both bulbs have "fired".

4. If the above conditions have been satisfied the machine is now ready to start. The method of starting and operating is explained on Pages 2 and 3.

FAILURE TO START.

(A) Supply not available at isolator switchfuse.

(B) Coil circuit fuses have blown.

(C) Master stop button has been locked 'off'.

(D) Spindle motor bulb or feed motor bulb have not "fired".

(E) Imperfect connections causing faulty contact.

ACTION TO BE TAKEN.

(A) Check fuses at distribution board or isolating switchfuse.

(B) Check coil circuit fuses.

(C) Check master stop button.

ACTION TO BE TAKEN (Cont.)

(D) If spindle motor bulb fails to "fire" ;

(1) Check that spindle speed selector switch has not been set to "Vertical spindle position".

(2) Check anode fuses situated in a compartment on the left hand side of the control cubicle.

(3) Starting coil is faulty or has been set incorrectly, viz. if the distance between the mercury and the starting electrode is too great, the starting electrode may not be pulled into the mercury by the starting coil assembly. See Diagram 14.

IMPORTANT. On no account should the starting electrode be allowed to remain in the mercury as this will prevent starting entirely and probably damage the bulb. If the starting electrode is set very closely to the mercury, this will also lead to indifferent starting.

(E) If the feed motor bulb fails to "fire" the diagnosis is as for the spindle bulb.

OVERLOAD. Only an overload on the hydraulic pump motor will result in the stopping of both spindle motor and feed motor. All other overloads are so arranged that only the feed motor will stop. Should overload occur it will be necessary to reset these by hand with the reset buttons provided on main cubicle doors. The spindle motor and feed motor overloads are of the oil dashpot type and it should be ensured that these are set correctly and filled with Grade 12DP2 Oil. All other overloads are of the thermal type and require no attention.

MAINTENANCE. We would recommend a periodical inspection of the following :-

(A) Inspect spindle and feed motor and cable reel brush gear and brushes, and ensure brushes are free in holders.

(B) Inspect all fixed and moving contacts of the contactors in main control cubicle. Do not change contacts because they look burnt unless they are definitely faulting. Under no circumstances should worn contacts be filed.

(C) Inspect oil level of the spindle and feed motor overloads, if necessary re-fill with oil previously specified.

SPARE FUSES. A complete set of spare fuses are supplied with each machine as follows :-

3 - Main fuses, situated in main isolating switch.

3 - Spindle anode fuses) Situated on plate mounted
3 - Feed anode fuses) on upper cubicle door.

NOTE:- The coil circuit fuses are of the re-wirable type.

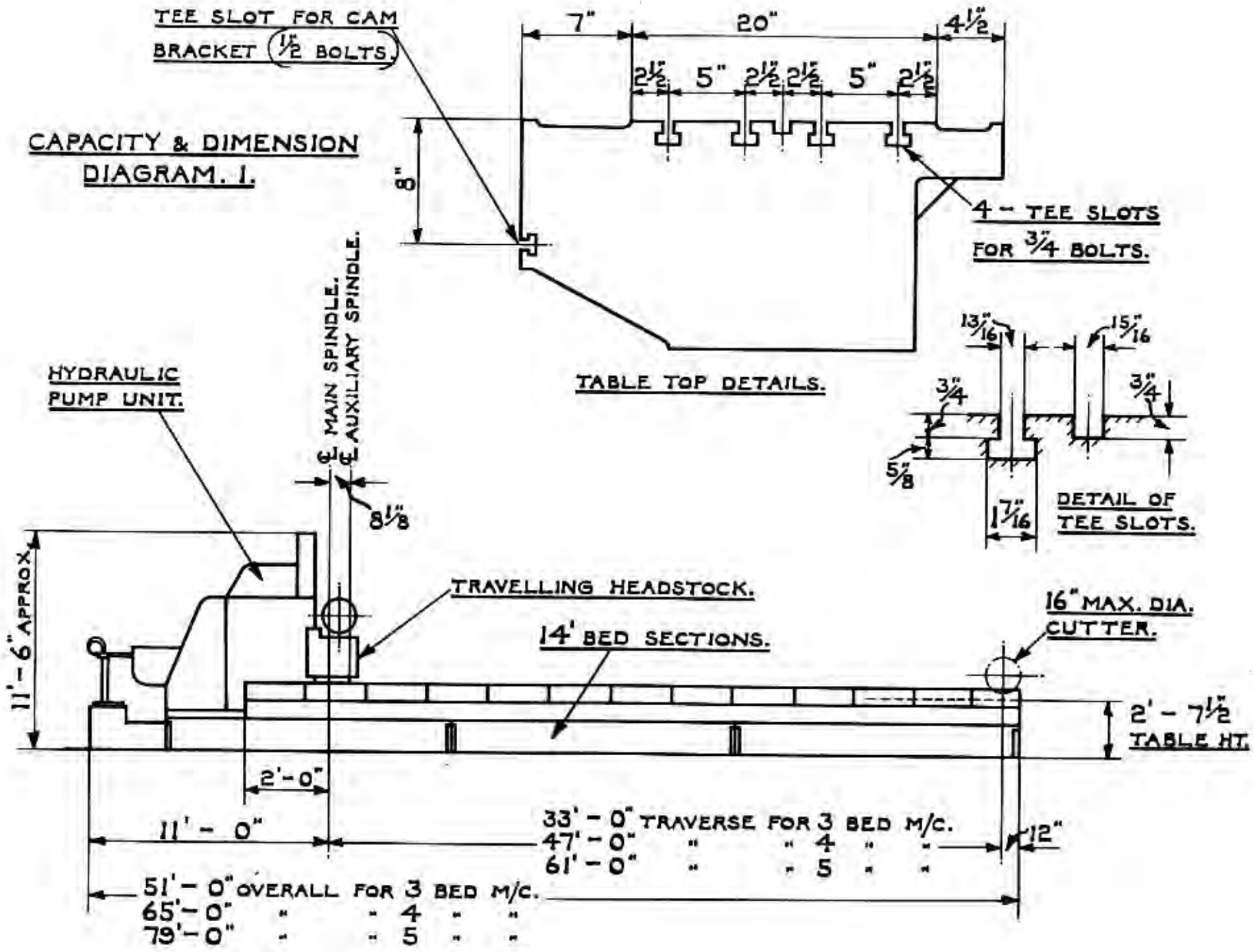
KEY OF ABBREVIATIONS USED ON DIAGRAM

M. I.	Main isolator switch and fuses
H. P. C.	Hydraulic pump contactor
S. L. S. C.	Spindle low speed contactor
S. M. S. C.	Spindle medium speed contactor
S. H. S. C.	Spindle high speed contactor
S. S. C.	Spindle starting contactor
S. M. T.)	
S. M. T1.)	Spindle motor timers
S. M. T2.)	
M. S. R.	Medium speed relay
H. S. R.	High speed relay
S. S. C. T.	Spindle starting contactor timer
F. S. A. R.	Feed slow approach relay
F. F. C.	Forward feed contactor
F. F. R.	Forward feed relay
F. R. C.	Feed return contactor
S. P. M. C.	Suds pump motor contactor
O. P. C.	Oil pump contactor
S. E. R.	Spindle exciter relay
F. E. R.	Feed exciter relay
F. M. B. C.	Feed motor braking contactor
F. O. S. R.	Feed overspeed relay
S. M. F. R.	Spindle motor fluttering relay
F. M. F. R.	Feed motor fluttering relay
F. M. O.	Feed motor overload
S. M. O.	Spindle motor overload
F. S. S.	Feed speed selector switch
S. M. R. S.	Spindle motor reversing switch
S. S. R.	Spindle starting resistance
F. L. S.	Forward limit switch
R. L. S.	Return limit switch
S. A. D.	Slow approach limit switch
S. P. M. O.	Suds pump motor overload
H. P. M. O.	Hydraulic pump motor overload
T. L. S.	Top limit switch
O. P. M. O.	Oil pump motor overload
'B'	Double pole change over limit switch

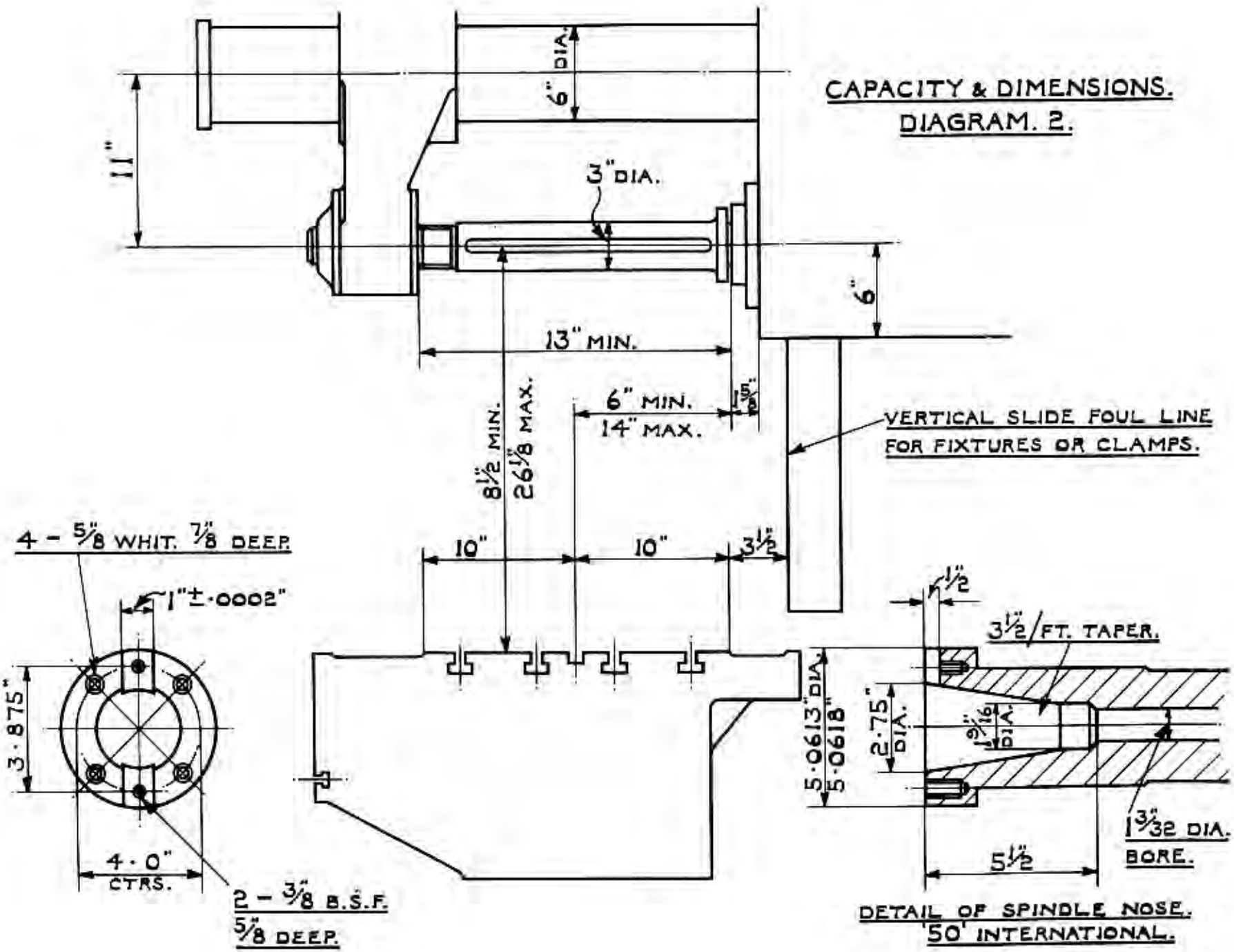
LIST OF BALL BEARINGS.

WHERE USED	TYPE	QUANTITY	REF. NO.
Headstock Spindles	Taper Roller	4	Timken 672/683 (Precision 3)
	Plain Roller	4	S. K. F. C. R. M. 22.
Pinion Shaft (Top)	Taper Roller	2	Timken 672/683 (Commercial)
Pinion Shaft (Btm.)	Plain Roller	1	S. K. F. C. R. M. 22.
Wormshaft	Angular Contact	2	MJT. $2\frac{1}{4}$ Ransome & Marles
Layshaft	Deep Groove	2	S. K. F. R. M. S. 16.
	Roller	1	S. K. F. C. R. M. 16.
Jockey Pulley	Deep Groove	2	S. K. F. R. L. 9.
Cross Traverse Screw	Thrust	1	S. K. F. 08.
	Thrust	1	S. K. F. 010.
Balance WT Rollers	Deep Groove	8	S. K. F. R. L. S. 10.
Outboard Steady	A. C. Unit	4	R & M. MJT. $2\frac{1}{2}$ (Special matched bearings)
Hydraulic Tracer Slide	Thrust	1	S. K. F. 08.
Spindle Motor		1) 1)	HOFF. MS14V HOFF. RMS17V
Feed Motor		1) 1)	HOFF. MS10V HOFF. MS12V
Hydraulic Pump Motor		2	HOFF. 330

CAPACITY & DIMENSION DIAGRAM. 1.



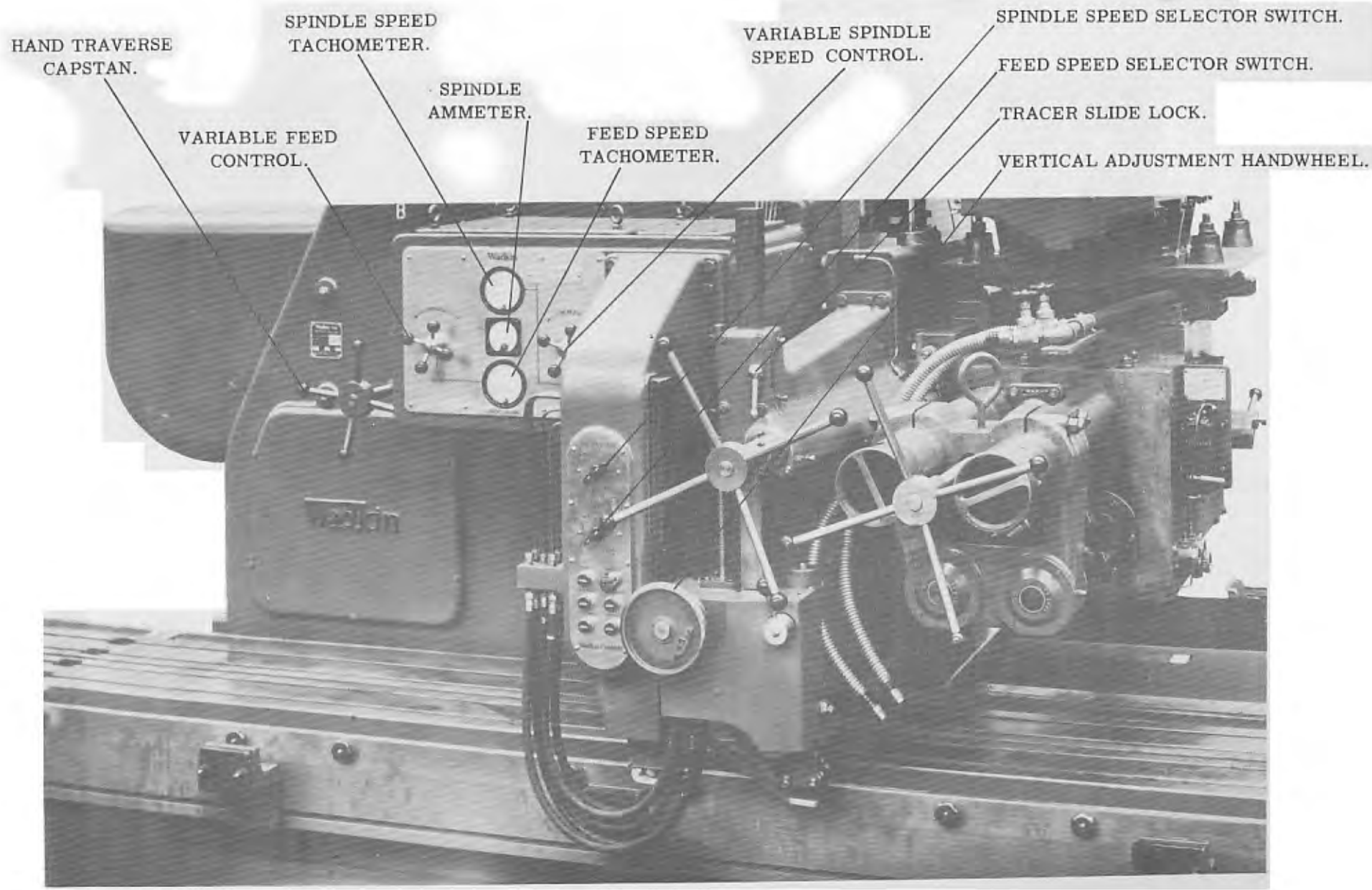
CAPACITY & DIMENSIONS. DIAGRAM. 2.



DETAIL OF SPINDLE NOSE. '50' INTERNATIONAL.

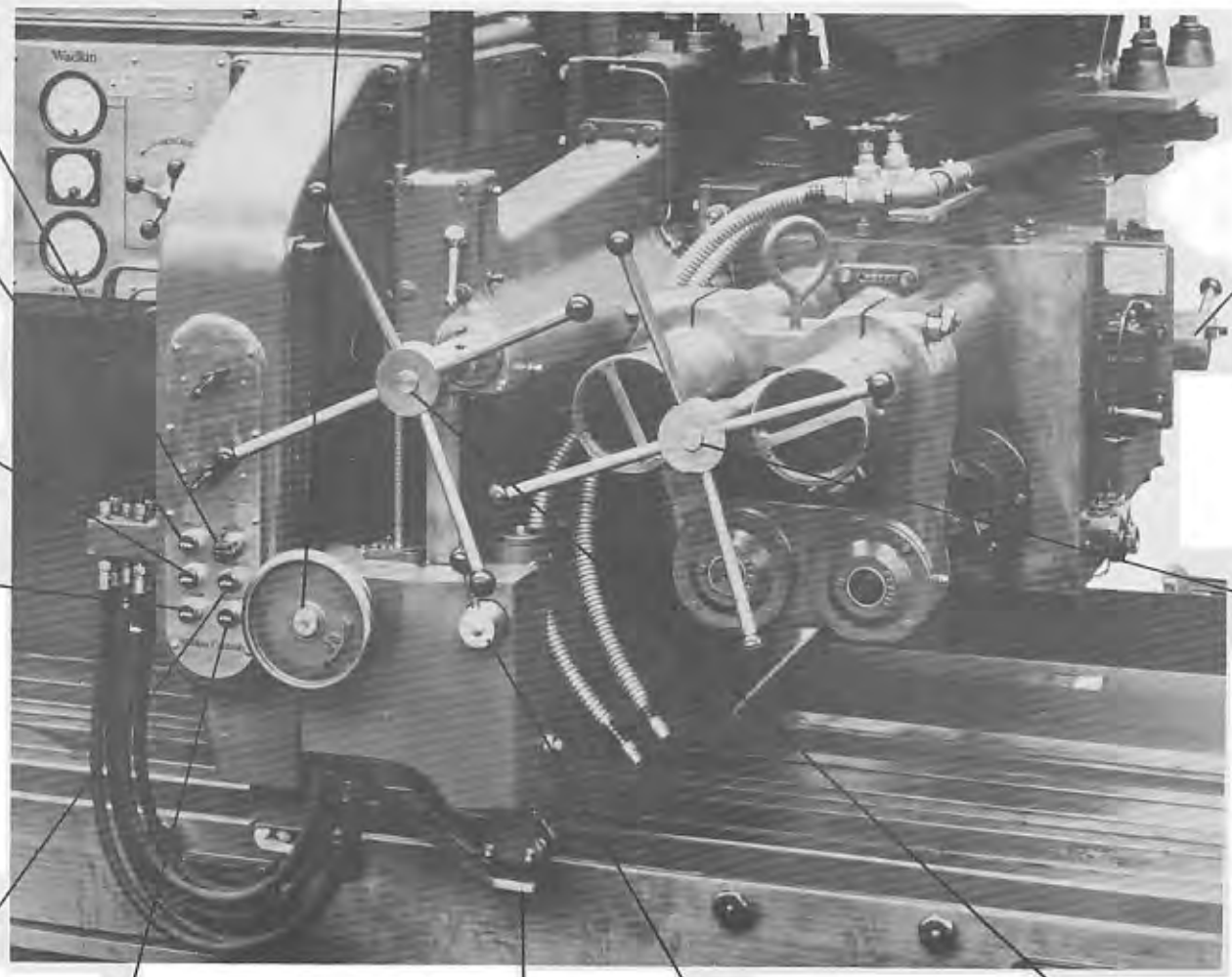
THE CONTROLS.

Diagram 3.



THE CONTROLS.

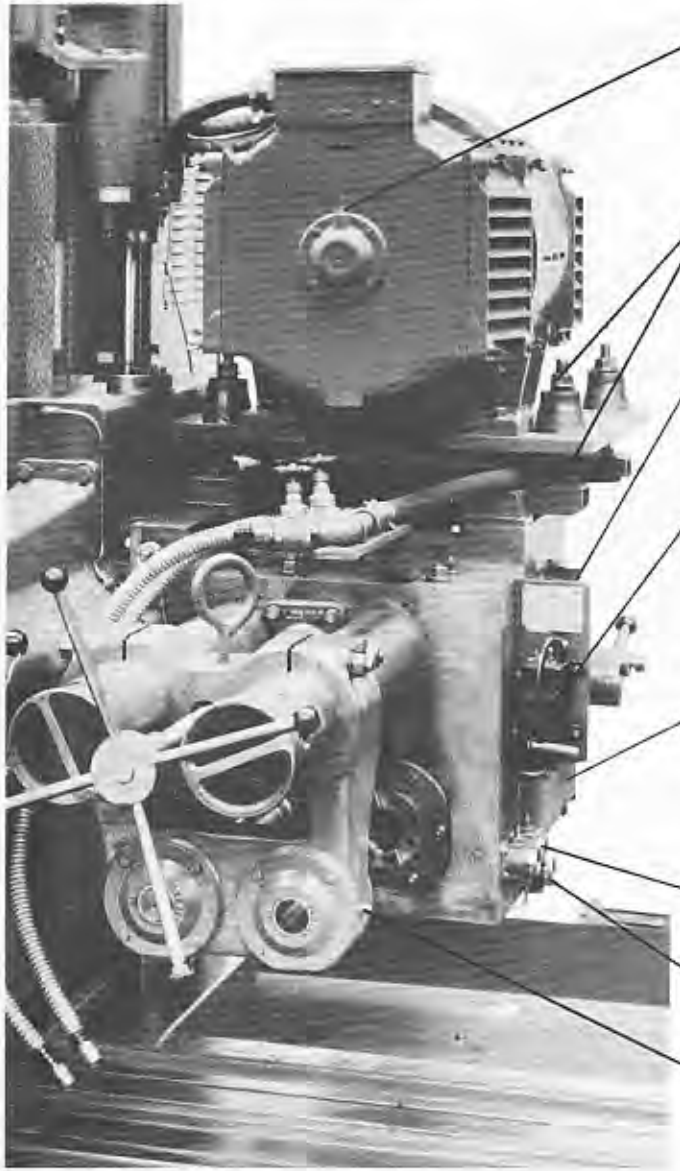
Diagram 4.



LUBRICATION.

Diagram 5.

SPINDLE HEADSTOCK.



2 - GREASE POINTS ON SPINDLE MOTOR. USE GREASE GRADE L. 6.

HEXAGON NUTS FOR VEE BELT TENSIONING.

GEARBOX FILLER CAP. USE GEARBOX OIL GRADE L. 2.

HAND PUMP FOR FRONT SPINDLE BEARINGS. GARGOYLE DTE. LIGHT OIL. 4 STROKES EVERY 4 HOURS.

2 - GREASE POINTS ON REAR BEARINGS INSIDE BELT GUARD. 1 - SHOT EVERY 3 MONTHS. GREASE GRADE L. 6.

SPINDLE BEARING OIL SIGHTS.

GEARBOX OIL SIGHT.

2 - GREASE POINTS ON OUTBOARD STEADY. 1 - SHOT EVERY 3 MONTHS. USE GREASE GRADE L. 6.

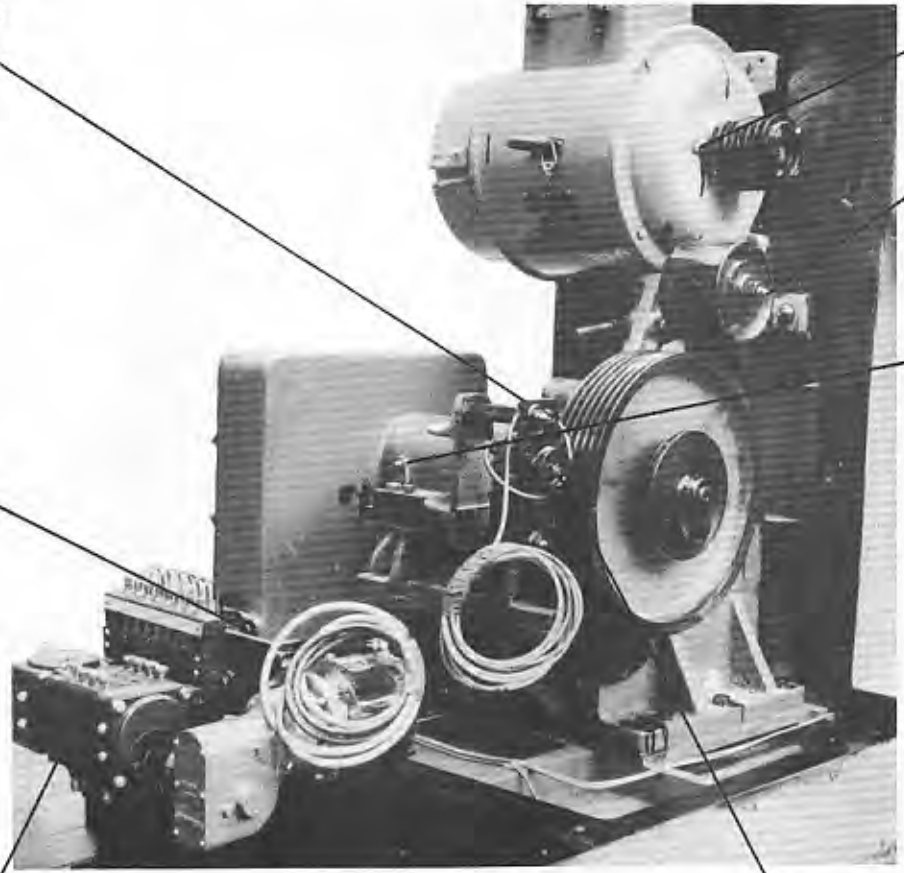
FRONT BEARINGS for both spindles are lubricated from a hand pump, 4 strokes every 4 hours. The rear bearings for both spindles are lubricated by grease gun, one shot every 3 months. Drain the front bearings every six months by removing the 6" x 2" cast iron covers below the spindle bearings, see Diagram 5.

THE GEAR BOX. Keep the gear box topped up to the sight glass level with medium gear oil, approximate capacity 2 gallons.

SPINDLE MOTOR. Grease main spindle motor bearings by one shot of grease every 3 months.

SPINDLE DRIVE. The vee belts do not normally require attention, but should any adjustment be necessary this can be effected by adjustment of the hexagon nuts carrying the motor platform, (see Diagram 5). Use good quality ball bearing grease in all grease nipples.

TRAVERSE MECHANISM.



DIPSTICK & FILLER CAP FOR WORM GEARBOX. GEARBOX OIL GRADE L. 2.

FILLER CAP FOR PICK OFF GEARCASE. GEARBOX OIL GRADE L. 2.

MOTORISED OIL PUMP LUBRICATING ALL POINTS ON TRAVELLING SADDLE. OIL GRADE L. 2.

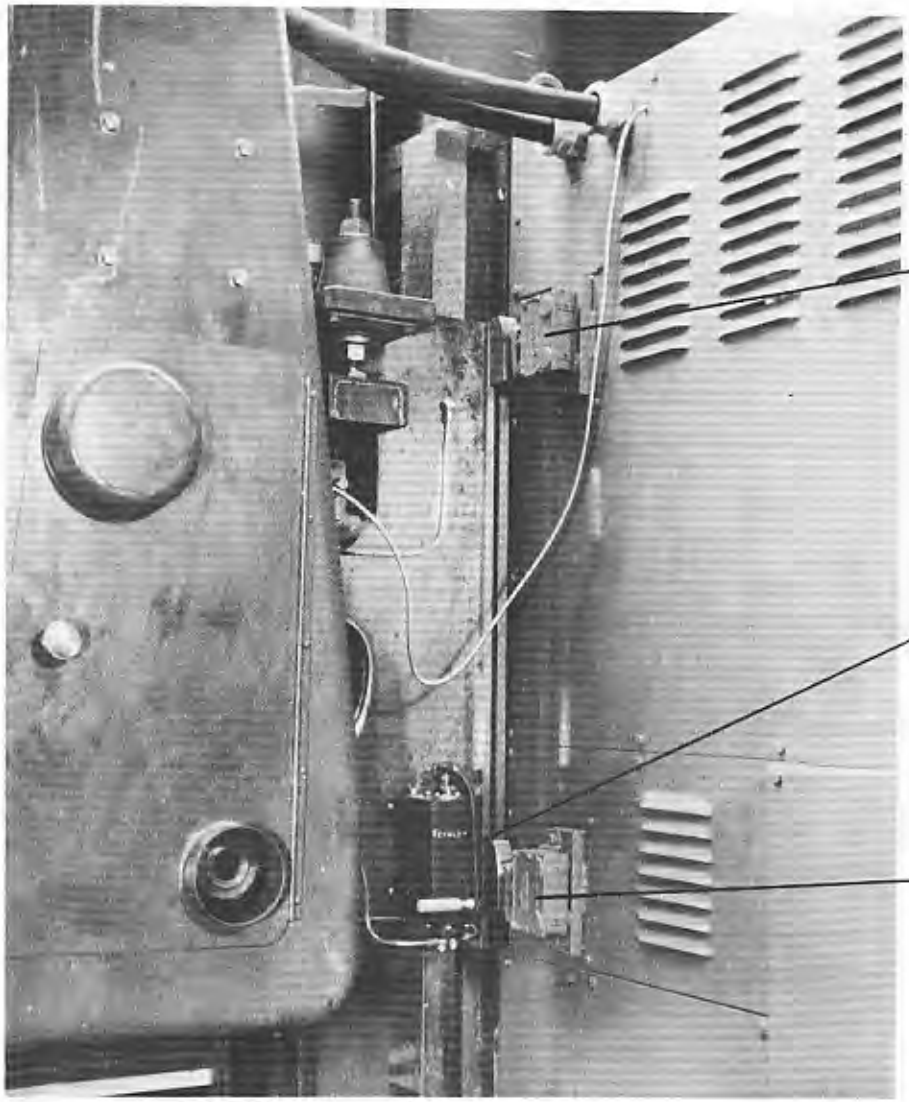
2 - GREASE POINTS ON FEED MOTOR. 1 SHOT EVERY 3 MONTHS. GRADE L. 6. GREASE.

1 POINT ON JOCKEY. 1 SHOT EVERY 3 MONTHS. GRADE L. 6 GREASE.

2 - GREASE POINTS ON LAYSHAFT. 1 SHOT EVERY 3 MONTHS. GRADE L. 6 GREASE.

STAUFFER ON TACHOMETER. GRADE L. 6 GREASE.

INTERMEDIATE SLIDE.

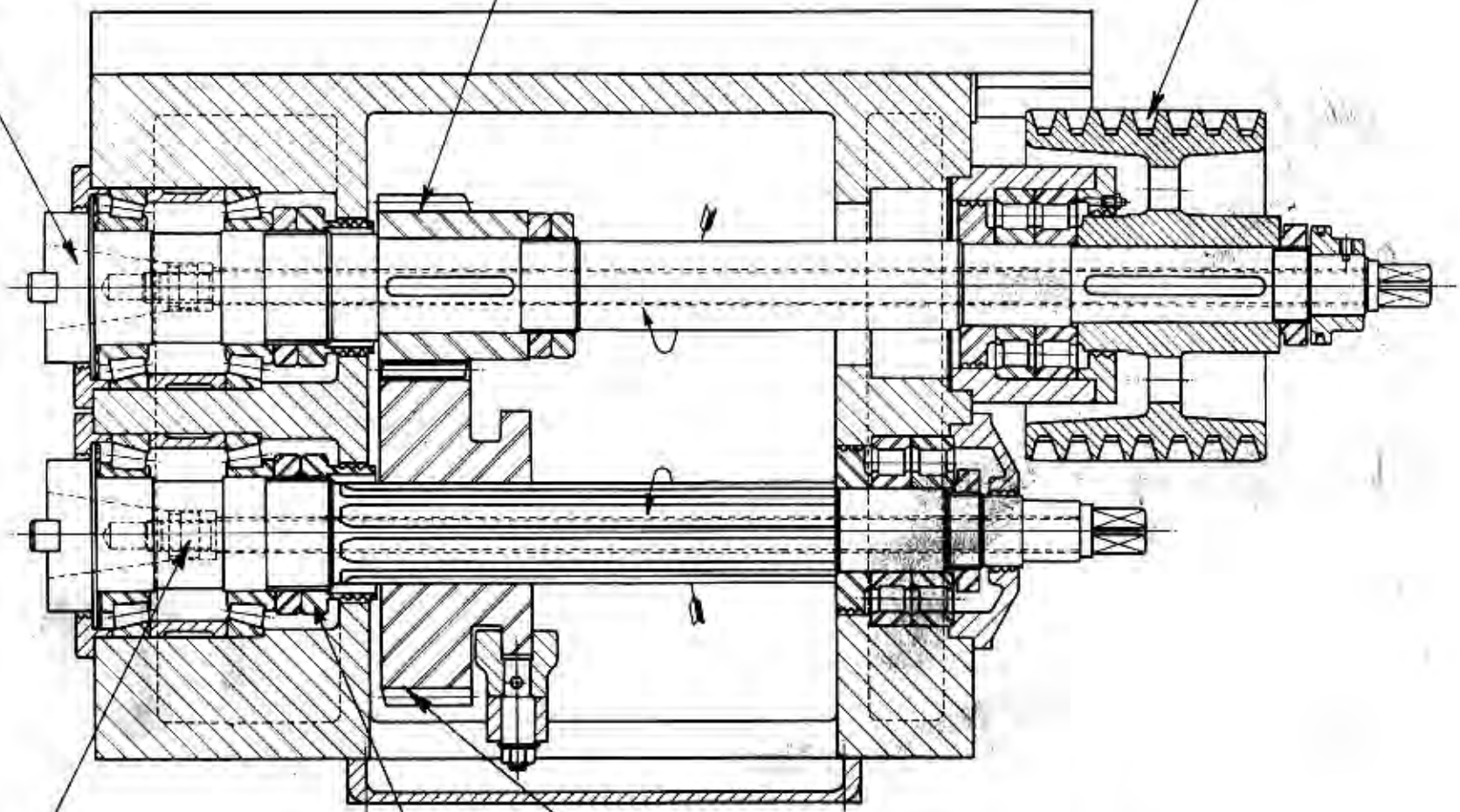


INTERMEDIATE SLIDE AND VERTICAL SLIDE. The Intermediate Slide is mounted on the headstock and carries the gear box. It is hydraulically operated over 17. 5/8" total rise and fall. Lubrication for the slideways is provided by a hand feed oil pump charged with medium machine oil, mounted on the rear of the intermediate slide. (See Diagram 7). The pump should be used at least once per shift to lubricate the four points on the horizontal slide faces, and the train of spur gears from the cross traverse screw.

MAIN SPINDLE SPEEDS
VARIABLE BETWEEN
275 & 2500 R.P.M.

22 TEETH.

8 - FENNER VEE ROPES
No. 105C.

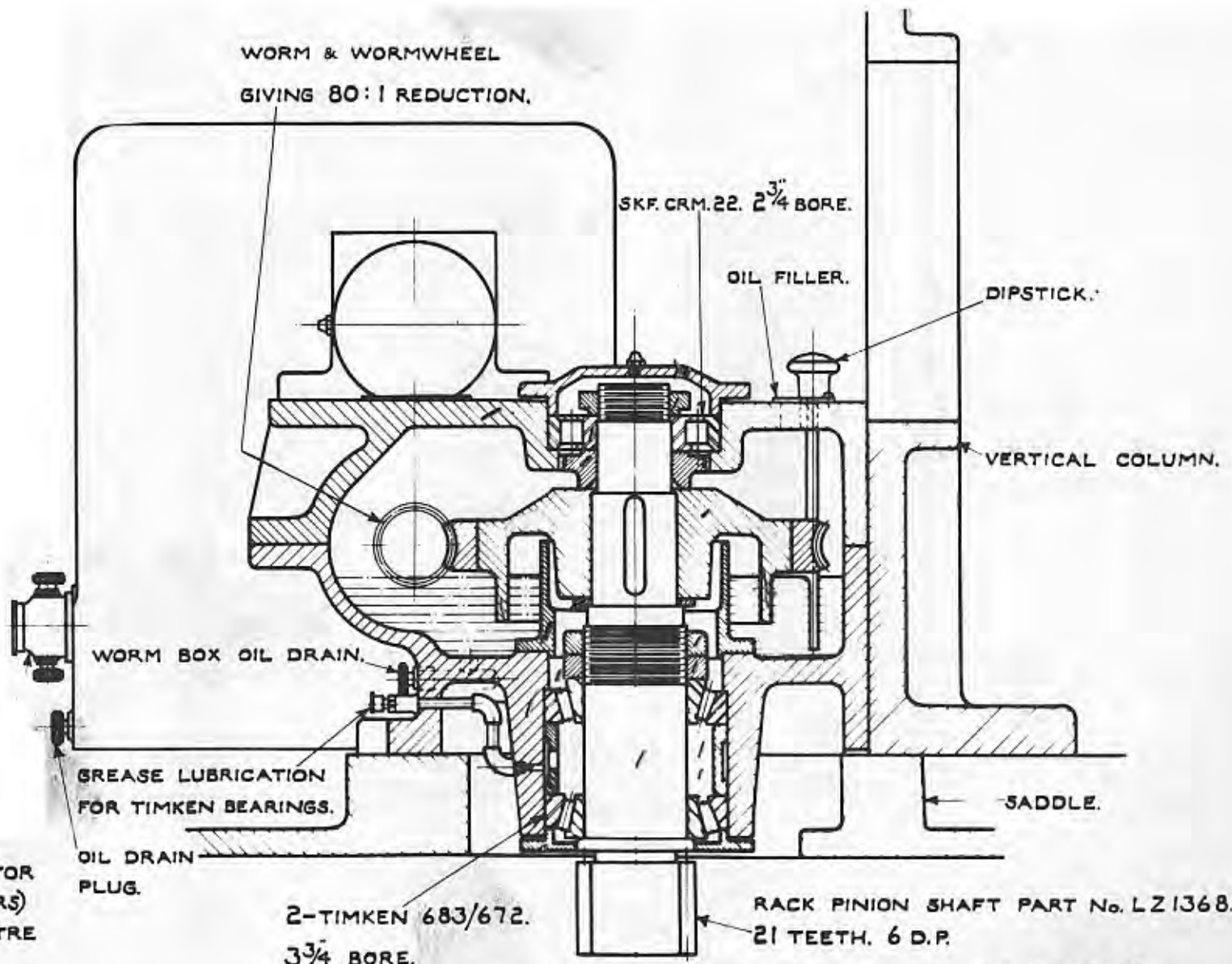


AUXILIARY SPINDLE SPEEDS
HALF THE MAIN SPINDLE SPEEDS.

43 TEETH.

SPINDLE ADJUSTING
LOCKNUTS.

DIAGRAM 8.



OIL LEVEL INDICATOR
(FOR PICK-OFF GEARS)
OIL LEVEL IS CENTRE
OF SIGHT GLASS.

DIAGRAM 9.

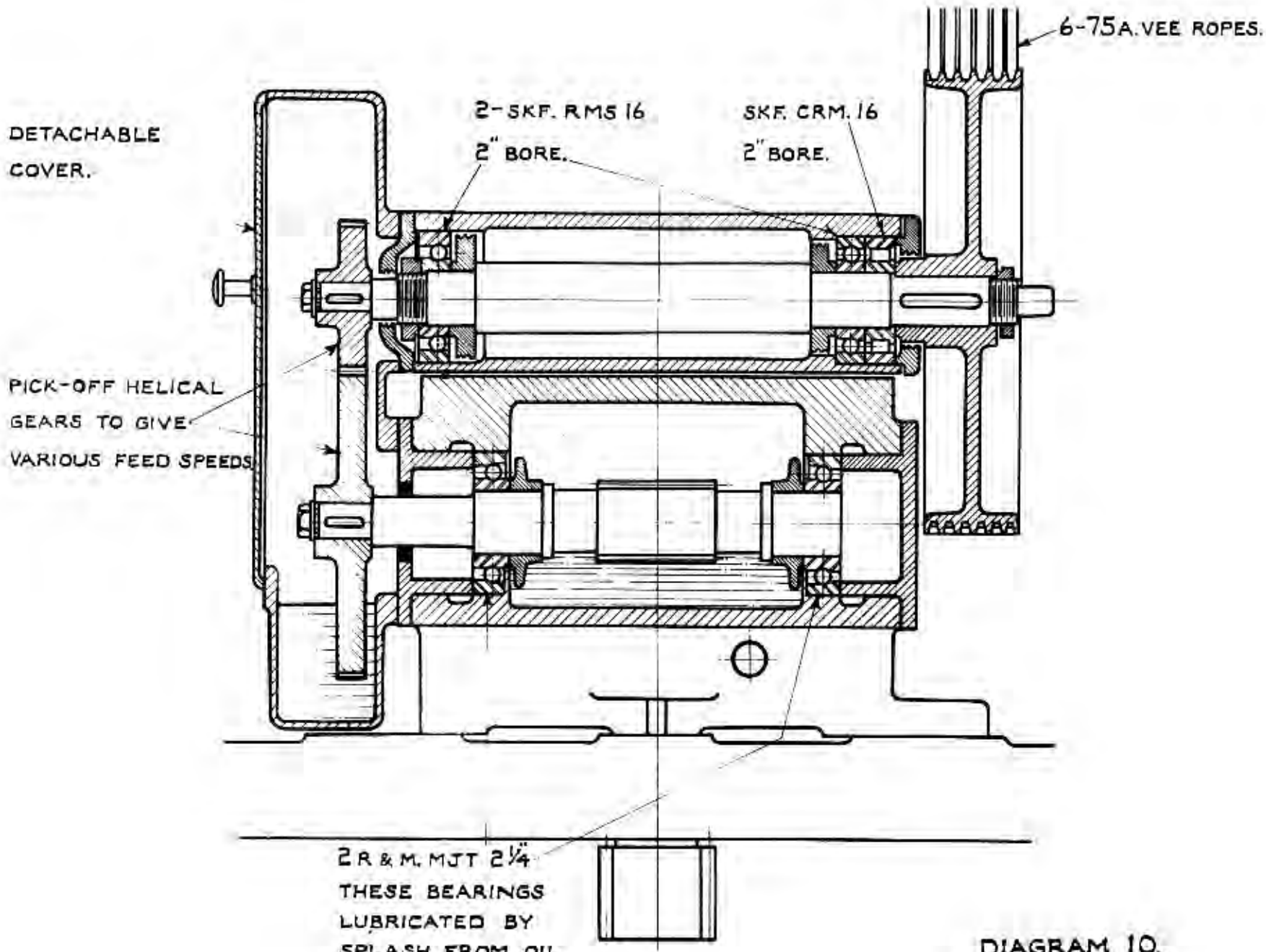
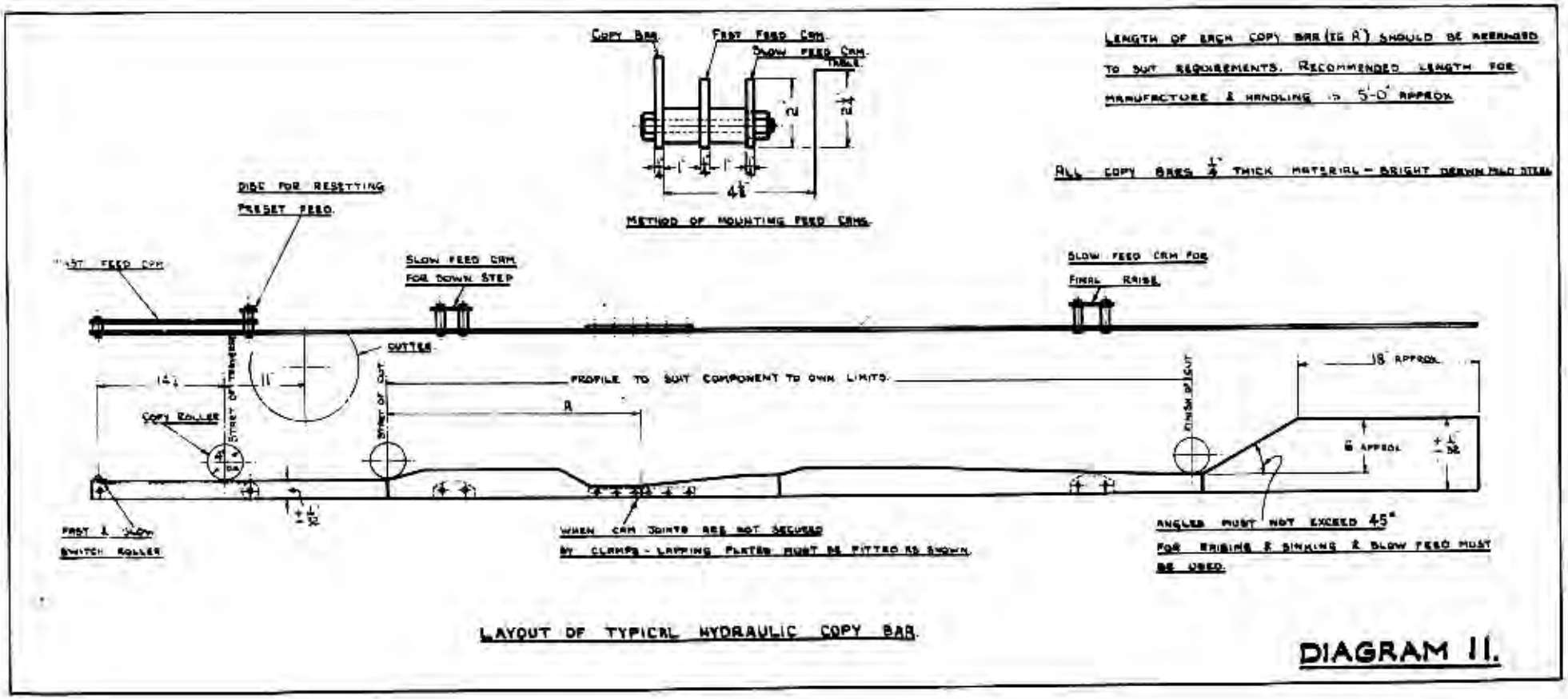
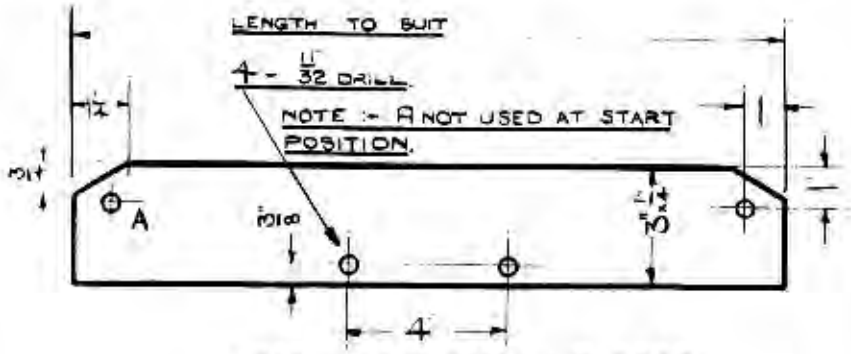

6-75A. VEE ROPES.
2-SKF. RMS 16
2" BORE.
SKF. CRM. 16
2" BORE.
DETACHABLE
COVER.
PICK-OFF HELICAL
GEARS TO GIVE
VARIOUS FEED SPEEDS.
2 R & M. MJT 2¼
THESE BEARINGS
LUBRICATED BY
SPLASH FROM OIL
BATH.

DIAGRAM 10.

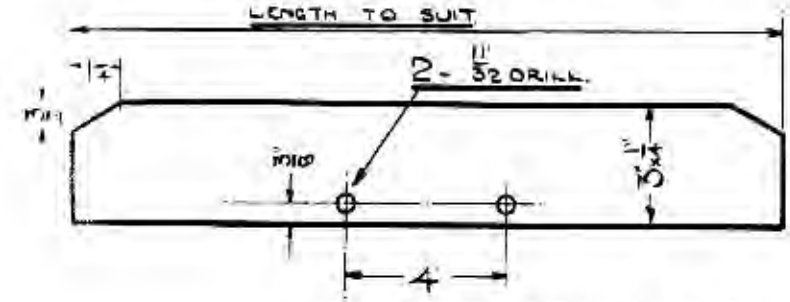


LAYOUT OF TYPICAL HYDRAULIC COPY BAR.

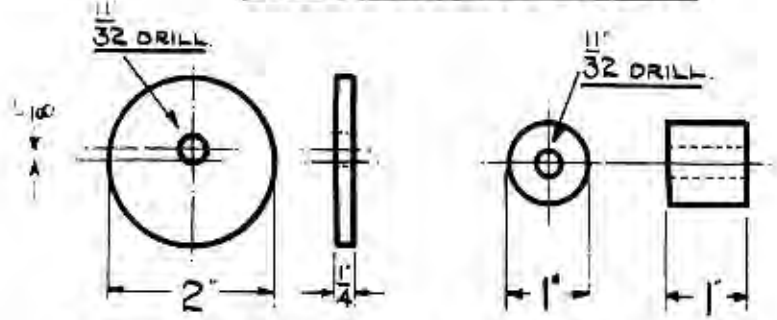
DIAGRAM 11.



FAST FEED CAM - LZ 5323.



SLOW FEED CAM - LZ 5326

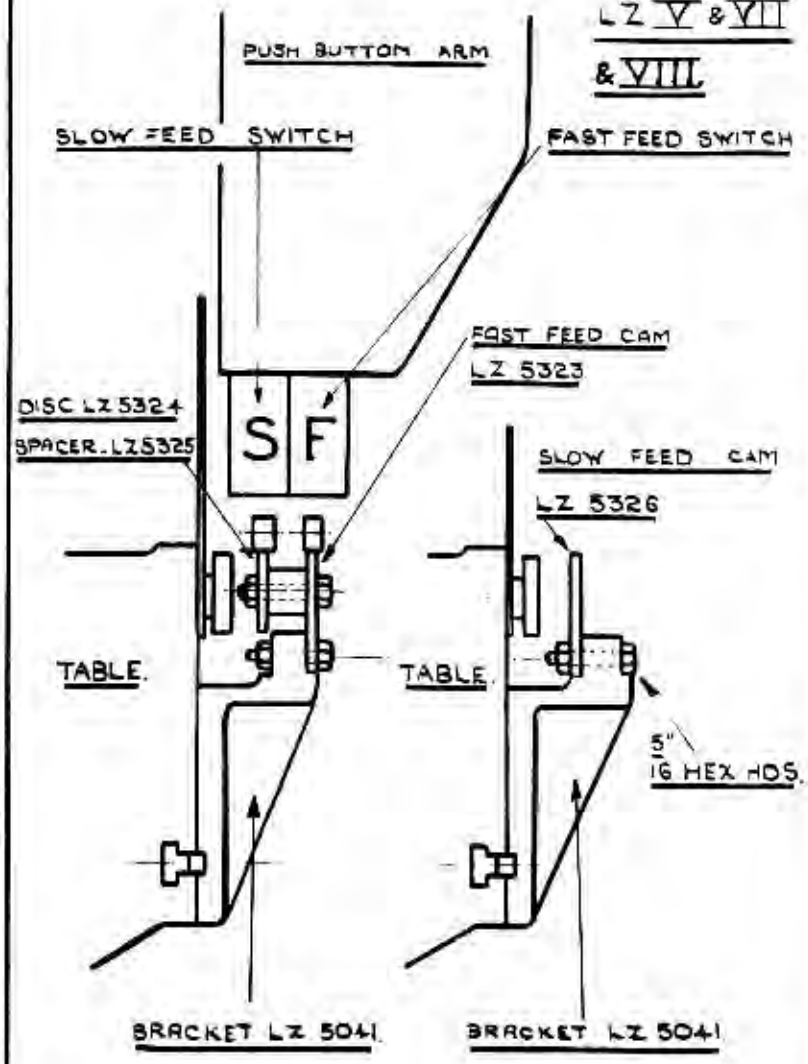


ECCENTRIC DISC - LZ 5324. SPACING SLEEVE - LZ 5325.

MATERIAL :- BDMS.

DETAIL OF FEED CAMS ETC.

LZ V & VII & VIII



FAST FEED. SLOW FEED.

METHOD OF MOUNTING FEED CAMS.

DIAGRAM 12.

Diagram 13.

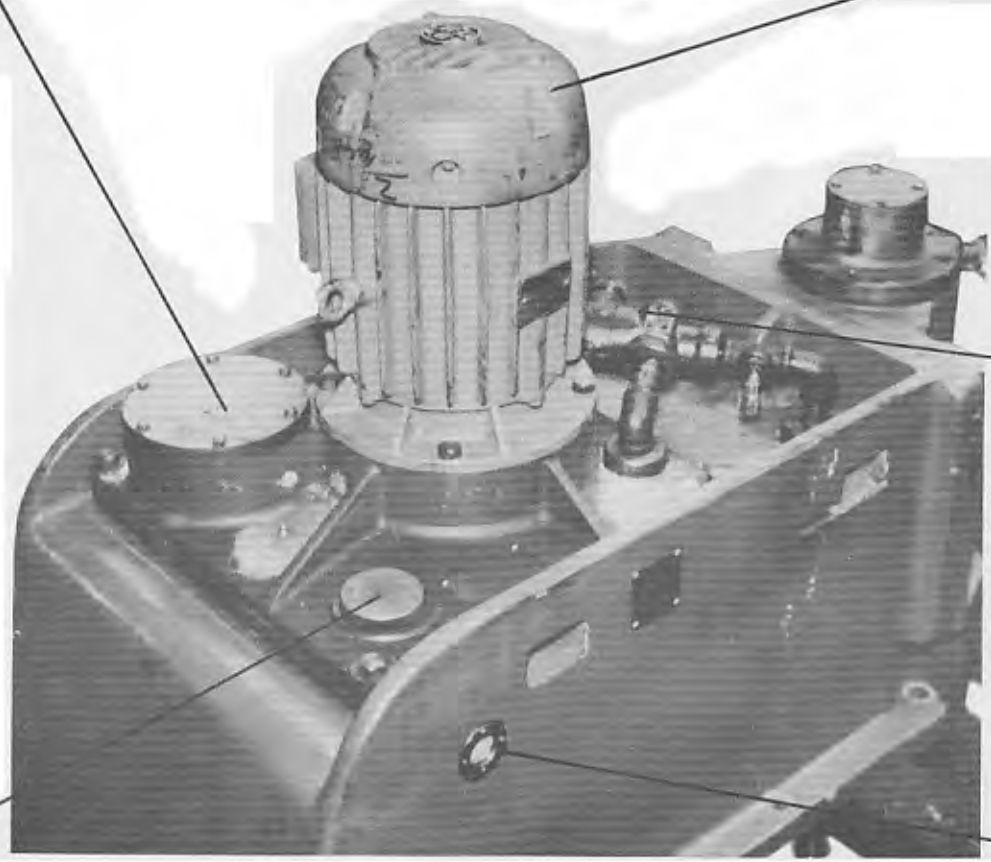
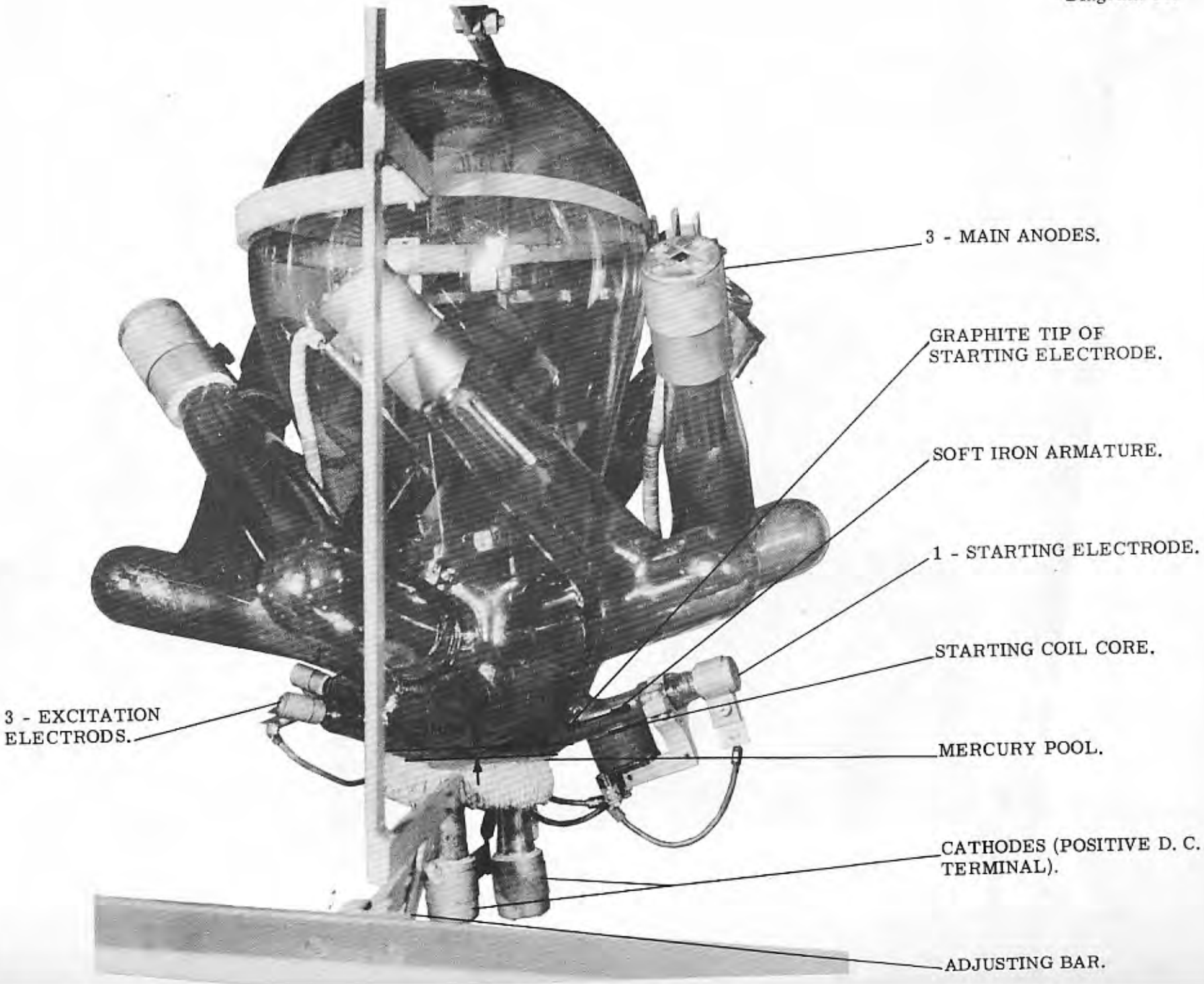

INSPECTION COVER & ACCESS TO PUROLATOR OIL FILTER.
PUMP MOTOR.
PRESSURE CONTROL VALVE.
FILLER CAP.
OIL SIGHT LEVEL.

Diagram 14.


3 - MAIN ANODES.
GRAPHITE TIP OF STARTING ELECTRODE.
SOFT IRON ARMATURE.
1 - STARTING ELECTRODE.
STARTING COIL CORE.
3 - EXCITATION ELECTRODS.
MERCURY POOL.
CATHODES (POSITIVE D. C. TERMINAL).
ADJUSTING BAR.

HORIZONTAL TRAVERSE CAMS.

DIAGRAM 15.