2 5/8-6, 2 5/8-6S (Spindle Stopper) 3 1/4-6, 3 1/2-4, 4 1/8-4
BAR AUTOMATICS and ATTACHMENTS

OPERATOR'S HANDBOOK

W250 300 12-62
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PRINCIPAL DIMENSIONS 2⅝-6, 2⅝-6S, 3¼-6, 3½-4, 4⅛-4

	2⅝"-6		2⅝"-6S		3¼"-6		3½"-4		4⅛"-4	
Bar Capacity: Round	2 "	67 mm.	2 "	67 mm.	3¼"	82·5 mm.	3½"	89 mm.	4 "	105 mm.
Hexagon A/Flats	2¼"	57 mm.	2¼"	57 mm.	2 "	72 mm.	3"	76 mm.	3 "	90 mm.
Square A/Flats	1 "	46 mm.	1 "	46 mm.	2 "	58 mm.	2 "	62 mm.	2 "	74 mm.
Bar feed stroke, standard cams	½"-5"	12-127 mm.	½"-5"	12-127 mm.	½"-5"	12-127 mm.	½"-5"	12-127 mm.	½"-5"	12-127 mm.
Bar feed stroke, special cams	5"-10"	127-254 mm.	1¼"-6¼"	127-160 mm.	5"-10"	127-254 mm.	5"-10"	127-254 mm.	5"-10"	127-254 mm.
Feed stroke on main tool block	0"-5"	0-127 mm.	0"-5"	0-127 mm.	0"-5"	0-127 mm.	0"-5"	0-127 mm.	0"-5"	0-127 mm.
Feed stroke on independent slides	0"-5 "	0-143 mm.	0"-5 "	0-143 mm.	0"-5"	0-143 mm.	0"-5 "	0-143 mm.	0"-5 "	0-143 mm.
Approach stroke on main block and independent slides—Up to and including Inspection No. 9576	Standard 3½" Special 5"	89 mm. 127 mm.	Standard 3½" Special 5"	89 mm. 127 mm.	Standard 3½" Special 5"	89 mm. 127 mm.	Standard 3½" Special 5"	89 mm. 127 mm.	Standard 3½" Special 5"	89 mm. 127 mm.
Approach stroke on main block and independent slides—Machine inspection No. 9577 and after	Standard 5" Special 3½"	127 mm. 89 mm.	Standard 5" Special 3½"	127 mm. 89 mm.	Standard 5" Special 3½"	127 mm. 89 mm.	Standard 5" Special 3½"	127 mm. 89 mm.	Standard 5" Special 3½"	127 mm. 89 mm.
Feed stroke lower cross slides	0"-1¾"	0-44 mm.	0"-1¾"	0-44 mm.	0-1¾"	0-44 mm.	0"-1¾"	0-44 mm.	0"-1¾"	0-44 mm.
Feed stroke upper cross slides	0"-2½"	0-63 mm.	0"-2½"	0-63 mm.	0"-2½"	0-63 mm.	0"-2½"	0-63 mm.	0"-2½"	0-63 mm.
*Feed stroke intermediate cross slides	⅛"-1 13/32"	3-35 mm.	⅛"-1 13/32"	3-35 mm.	⅛"-1 13/32"	3-35 mm.				
Spindle speed range r.p.m.	77-1004		77-873		77-1004		60-786		60-786	
Number of steps	24		23		24		24		24	
Feed range at 5" stroke	0·0044"-·076" 0·11-0·92 mm.		0·0044"-·076" 0·11-1·92 mm.		0·0044"-·076" 0·11-1·92 mm.		0·0057"-0·096" 0·15-2·44 mm.		0·004"-·068" 0·1-1·72 mm.	
Range of cycle times in seconds	7·1 to 922 seconds		7·8 to 922 seconds		8·3 to 924 seconds		8·3 to 924 seconds		11·9 to 1315 seconds	
Idle time	3 seconds		3 seconds		4·1 seconds		4·1 seconds		5·9 seconds	
Motor h.p. and r.p.m. Standard	30 x 1450		30 x 1450		30 x 1450		30 x 1450		30 x 1450	
Special	40 x 1450		40 x 1450		40 x 1450		40 x 1450		40 x 1450	
Overall dimensions without stock carriage			5' 2" x 13' 10"	1562 x 4200 mm.			5' 2" x 13' 10"	1562 x 4200 mm.		
Overall dimensions with stock carriage			5' 2" x 21' 9"	1562 x 6626 mm.			5' 2" x 21' 9"	1562 x 6626 mm.		
Approximate net weight including electrics			12½ tons	12,700 kg.			12·4 tons	12,500 kg.		

*Later machines only. Previously ¼"-1⅝", 6-41 mm.

INDEX

ATTENTION PLEASE

There are a number of simple instructions worthy of special mention which operators in general are most liable to overlook. These are listed below and are well worth studying.

CONCERNING TOOL SLIDES

1. Gib strip adjustment needs great care. While it should not be set too free and prevent accurate sizing, the tendency usually is to set too tight.
2. Remember to release the slide stops before changing tool strokes and adjustment and reset afterwards.

CONCERNING MANUAL CONTROLS

1. When the feed clutch is engaged, start the machine only by the inching button.
2. After starting the machine allow a lapse of a few seconds before engaging the feed clutch to enable the electrical control gear to change to "delta" and the lubrication system to operate.
3. Always ensure that tools are well clear of the work before engaging the fast motion lever.
4. When a slipping clutch has disengaged, locate the cause of the overload before re-engaging and re-starting the machine.
5. Remember you cannot handwind the machine through the feed motion if the set-up includes a threading operation unless the necessary adjustments are made.
6. Test all clutches by hand for adjustment. They should not be set so slack as to cause slip or too tight, and excessive pressure should not be required to operate them.

CONCERNING LUBRICATION

1. Check the oil levels in tanks and sumps. They must not fall below the levels indicated.
2. Frequent checks of spindle sight-feeds are necessary, also check that the main drive oil is circulating.
3. Turn Purolators daily, apply oil gun to all nipples and oil parts not served by the automatic system.

CONCERNING COOLANT

1. Do not use soluble oils, which cause rust.
2. See that strainer box is kept clear of swarf.
3. When a swarf conveyor is fitted, see that both the basket and strainer are kept in position.
4. Keep the level of coolant in the tray as high as possible.
5. Clean the tray of swarf and sediment at regular intervals.

SECTION ONE
INSTALLATION

INSTALLATION

SEE SHEETS 4.1, 4.2 AND 4.3

When planning the siting of a machine consider the space required for chip removal, bar loading and servicing, i.e., centre-shaft removal. Dimensions of suitable lifting bars for use with a crane and rope slings are shown on Sheet 4.2. Slings must not lie against the machine during hoisting. Examine the position of the sling with tension on the rope before the full weight of the machine is lifted.

Where a crane is not available, the machine may be moved by "wedge" truck or rollers and continuous machined surfaces are provided on the underside of the tray to facilitate the operation. Rollers must be longer than the machine tray width.

Careful handling of the new machine will ensure accurate alignment.

With the machine in position on the factory floor, level with the four jack screws provided in the tray, it is recommended that steel plates be placed between floor and screws. Longitudinal and lateral alignment levels can be checked with a precision level on facings provided at both ends of the tray and on the top of the spindle drum housing, Sheet 4.2. Wedges should then be placed at the position shown.

Foundation bolt holes are also provided for use where required—bolts to be embedded in the floor approximately 5" deep.

Where not bolted, machines can be grouted or cemented by any shop approved method.

Earlier machines do not have jacking screws or bolt holes. Levelling with wedges as above and cementing is recommended.

The stock carriage tube assembly (weight one ton) (1.02 tonnes) should be lifted into position and the stand fitted.

The carriage indexing gears must be assembled with the meshing marks together, as shown on Sheet 4.1 and the cover segments fitted.

Steel plates should be placed under the screws in the carriage stand. Initial alignment can be made by sighting through the tubes and then by adjusting the position of the stand to obtain a uniform clearance all round between the cover segments and the carriage indexing gear. The holding down bolts must be cemented and secured.

The bar feed spring and cover is fitted as shown on Sheet 4.20. The splash guard brackets and splash guards may also be assembled.

All protective grease should then be removed from internal and external parts with paraffin or white spirit, taking care not to contaminate lubrication oil with grease and cleaning fluid residue.

Coolant strainers, work baskets, chutes, etc., can be placed in position, Sheet 4.3.

The swarf conveyor, if supplied, may also be fitted. Sheet 4.38 shows the position of chutes, electrical connection, etc.

Later machines have an aperture in the tray floor for use with underground disposal systems, where all swarf and coolant passes through the tray and is conveyed to a collection depot. Machines are supplied with a cover plate fitted over the aperture and this should be unscrewed during installation in shops using the system and connections made to the coolant supply.

ELECTRICAL EQUIPMENT

Sheet 4.2 shows the position of the incoming cable entry. The standard control panel includes an isolator and main fuses. It is only necessary to connect the line and earth. Direction of main motor rotation should be clockwise looking at the pulley. Before starting motor read through "Starting Up" procedure, Sheet 1.4.

The wiring diagram is included in the pocket inside the door of the control panel enclosure, together with the spare sheets for all panel units.

Careful attention should be given to see that all main motor fuses and thermal overload heaters are correct for the electrical supply. This is important when dual voltage motors are supplied.

Standard work lamp transformer tappings provided are 110v., 50v., 32v. and 25v. Check the tapping against the lamps supplied.

The above details are checked by Wickman before despatch but should be re-checked at the customer's site.

It is impossible in a general handbook of the present kind to cover all electrical equipment on every machine as requirements vary considerably. Reference should be made to the wiring diagrams and other information forwarded with each machine.

The swarf conveyor motor starter on current machines is fitted to the control panel. Provision is also made for fitting an auxiliary motor starter when required.

Earlier machines (with floor mounted control cubicles) were fitted with a separate push button starter on the end bracket, adjacent to the conveyor outlet.

On star-delta equipment operation of the timer should be checked for a time lag of approximately 15 seconds and all starter gear should be checked for freedom of operation.

STARTING UP

The system has two separate parts with the two plunger pumps contained in the same unit and chain driven from the constant speed shaft. Access to the unit is through a cover on the lower face of the motor end of the main drive housing. Chain adjustment is described on Sheet 2.1.

One side of the pump raises oil from the main drive housing sump and passes it through the lower Purolator filter to distributors which supply all points in the main drive housing. The circuit contains a pressure relief valve set at 10-15 lb./sq. in., the excess oil being fed to the upper camshaft oil bath. The bath supplies a number of drip points, and should be kept clean of dirt and grease. A strainer box fitted to the pump intake must not be allowed to become choked. Examine twice a year and clean sump if necessary. Check oil level in sump by sight glass in front of housing and regularly fill.

The other side of the pump unit draws oil from the tank in the beam through the upper Purolator filter and passes it to sight feed headers for the spindles and to distributors for all drum housing and cross slide feeds. The circuit contains a pressure relief valve set at 10-15 lb./sq. and contained in a block. When a "flush" button in the block is pressed the relief valve is blocked and a surge of oil is passed to the spindles and drum housing feeds. The "flush" button should be pressed daily on starting the spindles.

Oil in the drum housing should be maintained to the level indicated on the rear inside face of the drum housing. Keep clean of grease and soluble coolant contamination.

A priming plug is provided on the Purolator housing for filling or for releasing air locks. Purolator handles should be turned clockwise two or three turns each day to clear the element of foreign matter. The units should be removed twice a year and the element cleaned with paraffin and a soft brush. Use a solvent on gummy deposits.

Fill all nipples with grease, etc., as indicated on the chart, Sheet 4.4. Use ball bearing grease sparingly in the spindle nose labyrinth seal nipples.

An oil chart on pages 5.24 and 5.25 gives a summary of suppliers comparable lubricants.

STARTING UP

Before starting-up the following procedure should be carefully carried out:–

1. Ensure that all protective grease has been cleaned off the machine and that the oil tanks in the beam, the sumps and the tray are clean.
2. Fill (1) the oil tank in the beam, (2) the sump of the main drive housing and (3) the sump of the drum housing, to the gauges. Use Wickman oil grade 4.
3. Apply the grease gun to all the nipples as shown on lubrication chart, Sheet 4.4 using a heavy oil.
4. Either fill the tray with coolant (approximately 180 gallons [820 litres] will be required) or remove the coolant pump chain, if this has not been done before despatch, as running dry may cause the coolant pump to seize. Place the strainer box, weir and tray plate in position as shown and check that all coolant taps are closed.
5. Set the range change sliding gear in neutral and the feed clutch in brake. See Sheets 4.5 and 4.9.
6. Check the direction of rotation of the motor (clockwise looking on pulley). Read sheet on controls before starting machine.
7. Run the motor to check that the lubrication system is working. On starting, the flush button should be pressed to flush the spindle drum system with oil. See that the spindle sight feeds are functioning correctly. Remove the cover over the speed pick-off gears and see that the main drive lubrication system is working by observing the oil pipes feeding the pick-off gears.
8. Check that the collets and feed fingers are fitted correctly. Disengage the collet operating roller and place the bar feed pusher plate in the down position.
9. Test the freedom of the spindle drum and tool slides and the clearance of any toolholders and attachments fitted, by handwinding the machine through a complete cycle.
10. Re-engage range change sliding gear.
11. The machine is then ready for normal running.

See Sheet 2.10 for machines with conveyor.

CONTROLS

SHEETS 4.5 AND 4.6

Principal controls are the main motor push buttons, feed clutch lever, fast-slow clutch lever, handwind engagement lever, index clutch lever, hand collet lever, bar feed shoe disengage knob, automatic stop control and conveyor push buttons. Machines are fitted with main motor push buttons and front-rear selector switches.

The three motor controls, stop button, front-rear selector switch, and start-jog button are duplicated on the front and rear of the machine.

The front-rear selectors are two-position switches and both must be at the same setting, either "front" or "rear" before the appropriate start-jog button can be used to start the main motor.

Setting both selector switches to the "front" position renders the rear start-jog button inoperative, similarly setting both selectors to "rear" renders the front start-jog button inoperative.

The start-jog buttons are dual purpose switches. To set the button for "jog" or "inch" purposes, turn the knurled guard ring surrounding the push button to "jog". This setting renders the start-jog button on the opposite side of the machine capable only of jogging the motor irrespective of its own setting. Therefore, before leaving one side of the machine to work at the other side, the front-rear selector should be set to the side required and the start-jog selector set to start.

The stop button on either side of the machine will stop the motor irrespective of the setting of any other switch.

As a safety precaution, a front-rear selector switch should be set to the side on which the operator is making adjustments.

Auto stop control (later machines) is a three-position switch mounted above the front push buttons. When set to "run" position the machine is arranged so that the feed and main motor will stop automatically with the collet open ready for bar loading, when the bar stock is exhausted. When set to "trip" the feed and main motor will stop every cycle with collet open, with or without bars in the collets. When set to the "set-up" position, the machine will continue running with or without bars in the collets. This position is most useful when setting-up the machine.

AUTO STOP CONTROL ON EARLY MACHINES

These machines are fitted with a two-position switch. When set to "on" the machine feed will stop every cycle with the collet open but with main motor and spindles running. It is necessary to return the switch to the "off" position before feed can be re-engaged. When set to "off" the machine will continue running with or without bars in the collets.

The operation and setting of the timing for both types of switch is described on Sheet 2.9.

Feed clutch levers are fitted at front and rear of the machine. There are three positions; up into feed, down into brake and neutral between. The brake position prevents over-running when disengaging the feed.

The fast-slow clutch lever is fitted at the front of the machine. To operate the clutch, the lever must be first pulled outwards to engage a slot in the clutch shaft. It can then be moved up for feed motion or down for fast motion. There is no neutral with this clutch. On releasing the lever it will spring out of engagement with the clutch shaft. This lever should be used only when tools are clear of work.

The handwind engagement lever is situated under the feed engagement lever and is duplicated on the front and rear of the machine. By pushing the lever downwards the handwind is engaged. It is interlocked with the feed engagement lever. This prevents the handwind being engaged at any other time except when the feed engagement lever is in neutral. Once the handwind has been engaged the feed engagement lever cannot be moved from neutral until the handwind has been disengaged.

The handwind crank is detachable and can be dogged on to the handwind shaft at front or rear of the machine. It makes 180 turns for one complete cycle of the camshaft; the camshaft moving through 2° for each revolution of the handwind crank.

To handwind the machine when the feed trip solenoid is de-energised, it is necessary to hold the feed lever up against the trip spring while engaging the handwind gears.

INDEX CLUTCH LEVER

Raising the index clutch lever until the plunger handle drops into the hole in the bracket renders inoperative the drum indexing, collet operation, bar feed and drum locking mechanisms. By this means it is possible to repeat a cut as many times as required during setting.

An interlock is fitted so that the clutch cannot be disengaged during the indexing of the drum. The clutch is spring-loaded into engagement and due to the shape of the dogs, will drop back into place only at the correct time.

To ensure constant oil supply to all spindles it is inadvisable to run the machine for long periods with the indexing mechanism disengaged.

COLLET HAND OPERATION LEVER

The collet may be opened and closed by hand by placing the hand lever provided in the collet operating lever. This must be raised to engage the operating mechanism. A gap in the cams is provided to allow for hand operation when bar loading. A stop is provided for the collet operating slide to enable the collet mechanism to close to a constant position, after hand or cam operation.

BAR FEED DISENGAGE KNOB

Later machines are fitted with a threaded knob, mounted on the bar feed slide to enable the bar feed shoe to be quickly wound clear of the bar feed tubes.

Early machines are fitted with a spring plunger to retain the shoe in the clear position.

Conveyor push buttons are mounted in the control panel door, or on early machines, the machine end bracket. They are independent of the main motor and can be used separately to remove swarf from the machine.

OPERATING ADJUSTMENTS

Changing spindle speed gears – see speed and feed charts, Sheets 4.43 to 4.47.

Example use of speed and feed plate and charts is shown on Sheet 4.47.

Remove the cover on the main drive housing situated above the belt guard, for access to the spindle speed pick-off gears "A" and "B" Sheet 4.7.

Remove the cover next to the Purolator on the rear of the main drive housing for access to the high-low range change, Sheet 4.7. Machines fitted with cast covers, the middle of three on the rear of the housing.

The speed and feed plate on the front of the main drive and the charts, Sheets 4.43 to 4.47 show gears "A" and "B" in the top column and the spindle speed N/min. for the high range "CC" and low range "DD".

The two gears are keyed on taper shafts and held by slotted washers and hexagon nuts. Unscrew the nuts sufficiently to remove the washers and slide the large gear extractor (573.X.117 in tool kit) over the groove in the gear boss. Tighten the extractor bolt against the end of the shaft to withdraw the gear. One gear should be just withdrawn enough to be free on its taper and then the other gear completely removed. This ensures that gears remain in mesh and prevent the shaft from turning whilst using the extractor. A gear that is very tight will free if the extractor bolt is given a sharp tap with a mallet. Gears and shaft to be cleaned before replacing.

To change the high-low range, release the pad bolt and slide the glut and gears into the position required, re-clamping the pad bolt. Slide to the right for the high range "CC" and to the left for the low range "DD"

Changing feed gearing–see speed and feed plate or charts, Sheets 4.43 to 4.47.

Remove cover on main drive housing, motor end (next to speed pick-off gear cover) for access to gears "H" and "F", Sheet 4.8.

Remove the upper cover on the front of the main drive (nearest to spindles) for access to gears "J" and "K", Sheet 4.8.

The feed and speed plate or charts show the feed pick-off gears, "F", "H", "J" and "K" in the vertical columns on the left hand side, cycle time "T" in seconds in the middle.

The four feed gears are keyed on taper shafts and held by washers and nuts. Change the gears as described for the speed gears, using the small extractor supplied in the tool kit. Partially lossen all four gears before removing nuts, washers and gears from the shafts.

Changing feeders and steady bushes–Sheet 4.9 illustrates the bar feed end of the spindles.

The feed tubes should be withdrawn from the machine in station 1 where the collet hand operation is fitted, the machine being stopped just after indexing with the collet open. To obtain extra clearance, place the spacing block (item 573.X.113 in tool kit) between the stop collar on the front guide bar and the bar feed slide. It should be placed in position when the bar feed slide withdraws, immediately before indexing commences.

Unscrew the hexagon nut clamping the pad holding the stock tubes in place, turn the pad clear and withdraw the stock tube approximately 3'. Use the bar feed disengage knob to withdraw the shoe clear of the feed tube bobbin.

Loosen the three nuts holding the stop plate to the centre stop between the spindles and partially turn the plate to withdraw the tube assembly out of the machine. Place the assembly on a $\frac{3}{8}$" diameter rod held in a vice, through the holes drilled in the tube at the feeder end. This enables the feeder to be unscrewed (left hand thread) with the wrench provided without distorting the tube. Gripping the tube in a vice will distort the tube and prevent the feeder being easily unscrewed. Do not use a mallet on the wrench to overtighten when replacing feeders.

Feeders should be clean and the thread completely free of grit.

Steady bushes are held in the bobbin end of the tube assembly with a slotted nut locked with another slotted nut. Use the adjustable "C" wrenches to unscrew these nuts (left hand threads).

CHANGING COLLETS

Collets are changed by turning the one-piece adjusting sleeve and tube until it is unscrewed from the collet (right hand thread) and withdrawing the collet past a locating key in the spindle nose. A pin wrench (item 573.X.106) is provided to turn the adjusting sleeve. The collet adjustment is locked by a spring plunger locating in one of a series of holes in a flange on the sleeve. The plunger should be withdrawn and held out of engagement by sliding a small pin attached to the plunger into a retainer slot cut in the plunger housing.

Replacement collets should be well cleaned and the spindle nose seating examined and cleaned of grit and coolant scum deposits before fitting the collet on the spindle nose locating key and screwing the adjusting sleeve into the collet. Feeder and stock carriage tubes should be replaced.

Before replacing bars in the feeders and finally adjusting collet tension, set the bar feed stroke.

SETTING BAR FEED STROKE
SHEETS 4.9 AND 4.20

It is important when the bar feed stroke is to be increased to adjust the centre stop to the maximum rear position. Use the "T" type wrench on the two $\frac{7}{16}$"(11.1 mm) square head locking screws in the centre stop.

Unclamp the two hexagon nuts below the bar feed roller bracket,Sheet 4.9, and move the bracket until the stroke required is indicated on the bar feed slide scale. Re-clamp tightly to prevent slip and consequent short bar feeding. Handwind the machine until the slide is in the rear position and reset the centre stop with the stop plate just clear of the feed tube bobbin.

BAR FEED CAMS

½"-5" (12.7 – 127mm) cam supplied as standard, 5"-10" (127 – 254mm) cam, 544.Y.106B available to order. **2 " 6S only;** ½"-5" (12.7 – 127mm) cam supplied as standard, 1¼"-6¼" (32 – 159mm), 502.V.258, available to order.

OPERATING ADJUSTMENTS(continued)

ADJUSTING THE BAR STOP

Coarse adjustment is made by transferring a pin locating the bar stop casting along a series of holes in the operating shaft. Fine adjustment on later machines is controlled by a square screw on the bar stop casting. On earlier machines, fine adjustment is effected with slotted nuts on each end of a sleeve mounted on the operating shaft.

The operating mechanism is arranged as standard to swing the stop up to the spindle between the 1st and 2nd stations. This can be modified to swing over the 1st station cross slide to the bar feed position. This modification is more fully covered on Sheet 2.8.

BAR LOADING

Bar stock should be in good condition and considerable output time can be gained if bars are clean, straight and free from scale, corrosion and paint. Bar loading is the operation performed most frequently and can account for a large proportion of down time, particularly on longer components of short cycle time. To remove an unsatisfactory bar in a machine loses valuable working time; bars with a large variation in diameter are also disadvantageous. Grading of bars to approximately the same overall length is recommended.

Bars should be chamfered at both ends and in certain cases, an end squared to prevent drill breakage.

The machine should be stopped with collet open and bar feed slide forward as shown in Sheet 4.9. Machines equipped with the later auto stop control automatically stop ready for loading with the feed disengaged and main motor stopped.

During normal running of the machine it is necessary to remove the old bar end from the collet. On short components with the bar stop close to the collet, insert the hand lever in the socket in the stop bracket and swing the stop sufficiently to remove the bar end. The bar ends must not be allowed to drop into the conveyor trough.

Enter the new bar into the feeder tube. Later machines have a cast step on the bar feed slide on which a lever can be supported, to enable large diameter bars to be easily lifted into position through the steady bush. Insert a short length of bar into the stock tube and tap the new bar through the feeder and collet for a suitable distance. This distance depends on the tooling set-up and the condition of the end of the bar. Where the bar is fed out partially machined on previous cycles, i.e., drilling through deeper than the part-off tool and breaking down behind the part-off tool, it is essential that the tools advancing in fast motion clear the new bar.

After loading a new bar, close the collet with the hand operating lever, adjusting collet tension as necessary. Collets should close with a good swift pull on the hand lever, the operator standing sideways to the machine to enable his body weight to assist the operation.

The horizontal action of the hand lever enables collet tensions greater than normal requirements, to be set by using a longer lever. Unless it is absolutely necessary, i.e., extremely heavy combined end cuts on tough alloy steels, extra tension should not be used.

Under no circumstances should a collet tension be set that cannot be easily closed by a lever of 4' maximum length. Do not use the "inch" or "jog" button to close the collet under power.

The spring load for bar feeding is adjustable, Sheet 4.20 and should be set to the maximum required for consistent bar feeding length. Screwing the square ended shaft on the spring tube clockwise increases the spring load.

SETTING LONGITUDINAL SLIDES

The centre tool block and the independent longitudinal slides are adjusted for feed stroke on the three quadrants shown in Sheet 4.10.

Adjustment is easier with the machine stopped in the "dwell" position indicated on the timing dial and the stops on the centre block and longitudinal slides adjusted clear, Sheet 4.10.

Loosen the two hexagon socket screws in the setting block sufficiently to move the block to the stroke required, indicated on a scale on the quadrant. Re-tighten the screws and re-set the slide stops.

The position of the two independent longitudinal slides can be adjusted 3½" by means of hexagon nuts along a screwed pusher rod and the slide stops may be moved into several positions to accommodate this adjustment. The centre block position is not adjustable and the forward position is approximately constant.

CROSS SLIDE ADJUSTMENTS

The capacity charts give the maximum forward and back positions and main dimensions of the cross slides.

Adjustment is made by releasing the clamping nut on the top face of the slide and turning the graduated "micrometer" knob as required. Tighten the nut after adjustment to avoid strain on the adjusting screw.

All cross slides, except the cut-off slide in 6th station, are fitted with dead stops bearing on stop screws in the spindle drum. At each indexed position of the spindle drum, each slide operates against a different stop screw, so that small errors as may exist in the position of spindles in the drum can be cancelled out. The drum stop screws are normally set at Wickman Ltd. before despatch but if small consistent errors are obtained during running, the screws can be adjusted with the spanner supplied.

The cross slide mounted dead stops should be re-set after each slide and each stroke adjustment.

STROKE ADJUSTMENT SHEETS 4.11 AND 4.32

Access through lower hinged doors on drum housing.

A special ring spanner is supplied to release the hexagon nuts on the pivots at the lower ends of the operating links. Adjustment is made by sliding a pivot along the rocking lever tee slot and re-tightening the hexagon nut. Scales on the rocking lever and an indicator on each pivot block show the fees stroke set.

The setting should be made with the machine stopped at the "dwell" position and the cross slide adjusted clear of the dead stop. This is particularly important when re-setting intermediate cross slide feed strokes (3rd and 6th station).

The upper cross slides may be set from the "standard" range of strokes to a "long" range of strokes, the long range strokes being twice the scale reading. The changeover is obtained by removing the covers on the top of the drum housing and transferring the upper link pivot connection from an outer hole "B" in the operating lever to an inner hole "A". Instructions for this are given on Sheet 2.8.

Machines are normally supplied fitted to the outer hole "B", the feed stroke setting being equal to the scale reading.

INTERMEDIATE CROSS SLIDES, 3rd AND 6th STATIONS (SIX SPINDLE MACHINE ONLY) SEE ALSO SHEET 2.8.

Later machines are arranged to obtain two ranges of feed strokes on the intermediate cross slides, the shorter range being fitted as standard.

The changeover, as on the upper cross slides, is by transferring the link pivot from an outer hole "B" in the intermediate slide operating lever to an inner hole "A". The two ranges of feed stroke for the rocking lever scale setting are given on a plate fastened to the rocking lever, the scale being marked in numbers corresponding to the different feed strokes in the two ranges.

Earlier machines have one range of feed strokes equal to the scale readings.

Other adjustments, including auxiliary cross slides and auxiliary longitudinal motions are described in the sections on machine construction and attachment adjustment.

SECTION TWO
MACHINE CONSTRUCTION

SPINDLE SPEED DRIVE SHEETS 4.13 TO 4.16

The initial machine drive described below covers that part of the drive from motor to spindles and indicates where the drive is taken off for further reduction for the feed and fast motion drive. This is described on Sheet 2.5. The motor, Sheet 4.14 is mounted on a platform pivoted on the tray and situated at the rear of the main drive housing.

The drive to a constant speed pulley shaft in the main drive housing is by vee belts. To adjust the belt tension the motor platform is raised or lowered by means of two adjusting bolts. Sheet 4.14 also shows direction of rotation of pulleys.

The constant speed pulley shaft drives the "second" shaft through the range change gears, providing an initial high and low speed range. These gears have a neutral position to disconnect the drive for safety purposes when checking motor rotation.

The drive from the "second" shaft is transmitted by spindle speed pick-off gears to the centre shaft. A list of gears is given on Sheet 4.15. The centre shaft extends along the main drive housing through the hollow centre guide between the housings and through the centre of the spindle drum to a gear on the rear face of the drum.

Access to the speed pick-off gears is at the motor end of the main drive housing and to the range change at the rear side of the housing. Gear changing is described on Sheet 1.6.

Standard attachments are driven from the centre shaft to keep a direct speed relationship with the spindle. The gears and chain wheels required are supplied fitted.

The initial drive for the feed gearing is taken from the centre shaft, so that tool feed for each spindle revolution remains constant with any change of spindle speed, and the overall cycle time will vary with spindle speed changes.

Drives requiring constant speed are taken from the constant speed pulley shaft. These are the fast motion drive, coolant pump drive and the lubrication oil pump drive. All are chain drives and the position of the chain wheels can be seen on Sheet 4.15. All chain drives, with the exception of the oil pump drive, are provided with jockey sprockets to tension the chains. The oil pump is mounted on a swinging bracket and chain tension is adjusted by moving this bracket. The chain drives are illustrated with directions for adjustment on Sheet.

Do not overtighten chains. Correct adjustment should allow the middle of the longer run of any one chain to be moved sideways a minimum of ¾".

SPINDLE DRUM SHEETS 4.17 TO 4.19

The drive from the motor was described to the point where the centre shaft passes through the hollow centre guide to the spindle drum.

Sheet 4.17 illustrates this end of the centre shaft, with the spindle drive gear keyed to it and driving gears mounted directly on each work spindle.

The spindle drum carries the work spindles and the centre guide on which the centre or main tool block slides. This arrangement ensures consistent alignment of work spindles with the centre tool block. The end thrust of the tools upon the spindle drum is taken by a stop ring secured to the front of the spindle drum. This stop ring also carries stop screws which are adjustable dead stops for the innermost position of the cross slides, giving independent setting between each cross slide and spindle in each indexed station.

Hardened steel thrust pads are fitted in the rear flange of the spindle drum to eliminate end float and are adjusted by screws and locknuts. These should be set with no clearance between pad and drum housing face when the drum is cold.

The drum is supported at both ends in machined diameters in the drum housing. A gear on the rear (bar feed end) of the drum, meshing, in the case of the Six Spindle machines, directly with a Geneva gear and for Four Spindle machines through a gear train to the Geneva gear. A further gear is taken from the drum indexing gear to drive the indexing of the stock carriage. Sheet 4.22.

WORK SPINDLES

The work spindles are mounted in a pair of Timken precision taper roller bearings at the front and an extra precision parallel roller bearing at the rear, see Sheet 4.17. The front bearings are protected against ingress of coolant and swarf by a piston ring seal and labyrinth seal. A front cap covering the seals is provided with grease nipples so that the seal assembly can be filled with grease for the exclusion of foreign matter. Inspection of the seal assembly can be made by removal of this cap and the short spacer sleeve which contains the piston ring removal of this cap and the short spacer sleeve which contains the piston ring lightly sprung in the bore of the sleeve. As with any piston ring assembly, careful dismantling and assembly is required and as the end cap clamps the outer race of the front bearing, end float checking of the bearings is essential after reassembly. Where fitted, remove coolant thrower rings from spindle nose for access to end caps.

FRONT BEARING END FLOAT

The Timken taper roller bearings are adjusted by a slotted locknut accessible by removing the front upper cover on the drum housing. On earlier machines the

locknut is locked by a set screw and copper pad. On later machines the locknut is split and clamped by a cap screw. With either type of nut the screw should be kept lightly clamped whilst adjusting bearings. The following procedure is recommended when checking and adjusting:—

1. Check end float with clock indicator (preferably a magnetic base type) mounted on the spindle drum and "feeling" against the spindle.
2. Check with bar gripped in collet.
3. Use a short lever to exert pressure on the spindle, pushing the spindle the extent of the end float to obtain a reading.
4. The end float should be very gradually reduced by adjusting the locknut with short sharp taps on a wrench or broad punch located in the slotted nut. Remember, actual nut movement should be small, 1/16"(1.5mm) turn on the outside of the nut will reduce end float approximately ·00017" (0.004mm). End float of ·0006"-·0008" (0.015 — 0.020mm) should be set for normal speeds.
5. End float can be increased to ·0008"-·0010" (0.020 — 0.075mm) for high speeds.
6. The locking screw in the nut should be tightened after each adjustment before reading end float and only slackened sufficiently to allow the nut to turn when adjusting.
7. After each adjustment, before reading end float, the spindles should be jogged to settle the rollers.
8. When over-adjustment reduces end float below ·0006" (0.015mm) it is necessary, after turning the nut back, to separate the bearings a small amount by mallet blows on the rear (bar feed end) of the spindle. In this case it is possible to jolt the front bearing and piston ring carrier away from the spindle shoulder; therefore the spindle should also be struck in the opposite direction to re-seat the front bearing. This procedure ensures correct end float reading and if not fully applied may give a false reading which will increase under operating load as the bearings re-seat.
9. When adjusted satisfactorily run the machine at about 150 r.p.m., gradually increasing to the spindle speed required, watching the temperature at regular intervals on a thermometer placed in an end cap screw hole. Temperature should not exceed shop temperature, + 70°F. (21°C) at approximately 400 r.p.m.

The following information applies if spindles and bearings are dismantled from the drum:—

1. Check that oil feed and circulation holes are clear.
2. Assemble bearings on spindle with the biggest bore for the adjustable bearing, i.e., nearest the lock nut. This makes the end float adjustment easier.
3. Eccentric marks on outer races to be in line and radially outwards.
4. Eccentric marks on inner races to be in line.
5. The front bearing and piston ring carrier to be pressed hard against the spindle shoulder.

Front and rear bearings are lubricated in 4th and 5th stations on Six Spindle machines and in 4th station on Four Spindle machines by oil from a pressure header on the beam above the drum housing. Sight drip feeds mounted on the beam are provided for checking flow. Spacing rings on the spindle assembly retain the lubricant to a suitable level and drilled passages in the drum allow internal oil flow around the front bearing assembly.

Collets are of the drawback type and are opened and closed by a toggle mechanism on the rear end of the spindles and a spring compensator is included to accommodate small variations in bar size. The collet may be removed from the spindle by releasing the spring plunger and turning the collet adjusting sleeve until the collet is screwed clear.

The tension on the collet is adjusted by means of the collet adjusting sleeve, and after fitting new collets, must always be tested by hand before running under power.

When adjusting the collet tension, extra clearance for the spanner (item No. 573.X.106) may be obtained by placing a spacing block (item No. 573.X.113) between the stop collar on the front guide rod and the bar feed slide, see Sheet 4.9.

The spacing block is provided in the tool kit and should be placed in position when the bar feed slide withdraws immediately before indexing commences.

The feed fingers are fitted to feed tubes carrying on their outer ends the bar feed bobbins mounted on anti-friction bearings. To remove the feed fingers it is first necessary to slide back the stock carriage tubes. These are held in the stock carriage indexing gear by clamps which must be slackened and turned clear to release the stock carriage tubes. By turning the plate on the rear of the centre stop the feed tubes may be removed from the machine complete.

To extract the feed tube in 1st station it is necessary to withdraw the bar feed shoe. Later machines are fitted with a screwed knob which can be pulled down to withdraw the shoe or turned to retain in the withdrawn position. On early machines it is necessary to depress the shoe which is retained in the down position by a spring plunger. Bar steady bushes are fitted in the end of the feed tubes and are retained by a screwed sleeve and slotted locknut.

WORK SPINDLES–2⅝"-6S SPINDLE STOPPER SHEETS 4.18 AND 4.19

The spindle stopper version of the 2⅝"-6 machine enables spindles to be stopped and held in stations 2, 3, 4 and 5. All combinations of stopping and starting can be arranged between these stations.

Standard machines cannot be converted to a spindle stopper and provision must be made at an early stage of manufacture.

Sheet 4.18 shows the spindle drum assembly; each spindle gear is driven from the central gear and runs loosely on ball and roller bearings when the multi-plate brake is engaged. The brake contains a series of pre-loaded cushion springs which limit and maintain the brake torque and is sufficient to brake the spindles to a standstill.

The multi-plate drive clutch on each spindle is engaged by the axial thrust imparted by a row of balls, squeezed inwards against conical and flat faces by the clutch bobbin when it is moved by the cam operated clutch glut. The clutch is adjusted by turning the slotted nut from serration to serration on its right hand thread, the serrations being maintained in engagement by a series of clutch plate separation springs. The clutch is accessible for adjustment in 6th station and an adjustment of one serration at a time can be made by a sharp hammer blow on the clutch punch, 573.X.155. After adjustment the clutch must be checked using hand lever 502.X.251 and a spring balance reading between 50 and 70 lb. measured at the knob end of the lever should be maintained.

The clutch gluts are operated during indexing of the spindle drum by a series of cams secured in housings at the bar feed end of the drum housing. The cams may be selected to suit varying tooling requirements and are supplied to order. A cam housing and one set of cams for stopping in the following conditions are supplied as standard:–

Stop in 4th, Start in 5th or
Stop in 5th, Start in 6th

When fitting new cams handwind through index to ensure that the rollers pass freely all round the cam track.

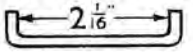
Cross slide attachments and drives for use on Spindle Stopping machines are usually designed for a special and limited application to suit customers' components.

DISMANTLING

It is recommended that spindle removal be undertaken by Wickman Service Engineers. A brief guide to the procedure is given below.

The drive clutch and brake clutch gluts and operating shaft should be first removed, preferably in 6th station. Unscrew the drive clutch glut retaining nut and the end nut at the brake glut (accessible through drum housing). Withdraw shaft through gluts sufficiently to remove half collars on drive glut end and the key in the shaft at the brake glut end. Dismantle shaft bearing at drive glut end and withdraw shaft, gradually unscrewing the remaining nuts.

Remove feed tube, collet tube, collet adjustment assembly, collet sleeve, toggle carrier and toggles. Unscrew from the spindle the thrust pad retainer nut, remove pads and then the drive clutch ball assembly.

Retaining clips 

in shape, fitted over the operating sleeve will hold the ball thrust ring and retain the 33 operating balls.

Drive clutch plates can then be stripped and the bearing retaining nut unscrewed. Radial access to the nut locking screw is through a hole in the spindle gear (5/32" A/Flats hexagon wrench required).

Unscrew the brake clutch sleeve stop fitted radially to the spindle and the adjacent front bearing adjusting nut.

Dismantle the spindle nose thrower ring (where fitted) and unscrew the front cap covering the piston ring seal and carefully remove the short spacer sleeve.

The spindle may then be withdrawn, stripping the drive gear and bearings, the rear bearing spacer, brake plates and operating sleeve and the front bearing nut and spacer, leaving in the drum the rear roller bearing and spacer and the brake spring assembly. The front bearings and spacers should withdraw with the spindle.

The brake spring assembly is retained in the drum with a taper point screw and locknut and if the assembly is removed care is needed when replacing to align the keyway with the torque pin fitted in the drum bore.

The rear roller bearing is held between an end cover and a spacer located against a circlip in the drum bore. This circlip should have its deepest section over the oilway recess in the spacer.

Assemble bearings as directed for the standard machine spindle, Sheet 2.2.

Replace spindle and its component assemblies in the reverse order to dismantling, ensuring correct order of replacement as the spindle is fed through the bearings. Front bearing end float will need adjustment as directed on Sheet 2.2. Other adjustments as follows:–

Hold glut shaft in brake position by screw and collar in end of glut shaft and adjust brake glut retaining nut to obtain 3/32" compression of the brake springs.

Thrust pads to be assembled according to marks.

Clutch to be in neutral when tightening the thrust pad retaining nut.

COLLET OPERATION AND BAR FEED OPERATION SHEETS 4.9 AND 4.20

After the workpiece is cut off in 6th station the machine is indexed to 1st station, the collet opened, bar stock fed out to the bar stop and the collet closed just before the advancing tools start cutting; see timing diagram Sheet 4.48.

The collet operation mechanism consists of a cam operated slide moving on two round guide bars mounted between the drum housing and the end bracket. A bonded fabric shoe carried in a slot in the slide engages in a groove in the collet sleeve on the work spindle and is spring loaded so that if a collet sleeve indexes out of position the shoe will be depressed and rendered inoperative.

The collet slide is operated by a roller and barrel cam direct from the main camshaft and can be disengaged by loosening a pad bolt and pulling the roller carrier outwards clear of the cams, Sheet 4.20. Adjustable nuts carried on a rod provide a stop for the operating slide and enable the mechanism to close the collets to a constant position, with either hand or cam operation. Sheet 4.20 shows the correct adjustment for these nuts.

The bar feed mechanism is spring operated and controlled by a barrel cam on the main camshaft. The slide is mounted, as the collet operation slide, on the two guide bars and carries an aligning ring and a spring loaded shoe. The aligning ring encircles all the bar feed tubes and in 1st station restrains the feed tube bobbin between the ring and the spring loaded shoe. The spring loaded motion of the slide and shoe feeds the bar feed tube and bar through the collet tube to the bar stop. On the return cam stroke the aligning ring returns the tube to a "ready to be fed" position and holds it there, together with the other bar feed tubes. Any endwise movement of the tubes is limited by the aligning ring an adjustable centre stop, carried on a shaft extension of the stock carriage and centrally placed between all spindles, Sheet 4.20.

Two cams are needed to cover the bar feed stroke range; ½"-5" (12.7 – 127mm) cam supplied as standard, 5"-10" (127 – 254mm) cam, 544.Y.106.B. available to order.

2⅝"6-S machines only; ½"-5" (12.7 – 127mm) cam supplied as standard, 1¼"-6¼" (32 – 159mm) cam, 502.V.258 available to order.

Collet tension and bar feed stroke adjustment is described under operating adjustments, Sheet 1.6.

Later machines are fitted with a limit switch operated by a rod and adjustable clamp from the bar feed slide. The function and setting of the mechanism is covered under "Auto-Stop Mechanism" Sheet 2.9.

INDEXING AND DRUM LOCKING SHEETS 4.13, 4.21 AND 4.22

The spindle drum is indexed anti-clockwise (looking on the collets) by gearing from the Geneva wheel. The Geneva gear meshes direct with the drum gear on Six Spindle machines and through a gear train on Four Spindle machines. The mechanism is mounted at the rear of the machine on the bar feed end of the drum housing and is shown diagrammatically on Sheet 4.13. The four-slot Geneva wheel and gear is driven by the passage through one of the slots of a roller carried on an arm mounted on the bar feed cam drum.

During each fast motion cycle the drum is unlocked and indexed to the next station, .050" (1.27mm) past the final position. This allows a spring loaded latch in the drum housing to drop into position before the drum is clamped back against the latch and locator pads on the drum by the drum locking mechanism.

The latch, which is accessible through the front upper cover, should be adjusted with the latch sitting on the locator pad to give 1/32" to 1/16" (0.8 – 1.6mm) clearance to the nuts, as shown in Sheet 4.21.

The drum locking mechanism, accessible through the rear upper cover, is essentially a toggle mechanism arranged to lock the spindle very near to the dead centre position of the toggle.

The toggle pivots on a shaft with eccentric adjustment to obtain the correct clamping pressure and a stop screw in the drum housing is set ·010" clear of the toggle link to give the correct toggle offset when locked. The following procedure should be made to test for correct adjustment and should preferably be done when the spindle bearings have reached normal running temperature.

Place a tommy bar approximately 12" (150mm) long, 5/8" (16 mm) diameter, in the socket in the upper toggle link (a screwed cover on the top of the drum housing will have to be removed). Disconnect the pin in the operating lever and long spring box rod situated near the end bracket, Sheet 4.21. Pull the tommy bar down slowly by hand as far as it will go. The toggle should just bind on the drum and if correct a slight resistance can be felt as the toggle grips when the tommy bar is slowly lifted. The high point of the eccentric is marked on the end of the shaft, visible from the collet end.

The toggle is operated by a link to a lever on the drum locking shaft which is connected to a cam lever by a pre-loaded spring box assembly. Sheet 4.22. The long connecting rod should be adjusted to compress the spring 1/8" (3.2mm) when the drum is locked.

FEED DRIVE SHEETS 4.13, 4.23 AND 4.24

The feed drive is transmitted by chain from the centre shaft to a hollow sleeve carrying a gear reduction to the first feed pick-off gear shaft; gear "F" on the speed and feed charts. The mating gear "H" is mounted on one end of a shaft with gear "J" on the other end, meshing with gear "K" on the final pick-off gear shaft. A list of gears is given on Sheet 4.23.

The final pick-off gear shaft carries the feed overload slipping clutch to protect the drive during the feed part of the cycle. The sideways disengaging action of the spring loaded clutch closes a relay which changes the feed to "brake" by energising the feed trip solenoid. The main motor then stops. Before the slipping clutch is re-engaged by sliding the driving dogs into mesh, the cause of overload should be located and corrected. Access to the clutch is through the cover carrying the speed and feed plate, Sheet 4.24.

After passing through the slipping clutch, the feed drive is transmitted by a pair of gears to the feed side of the feed motion-fast motion clutch.

A roller "freewheel" clutch is built into the gear on the clutch shaft to maintain the drive whilst the clutch is in neutral when changing from fast to slow or slow to fast.

The fast motion drive is taken from the constant speed pulley shaft by chain directly to the fast side of the feed-fast clutch.

The drive either fast or feed, then passes through the fast motion slipping clutch, to a pair of gears driving one side of the feed-brake clutch on the final feed shaft. Bevel pinions at one end of this shaft drive the worm and wormwheel on the main camshaft and a chain wheel on the other end drives the upper camshaft worm and wormwheel. The final feed shaft also carries the handwind gear which can be engaged by a handwind pinion when the feed-brake clutch is in neutral.

The feed-fast clutch is operated by a yoke and lever from two adjustable dogs in the "T" slot on the upper wormwheel. The timing of the dogs can be set as required, normally shifting the clutch at the start of the feed period, 155, and at the end of the dwell when tools have finished cutting, 310°. Hand operation of the clutch, which should only be used when tools are clear of the work, is provided at the front of the machine, see "Controls". Sheet 4.5.

A diagrammatic illustration of the fast-feed clutch control is also shown on Sheet 4.33.

The brake side of the feed-brake clutch serves to brake the drive to the camshafts when the feed clutch is disengaged manually or by the auto stop control feed trip, Sheet 2.9.

Instructions for adjusting the multi-plate clutches are given on plates fixed to the machine. To increase the driving power of a clutch, rotate the spring ring around the adjusting nut and withdraw the locking plunger. Rotate the nut in the direction of the arrow stamped on the nut until the plunger can be engaged in the next hole in the locking plate. Do not adjust more than one hole at a time before testing with the hand lever. Replace the spring ring.

FEED MOTION-FAST MOTION CLUTCH. When the hand lever is operated from a midway position the sliding part of the clutch should first move easily, build up resistance to a maximum just as the plates compress together and then ease slightly as the internal clutch toggles move over their high point. Set the minimum adjustment to obtain this feel without obtaining obvious clutch slip or overheating.

FEED-BRAKE CLUTCH. Set the brake clutch fairly slack with less "bite" than the feed-fast clutch so that when the trip mechanism operates the clutch will be engaged fully but the braking action will not be severe. Adjust the feed clutch and ensure that the trip mechanism consistently disengages the feed and engages the brake clutch.

SLIPPING CLUTCHES. These clutches are assembled with the minimum number of springs and plungers necessary to transmit the torque. Spare plungers, springs and screwed plugs are supplied in the equipment kit and can be fitted when required. It is recommended that the number of plungers in use is kept to a minimum to ensure that the clutches will disengage when necessary. Fit extra plungers, etc., in pairs equally spaced around the clutch body.

THE MAIN CAMSHAFT SHEETS 4.16 AND 4.29

The main camshaft extends from the wormwheel in the main drive housing through the drum housing to the stock carriage end of the machine. It carries the cross slide feed and approach stroke cams, bar stop, bar feed and collet operating cams, spindle drum locking cams, the Geneva arm and roller and the index clutch.

A cam drum is fitted in the main drive housing to carry cams for special end working attachments when these are required and a 2" (50.80mm) bore is provided in both walls of the housing to carry a bar on which the necessary levers can be pivoted.

An auxiliary cam disc is provided in the drum housing to accommodate special cams for varying independently the movements of the cross slides or cross slide attachments when required. A timing hole is provided in this auxiliary cam disc which lines up with a corresponding hole in the drum housing wall when the camshaft is at 0° timing angle.

The keyway in the shaft and the vee grooves across the diameter of the auxiliary cam disc and the spare cam drum, are horizontal and to the front of the machine at 0° timing angle. At this point the Geneva roller is just entering the Geneva wheel.

INDEX CLUTCH OPERATION SHEETS 4.16 AND 4.29

The bar feed cam drum is driven by a dog clutch spring loaded into engagement and carried on the main camshaft. Lifting the index clutch lever until the plunger handle locates in a hole in an adjacent bracket, withdraws the clutch teeth and renders inoperative the bar feed, collet operation, drum indexing and drum locking mechanisms. An interlock latch is fitted so that the clutch cannot be disengaged during the indexing of the drum.

UPPER CAMSHAFT SHEETS 4.27 AND 4.33

The upper camshaft is transversely mounted across the top of the main drive housing. It carries disc cams which operate the centre tool block and the longitudinal slides. Cam carriers are also fitted for cams to operate the 3rd and 6th station longitudinal motions on Six Spindle machines. Four Spindle machines are fitted with a spacer in place of the rear cam carrier.

The cam dogs controlling the fast motion clutch are mounted in a T-slot on the face of the wormwheel; a timing dial is provided at the front end of the upper camshaft. On later machines a timing dial is also provided at the rear end of the upper camshaft.

The wormwheel drives the upper camshaft through serrations on the face of the wormwheel and a serrated plate engaging a tenon slot in the upper camshaft. By releasing the centre screw and the two outer screws this serrated plate may be disengaged from the wormwheel. By handwinding the machine, the lower camshaft and the upper wormwheel may be turned while the upper camshaft remains stationary, thus enabling the timing to be altered or corrected as required. It is vitally important that the serrations engage properly and that screws are well tightened after altering the timing.

A vee groove is cut across the periphery of the cam discs and is vertically above the centre of the camshaft at 0° timing angle.

CENTRE TOOL BLOCK AND LONGITUDINAL SLIDES OPERATING MECHANISM SHEETS 4.28, 4.29 AND 4.30

The mechanism derives its motion from cams on the upper camshaft, the three slides being operated by a series of racks and levers to give each slide a constant fast approach stroke and an infinitely variable feed stroke; centre block 0"-5" (0 – 127 mm), independent longitudinal slides 0"-5⅝" (0 – 143mm). A sliding block with provision for three sets of pinions and slideways for racks is carried in guides on top of the main drive housing and when cam operated, imparts the fast motion stroke to the three slides. The block is locked in the forward position and three separate quadrant levers are cam operated to provide the feed motion through the racks and pinions to the slides.

At the end of the fast motion approach stroke the sliding block lockbolt enters a tapered seating on the block; if the seating is not directly under the lockbolt the block will be moved and consequently double the movement on the tool slides. The setting is shown on Sheet 4.30 unless dismantled or cam wear has occurred, adjustment should not normally be necessary. The adjusting procedure is as follows:–

Stop the machine at the end of the fast approach stroke with the lockbolt "IN" and remove the sheet metal covers. Dismantle the lockbolt operating lever by removing its eccentric pivot pin.

Release the sping load on the lockbolt by unscrewing the retaining cap. Spring load is approximately 60 lb. (27 Kgf) and the cap can be held down by an assistant if two opposing screws are first removed.

Fit a long " B.S. fine bolt or stud in the thread in the lockbolt to enable it to be pulled clear of the seating. With the lockbolt withdrawn handwind the machine backwards until the sliding block starts to retract then carefully forwards until the block is just at the maximum forward position on the fast motion cam.

The block should then be moved with gentle blows from a mallet until a ·003" (0.076mm) feeler can be trapped between the outer part of the cam and the roller. In this position the lockbolt should fit exactly in the tapered seating without moving the sliding block setting. To re-set release the pad bolt holding the roller pin and turn the pin by the hexagonal end to obtain exact seating. The eccentricity must be kept in the lower half as shown on Sheet 4.33.

After adjusting the pad bolt nut must be tightened to a maximum to prevent pin movement.

Assemble the operating lever and adjust its eccentric fulcrum by the squared end to just nip the lockbolt down in the seating with the roller on the inner cam.

CHANGING FEED STROKE

This is dealt with under "Operating Instructions" Sheet 1.7.

CHANGING FAST MOTION APPROACH STROKE

Two alternative cams are available for 3½" (88.9 mm) and 5" (127 mm) stroke. Changing involves removal of the upper camshaft.

Auxiliary motions are available for 3rd and 6th stations on Six Spindle machines, see Sheet 3.1.

CENTRE BLOCK AND LONGITUDINAL SLIDES

The centre block, fitted with bushes and scraper rings, slides on the centre guide which indexes with the spindle drum. Torque loads are taken against guide faces in the beam by a guide block on top of the guide arm, adjustment for wear being provided by a gib strip. When adjusting the gib strip carefully check the adjustment throughout the travel as wear will tend to occur on the portion covered by short strokes. Access is through covers on top of the beam, Sheet 4.29.

Oil is fed from drip points in the beam to a strainer on the guide block and down a pipe to the reservoir between the bushes in the centre block. Drain and filler plugs are provided for periodical draining and flushing out.

The block is pushed by a double link from the lower centre rack and no endwise adjustment is provided. The stop rod is provided to control length accurately. Stop nuts should be slackened off well clear before adjusting slide strokes as the final position of the block is not constant for all strokes.

The faces and tenon slots are ground to close tolerances and stock toolholders and attachments may be fitted to any face without selection for height or centrality.

The longitudinal slides are mounted on vee guides fitted on the beam which are accurately adjusted for alignment and centrality by a tenon block secured to each end of the vee guide. Screws in the beam clamp the blocks to one side of a beam slot.

Tapered gib strips are provided and the headed screws at each end of slide should be adjusted with the tool (573.X.108) supplied in the kit.

Each slide is pushed by a rod screwed into the pusher bar and is adjustable for position (3½") (88.9mm) by means of nuts on the rod. A spacer between the nuts is slightly wider than the bracket on the slide to allow for slight mis-alignment of the pusher rod.

As with the centre, block stops should be well clear before adjusting stroke.

CROSS SLIDE OPERATING MECHANISM SHEETS 4.31 AND 4.32

The mechanism is situated in the drum housing and consists of a series of levers and pivoted links operating upon gear quadrants and racks to give the slides a two-part motion of fast approach and withdrawal and a slow feed similar to the longitudinal slides.

The fast approach is by cam operated toggles, actuating two heavy "rocking" levers through a short arc. A cam on the main camshaft extends a toggle, swinging the front lever pivot on to two stop screws in the drum housing floor. A second cam on the main camshaft imparts a similar motion to the rear rocking lever. Adjustment to the stop screws should only be required after long service. Sheet 4.31 illustrates and explains the adjustment.

Clamped in tee slots on the rocking levers are adjustable link pivots with links extending to suitable levers on the cross slide operating shafts. An extension of each rocking lever carries a cam roller controlled by the feed motion cams on the main camshaft.

Fig. 35 shows the adjustment provided for meshing gear quadrants and racks on the lower cross slides.

All cross slides have independent feed stroke setting, adjustable by sliding the appropriate link pivot along the rocking lever tee slot to a setting indicated by a pointer on a scale. See also "Operating Adjustments" Sheet 1.7.

The upper cross slides have a double range of feed strokes, the "long" range being equal to twice the scale reading. The changeover is obtained by transferring the upper link pivot connection from an outer hole "B" to an inner hole "A" in the operating lever. It is necessary to remove a retaining circlip on the pivot pin and to restrain the slide spring load with pressure on the top of the operating lever to withdraw the pin.

Changing intermediate cross slide feed stroke range (later machines). The changeover as on the upper slides is by transferring the link pivot from an outer hole "B" in the operating lever to an inner hole "A".

Access to the operating lever is by removing the screwed cover on the side of the drum housing.

Set the maximum stroke on the rocking lever scale and with the slides in the withdrawn position adjust the micrometer head to bring the slides to the maximum back position. A hexagon headed bolt clamps the link pivot to the operating lever, the bolt passing through the lever into the threaded pivot. Unscrew and withdraw the bolt and slide the link and pivot along a slot in the lever to the alternative hole setting. It is necessary to restrain the slide return spring with pressure on the operating lever or the end of the slide. Replace the clamp bolt and set the feed stroke and slide position as required.

Earlier machines have one range of feed strokes, the link pivot having an eccentric to adjust the slide position when assembling for angular variations of the shaft serrations.

BAR STOP AND OPERATION

Operating adjustments are described on Sheet 1.7. The bar stop movement is derived from two cams on the main camshaft, operating on a lever fitted with two cam rollers. One cam and roller swings the stop into position and the other returning the stop after bar feeding. The lever is connected to an upper operating lever on the bar stop shaft with a spring box link and carried on brackets between the housings. The mechanism is protected by a front and rear cover secured to the main drive housing attachment face. Normal operation swings the stop up from between the lower cross slides to 1st station spindle centre, the upper operating lever contacting an adjustable stop and compressing the spring box $\frac{1}{8}$".

The stop can be arranged to swing over the 1st station slide by fitting the upper spring box pivot connection and operating lever on the opposite side of the bar stop shaft. The front cover should be removed, the adjustable stop in the support bracket released and withdrawn, and the locknut on top of the sping box link unscrewed. The spring link can then be dis-connected from the lever by turning the hexagon on the spring shaft at the top of the tube clockwise. This should detach the operating arm which together with the shaft, can be turned over and re-connected to the spring box. The stop and stop arm should then be re-aligned to the spindle and the dead stop fitted in the location provided and adjusted to compress the spring box $\frac{1}{8}$".

On later machines the stop is formed with a shaft end which is clamped in the bar stop arm. A square headed screw acts on the shaft end for fine adjustment.

Earlier machines have a rectangular section stop screwed to the bar stop arm and when arranged to swing over the cross slide, some restrictions are imposed on the height of 1st station toolholders and the positions of 1st station centre block tools.

THE AUTOMATIC STOP MECHANISM
SHEET 4.33

The feed-brake clutch is hand operated by a feed engagement lever from the front or rear of the machine to stop or start the machine cycle–see "Controls" Sheet 1.5.

The machine can be arranged to stop automatically by releasing a spring loaded lever held by a solenoid operated trip latch, the spring load moving the clutch into brake. The mechanism shown in Sheet 4.33 operates in the following manner.

When the feed clutch is first engaged a lever "A" is also lifted which puts tension on the spring "B". This tension is retained by the latch "C" which is spring loaded into engagement with the detent sleeve "D".

The spring tension has no effect on the feed clutch operation until the solenoid is engaged. The downward pull of the solenoid releases the latch and the spring tension pulls the clutch out of feed into brake.

The setting of the latch relative to the clutch engagement is set by adjustment of the detent sleeve "D" up or down the spring rod. Nuts are provided on the spring rod to adjust the tension.

The solenoid bracket is adjustable up and down to give the correct disengagement of the latch which should be 1/16" clear of the detent sleeve when the solenoid is fully down.

A second detent is provided for the latch to hold the spring pressure when the clutch is neutral, i.e., when the handwind is engaged.

This chart, Sheet 4.36 is a guide to the normal reasons for the machine stopping by the automatic action of the trip solenoid and applies to later machines fitted with the three-position switch (run, trip, set-up).

*Denotes a special tooling switch supplied to customers' tooling for loading, transfer and pick-up devices and other non-standard attachments, to safeguard or interlock the mechanism. The threading return check switch is supplied with the threading attachment, see Sheet 3.10.

The feed trip solenoid is brought into action by switches, the two timed stops being:–

(a) after drum indexing with collet open and bar feed slide forward.
(b) with slides withdrawn clear of the components just before indexing.

To stop as outlined at (a) a cam timed switch, Sheet 4.33 is fitted as standard and is operated by a cam on the upper camshaft in conjunction with the bar feed slide switch and the three-position "auto-stop" switch set to "run". During bar feeding the bar feed slide is stopped approximately ½" short of its available travel by the bar contacting the bar stop. When the bar is so short that the slide is able to move an extra ¼", a switch adjacent to the slide is operated by the slide to prepare a circuit to a panel mounted relay.

When the cam timed switch completes the circuit, the panel relay energises the trip solenoid and the clutch is moved into brake. The action of the clutch moving into brake closes a "brake interlock" switch and this, combined with the panel relay, allows the main motor contactor to open and the motor stops. See the wiring diagram for a full explanation of these circuits.

To stop as outlined at (b) an extra cam timed switch and wiring has to be fitted to the upper camshaft. This is supplied to order when the threading return switch is specified or special attachments require the machine feed to be stopped before indexing to prevent damage or to interlock functions.* The combined action of the attachment switch and the extra cam timed switch directly energises the trip solenoid and the feed clutch moves into brake. As the panel relay is not affected the motor and spindles are left running. See Sheets 3.10 for threading limit switch.

In addition to stopping as outlined for (a) and (b), operation of the switch adjacent to the feed overload clutch will directly energise the trip solenoid and stop the feed instantly during any part of the machine cycle. Other switches can be arranged to stop the feed as above for safety purposes on special attachments. Setting of the overload clutch switch is shown on Sheet 4.35.

Earlier machines are fitted with a manually operated two-position "auto stop" switch and also the cam timing switch. Setting of the cam switch is as later machines, Sheet 4.33. The function is described under "controls" Sheet 1.5.

* On later machines the extra cam-timed switch is fitted to the machine as standard. The combined action of the attachment switch and the extra cam-timed switch directly energises the panel relay operating the trip solenoid, braking the feed and stopping the main motor as in (a) above.

COOLANT SHEETS 4.37, 4.38 AND 4.39

Coolant is supplied from the tray by a gear pump, chain driven from the constant speed shaft. Chain adjustment is described on Sheet 2.1. An adjustable gland is fitted to the driving shaft to prevent leakage and this should be adjusted as lightly as possible to prevent possible overheating and pump seizure. A relief valve is fitted in the pipe system to return excess coolant to the tray. Coolant taps are arranged adjacent to the lower cross slides and on headers on each side of the machine and additional plugged holes are provided in the headers.

The chain drive should be removed when the machine is to be run without coolant in the tray.

The strainer box and weir must be in position at all times to prevent swarf entering the supply pipe. The strainer which is fitted with a loose lid should be inspected and cleaned at regular intervals. See Sheet 4.37.

Machines constantly working on deep hole drilling and using oil fed drills or oil fed carbide reamers are equipped to special order withsan additional high pressure pump. For this system, pipework is installed to draw the supply from a tray strainer, a magnetic drum filter or a separate piped supply. Machines equipped with the magnetic drum filter should be cleaned and serviced as directed by the makers' instructions.

STOCK CARRIAGE

The two main parts, the stand and the tube assembly, are erected and aligned as described on Sheet 1.1. The tube assembly has a central tube to which are secured two tube carriers to space and guide the stock tubes. The rear carrier is supported on rollers in the stand.

At the machine end the front carrier is gear driven during indexing by a pinion from the drum indexing mechanism and must be correctly meshed to the marks on the gears. The stock tubes are located by a flanged sleeve secured to each tube and clamped in pairs to the front carrier.

The tubes should be handled carefully; bent or distorted tubes will make it more difficult to slide the tubes through the carriers.

Convoluted spring linings to provide resilient support for the bar stock are not normally required but are available in the following sizes to order:

2⅝"-6 and 2⅝"-6S machines, up to and including 2⅝" bar, and up to and including 1½" bar, 3½"-4 machines, up to and including 3½" bar.

Where supplied springs should be kept well lubricated with soft grease.

Later 4⅛"-4 and 3¼"-6 machines are fitted with steady bushes, carried in end caps on the machine end of the stock tubes and retained by a latch fitted to the cap. Bushes can be replaced by loosening a cap screw in the end of the cap and pivoting the latch out of a locating slot cut in the bush. The bush can then be withdrawn from the tube and a new bush fitted.

SWARF CONVEYOR SHEET 4.38

The swarf conveyor is fitted an an optional extra but conduit and wiring is normally fitted to all machines, from the panel terminals to a junction box on the beam to simplify later installation. A conveyor unit supplied separately includes control buttons and contactor for panel mounting and conduit, wiring and a "Niphon" socket for installation to the machine.

The screw type conveyor is driven by a ¼ h.p. motor and reduction gear box, controlled by push buttons on the control panel door.

A shear pin in the coupling adjacent to the motor gear box provides overload protection in addition to that provided by thermal trips in the motor starter. Spare silver steel shear pins are supplied in a container clipped to the slide of the conveyor. Before replacing a shear pin the cause of the overload should be found and removed. Holes are provided in the end of the conveyor screw so that it can be turned by hand.

Steel chutes are fitted in the tray between the housings to guide the swarf into the conveyor. When a conveyor is fitted the coolant intake pipe extends to the drum housing end of the machine, as illustrated in Sheet 4.38. The main overflow of coolant is discharged into a basket under the main drive housing collecting the very fine swarf held in suspension in the coolant. The basket is accessible from the end of the machine and should be emptied at regular intervals.

SECTION THREE

STANDARD ATTACHMENTS

Standard attachments are available for high speed drilling, independent reaming and threading.

To avoid duplication of attachment parts, the attachments have been split into sections. The sections required for any desired combination of attachments can be found on the charts, Sheet 5.3 (25/8"-6 and 3¼"-6) and Sheet 5.4 (3½"-4 and 4 1/8"-4).

HIGH SPEED DRILLING

(Section 590)

This attachment, Sheet 5.5 can be fitted in all stations singly or in combination.

The head unit can be mounted in a bracket clamped to the centre block or to either of the two longitudinal slides or mounted in the reaming body and slide unit in 3rd or 6th stations (2⅛"-6 and 3¼"-6 only).

The two driving gears are fitted into the machine as standard. Four different ratios are available; the two lower ratios obtained with the drive spacer fitted and the two higher ratios with the drive spacer removed to allow engagement with the larger driving gear. All idler gears should be fitted so that the bracket "trails" and so, in case of a jam, will tend to throw the idler out of mesh.

The "ratio" gives the relative speed of the drill and the work. A ratio of 2:1 means that the relative drill speed is twice the work spindle speed, i.e., the "ratio" quoted allows for the fact that the drill and work spindle rotate in opposite directions.

The attachment will accommodate parallel shank drills up to ¾" diameter (20mm) held in collets.

Locknuts on the drilling spindle control a stop rod providing a fine adjustment for the forward position of the drill and positive end support.

AUXILIARY LONGITUDINAL MOTION

(Section 589) 2⅝"-6, 3¼"-6

The auxiliary longitudinal motion shown on Sheet 5.6 is used for pushing threading attachments or independent reaming attachments in 3rd and 6th stations.

The pivot bracket has three holes for the fulcrum pin and two positions on the face of the main drive housing, offering a total of six fulcrum positions.

The link connection to the attachment is in a graduated slot providing fine adjustment of stroke. The ranges covered by this graduated slot for each fulcrum position overlap. A choice of fulcrum position is thus available and may be used to avoid moving the bracket or fulcrum pin.

A shear pin is provided in the upper hole. In the event of a jam, the shear pin will be broken and the forward feed disconnected but the attachment will be positively withdrawn from the work. In 3rd station this shear pin may be replaced by a solid bolt if desirable, owing to the potential danger to subsequent tooling should the 3rd station attachment fail to function.

The attachment is interchangeable between 3rd and 6th stations, although some re-assembling is necessary.

Where 3rd station attachments are used a cam disc must be mounted on the upper camshaft; later machines have the cam disc for 3rd station built in the machine as standard.

JACKSHAFTS

Sections 584 (2 5/8"-6, 3¼"-6), 585 and 585A
(3½"-4, 4⅛"-4)
SHEET 5.10

Jackshafts, see Sheet 5.10 are used mainly to drive threading attachments. They run at spindle speed but in the opposing direction, being driven by chain from the centre shaft.

Should attachments fitted in the attachment bores be required to run at spindle speed, a 1:1 gearing will give this from the jackshaft. Standard 44-tooth gears 8 D.P. give this ratio.

On the 2 5/8"-6 and 3¼"-6 one jackshaft drives 3rd and 4th stations, whilst another jackshaft drives 5th and 6th stations. On the 3½"-4 and 4⅛"-4 one jackshaft drives 3rd station, while another jackshaft drives 4th station.

When the jackshaft is used to drive the clutch threading drive, one "Off" ratio and two "On" ratios are provided from each jackshaft. Where two clutch threading drives are driven from one jackshaft, i.e. on the 2 5/8"-6 and 3¼"-6 3rd and 4th or 5th and 6th stations, the "Off" ratio must be the same for both attachments, and both attachments must be cutting the same hand of thread. There are no limitations to the "On" ratios used either for diehead drives or clutch threading drives.

SLOW SPEED REAMING

SHEET 5.8

In some circumstances it is desirable to ream at a lower surface speed than is possible with the existing spindle speed which may have been fixed by other tooling. If the reamer is driven in the same direction as the work spindle but at a faster or slower speed, the difference between the speed of the work and that of the reamer will provide a suitable speed for reaming.

This rotation of the reamer can be obtained by mounting the reamer holder in a threading spindle, Section 586, and using other related sections as for a revolving diehead.

Right hand reamers should be driven slower than the spindle speed and left hand reamers faster than the spindle speed.

$$\text{The effective reamer R.P.M.} = \frac{\text{Work Spindle R.P.M.}}{\text{Ratio}}$$

INDEPENDENT REAMING

(Section 588) 2 5/8"-6, 3¼"-6
SHEET 5.7 AND 5.9

This attachment is available for use in stations 3 or 6. It is operated by the auxiliary longitudinal motion (Section 589).

Although particularly designed for reaming operations, the attachment can be used for other end working tools of the shank type and will also accommodate the high speed drill spindle assembly. The slide is attached to the centre tool block. It should be set with a minimum of overhang between the attachment and centre tool block in all positions.

The reaming cams used and the strokes obtained are shown in Sheet 5.9. Standard timing cams are timed with the centre tool block while the accelerated timing cams are timed to return early in order to clear the work before parting-off.

THREADING ATTACHMENTS

SHEETS 5.11 AND 5.12

Threading can be performed in stations 3, 4, 5 and 6 on the 2⅝"-6 and 3¼"-6 and in stations 3 and 4 on the 3½"-4 and 4⅛"-4.

There are two basic attachments; one for use in stations 4 and 5 on the 2⅝"-6 and 3¼"-6 and station 3 on the 3½"-4 and 4⅛"-4 and in a modified form in station 4 on the 3½"-4 and 4⅛"-4. The other is used in stations 3 and 6 on the 2⅝"-6 and 3¼"-6.

DRIVES

Threading operations are usually performed at lower surface speed than those suitable for turning or drilling and as it is not possible to vary the spindle speed during the cycle, and in order to obtain suitable surface speeds for threading whilse still using economical work spindle speeds, it becomes necessary to rotate the threading tool in the same direction as the work spindle but at a faster or slower speed. The difference between the work spindle speed and the threading tool speed will then provide an effective surface speed for threading.

A commonly used threading speed is one-fifth of the work spindle speed, requiring the threading tool to be rotated at four-fifths of the work spindle speed for right hand threads, or one-and-one-fifth times the work spindle speed for left hand threads. This is termed an "On" ratio of 5, being the ratio of work spindle revolutions to threading revolutions during the "On" threading of the die or tap. If the cycle time permits, slower ratios may be used to reduce cutting speeds, increase tool life and improve finish. Faster ratios may be employed on free cutting materials, thus permitting faster machine cycle times.

For example, with a work spindle speed of 500 r.p.m. and threading ratio of 5

the effective threading speed = $\frac{500}{5}$ = 100 r.p.m.

a "faster" ratio would be 4

effective threading speed = $\frac{500}{5}$ = 125 r.p.m.

For right hand threads and a ratio of 5, gears would be required to rotate the threading spindle at 500−100 = 400 r.p.m. (Left hand threads 500 + 100 = 600 r.p.m.

Since a solid tap or die after cutting the thread must also be run "Off" the component during the feed cycle, it is desirable that this non-productive operation be performed as quickly as possible. Excessive difference between forward and return speeds will, however, cause increased clutch wear and a possible difficulty in maintaining threaded length. These return speeds are termed the "Off" ratio and an "Off" ratio of 2 is normally used.

When using self-opening dieheads, the diehead drive (Section 582) is used to drive the attachment. The diehead drive is driven from a jackshaft. This gives an "On" ratio only, Sheet 5.11.

An alternative direct drive from the centre shaft is available on the 3½"-4 and 4⅛"-4 (Sections 583 and 583A) which gives an "On" ratio of 5. This drive does not require a jackshaft.

When using solid taps or dies the clutch threading drive (Section 581) is used. This is also driven from a jackshaft. This attachment gives an "On" ratio and an "Off" ratio. By permanently engaging the "On" side of the clutch, this drive may be used with self-opening dieheads, Sheet 5.12.

When considering the use of a threading attachment it is first necessary to establish the number of work spindle revolutions required. These depend on the lead, the length of thread and threading ratios used; an allowance of two threads is usually made for starting.

SELF-OPENING DIEHEADS

When using self-opening dieheads the number of work spindle revolutions required may be found by multiplying the number of threads to be cut, plus the allowance for starting, by the "On" ratio used.

For example, to cut a 20 t.p.i. thread ¾" long with an "On" ratio of 5:

Number of threads to be cut = ¾ x 20 = 15

Allowance = 2

Total 17

Work spindle revolutions required with threading ratio of 5 = 5 x 17 = 85 revolutions; OR

For a 1.5mm THREAD x 30 mm long:−

No. of Threads to be cut = $\frac{30}{1{\cdot}5}$ + 2 = 22

Work spindle revs required = 22 x 5 = 110 Revs.

SOLID TAPS AND DIES

When using solid taps and dies extra revolutions must be allowed for the tap or die to run off the job.

For the previous example it was found that the total threads to be cut = 17 and using an "On" ratio of 5 and an "Off" ratio of 2, the total "On" "Off" ratio = 5 + 2 = 7 and the revolutions required = 17 x 7 = 119.

To summarise:

Calculation (a)

Work spindle revolutions for self-opening dieheads = [(Length of thread x t.p.i.) + 2] x "On" ratio; OR

[(Length of thread ÷ Pitch) + 2] x "On" ratio.

Calculation (b)

Work spindle revolutions for solid taps and dies = [(Length of thread x t.p.i.) + 2] x ("On" ratio + "Off" ratio); OR

([Length of thread ÷ Pitch) x ["On" ratio + "Off" ratio].

The speed and feed charts, Sheet to show the available work spindle revolutions during the 147° of cutting time in the vertical column n(147°).

When threading in stations 3, 4 or 5 on 2⅝"-6, 3¼"-6 or station 3 on 3½"-4, 4⅛"-4 machines, and using standard timing cams, ascertain that the work spindle revolutions required for threading do not exceed the available cutting revolutions which are given on the speed and feed chart. The available cutting revolutions depend on the cycle time and are determined by the longest operation which, in some cases, may be the threading operation.

When threading in stations 3 and 6 on the 2⅝"-6, 3¼"-6 and employing accelerated timing cams, the work spindle revolutions required for threading should not normally exceed half of the available cutting revolutions. Provision is made for the return cam to be retarded in two 10° steps, giving a maximum 9/16 or 5/8 of the available cutting revolutions for threading.

When threading in station 4 on the 3½"-4, 4⅛"-4, the work spindle revolutions required for threading must not exceed one-third of the available cutting revolutions.

If the calculated revolutions required for threading exceed the maximum, either the cycle time must be increased to give more available cutting revolutions or a faster "On" ratio must be used.

THREADING CAMS

Threading cams are used with self-opening dieheads or with solid taps and dies. The timing of the movements given by these cams is shown on the timing diagram, Sheet 4.48 and the following sequence of movements to the threading push rod is produced.

1. Fast approach stroke
2. Feed stroke
   This is set set suit the thread being cut.
3. Drop back
   This is equal to the amount of the feed stroke and takes place while the threading tool continues, pulling itself along on the thread it is cutting.
4. Dwell
   This continues while the threading tool completes the cutting and, in the case of solid taps and dies, runs off the work.

   Fast return
   With accelerated timing cams this occurs while the centre tool block and the cross slides are still feeding forward.

SCALE SETTINGS (1)

For stations 4 and 5 on the 2⅝"-6, 3¼"-6 and stations 3 on the 3½"-4, 4⅛"-4, the following calculation applies:

Calculation (c)

To find scale setting required when using threading cams:

$$\text{Scale setting in inches} = \frac{\text{Available cutting revs.}}{2 \times \text{"On" ratio} \times \text{t.p.i.}}$$

(Maximum scale setting is 5½")

For example, to cut a 20 t.p.i. thread using an "On" ratio of 5:
From speed and feed chart, available cutting revolutions = 100 (this is determined by the longest operation):

$$\text{Scale setting} = \frac{100}{2 \times 5 \times 20} = \frac{100}{200} = ½"$$

The feed stroke = one-third quadrant scale setting. The total stroke at the nuts "A" on the pusher rod (Fig. 56) = fast motion (5" or 3½") plus one-third quadrant scale setting.

$$\text{Scale setting in mm} = \frac{\text{Available cutting revs} \times \text{Pitch}}{2 \times \text{"On" ratio}}$$

The total stroke of nuts "X" on the pusher rod (Sheet 5.14) = 4.75 x feed stroke required.

SCALE SETTINGS (2)

For stations 3 and 6 on 2⅝"-6, 3¼"-6.

Using threaded cams, the feed stroke required is first found from the formula given in Sheet 5.15 and the pivot position and pusher connection point also found on the chart.

SCALE SETTINGS (3)

For station 4 on 3½"-4, 4⅛"-4.

$$\text{Scale setting in inches} = \frac{\text{Available cutting revs.}}{1{\cdot}125 \times \text{t.p.i.} \times \text{"On" ratio}}$$

(Maximum scale setting is 5½")

The feed stroke = one quarter quadrant scale setting.

The total stroke at nuts "A" on the pusher rod (Sheet 5.16) = fast motion (5" or 3½") plus quadrant scale setting.

DATA TO BE GIVEN ON THE LAYOUT

The information obtained by methods explained in the previous pages should be incorpoarated in the tooling layout and not left for the setter to calculate. The following items for instance, should be considered essential:

1. Full details of sections to be used.
   These can be found from the chart. See Sheets 5.3 (2⅝"-6, 3¼"-6) and 5.4 (3½"-4, 4⅛"-4).
2. Position of the jackshafts to be fitted.
3. The gears to be used on the drive units for "On" and "Off" ratios.
4. The cams to be used.
5. The scale settings or, in the case of stations 3 and 6.
6. The pivot position and the pusher connection point.

FITTING DRIVE UNITS , JACKSHAFTS AND THREADING UNITS

DIEHEAD DRIVE (SECTION 582) SHEET 5.11

The end bearing housing is first fitted into the housing and is connected to the oil supply. The driven gears "B" are mounted on the centre boss. The shaft, less the splined extension shaft, is passed into the housing, placing on the gears "B" and the locknut. The front housing is then screwed to the face of the drive housing.

FULL THREADING DRIVE (SECTION 581) SHEET 5.12

The end bearing housing is fitted in the same way as described for the diehead drive. The gears "D" and "B" are fitted to the clutch unit. The shaft, less the splined extension shaft, is passed into the housing through the clutch unit which is locked up by its locknut. The front housing is then screwed to the face of the drive housing.

The glut shaft is now fitted. The latch housing is fitted complete and the glut shaft passed through and screwed through two locknuts and the glut. The shaft should be screwed into the glut until the latch just drops into its location when the clutch is in the "On" drive position. The glut operating spring, sleeves and locknuts mounted on a threaded rod, can then be screwed into the end of the glut shaft. The two locknuts inside the housing are set to just relieve the spring pressure on the glut when the clutch is in the "Off" drive position. The clamping screws in the glut must be tightened to secure the glut shaft.

Earlier machines have the glut spring fitted inside the housing, the spring being fitted over the glut shaft after passing the shaft through the glut. Set the shaft and locknuts as for the later models and clamp the glut and rod.

When the clutch is set for use with a self-opening diehead, the operating spring assembly is unscrewed from the glut shaft, the latch spring removed and the trip rod uncoupled. A retaining plate is then fastened to the front of the latch housing and the diehead opening rod screwed in the plate to retain the latch and glut shaft, with the clutch in the "On" drive position.

CLUTCH ADJUSTMENT

Both sides of the clutch should be adjusted to just give a satisfactory non-slip drive in the "On" and "Off" positions. The clutch manufacturer recommends a maximum axial load of 75 lb. on the clutch operating bobbin and this loading should not be exceeded. The glut spring should be removed and the clutch tested by levering with a bar between the main drive housing opening and the flats on the arms of the glut casting. A new clutch will not transmit full power until the friction surfaces have been bedded down. During the running-in stage one or two adjustments will be necessary, after which further adjustment will not be required for some considerable time.

The clutch is a wet plate type and requires a good oil supply on the plates to prevent undue wear and overheating.

JACKSHAFTS, 2⅝"-6, 3¼"-6

Gears are fitted to their respective centres and the shaft passed through the gear centres, the bearing and the sprocket. The whole is clamped up and the front housing secured. The jockey sprocket, fitted to the jockey arm, is fitted in the machine and the chain is then fitted, care being taken that the jockey is running on the slack side of the chain as shown in the end views, Sheet 5.10.

JACKSHAFTS, 3½"-4, 4⅛"-4

Jockey arms are first fitted into the housing. The spacer is fitted on the opposite side to the chain except when two jackshaft are fitted, when one spacer is fitted on the same side as the chain. The shaft is passed through the gear centres, the bearing and the sprocket. The whole is clamped up and the front housing secured. The jockey sprocket and the driving chain is then fitted, care being taken to ensure that the jockey is running on the slack side of the chain as shown in the end views, Sheet 5.10.

THREADING UNITS

The threading slide is first fitted. When using Section 586 in stations 4 and 5 on the 2⅝"-6, 3¼"-6 or in stations 3 and 4 on the 3½"-4, 4⅛"-4, the threading slide is fitted on the longitudinal slide.

When using Section 587 in stations 3 or 6 on the 2⅝"-6, 3¼"-6, the threading slide is fixed to the centre tool block and is positioned to minimise the overhang of the attachment on its slide during all movements of the attachment or centre tool block.

The trip rods and push rods are assembled to the attachment as shown on Sheet 5.14 (stations 4 and 5 – 2⅝"-6, 3¼"-6), Sheet 5.15 (stations 3 and 6 – 2⅝"-6, 3¼"-6), Sheet 5.16 (stations 3 and 4 – 3½"-4, 4⅛"-4), and the splined extension shaft with its nut fitted into the rear of the threading spindle. The attachment can then be mounted on to its slide and the shaft coupled to the drive unit and the rods and springs assembled. It should be noted that all brackets and rods may be fitted or removed from the attachment without disturbing the main body of the attachment if required.

The diehead or tap, or dieholder is fitted in the bore in the front of the threading spindle and driven by a central pin through the shank. It is essential that the spring ring be replaced to retain this pin during running. When using solid taps or dies it is essential that some form of floating holder be used.

When tapping in stations 3 and 6 on the 2⅝"-6, 3¼"-6, the reset bracket is attached to the central guide arm behind the centre tool block.

Coolant connections are provided in both attachments so that coolant may be supplied to the centre of the tap or die if desired.

The auxiliary longitudinal motion (Section 589) must be fitted when threading is to be performed in stations 3 and 6 on the 2⅝"-6, 3¼"-6.

SETTING THREADING ATTACHMENTS

Threading Attachment
Section 586

For use in stations 4 and 5 on the 2⅝"-6, 3¼"-6 (see Sheet 5.14) and stations 3 and 4 on the 3½"-4, 4⅛"-4 (see Sheet 5.16).

SELF-OPENING DIEHEADS

Setting the attachment for self-opening dieheads when using the threading cams:

1. Set the quadrant scale setting.
2. Handwind to beginning of feed stroke.
3. **Stations 4 and 5 on 2⅝"-6, 3¼"-6 machines, station 3 on 3½"-4, 4⅛"-4.**
   Set nuts "A" with the tap or die just clear of the thread to be cut. If the thread length is less than one-third the scale setting, a minimum clearance of one-third the scale setting less the thread length must be set between the tap or die and the work.

3A. **Station 4 on 3½"-4, 4½"-4.**
   Set nuts "A" with the tap or die just clear of the thread to be cut. If the thread length is less than one-quarter the scale setting, a minimum clearance of one-quarter the scale setting less the thread length must be set between the tap or die and the work.

4. Set nuts "B" just clear of the push sleeve.
5. Set nuts "C" to open the diehead when the correct length of the thread has been cut.
6. Set nuts "D" to close the diehead when the attachment is fully back.
   If thread lengths greater than 2" are to be cut, a minimum clearance must be set on nuts "B" equal to the thread length less 2".

SOLID TAPS AND DIES

Setting the attachment for taps or button dies. The threading cams must be used.

1. Set quadrant scale setting.
2. Handwind to beginning of feed stroke.
3. **Stations 4 and 5 on 2⅝"-6, 3¼"-6 machines, station 3 on 3½"-4, 4⅛"-4.**
   Set nuts "A" with the tap or die just clear of the thread to be cut. If the thread length is less than one-third the scale setting, a minimum clearance of one-third the scale setting less the thread length must be set between the tap or die and the work.

3A. **Station 4 on 3½"-4, 4½"-4.**
   Set nuts "A" with the tap or die just clear of the thread to be cut. If the thread length is less than one-quarter the scale setting, a minimum clearance of one-quarter the scale setting less the thread length must be set between the tap or die and the work.

4. Set nuts "B" just clear of the push sleeve.
5. Set nuts "E" on trip rod so that clutch trips over when the tap has reached full depth. This can be done by setting the nuts clear of the bush by the amount of the thread length less⅛".
6. Set nuts "F" to first reset the clutch with the attachment fully back, without "crowding" the clutch bobbin and causing excessive wear and strain.
   A longer pull rod will be required to cut a thread longer than 2" with a tap or button die.

THREADING ATTACHMENT

Section 587

For use in stations 3 and 6 on 2⅝"-6, 3¼"-6,
see Sheet 5.15

SELF-OPENING OR SOLID DIES OR TAPS

1. Handwind the machine to the beginning of feed stroke.
2. Set nuts "X" so that the die or tap is just clear of the thread to be cut. If the feed stroke is greater than the thread length, a minimum clearance must be set between the tap or die and the work by the amount of the feed stroke less the thread length.
3. Set nuts "W" to open the diehead, or nuts "V" to trip the clutch, when the correct length of thread has been cut.
4. Set nuts "Y" to pull the attachment sufficiently clear of the work when parted-off. Ensure that the setting of these nuts does not interfere with the forward movement of the attachment when cutting.
5. (When using a self-opening diehead). Set nuts "Z" to reset the diehead when the attachment is in the fully back position.
6. (When using solid taps or dies). Set nuts "S" so that the bracket on the centre tool block just resets the clutch when the centre tool block is in its fully back position, without "crowding" the clutch bobbin and causing excessive wear and strain.
7. Set the spring rod tension to keep the attachment back to nuts "X" at all times except when cutting.
8. When tapping, set the nuts "T" to prevent the attachment being pulled too far back under the spring tension.

In all cases the slide must be set on the centre tool block to give the maximum support to the threading attachment in all positions of the attachment and the centre block. Should the stroke of the centre tool block be altered after setting for tapping, the clutch reset nuts "S" must be re-adjusted.

GENERAL REMARKS

It is advisable to try out the threading attachment by the use of the inch button with the index clutch dis-engaged so that all settings and adjustments can be checked and adjusted as necessary.

Never handwind the machine through feed when threading is set.

When handwinding backwards, either relieve the nuts "A" or remove the tap or die. When using a self-opening diehead it may be tripped open in order to handwind backwards.

When setting, check movement of the attachment during cutting or backing-off, as movement will cease if the clutches slip. If this occurs, stop the machine and adjust the clutch, but do not adjust clutches too tight as this will cause excessive wear and strain and may prevent the clutch from fully engaging to run "Off".

Scale settings, clearances required and cams to be used should be specified on the layout and not left for the setter to calculate.

CHASING ATTACHMENTS - SIX SPINDLE MACHINES ONLY

These attachments can be fitted to the cross slides in 4th and 5th stations and comprise a chasing attachment unit, a drive unit and extra parts.

CHASING ATTACHMENT, SECTION 192, Mk. III, 4th STATION ONLY

Sheet 5.19 lists the cams available and the maximum capacities of the unit. Cams are available for 8 t.p.i. and 3mm. pitch but this depends on the material to be cut. 12 t.p.i. or 2mm. pitch in medium cutting steel will give a rough guide to the available capacity.

CHASING ATTACHMENT, SECTION 392, Mk. I, 4th AND 5th STATIONS

This unit is a larger version of Section 192, having increased maximum stroke as well as being more robust and is more readily interchangeable between 4th and 5th stations. Sheet 5.20 gives the capacity of the attachment and lists cams up to 4 t.p.i. and 6mm. pitch.

OPERATION OF THE ATTACHMENT

The chasing slide and cutter is passed back and forward along the length of the component by the lead cam and is advanced and retracted by the relief cam and tension spring. The two cams are carried on a camshaft in the attachment and driven from the drive unit. At the same time the attachment mounted on the cross slide is constantly fed forward by the standard cross slide cams.

During one revolution of the camshaft the chasing cutter advances to the work, makes one cutting pass along the component, retracts clear of the groove cut and returns back along the job to the starting point.

THE DRIVE UNIT

592.F. Mk. II, station 4. 592.E. Mk. II, station 5.

A chain drive from the centre shaft is taken to a special jackshaft unit fitted in the main drive housing. The front end of the jackshaft is connected to a gearbox mounted on the main drive housing attachment face. The final drive from the gearbox across to the chasing unit is by universally jointed shaft, which must be assembled so that the fork ends of the universal joints are in line.

The gearbox drive unit is fitted with two pick-off gears which are selected to give the ratio required to suit the job.

The ratio is the number of work spindle revolutions during one revolution of the attachment camshaft, i.e. with a ratio of 6:1 the spindle revolves six times during one revolution of the camshaft.

The gears used depend on the lead cam and the thread to be cut. The charts on Sheet 5.19 and Sheet 5.20 give a list of threads per inch (t.p.i.) and show the gear ratios required for various cam leads. Metric threads are given in a separate table and listed under "Lead to be Cut" (or the pitch of the thread).

With any one lead cam, various threads can be cut by using different gear ratios. Ratios of 3:1, 4:1 and 5:1 are preferred to obtain the maximum number of passes of the chasing cutter during the cutting cycle, 3:1 giving the maximum number of passes.

The gear ratio must be less than the number of work spindle revolutions during 8° dwell (see feed and speed charts, Sheets 4.43 to 4.47). This ensures at least one complete pass during the dwell to give a parallel thread.

CHANGING LEAD CAMS

Remove attachment from cross slide.

Remove cover plate above chasing slide.

Release the tension on the relief spring and unhook it from the spring anchor.

Swing the slide forward until roller is free from lead cam.

CHANGING LEAD CAMS, continued

Remove the large end cap on the face opposite to drive shaft.

Remove the camshaft nut, bearing and spacer.

The lead cam may then be removed. Extraction holes ¼" B.S.F. are provided in the inner cam.

The new lead cam is fitted in the reverse order, checking that there is clearance for the lead roller all the way round the cam track.

CHASING CUTTER

This must be designed to suit the lead cut. The width of the chasing cutter may be determined by the job when threading behind a shoulder. The length behind the shoulder must be equal to the total travel due to the lead cam, plus the width of the chasing cutter, plus an allowance at each end for clearance. The minimum width of undercut required can be determined as follows:

Minimum width of undercut = ·0725 L + $\frac{L}{R}$ + clearance

where L = lead of cam

R = ratio

clearance = ·010" (·025 mm.)

If found necessary to reduce the cutting load, teeth may be ground off the chaser, leaving 1 in $\frac{R}{2}$ teeth.

(Take $\frac{R}{2}$ to nearest less whole number).

e.g. Using ratio of 7, leave one in every

$\left(\frac{7}{2} = 3\frac{1}{2}\right)$ three teeth.

The chasing cutter is mounted on a removable bracket which clamps to the dovetail on the slide. A stop screw in the bracket can be set so that the bracket may be removed and replaced without altering the endwise setting. The height of the cutting edge is set from the edge of the bracket by the gauge provided.

SETTING

The feed strokes set on the cross slide is set to the depth of thread plus ·005" (·01 mm). This is so small that the stroke must be set and checked by using a dial indicator. With the cross slide at the start of feed, mount a dial indicator so that it registers the stroke of the slide. Handwind to the end of feed and check the travel indicated; adjust cross slide link until correct travel is obtained.

Taper in the thread can be eliminated by loosening the clamp bolts and adjusting the set screws in the strip behind the attachment. Ensure that all bolts are tight before running the attachment.

LEFT-HAND THREADS

Left hand threads are obtained by using left hand lead cams.

The spring, plunger and cap in the attachment chasing slide must be reversed to give endwise pressure in the opposite direction.

The gearbox drive assemblies for 4th and 5th stations are shown on Sheet 5.21 and Sheet 5.22. Use medium to heavy oil in the two parts of the box.

Modifications to the diehead attachment when used in the same stations as chasing and modifications to the auxiliary longitudinal motion in 3rd and 6th stations are also shown.

THREADING ATTACHMENT RETURN CHECK SWITCH

SHEETS 5.14, 5.15, 5.16 AND 5.18

The return motion of a threading attachment can be restricted when a tap is forced into a partially drilled hole, or a die forced on to an unsuitable diameter, resulting in severe damage to the attachment if the machine indexes.

The return check switch mechanism is designed to stop the machine feed just before indexing if the attachment fails to return.

It consists of a bracket mounted micro switch with a spring cushioned bell crank lever, a spring operated rod, stop plate and electrical conduit and wiring. Failure to return keeps the switch closed (11.LS* on wiring diagram) and allows a timing switch (4.LS) to energise the feed trip solenoid. (*Earlier wiring diagrams show 11.LS as 6.LS, 7.LS or 8.LS).

The switch bracket is bolted to the main drive housing face and the stop plate screwed to the threading attachment. The operating rod carrying the springs and clamp is passed through the stop plate.

To set the mechanism, stop the machine with the slides withdrawn just before indexing and arrange the cam on the upper camshaft to operate the switch and energise the solenoid. Sheet 5.18. Handwind back three turns of the handle and set the clamp on the operating rod to compress the springs and hold the micro switch in the closed position. Check that enough spring movement is available to cover any further return stroke.

It is advisable to check the action of the micro switch daily by holding the rod so that it does not operate the switch. In this condition the feed should be tripped when the attachment returns.

The return check switch bracket, rod, etc. is supplied as standard with new threading attachments, and can be supplied to order for earlier attachments when the mechanism was an optional extra. The parts are basically the same for all stations, 4th and 5th (2⅝"-6, 3¼"-6) being interchangeable; a different stop plate and longer flexible conduit and wires are required for 3rd station. The two sets of uncommon parts are listed as G/45 and G/36 on the chart, Sheet 5.3. The attachment is not considered necessary for stations where the component is parted off.

The upper camshaft cam, switch, wiring, etc. is not fitted as standard machine equipment and when required should be ordered.

The two switches, the check switch and upper camshaft switch, can be fitted by customers to existing attachments and machines. Electrical wiring is taken to an adjacent existing junction duct and the upper camshaft switch secured to the bracket carrying the existing feed knock-off switch, see Sheet 4.33.

The check switch can be prevented from working when threading attachment is not being used by tightening the screw and locknut provided against the bell crank with the switch in the operated position.

AUXILIARY CROSS SLIDE OPERATION

For special purposes, where the timing of standard cross slide cams and operating mechanism is unsuitable, the two upper and the two intermediate cross slides can be operated from auxiliary cross slide mechanisms.

The auxiliary cam disc shown on Sheet 5.17 is carried on the main camshaft in the drum housing and cams can be mounted on both faces. One cam operates the 3rd or 4th stations (2⅝"-6, 3¼"-6 machines) but not both and the other cam, 5th or 6th, but not both. On the 3½"-6, 4⅛"-4 machines one slide operates 3rd station and the other 4th station.

A cam lever assembly actuated by the cams is connected through links to the operating lever and shaft of the slide requiring the motion, the standard linkage from the rocking levers being disconnected. The lever assembly has a split cap for the fulcrum boss and this fits on the upper lever pivot between bosses in the drum housing, on either side of the machine. A limited amount of adjustment of the ratio of cam stroke to slide travel is provided as given on Sheet 5.17.

Information for design of auxiliary cross slide cams is given on Sheet 5.17 and should be used in conjunction with the timing diagram, Sheet 4.48.

SYNCHRONOUS DRIVE

SHEET 5.23

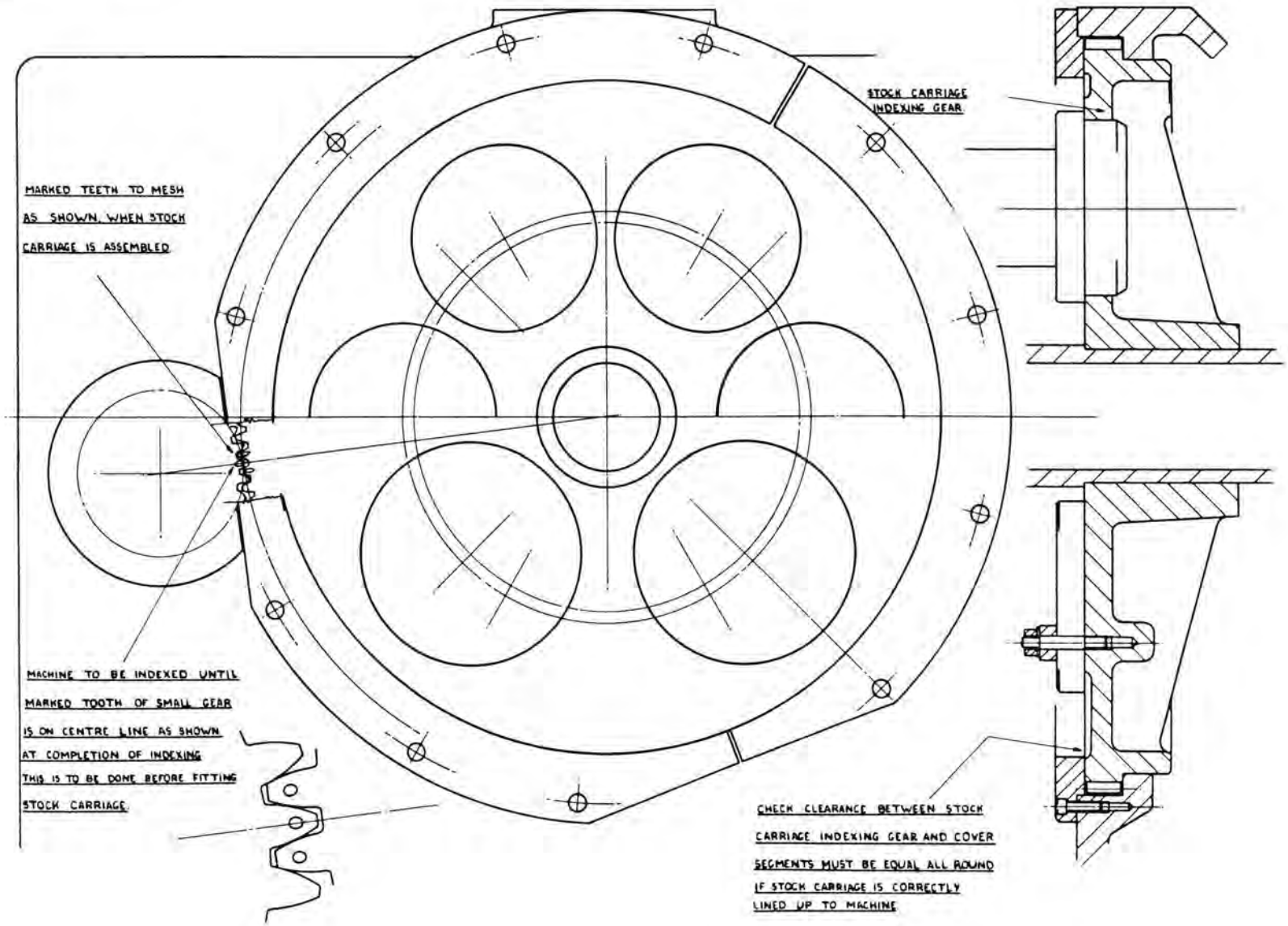
Using	590.H	High Speed Drill Drive
	584. Mk. II	Jackshaft. 2⅝"-6, 3¼"-6
	585. Mk. II	Jackshaft. 3½"-4, 4⅛"-4
	590. DX. 124/44	Driven Gear
	581. DY. 130/44	Driving Gear

Fitting the above units and gears to the main drive housing enables a drive synchronous with the spindle speed to be taken from the splined shaft coupling of the high speed drilling drive unit. This drive is used for pick-up, flat milling, slotting, multi-drill head and drifting attachments, designed to suit customers' components.

The drive is taken from a jackshaft (running at spindle speed) by two 44 tooth gears, the gear carrier and spacer being assembled to drive as shown on Sheet 5.23.

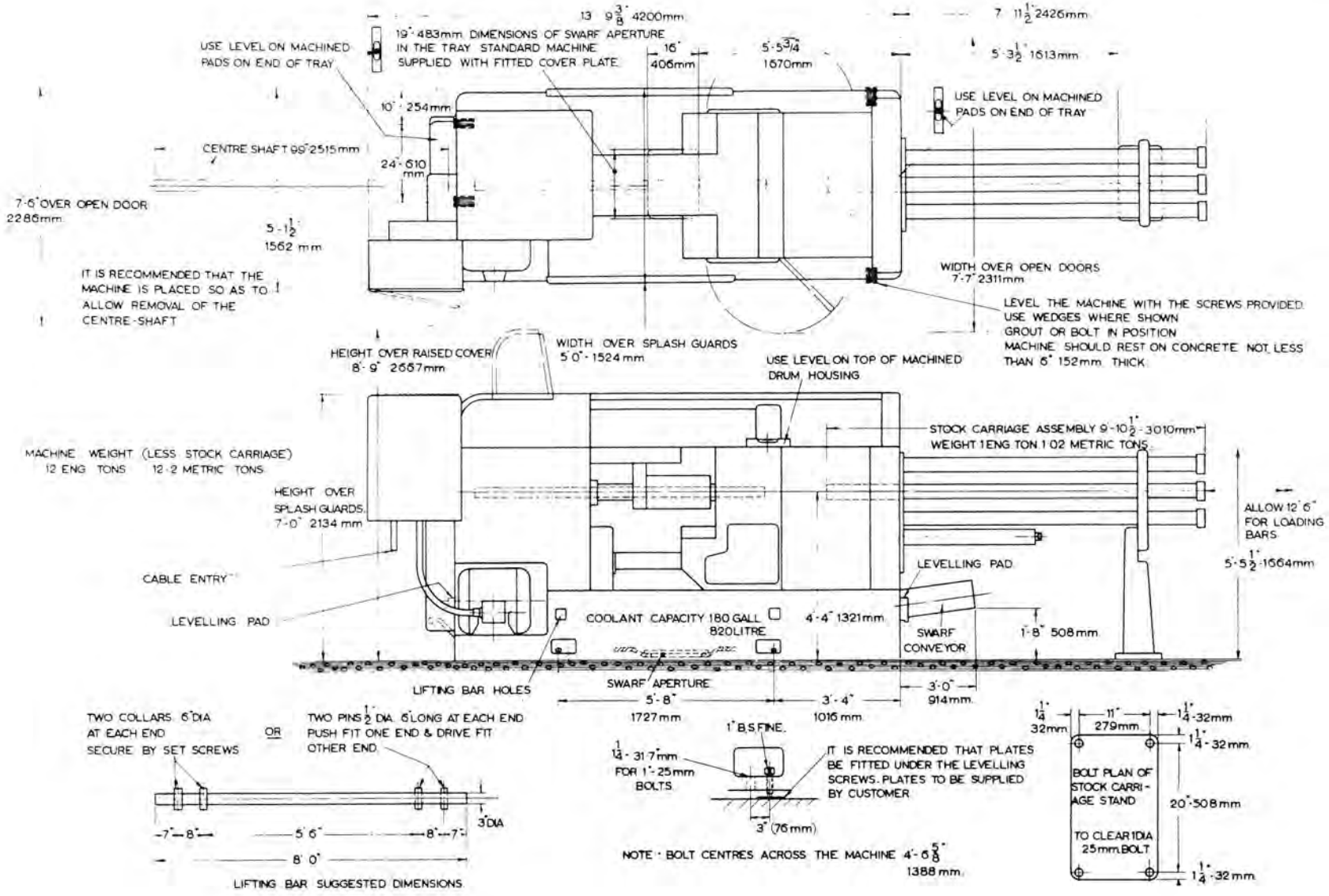
The high speed drilling drive unit is fitted without the drive spacer, idler gear bracket and locator peg.

MACHINE ILLUSTRATIONS & DIAGRAMS



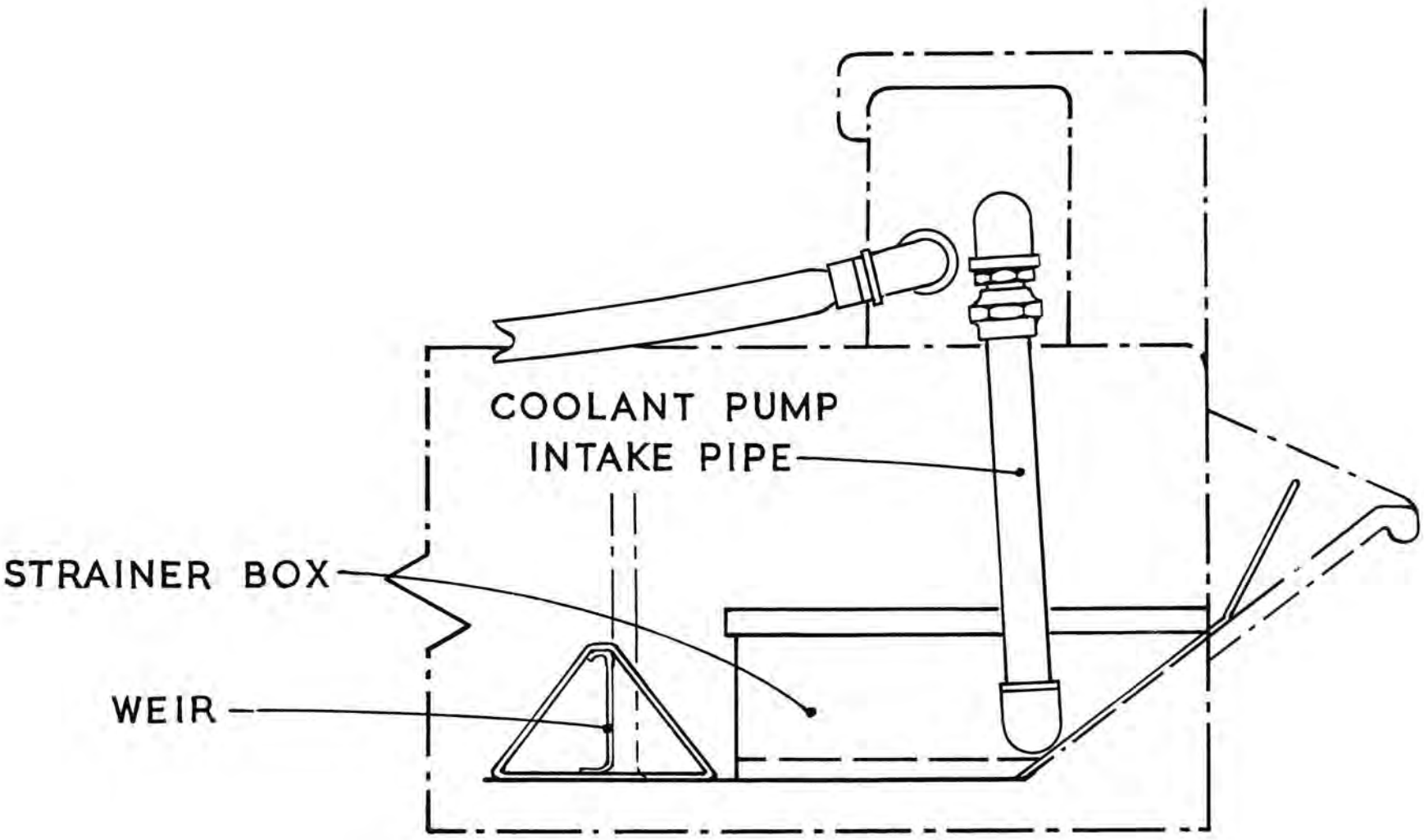
SHEET 4.1

Fitting Stock Carriage



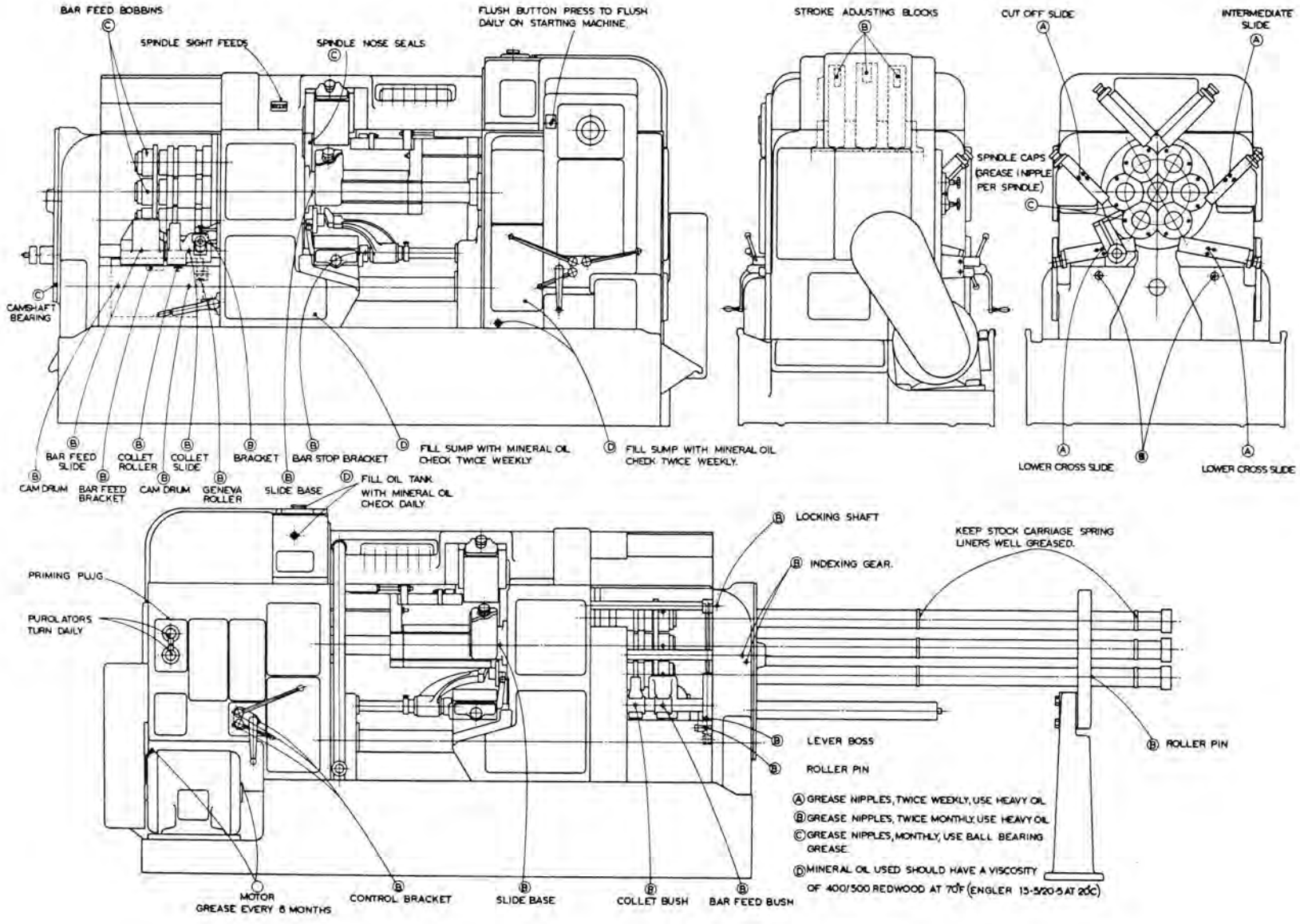
Foundation Drawing

SHEET 4.2

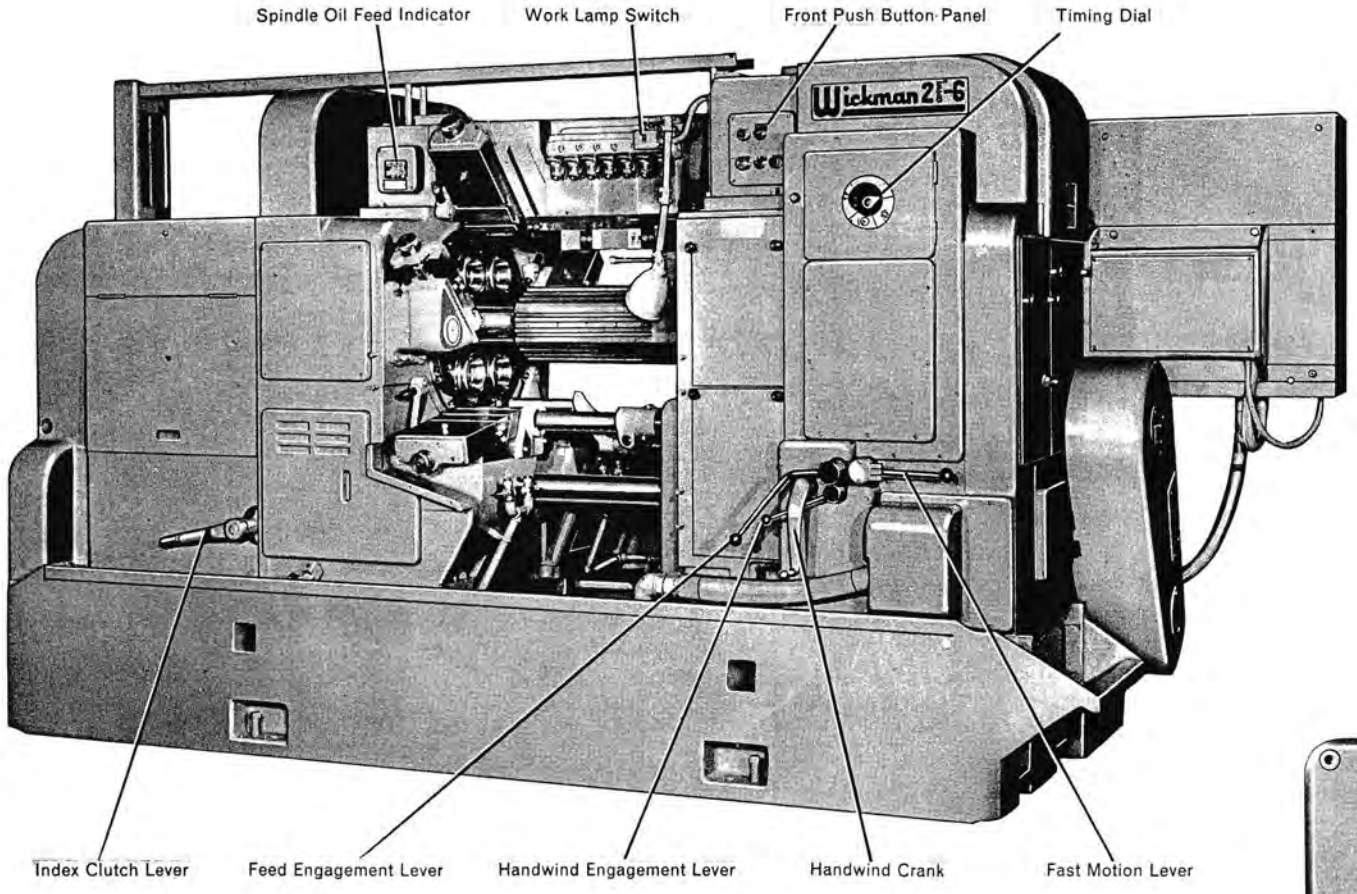


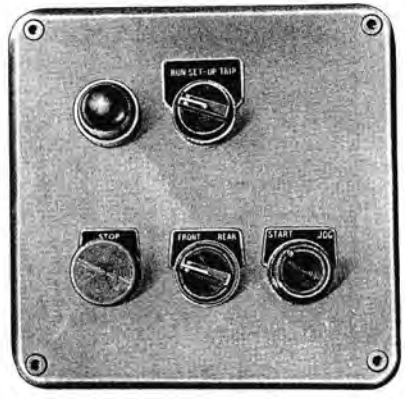
SHEET 4.3

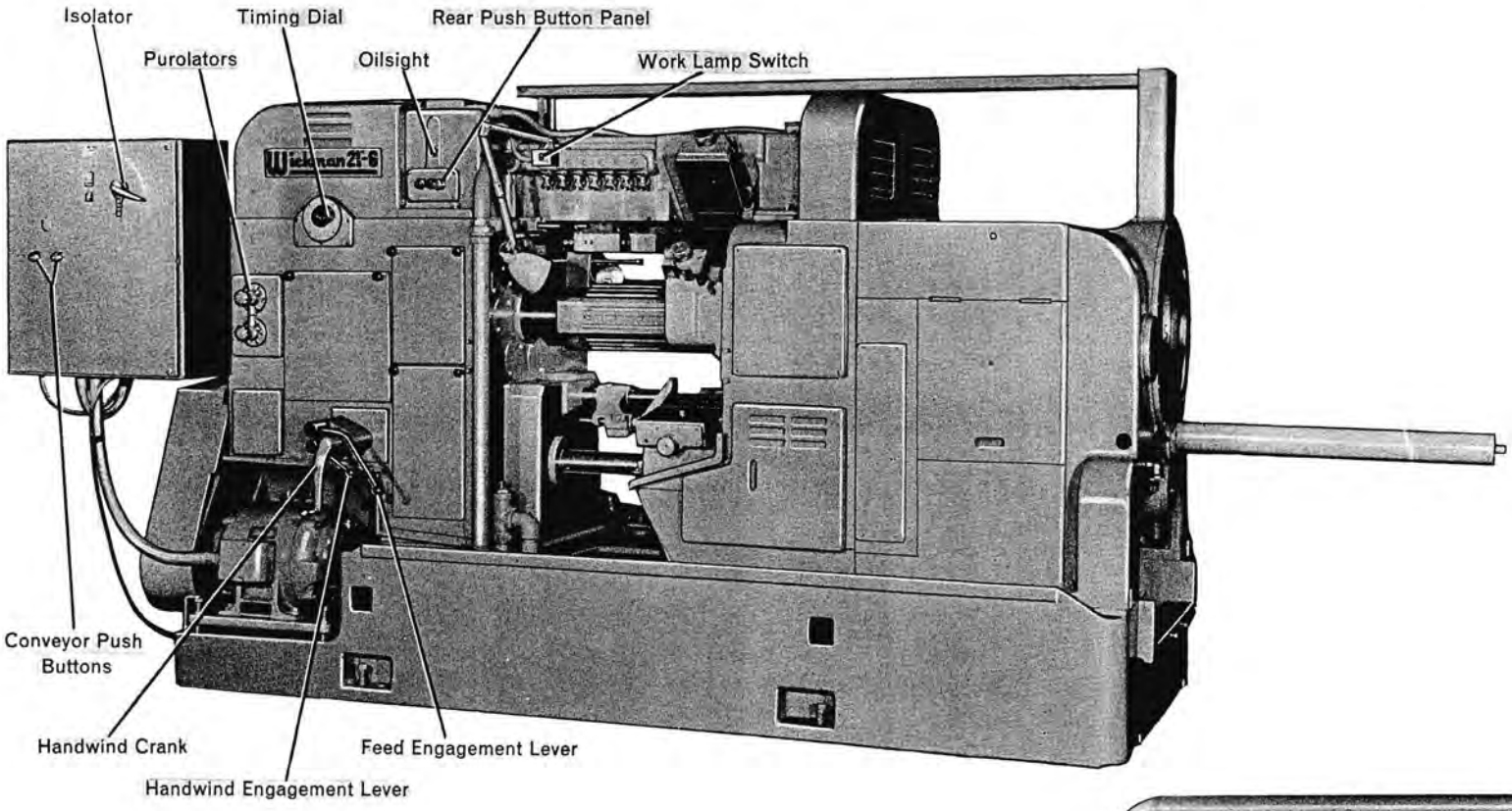
Strainer Box and Weir

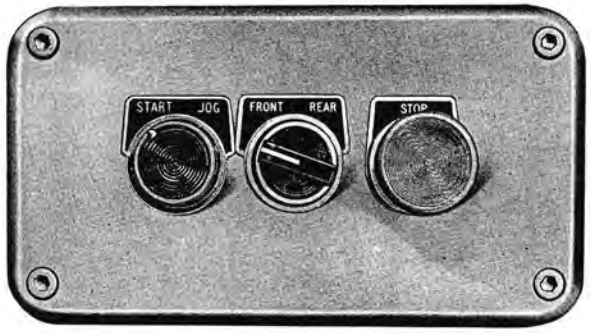


Grease and Oil Diagram

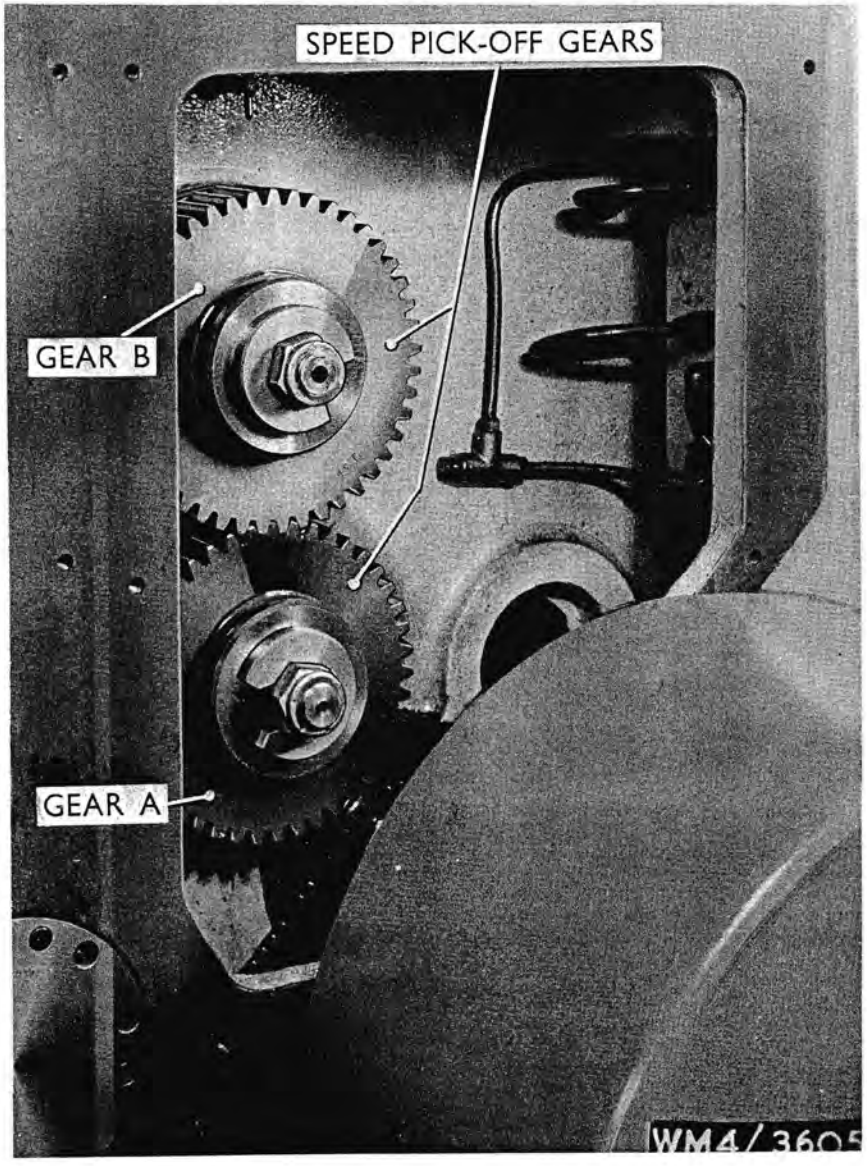

Spindle Oil Feed Indicator
Work Lamp Switch
Front Push Button Panel
Timing Dial
Wickman 2⅜-6
Index Clutch Lever
Feed Engagement Lever
Handwind Engagement Lever
Handwind Crank
Fast Motion Lever


RUN SET-UP TRIP
STOP
FRONT REAR
START JOG

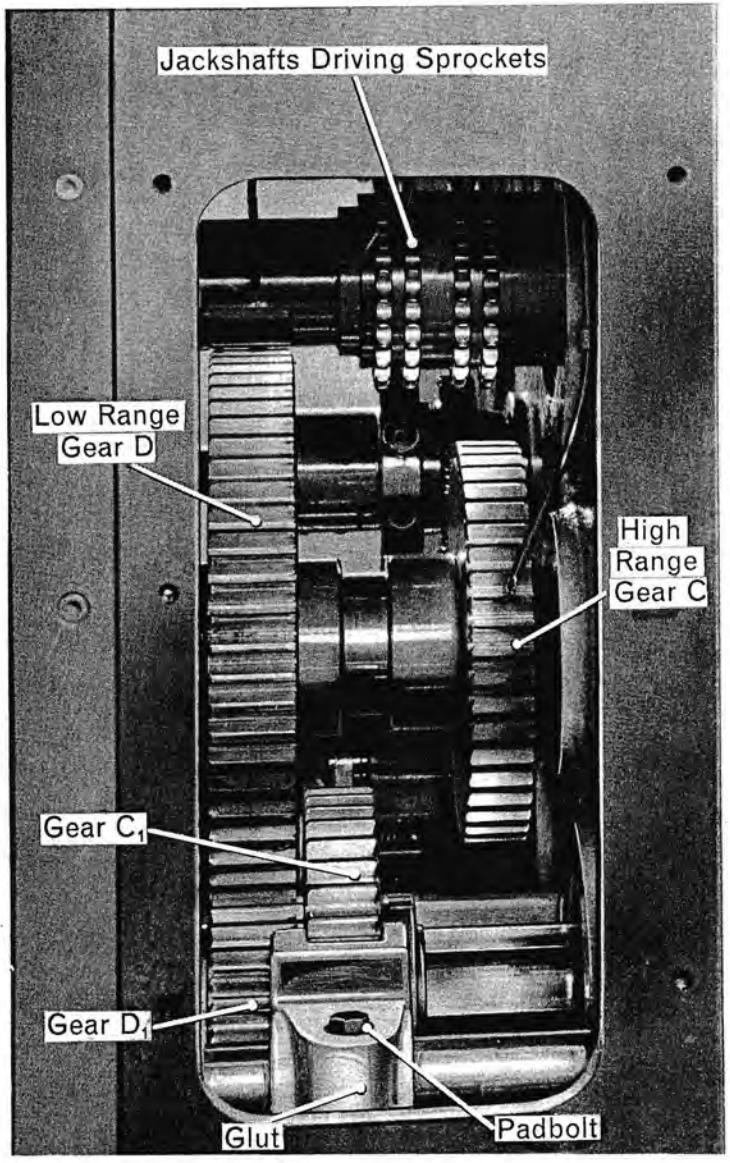




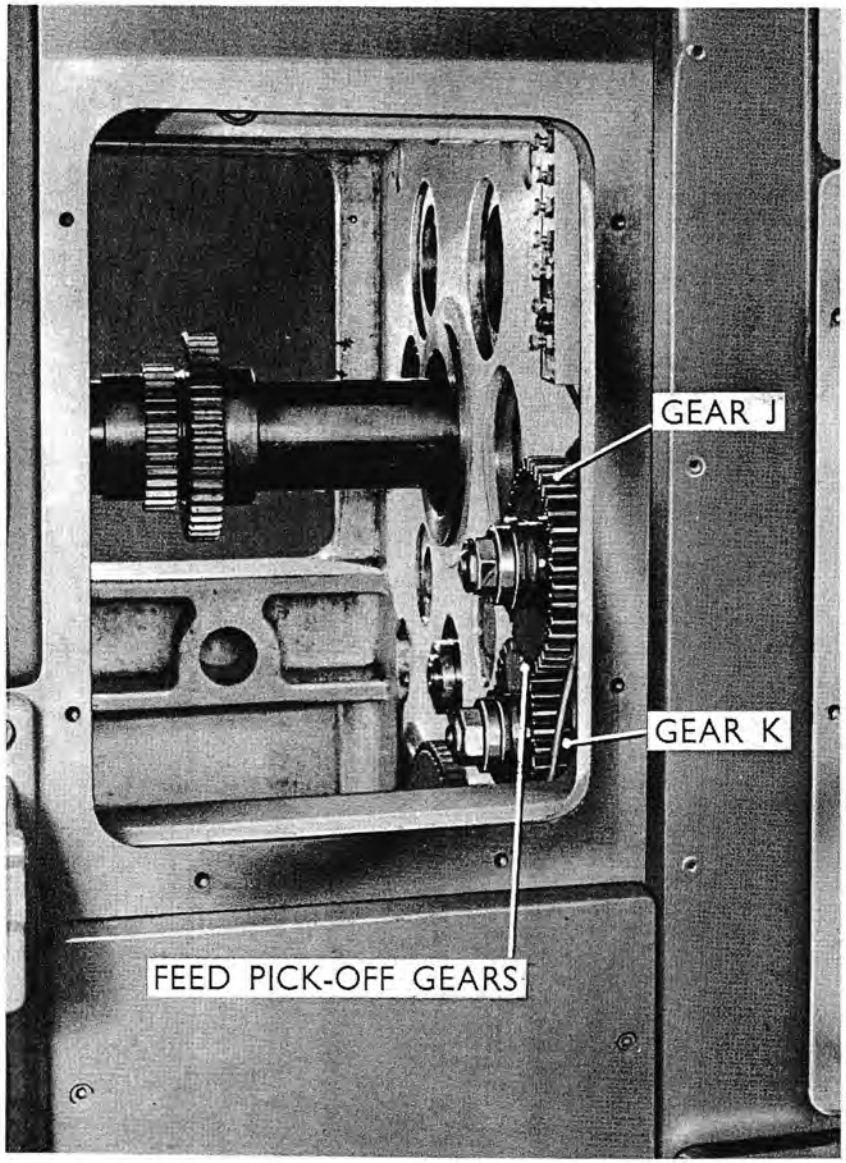
Rear Controls



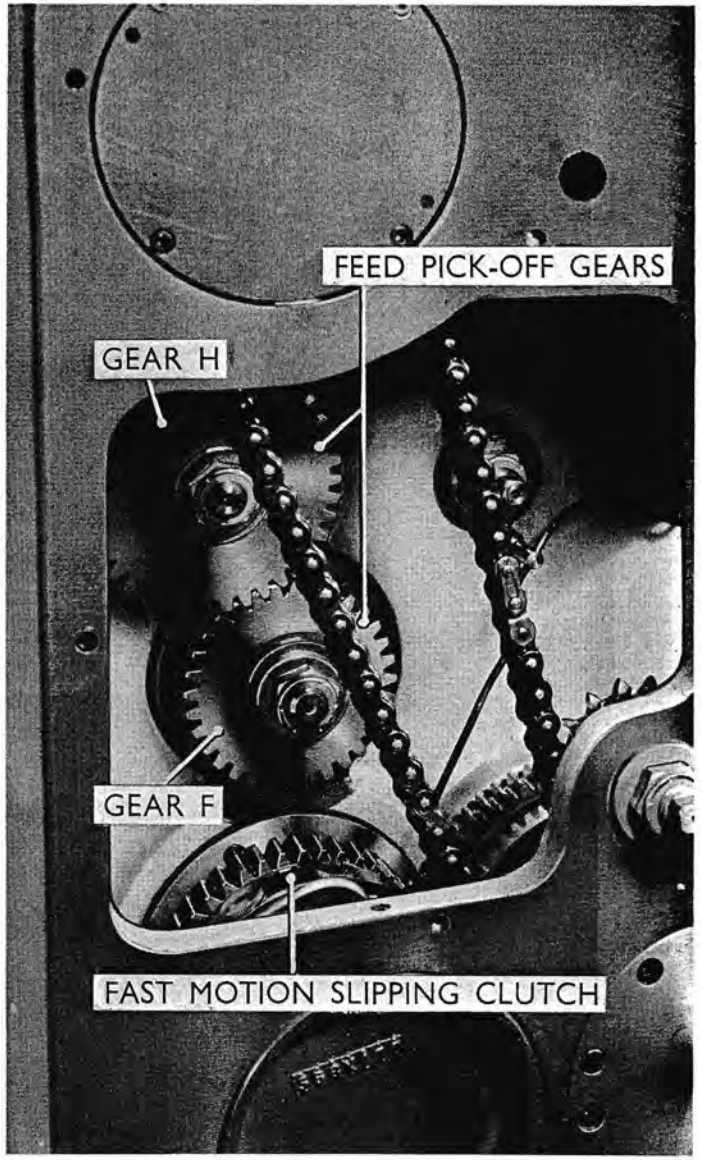
SHEET 4.7 **Speed Pick-Off Gears**



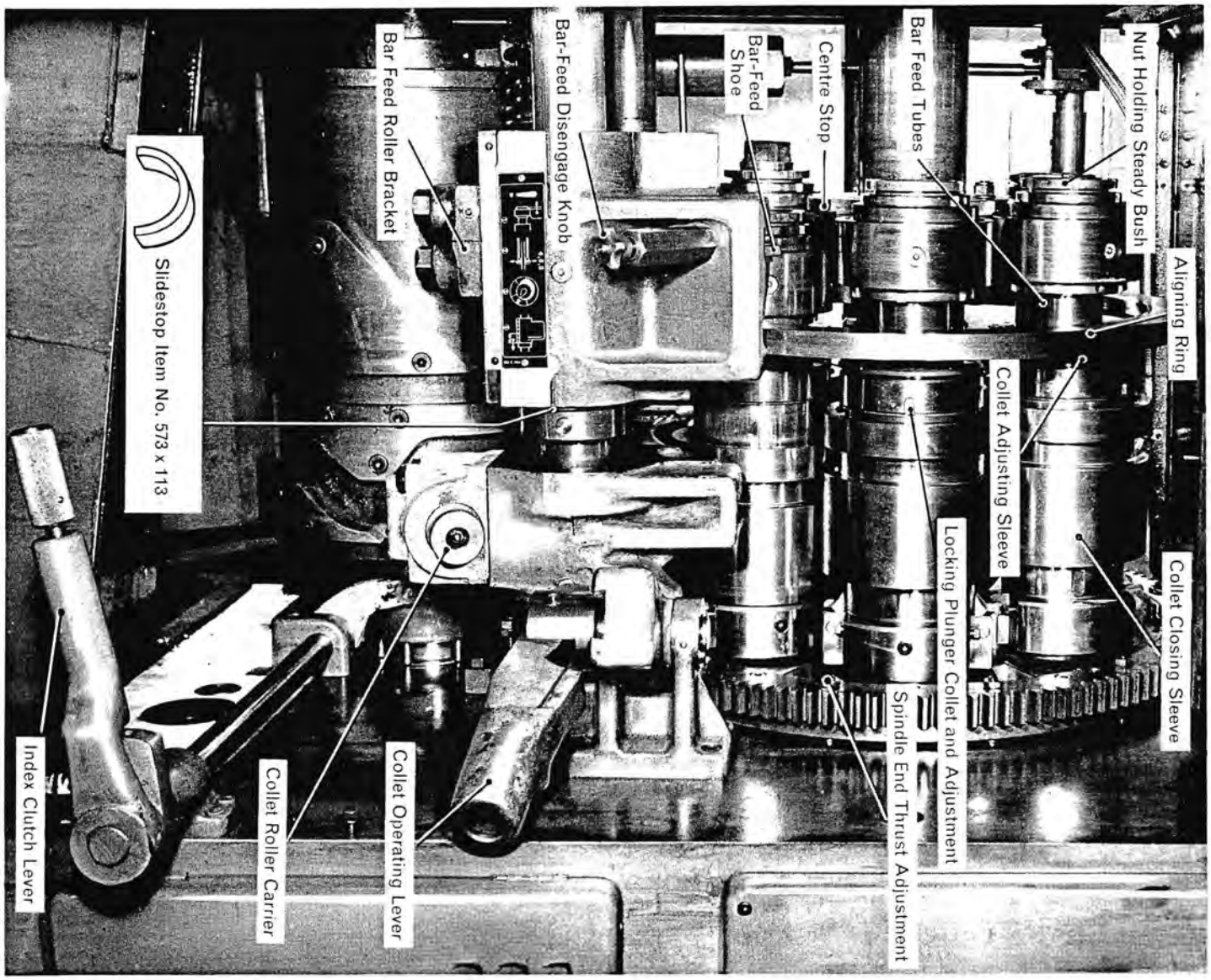
High-Low Range



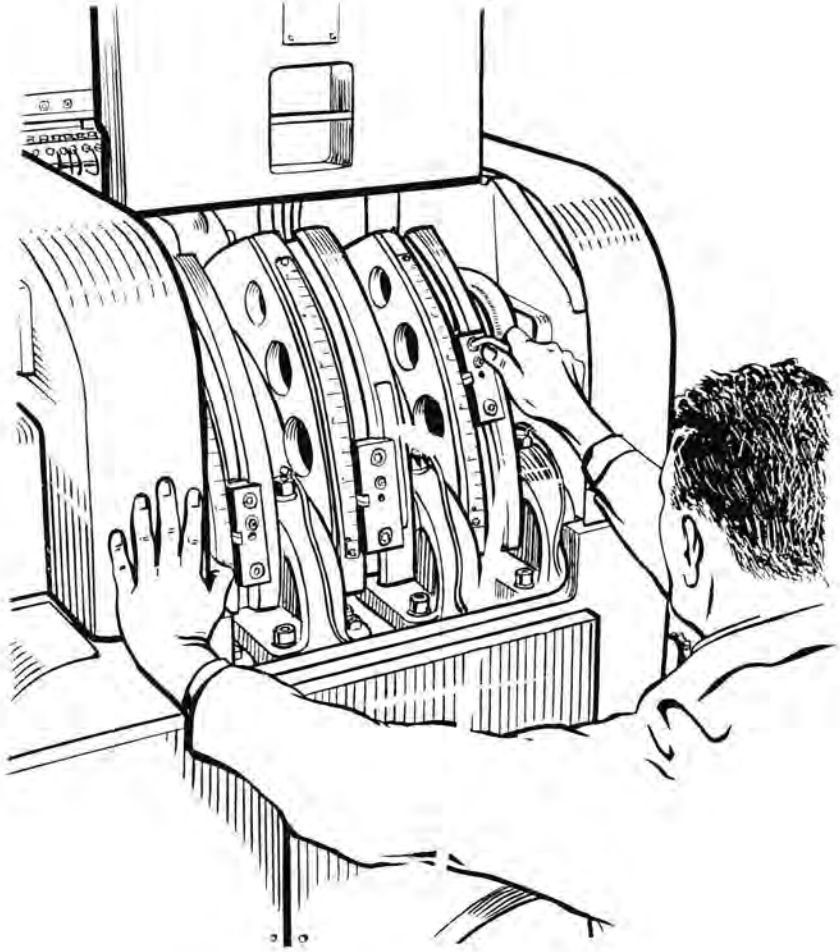
Feed Pick-Off Gears



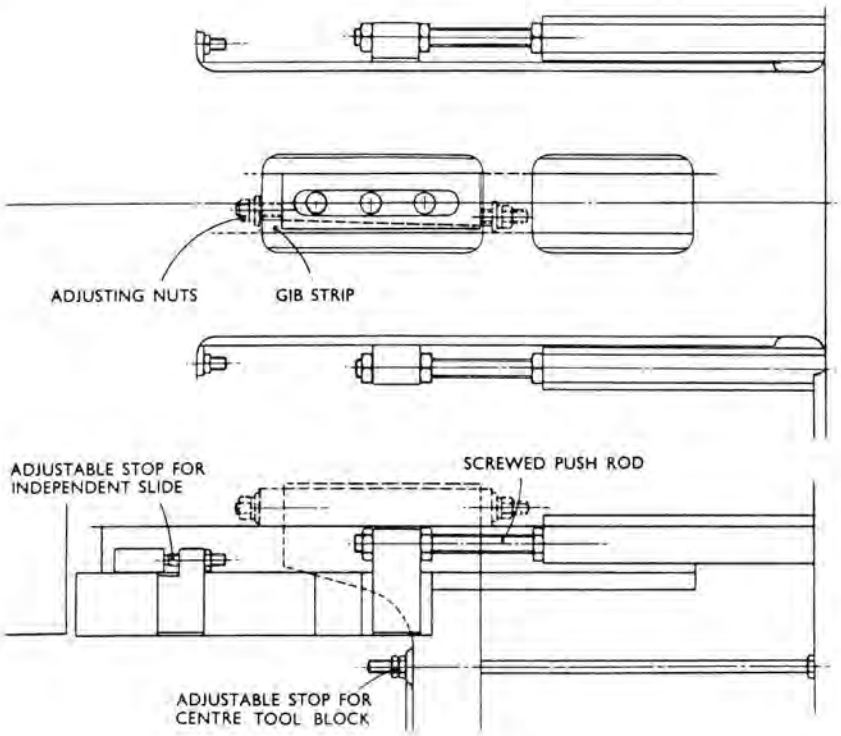
Feed Pick-Off Gears



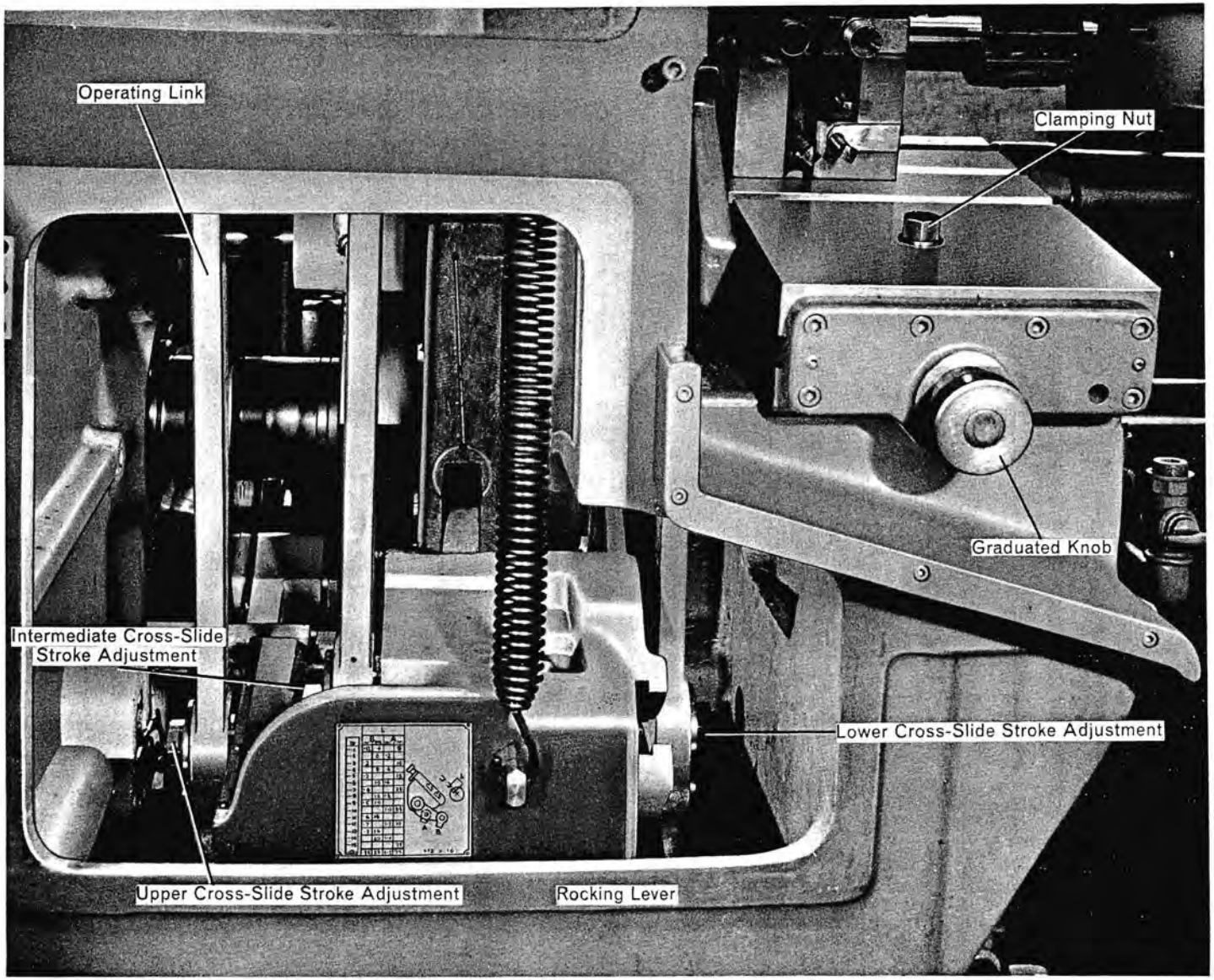
Bar Feed End of Spindles



Setting Longitudinal Slides



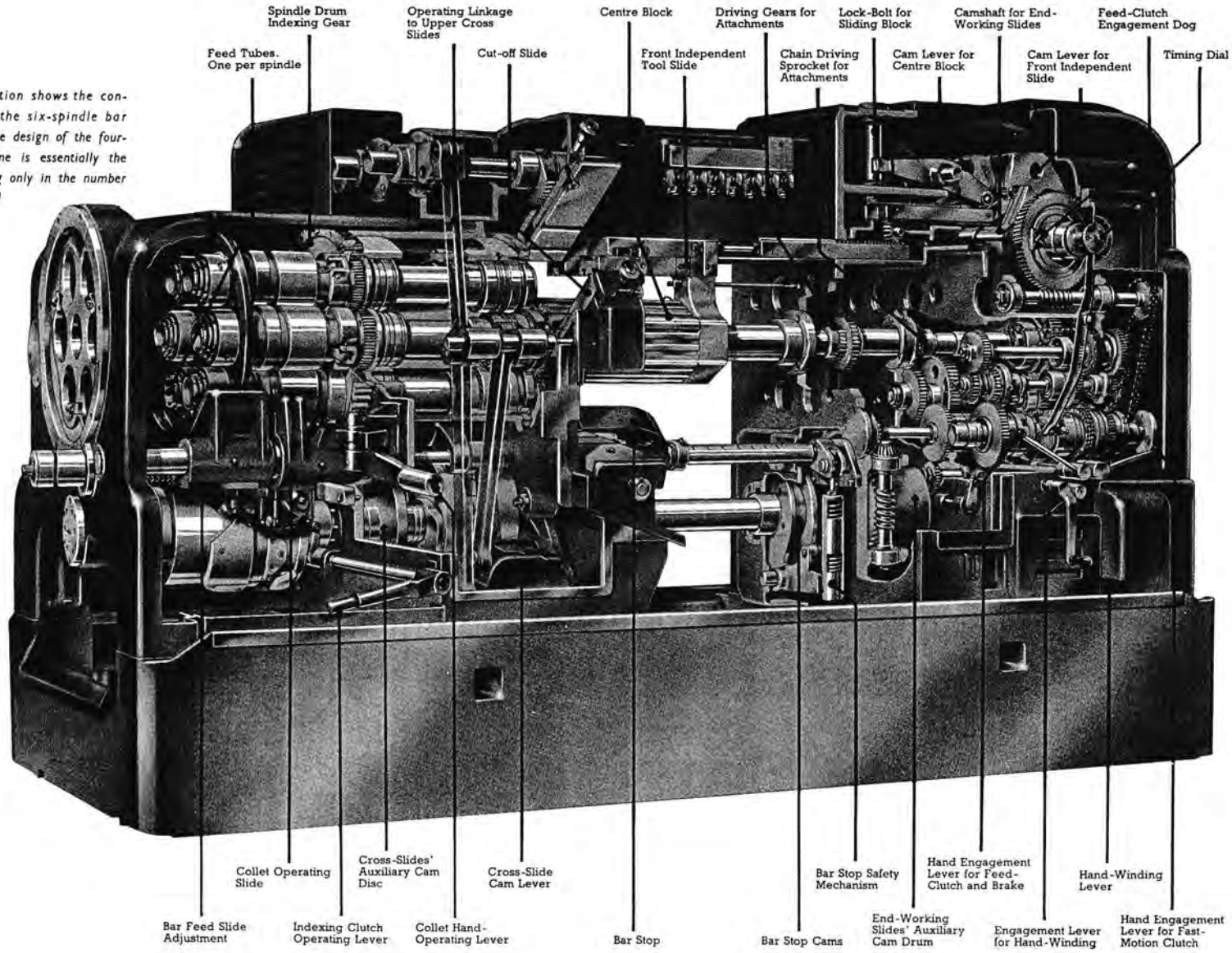
Centre Guide Gib Strip



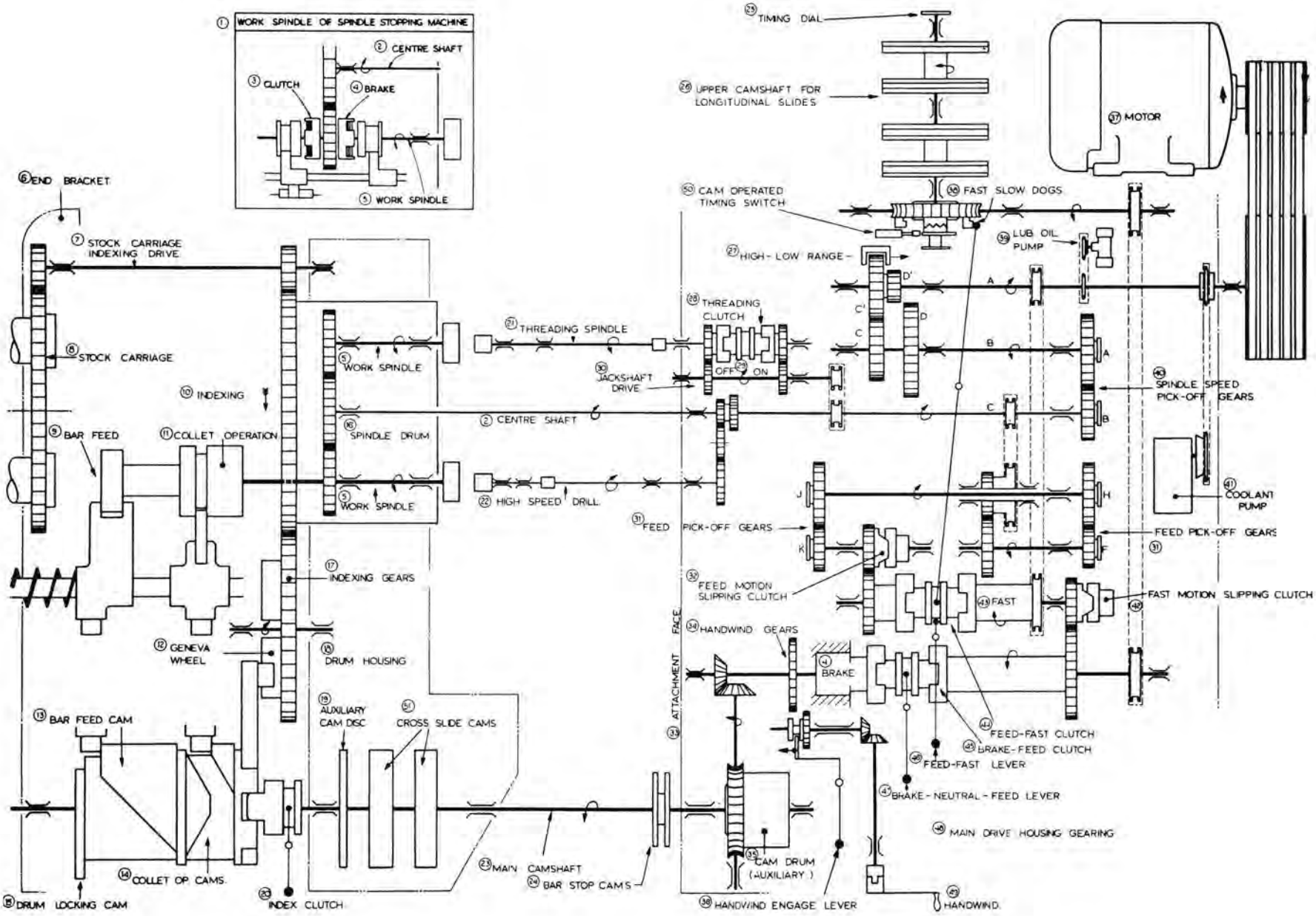
SHEET 4.11

Front Rocking Lever

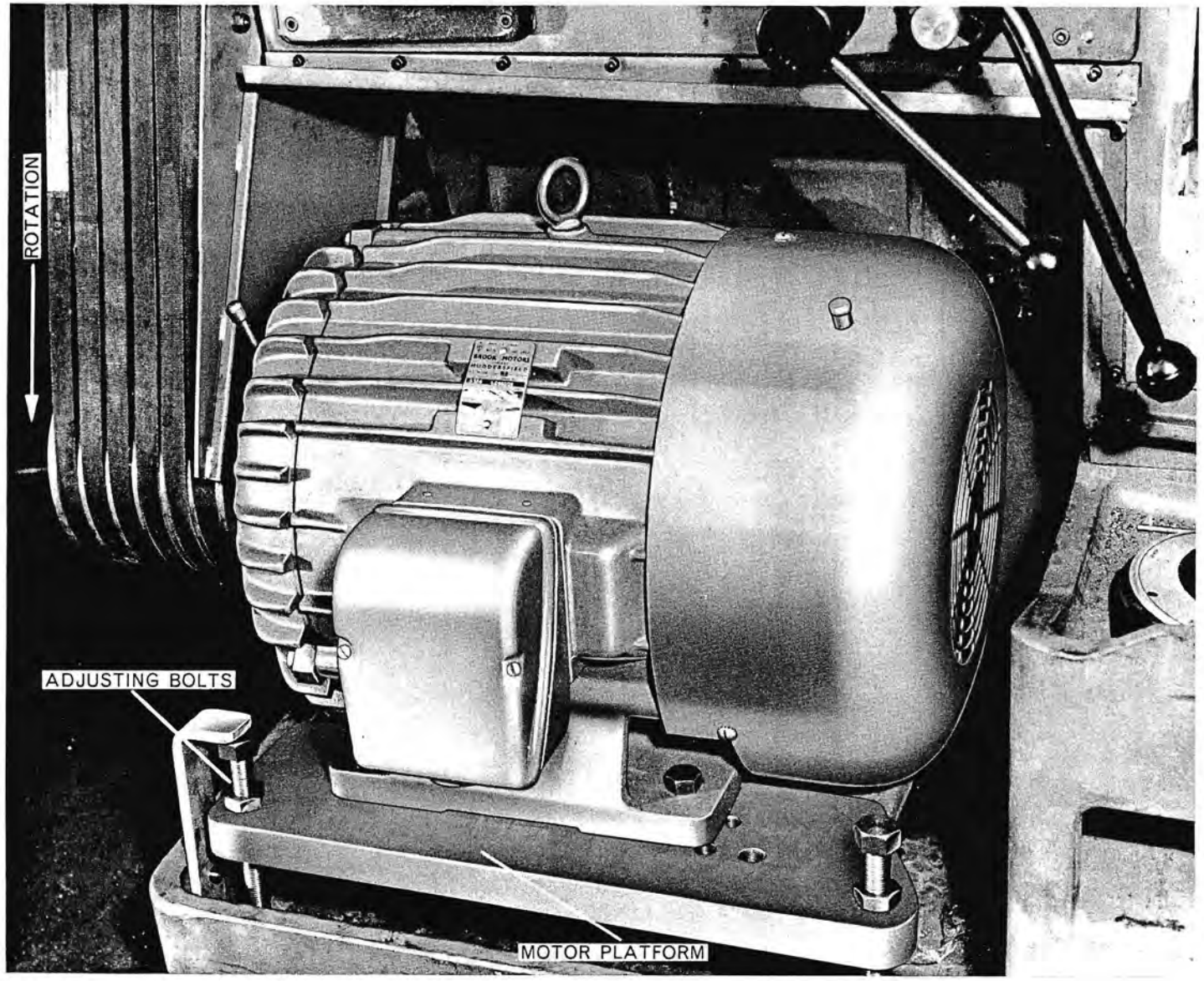
This illustration shows the construction of the six-spindle bar automatic: the design of the four-spindle machine is essentially the same, differing only in the number of spindles and tool slides.



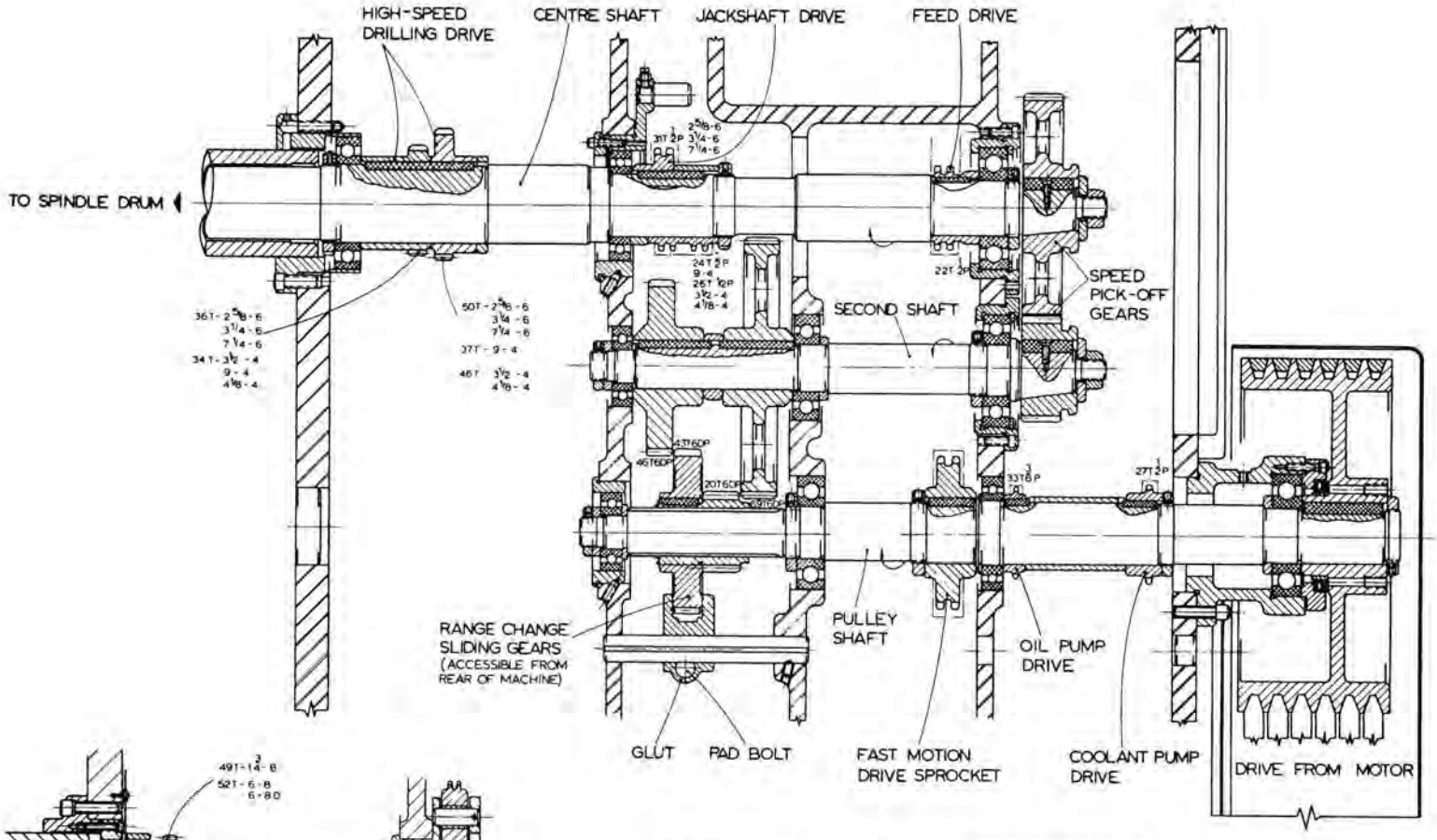
Cross Section of Machine

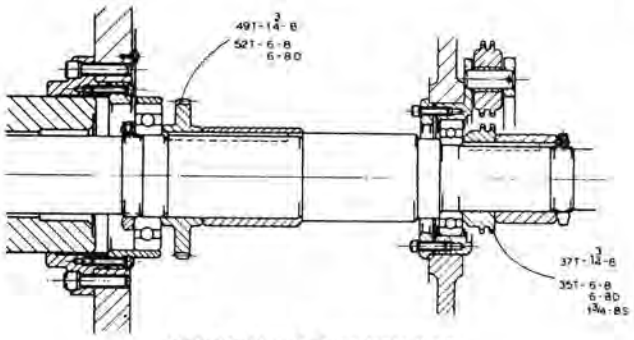


Layout of Gearing and Camshafts



Motor Platform

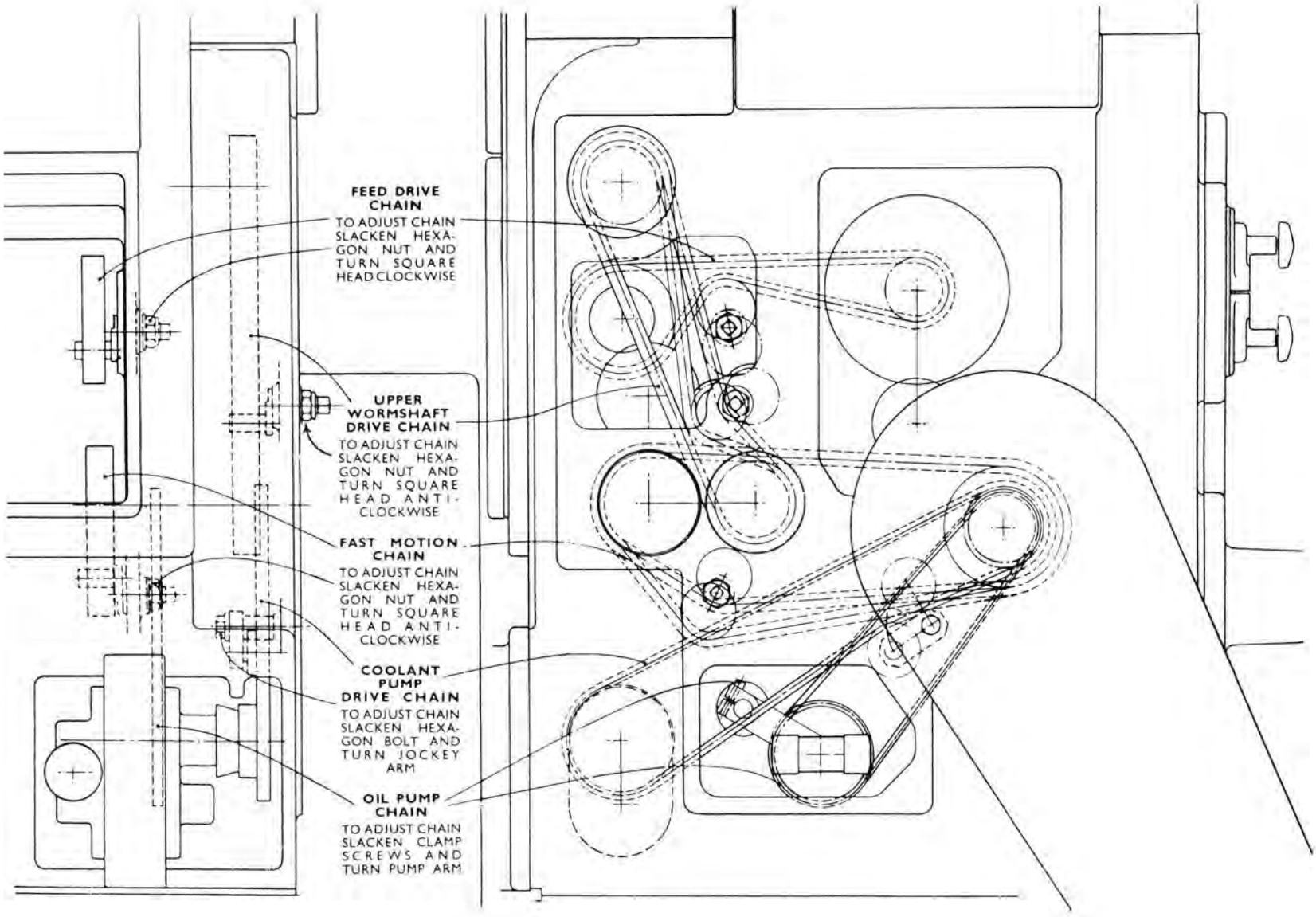




CENTRE SHAFT ARRANGEMENT
FOR $1\frac{3}{4}$-8, 6-8 & 6-8D

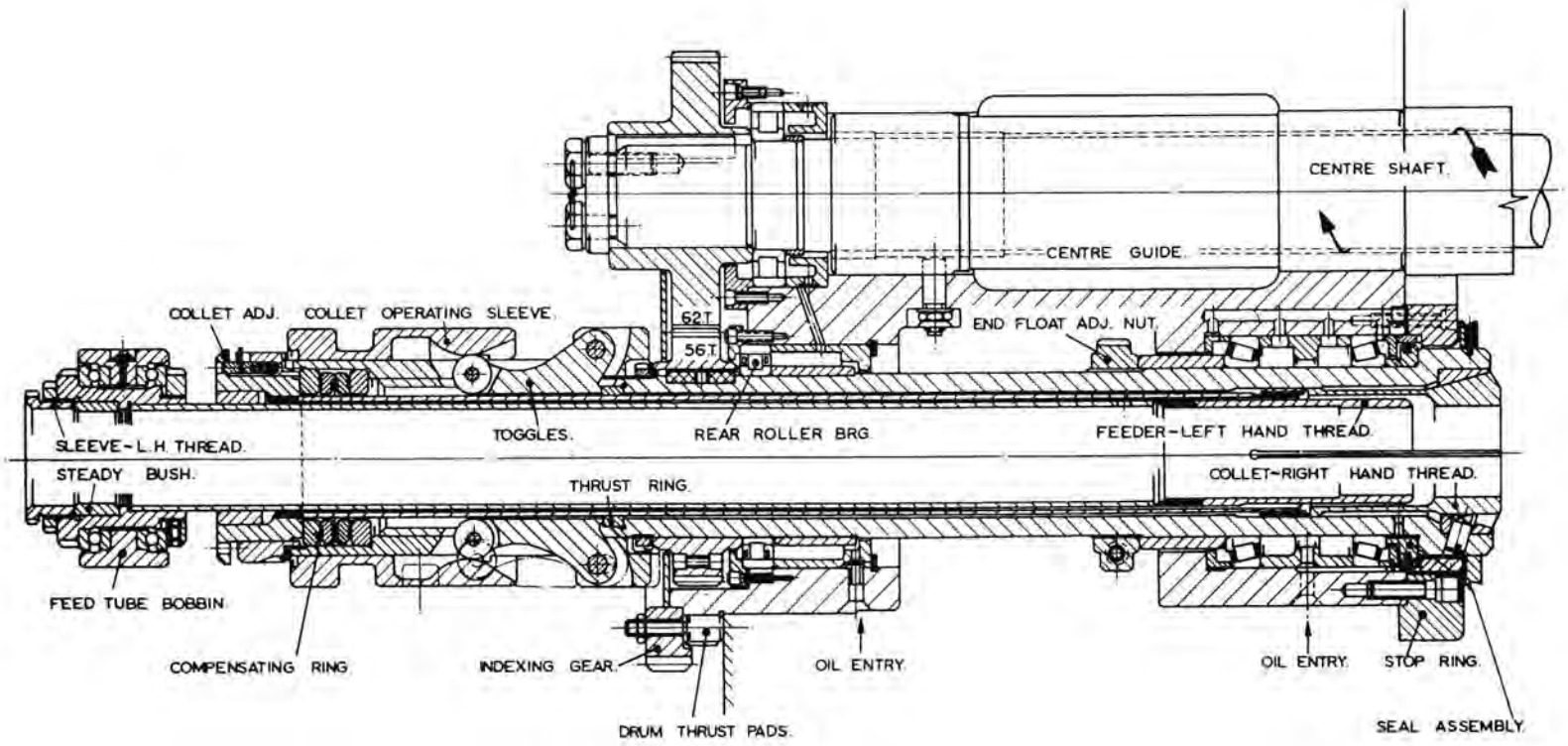
FM SPROCKET	MACHINE SIZE	MOTOR R PM
32T $\frac{5}{8}$P	$2\frac{5}{8}$-6 $1\frac{3}{4}$-8 6-8	1450
	$7\frac{1}{4}$-6 6-8 6-8D	960
23T $\frac{5}{8}$P	$3\frac{1}{4}$-6 $3\frac{1}{2}$-4 $4\frac{1}{8}$-4 9-4 $7\frac{1}{4}$-6 $7\frac{1}{4}$-6D 6-8D	1450
	$7\frac{1}{4}$-6D	960

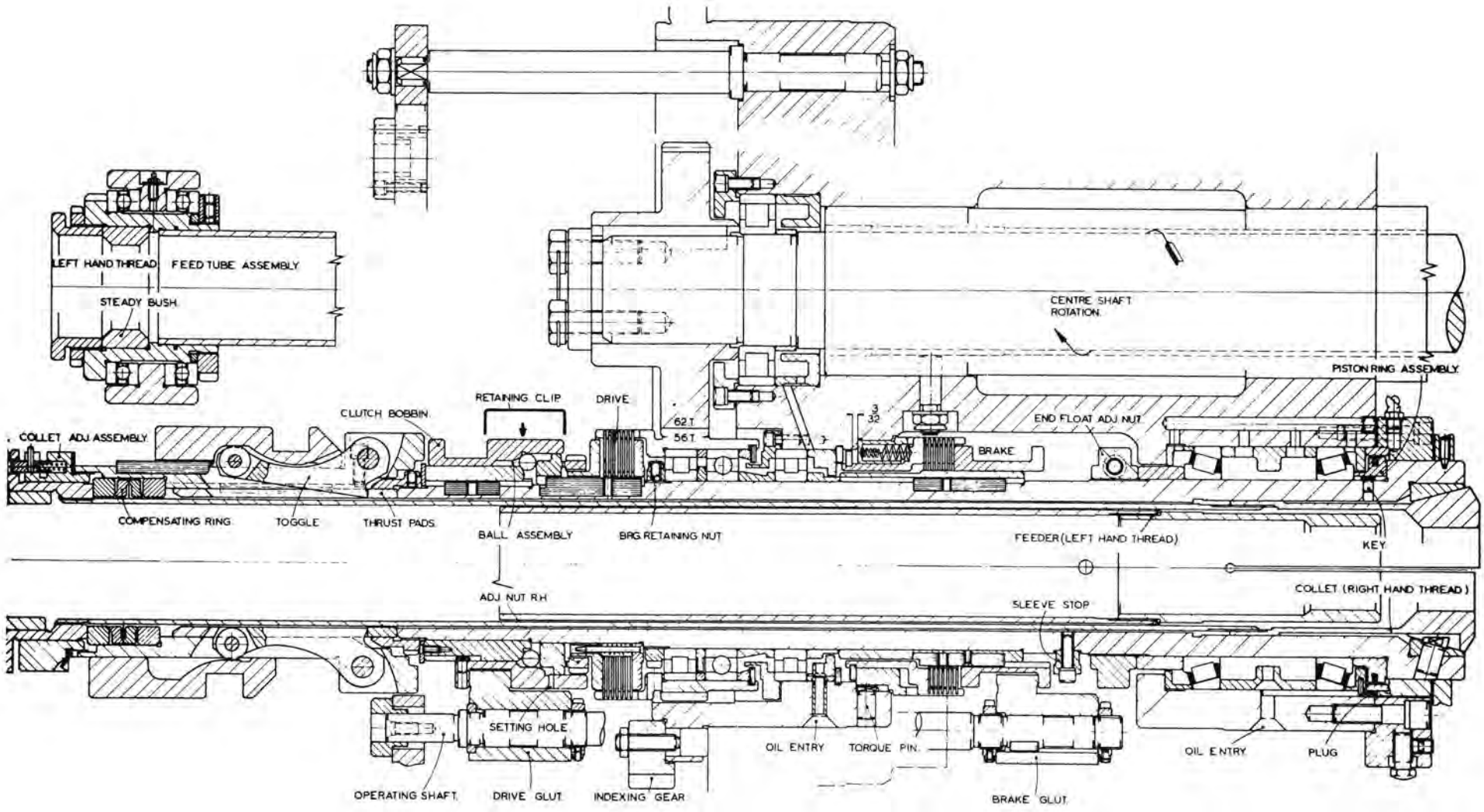
LIST OF SPEED GEARS 'A' AND 'B'	
No OF TEETH	DRAWING No
22	517 Y 159
24	517 Y 160
27	517 Y 161
30	517 Y 162
32	517 Y 163
35	517 Y 164
37	517 Y 165
40	517 Y 166
42	517 Y 167
45	517 Y 168
47	517 Y 169
50	517 Y 170
52	517 Y 171
55	517 Y 172
57	517 Y 173
60	517 Y 174
63	517 Y 175
65	517 Y 176

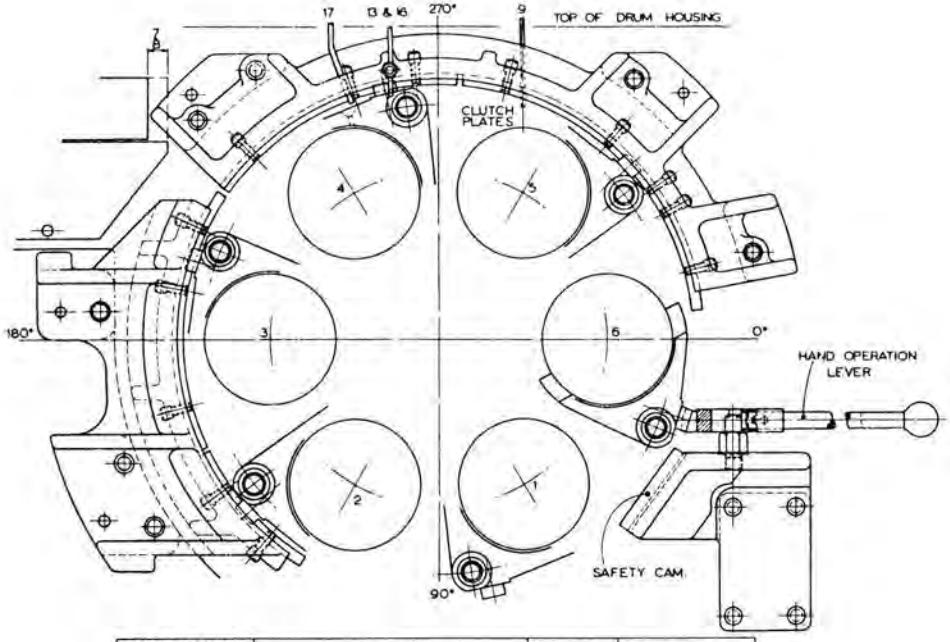


Adjustment to Chain Drives

SHEET 4.16

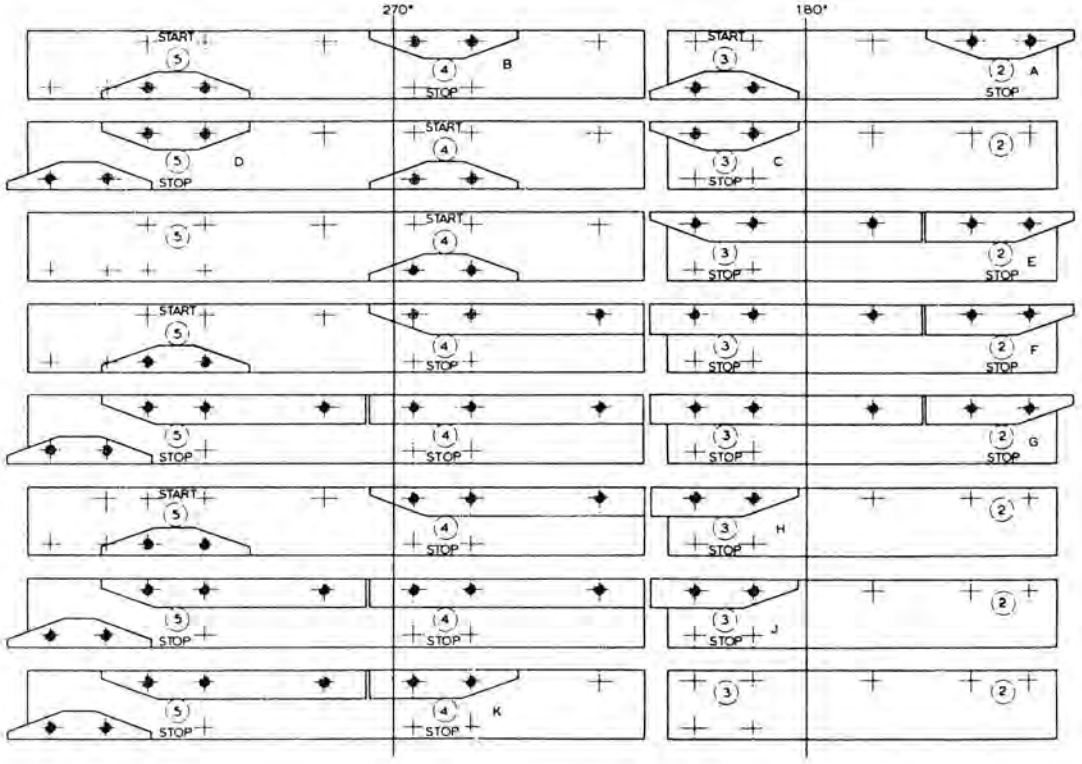

CENTRE SHAFT.
CENTRE GUIDE.
COLLET ADJ.
COLLET OPERATING SLEEVE.
62T.
56T.
END FLOAT ADJ. NUT.
SLEEVE-L.H. THREAD.
TOGGLES.
REAR ROLLER BRG.
FEEDER-LEFT HAND THREAD.
STEADY BUSH.
THRUST RING.
COLLET-RIGHT HAND THREAD.
FEED TUBE BOBBIN.
COMPENSATING RING.
INDEXING GEAR.
OIL ENTRY.
OIL ENTRY.
STOP RING.
DRUM THRUST PADS.
SEAL ASSEMBLY.


LEFT HAND THREAD
FEED TUBE ASSEMBLY
STEADY BUSH
CENTRE SHAFT ROTATION
PISTON RING ASSEMBLY
RETAINING CLIP
DRIVE
CLUTCH BOBBIN
COLLET ADJ ASSEMBLY
62 T
56 T
3/32
END FLOAT ADJ NUT
BRAKE
COMPENSATING RING
TOGGLE
THRUST PADS
BALL ASSEMBLY
BRG RETAINING NUT
FEEDER (LEFT HAND THREAD)
KEY
ADJ NUT R.H.
COLLET (RIGHT HAND THREAD)
SLEEVE STOP
SETTING HOLE
OIL ENTRY
TORQUE PIN
OIL ENTRY
PLUG
OPERATING SHAFT
DRIVE SLOT
INDEXING GEAR
BRAKE SLOT

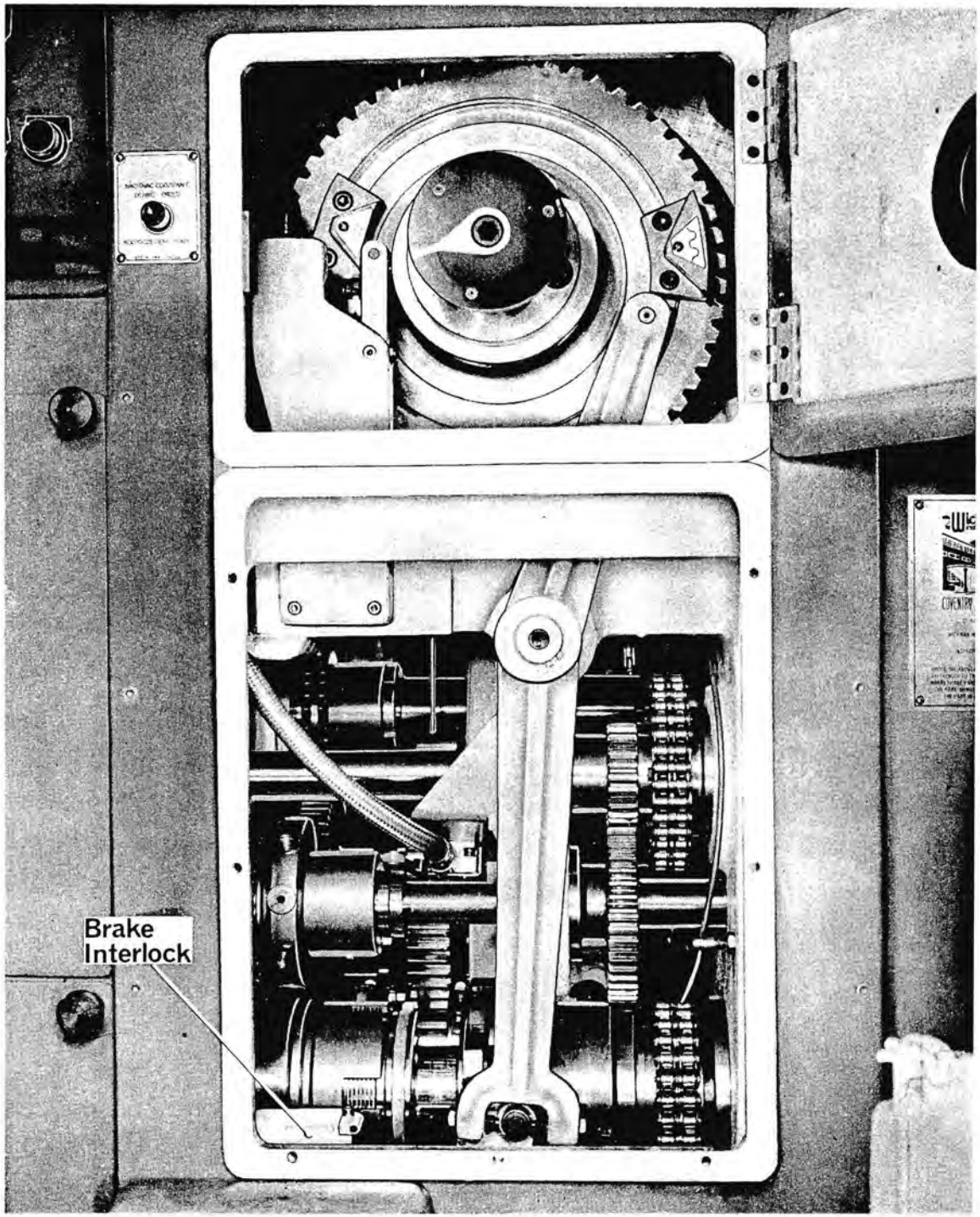


SPINDLE TO STOP & REMAIN STOPPED IN STATION	CAMS REQUIRED	DEVELOPMENT LETTER	CAM CARRIER (S) REQUIRED
2	502 X 230. (2 OFF)	A	502 Y 247.
3	502 X 230. (2 OFF)	C	502Y226. 502Y247.
4	502 X 230. (2 OFF)	B	502 Y 226.
5	502 X 230. (2 OFF)	D	502 Y 226.
2,3	502X230, 502X231, & 502X235.	E	502 Y 226 & 502 Y 247
2,3,4	502X230, 502X231, 502X233, & 502X235.	F	
2,3,4,5	502X230, 502X231, 502X233(2OFF)502X235	G	
3,4	502X230, 502X231 & 502 X 235	H	
3,4,5	502X230, 502X231, 502X233& 502X235	J	
4,5	502X230, 502X231 & 502 X 235	K	502 Y 226.

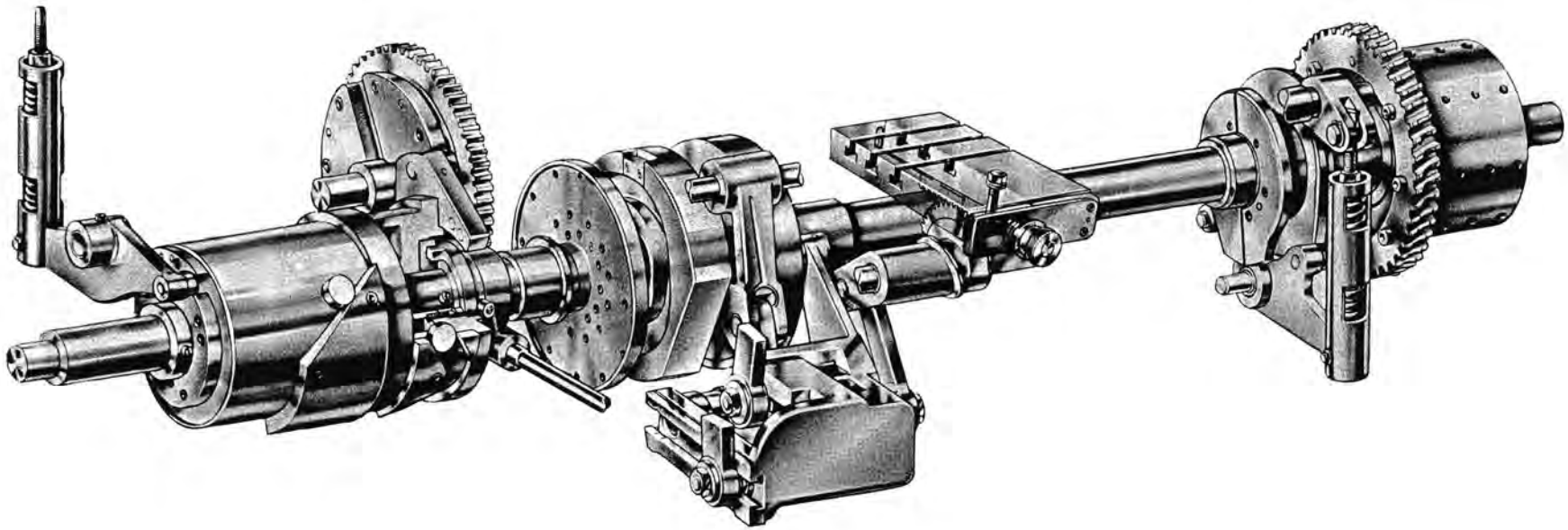
CAM CARRIER 502Y226. SUPPLIED AS STANDARD.
CAM CARRIER 502Y247. SUPPLIED TO SPECIAL ORDER.



Cams for 2 5/8" -6S

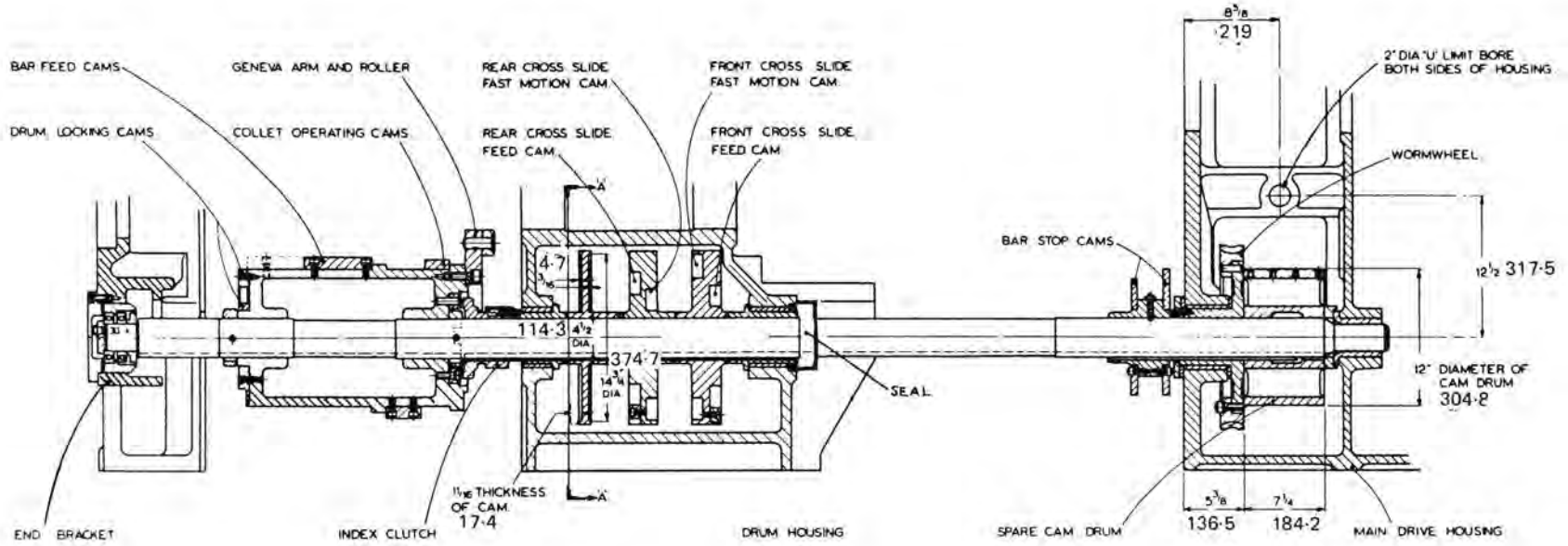


Fast and Feed Motion Clutches



SHEET 4.25

View of Main Camshaft



2⅝-6, 3¼-6	UPPER FRONT STN 5 SEC 593B REAR STN 4 SEC 593A
3½-4, 4⅛-4	UPPER FRONT STN 4 SEC 593B REAR STN 3 SEC 593A

HOLE POSITION	RATIO OF CROSS SLIDE STROKE TO CAM MOVEMENT ADJUSTABLE FROM-
A	·975 TO 1·3
B	·487 TO ·65

RADIUS 'R' MAX 6¼ MIN 3⅛
3⅛" CAM MOVEMENT

BEGINS M/C INSP N°	
2⅝-6, 3¼-6	INTER FRONT STN 6 SEC 593C INTER REAR STN 3 SEC 593

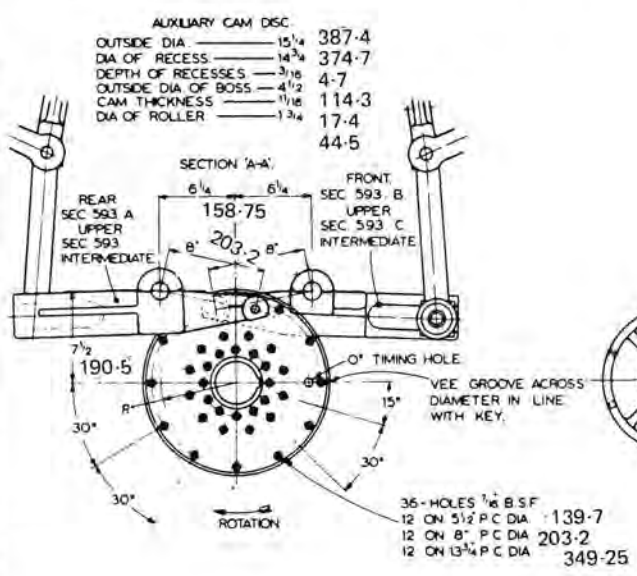
HOLE POSITION	RATIO OF CROSS SLIDE STROKE TO CAM MOVEMENT ADJUSTABLE FROM-
* A	·65 TO ·81
B	·4 TO ·55

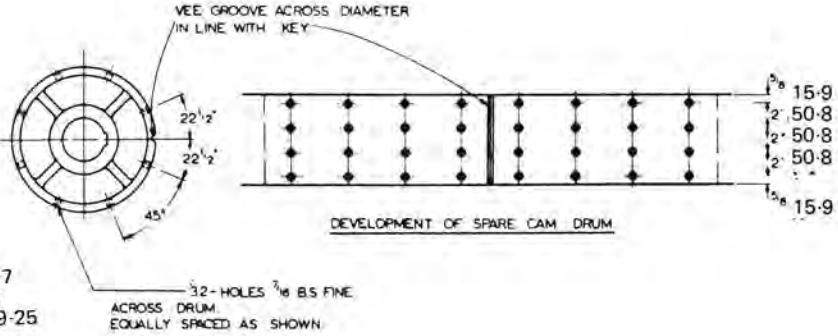
RADIUS 'R' POSITION 'B'
MAX 6¼ MIN 3⅛ (3⅛ CAM MOVEMENT)
* POSITION A
MAX 6¼ MIN 3 13/16 (2 7/16 CAM MOVEMENT)

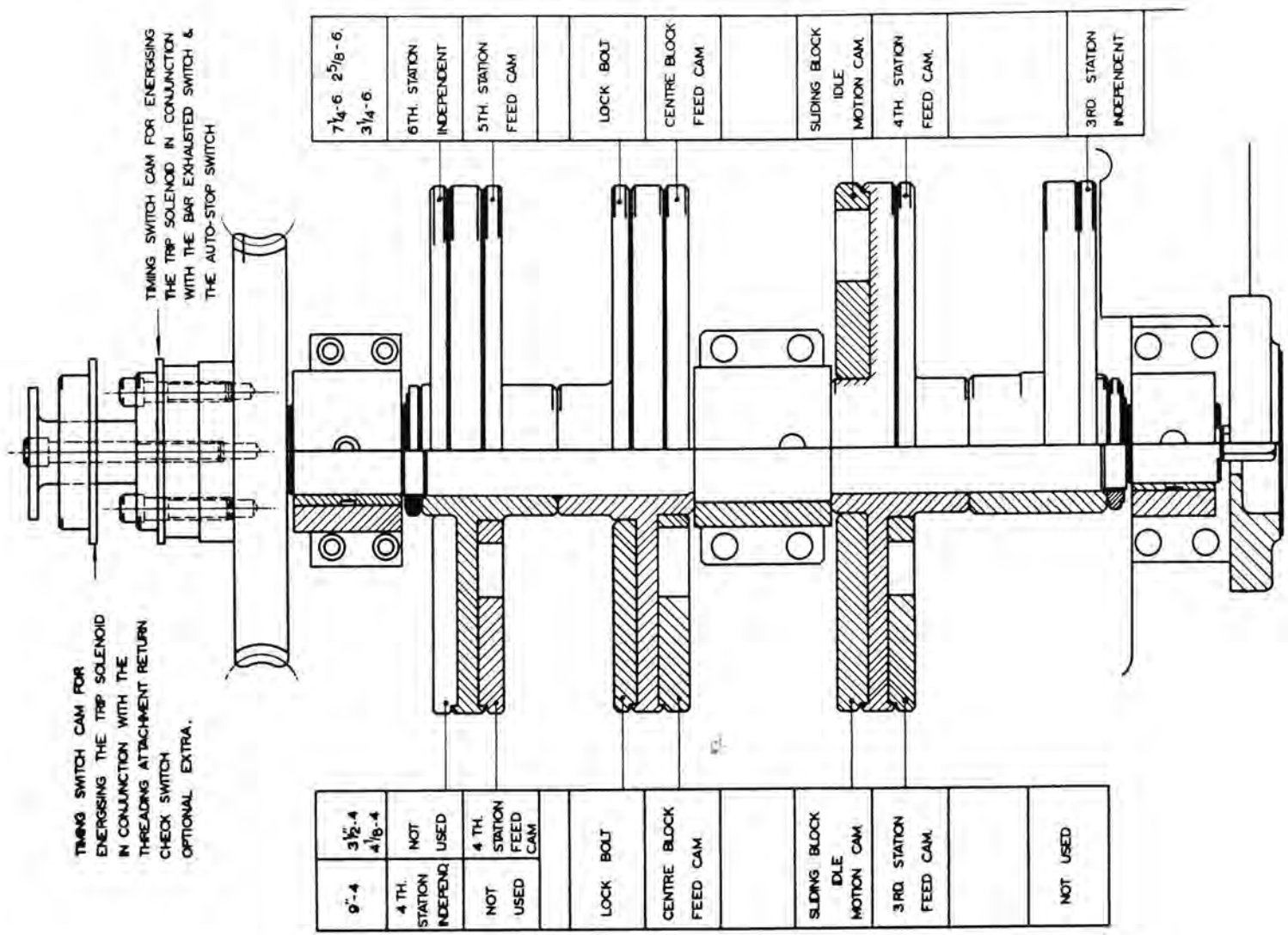
BEFORE M/C INSP N°
RATIO OF INTERMEDIATE CROSS SLIDE STROKE TO CAM MOVEMENT ADJUSTABLE FROM 1·0 TO 1·325

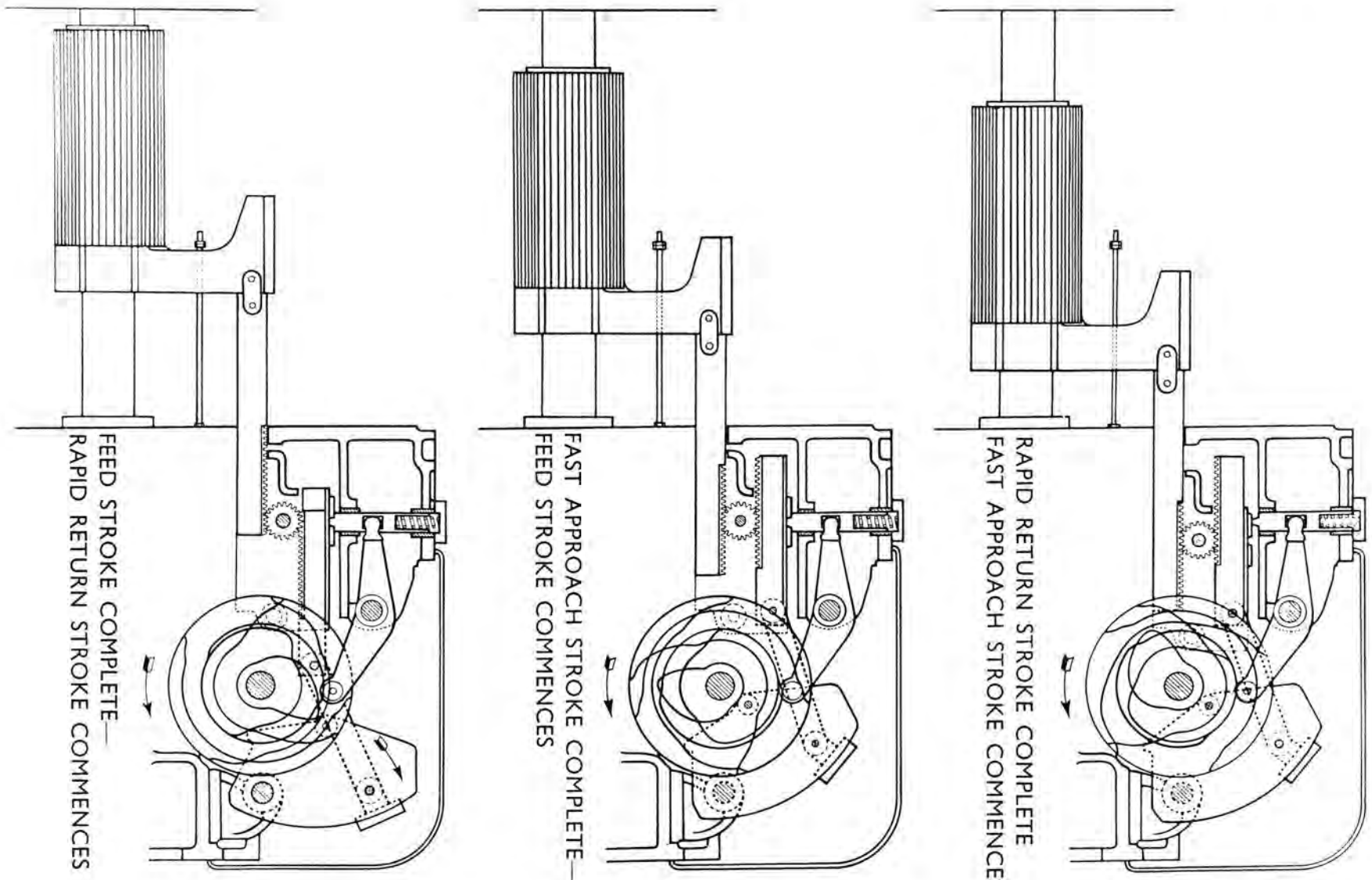
AUXILIARY CAM DISC

OUTSIDE DIA	15¼	387·4
DIA OF RECESS	14¾	374·7
DEPTH OF RECESSES	3/16	4·7
OUTSIDE DIA OF BOSS	4½	114·3
CAM THICKNESS	11/16	17·4
DIA OF ROLLER	1 3/4	44·5

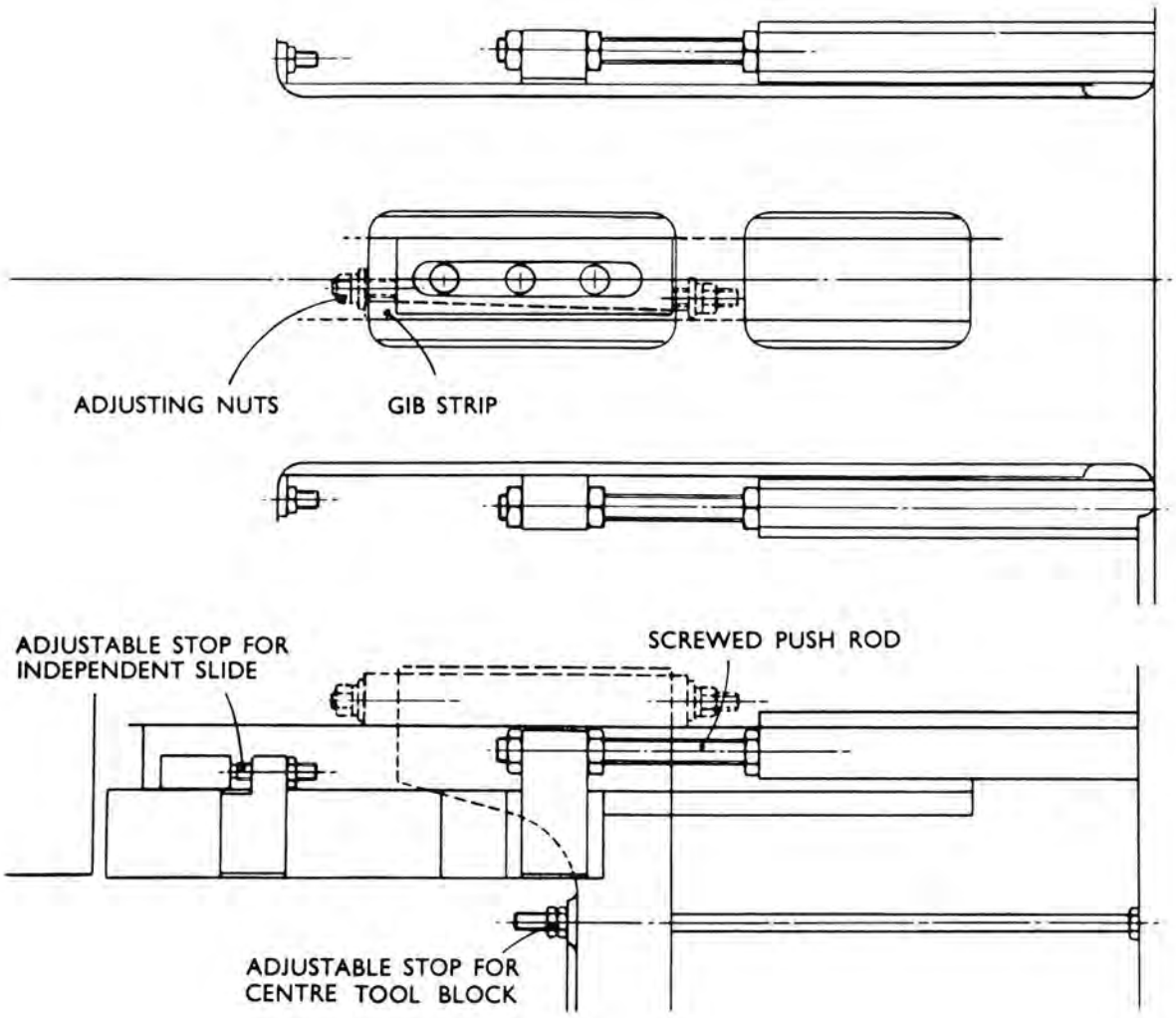




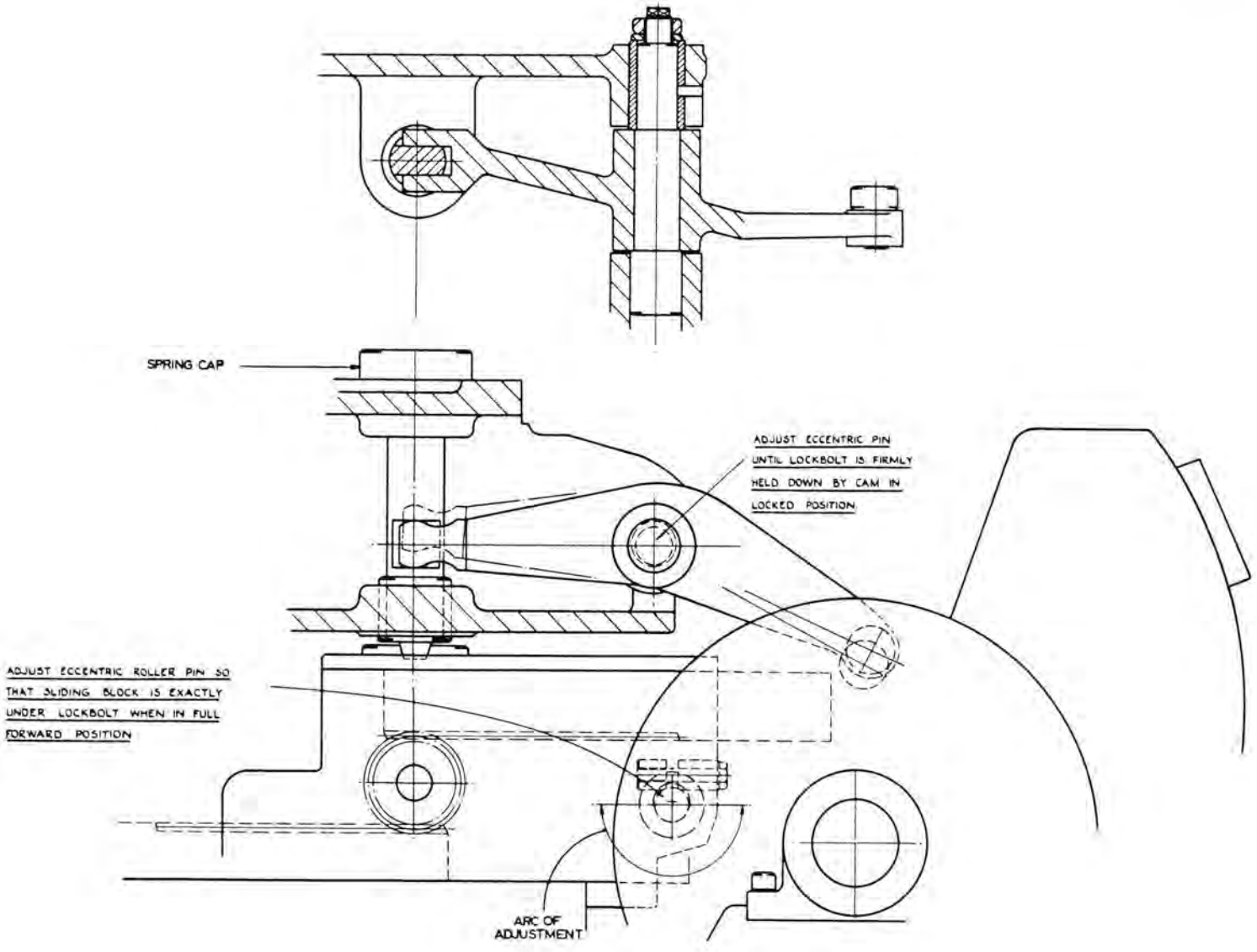

TIMING SWITCH CAM FOR ENERGISING THE TRIP SOLENOID IN CONJUNCTION WITH THE BAR EXHAUSTED SWITCH & THE AUTO-STOP SWITCH
TIMING SWITCH CAM FOR ENERGISING THE TRIP SOLENOID IN CONJUNCTION WITH THE THREADING ATTACHMENT RETURN CHECK SWITCH OPTIONAL EXTRA.
7¼-6 2⅝-6. 3¼-6.
6TH. STATION INDEPENDENT
5TH. STATION FEED CAM
LOCK BOLT
CENTRE BLOCK FEED CAM
SLIDING BLOCK IDLE MOTION CAM.
4TH STATION FEED CAM.
3RD. STATION INDEPENDENT
9"-4
4 TH. STATION INDEPEND.
NOT USED
3½"-4 4⅛-4
NOT USED
4 TH. STATION FEED CAM
LOCK BOLT
CENTRE BLOCK FEED CAM
SLIDING BLOCK IDLE MOTION CAM.
3RD STATION FEED CAM.
NOT USED



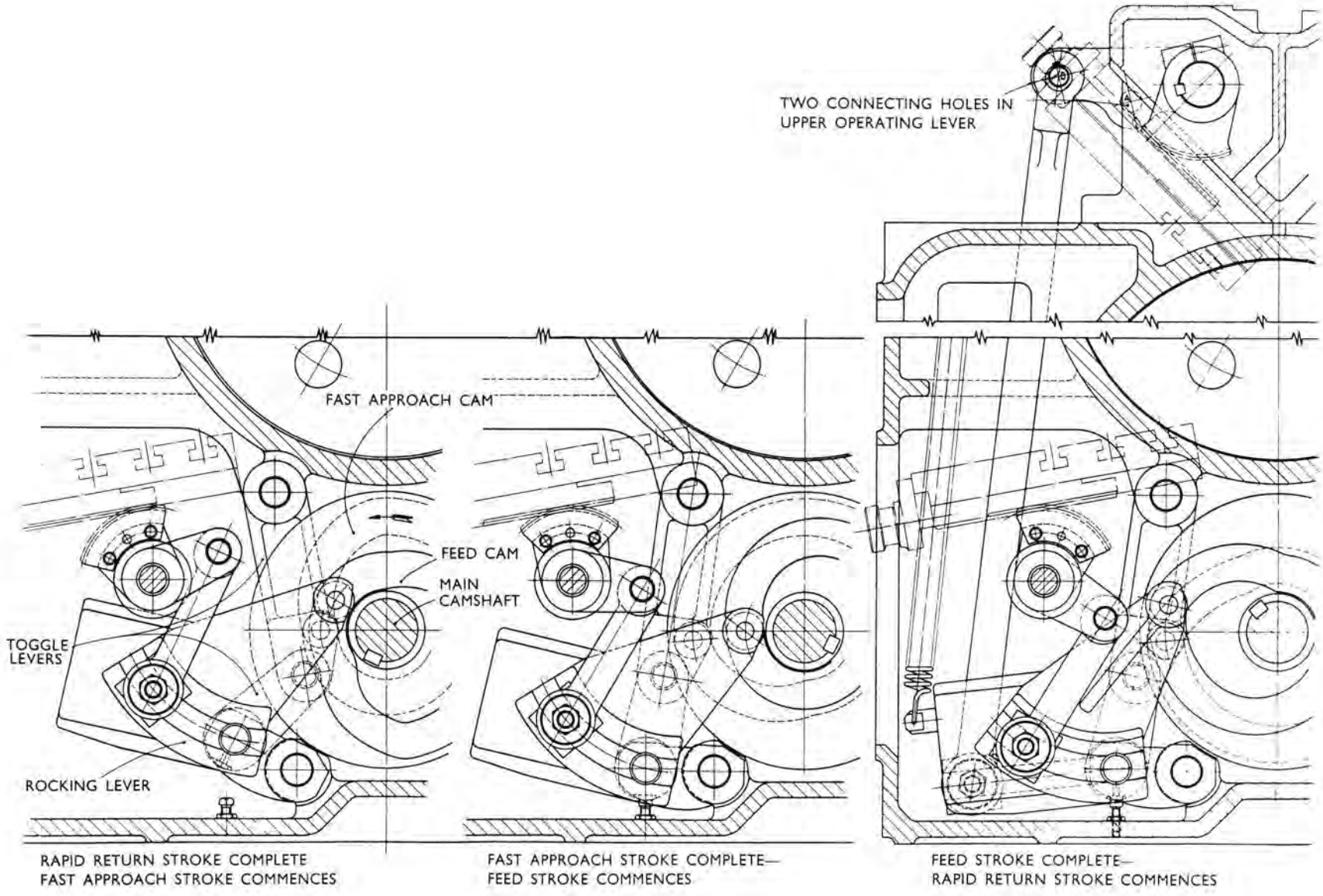
Longitudinal Slides Mechanism



Centre Guide Gib Strip

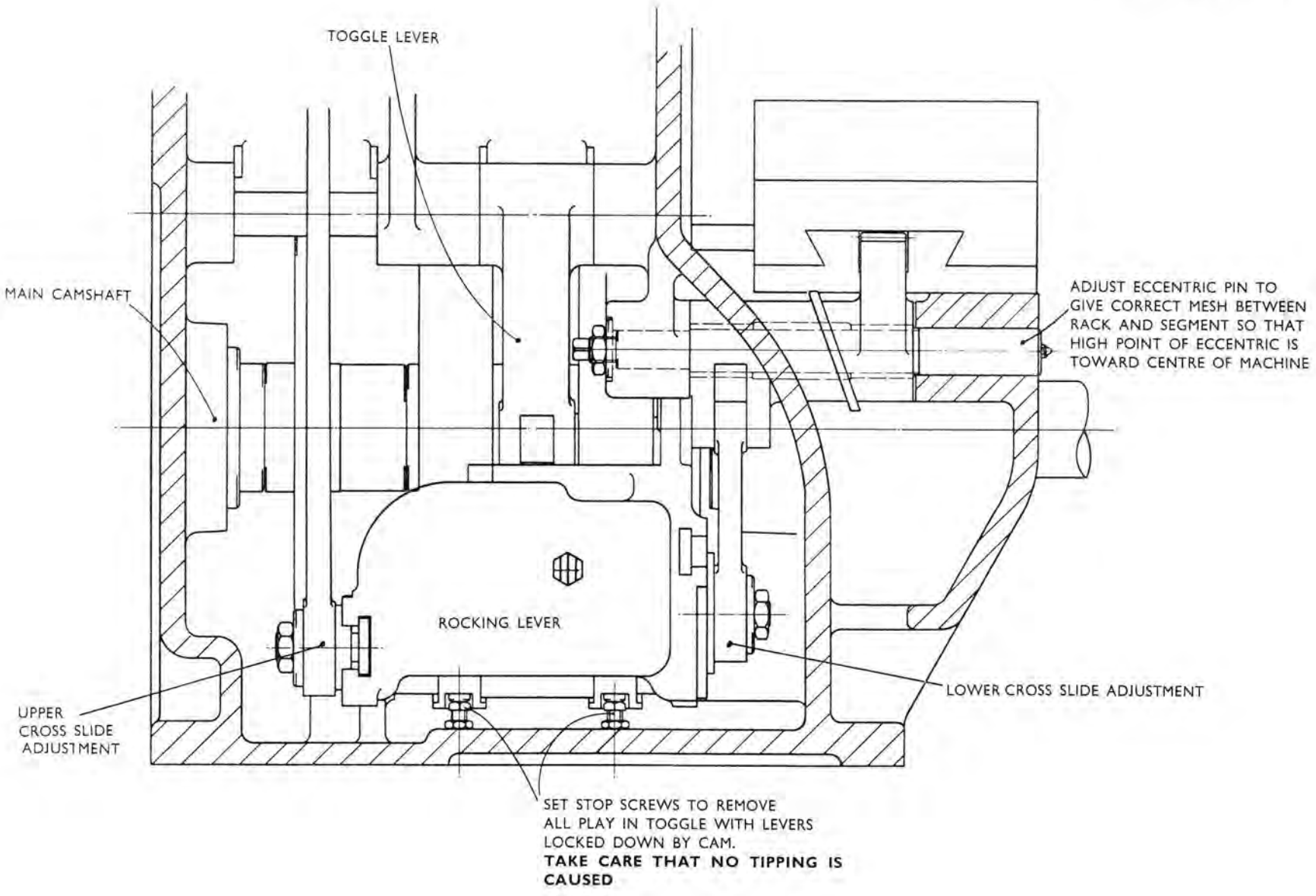


Lockbolt Adjustment

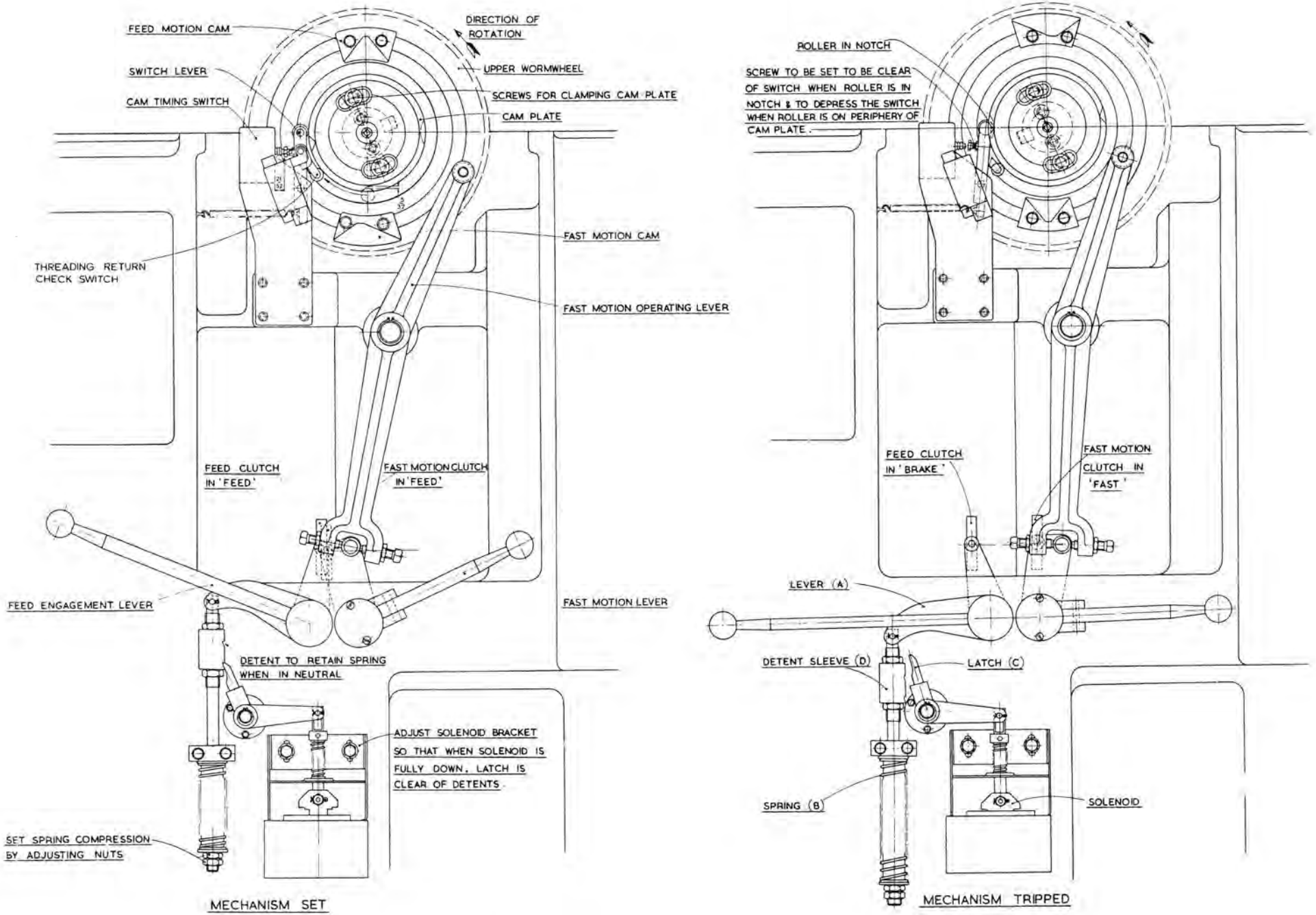


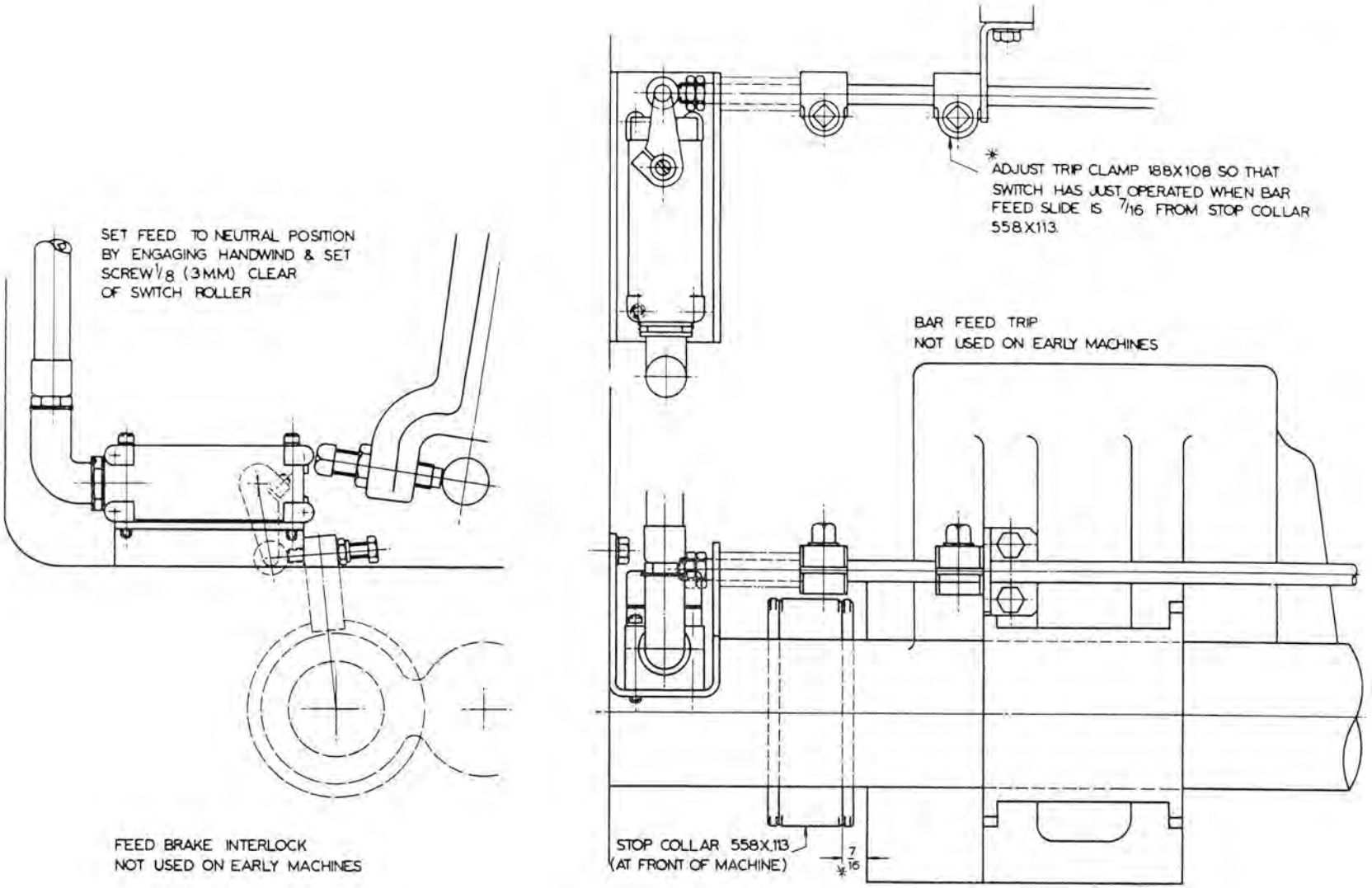
SHEET 4.31

Operation of Lower Cross Slide

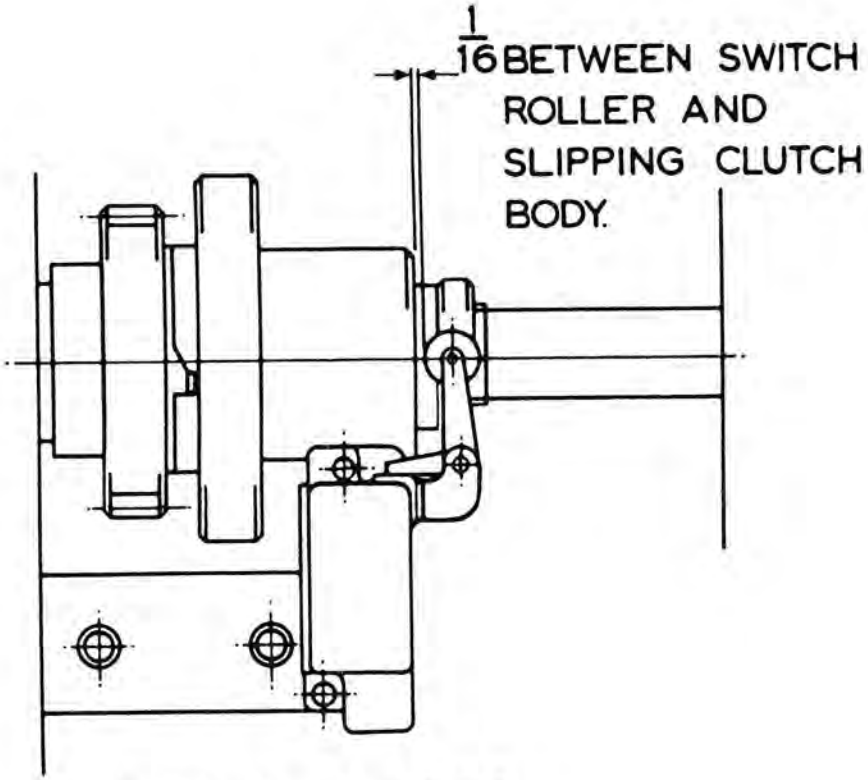


Setting of Cross Slide Operation

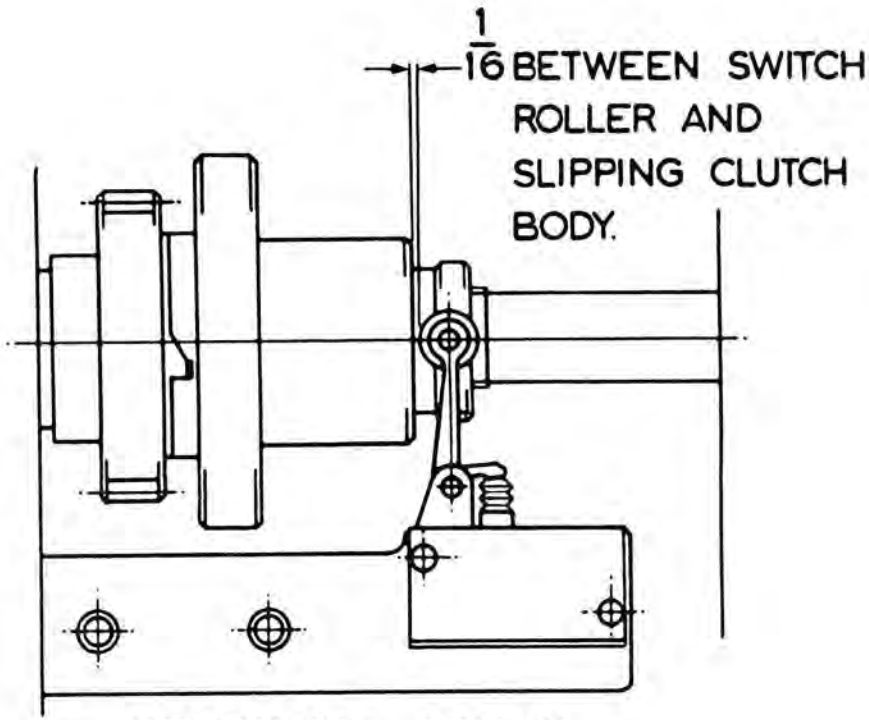

FEED MOTION CAM
DIRECTION OF ROTATION
SWITCH LEVER
UPPER WORMWHEEL
CAM TIMING SWITCH
SCREWS FOR CLAMPING CAM PLATE
CAM PLATE
FAST MOTION CAM
THREADING RETURN CHECK SWITCH
FAST MOTION OPERATING LEVER
FEED CLUTCH IN 'FEED'
FAST MOTION CLUTCH IN 'FEED'
FEED ENGAGEMENT LEVER
FAST MOTION LEVER
DETENT TO RETAIN SPRING WHEN IN NEUTRAL
ADJUST SOLENOID BRACKET SO THAT WHEN SOLENOID IS FULLY DOWN, LATCH IS CLEAR OF DETENTS
SET SPRING COMPRESSION BY ADJUSTING NUTS
MECHANISM SET
ROLLER IN NOTCH
SCREW TO BE SET TO BE CLEAR OF SWITCH WHEN ROLLER IS IN NOTCH & TO DEPRESS THE SWITCH WHEN ROLLER IS ON PERIPHERY OF CAM PLATE.
FEED CLUTCH IN 'BRAKE'
FAST MOTION CLUTCH IN 'FAST'
LEVER (A)
DETENT SLEEVE (D)
LATCH (C)
SPRING (B)
SOLENOID
MECHANISM TRIPPED



Feed Brake Interlock and Bar Feed Trip

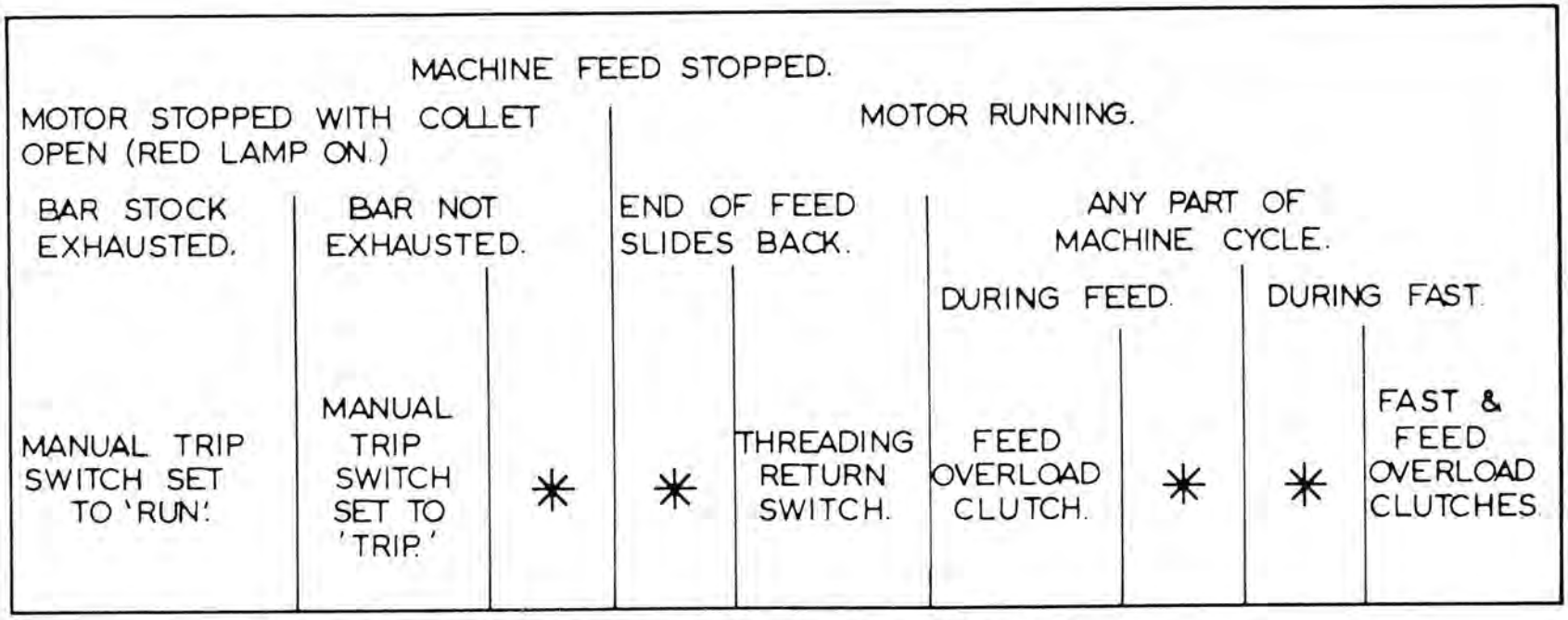


SETTING SLIPPING CLUTCH SWITCH

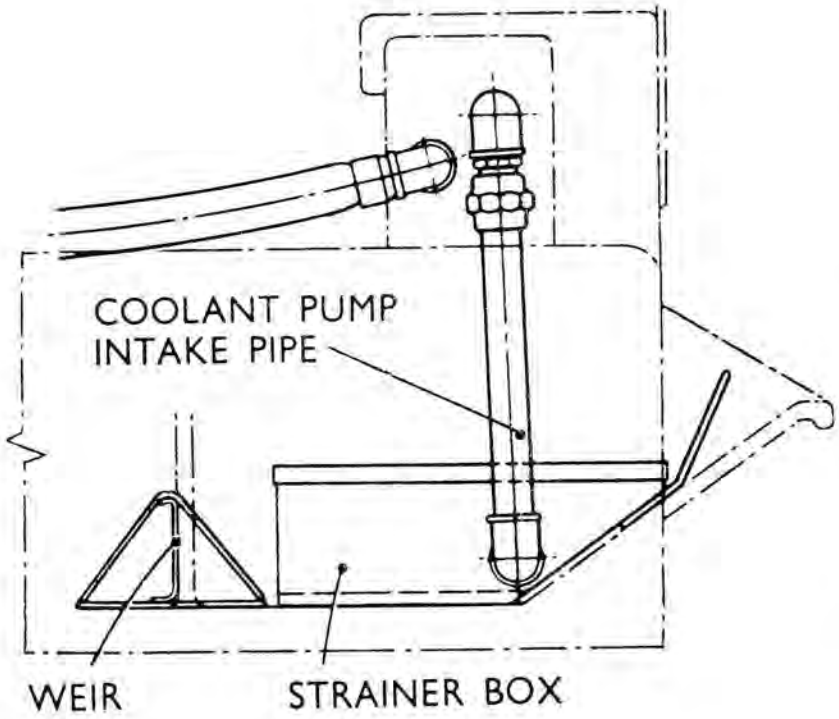


ALTERNATIVE SWITCH

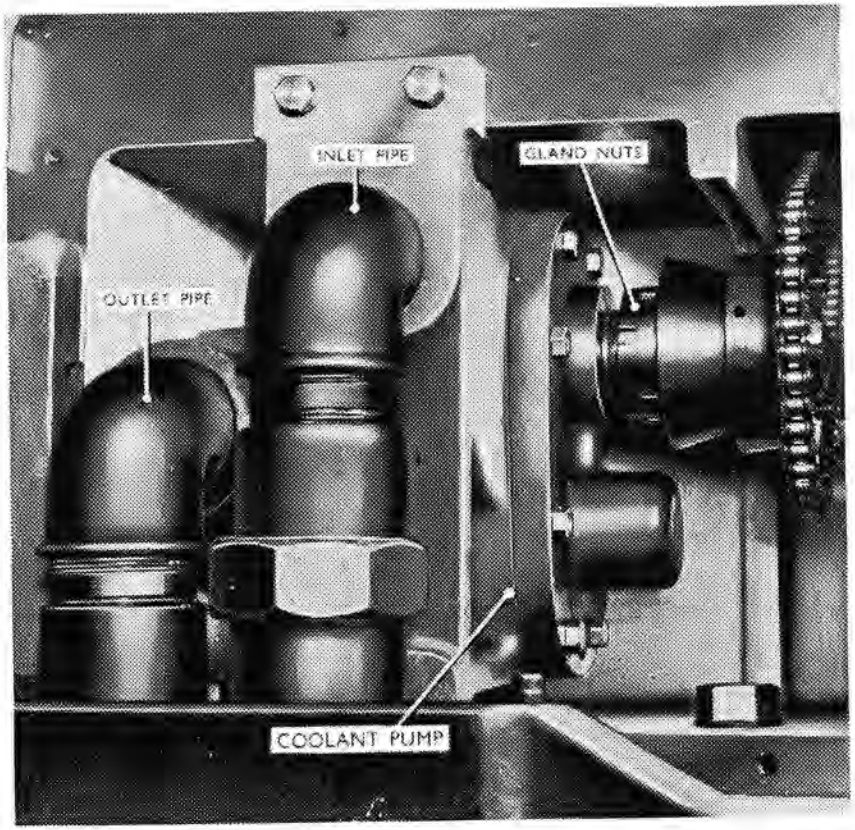
Setting Slipping Clutch Switch



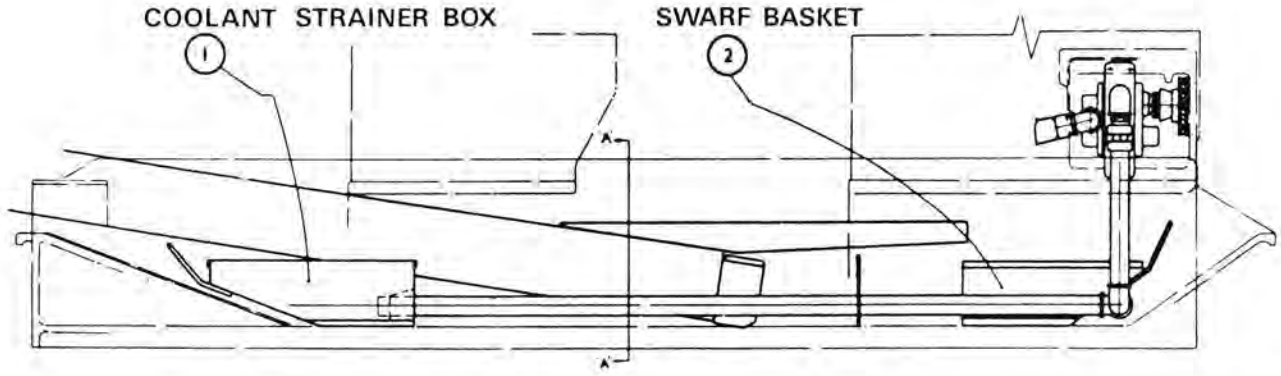
✳ SWITCHES FITTED TO SPECIAL ATTACHMENTS.

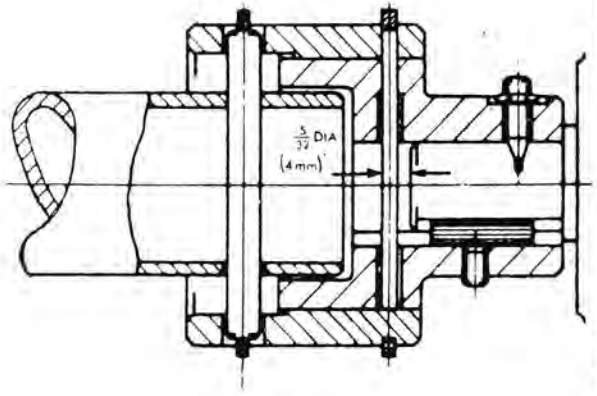


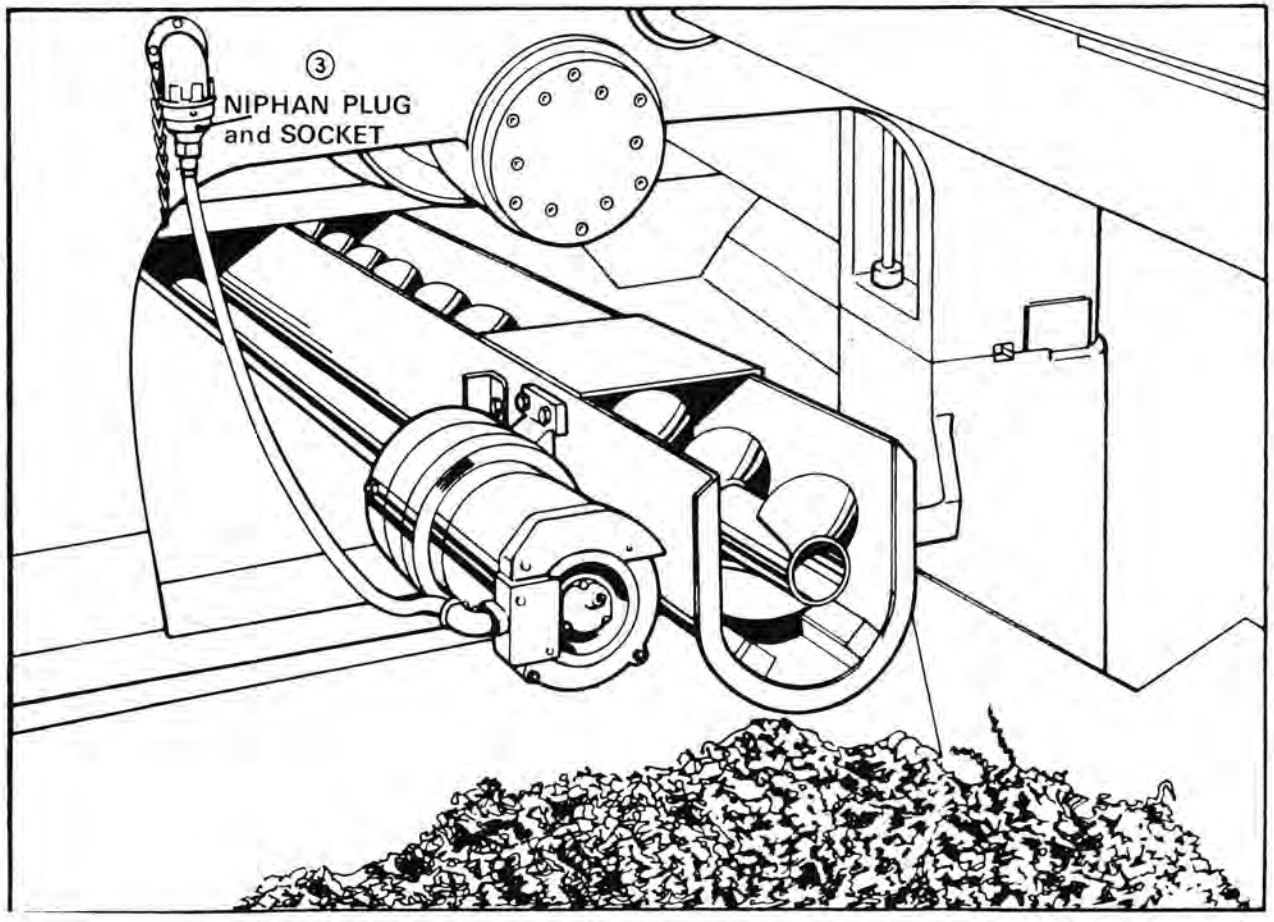
Coolant Pump



Coolant Pump



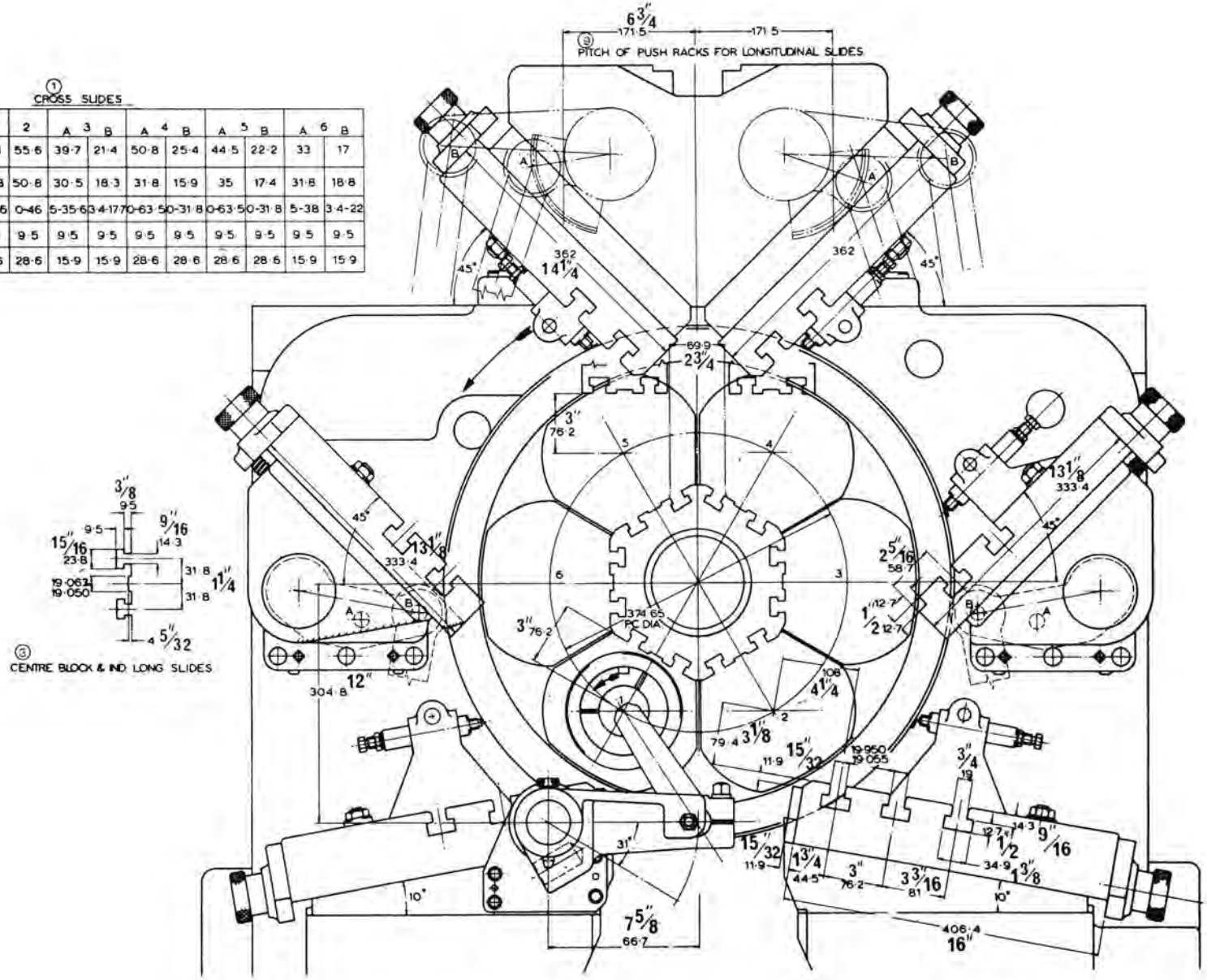




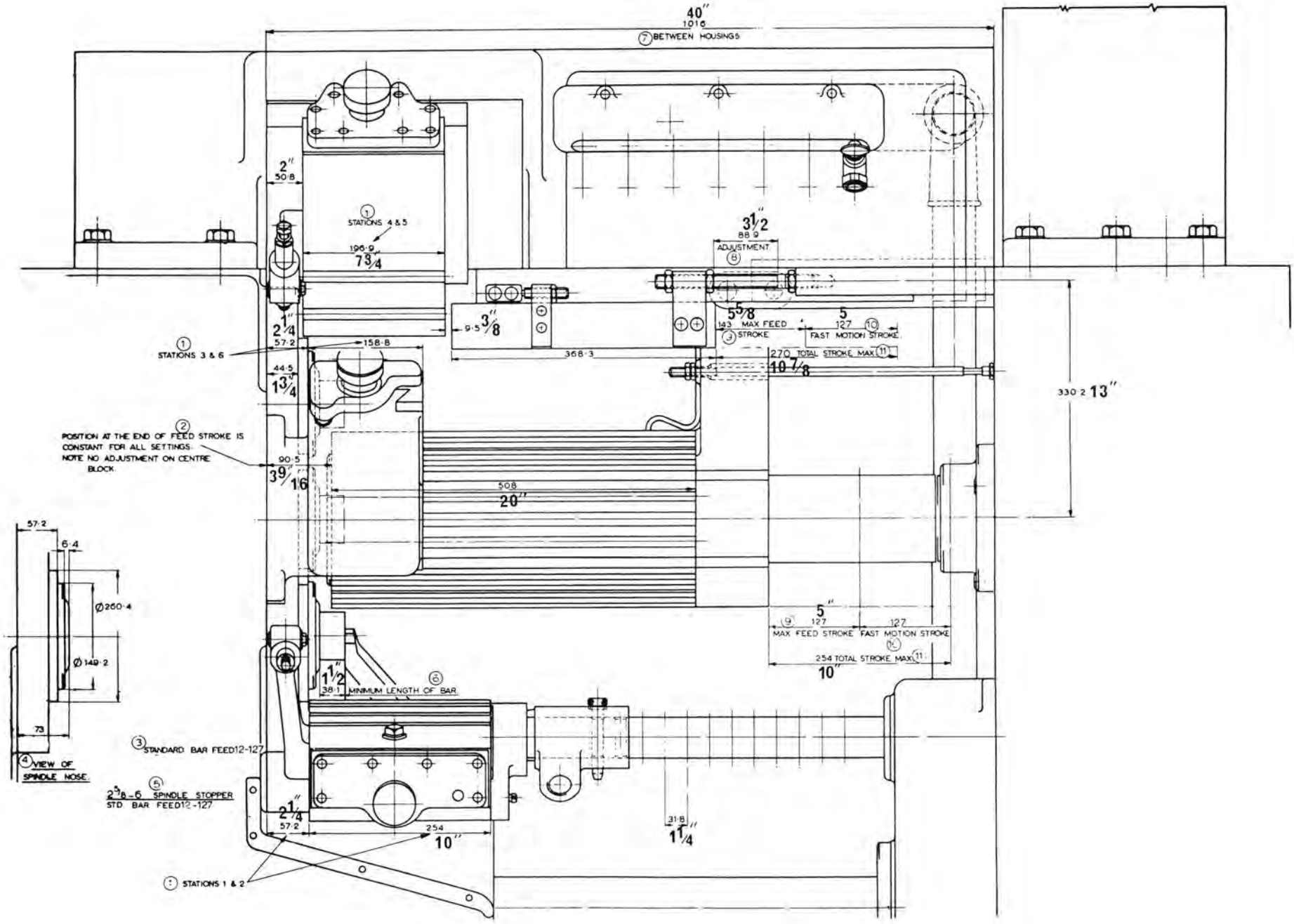
Swarf Conveyor

① CROSS SLIDES

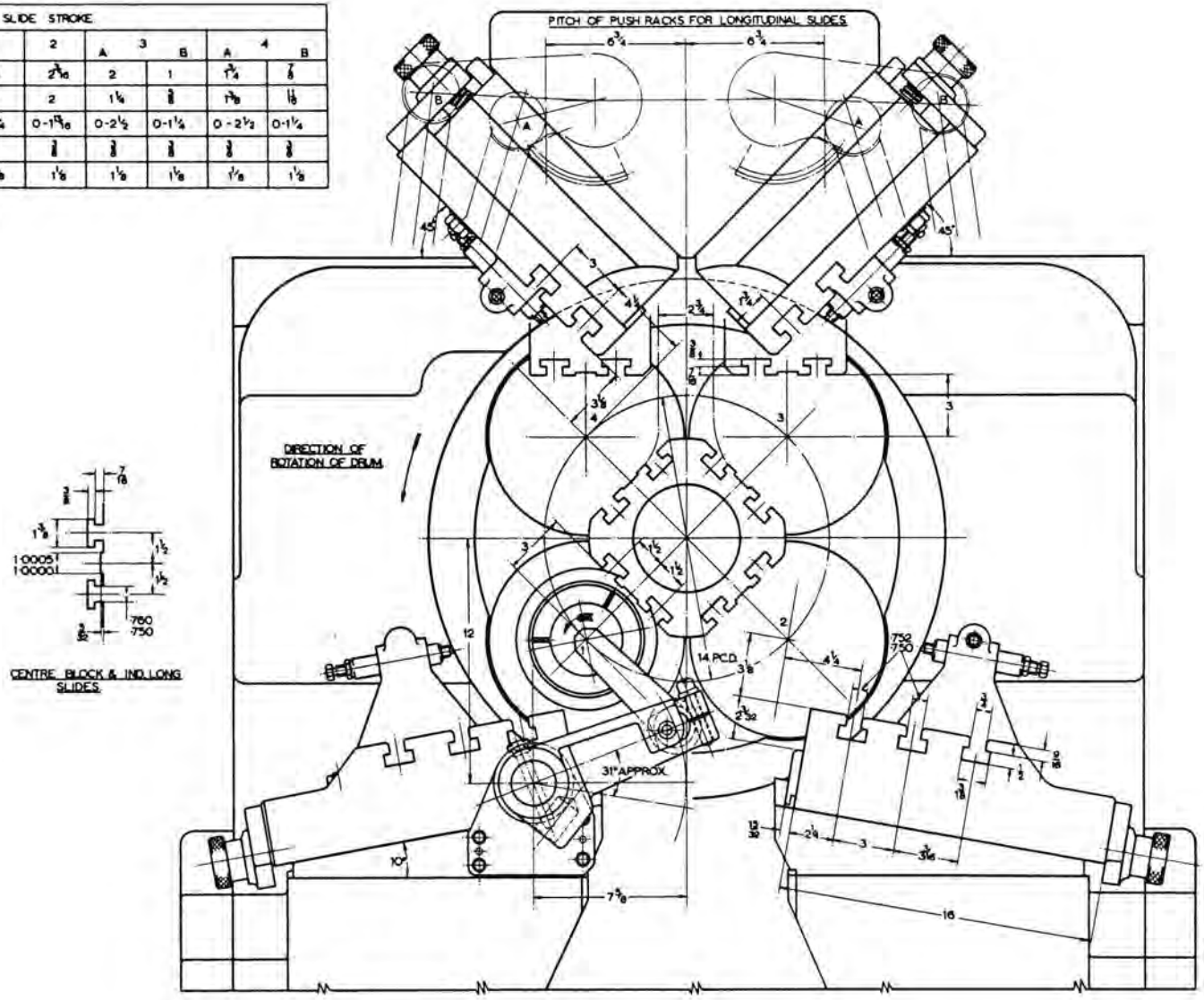
	STATION. →	1	2	A 3	B	A 4	B	A 5	B	A 6	B
③	APPROACH STROKE AT MIN. FEED.	41·3	55·6	39·7	21·4	50·8	25·4	44·5	22·2	33	17
④	APPROACH STROKE AT MAX. FEED.	50·8	50·8	30·5	18·3	31·8	15·9	35	17·4	31·8	18·8
⑤	FEED STROKE.	0-416	0-46	5-35·6	3·4-17	7 0-63·5	0-31·8	0-63·5	0-31·8	5-38	3·4-22
⑥	ADJUSTMENT FORWARD.	9·5	9·5	9·5	9·5	9·5	9·5	9·5	9·5	9·5	9·5
⑦	ADJUSTMENT BACKWARD.	28·6	28·6	15·9	15·9	28·6	28·6	28·6	28·6	15·9	15·9



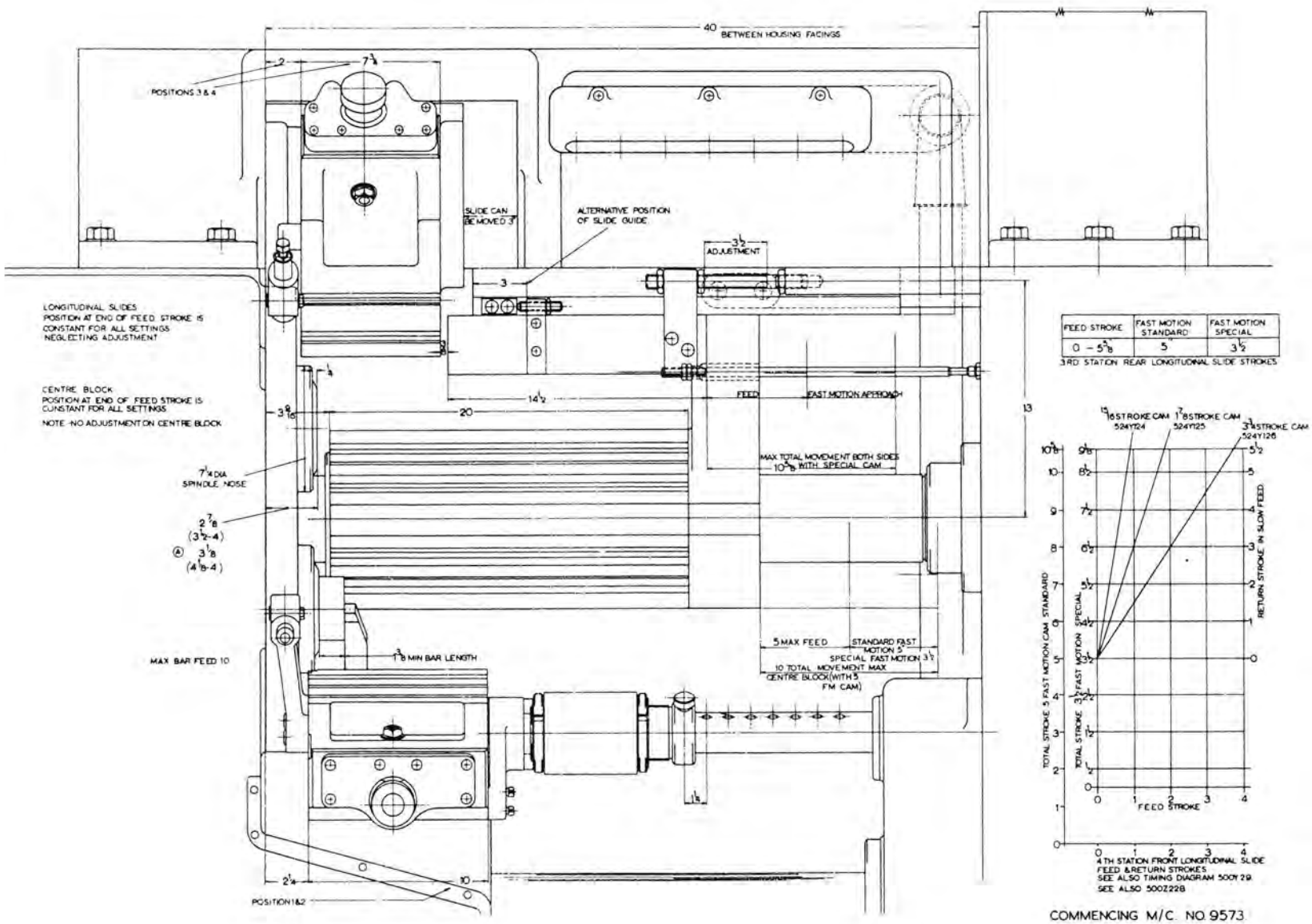
Capacity Diagram (2⅝"-6, 3¼"-6)


40"
1016
⑦ BETWEEN HOUSINGS
2"
50·8
① STATIONS 4 & 5
190·9
7 3/4
3 1/2
88·9
ADJUSTMENT ⑧
2 1/4
57·2
① STATIONS 3 & 6
158·8
9·5
3/8
368·3
5 5/8
143 MAX FEED ⑨ STROKE
5
127 ⑩ FAST MOTION STROKE
270 TOTAL STROKE MAX ⑪
10 7/8
330·2
13"
44·5
1 3/4
② POSITION AT THE END OF FEED STROKE IS CONSTANT FOR ALL SETTINGS. NOTE NO ADJUSTMENT ON CENTRE BLOCK
90·5
3 9/16
508
20"
57·2
6·4
Ø 260·4
Ø 149·2
73
④ VIEW OF SPINDLE NOSE
5"
⑨ 127 MAX FEED STROKE
127 ⑩ FAST MOTION STROKE
254 TOTAL STROKE MAX ⑪
10"
1 1/2
38·1
⑥ MINIMUM LENGTH OF BAR
③ STANDARD BAR FEED 12-127
2 3/8-6 ⑤ SPINDLE STOPPER
STD. BAR FEED 12-127
2 1/4
57·2
254
10"
31·8
1 1/4
① STATIONS 1 & 2

CROSS SLIDE STROKE						
STATION	1	2	3 A	3 B	4 A	4 B
APPROACH STROKE AT MIN FEED	1⅜	2 3/16	2	1	1¾	⅞
APPROACH STROKE AT MAX FEED	2	2	1¼	⅜	1⅜	1⅛
FEED STROKE.	0-1¾	0-1 9/16	0-2½	0-1¼	0-2½	0-1¼
ADJUSTMENT FORWARD	⅜	⅜	⅜	⅜	⅜	⅜
ADJUSTMENT BACKWARD	1⅛	1⅛	1⅛	1⅛	1⅛	1⅛



Capacity Diagram (3½"-4, 4⅛"-4)

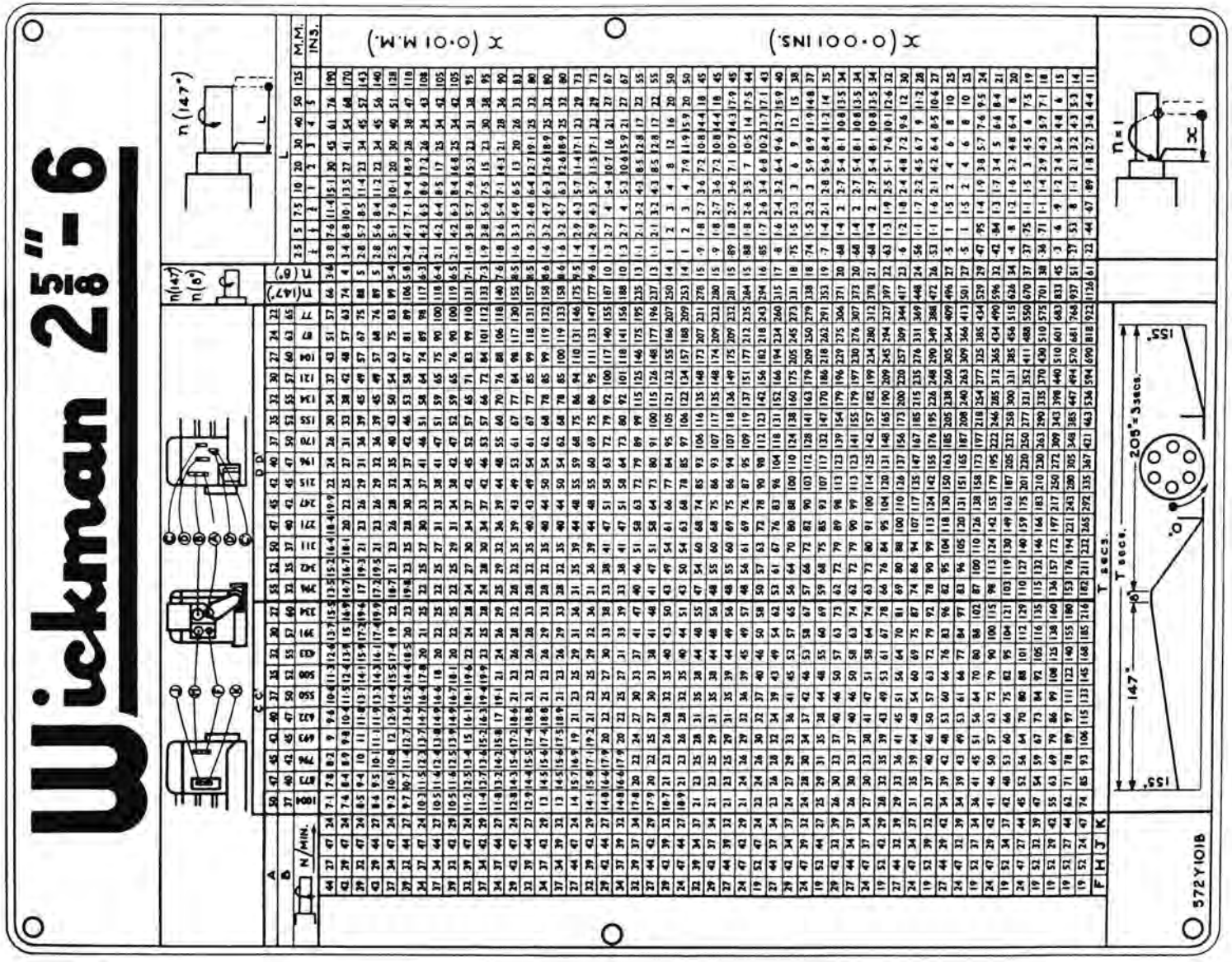


FEED STROKE	FAST MOTION STANDARD	FAST MOTION SPECIAL
0 – 5⅜	5	3½

3RD STATION REAR LONGITUDINAL SLIDE STROKES

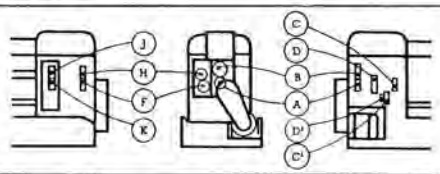
4TH STATION FRONT LONGITUDINAL SLIDE FEED & RETURN STROKES
SEE ALSO TIMING DIAGRAM 5007 29
SEE ALSO 5002228

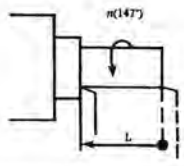
COMMENCING M/C. NO. 9573



NOTE: Highest Spindle Speed (1004 R.P.M.)
not available on 2⅝"-6S machines

Wickman 3¼"-6





A				CC¹									DD¹												n(147")	n(8")	L									
B				37	40	43	45	47	50	52	55	57	60	32	35	37	40	42	45	47	50	52	55	57	60	63	65			2·5	5	7·5	10	20	30	40	50	125	MM.
N/MIN.				1004	873	796	693	632	560	500	433	391	334	396	342	311	271	247	215	196	170	155	134	121	104	87	77			·25	·5	·75	1	2	3	4	5		INS.
44	27	47	24	8·3	8·9	9·4	10·1	10·7	11·7	12·5	13·8	14·8	16·6	14·7	16·3	17·5	19·5	21	24	25	29	31	35	39	44	52	58	66	3·6	3·8	7·6	11·4	15·1	30	45	61	76	190	
42	29	47	24	8·8	9·5	10	10·9	11·5	12·6	13·5	15	16·1	18·1	16	17·8	19·2	21	23	26	28	32	34	39	43	49	58	65	74	4	3·4	6·8	10·1	13·5	27	41	54	68	170	
39	32	47	24	9·7	10·5	11·1	12·1	12·9	14·3	15·3	17	18·4	21	18·2	20	22	25	27	30	33	37	40	46	51	58	69	77	88	5	2·8	5·7	8·5	11·4	23	34	45	57	143	
42	29	44	27	9·7	10·6	11·2	12·3	13	14·3	15·4	17·2	18·6	21	18·4	21	22	25	27	30	33	37	40	46	51	58	69	77	89	5	2·6	5·5	8·4	11·2	22	34	45	56	140	
37	34	47	24	10·3	11·3	12	13·1	14	15·5	16·6	18·5	20	23	19·9	22	24	27	29	33	36	41	44	51	56	64	75	85	99	5·4	2·5	5·1	7·6	10·1	20	30	40	51	128	
39	32	44	27	10·8	11·8	12·5	13·8	14·7	16·3	17·5	19·6	21	24	21	24	26	29	31	35	38	43	47	54	60	68	81	91	106	5·8	2·4	4·7	7·1	9·4	18·9	28	38	47	118	
34	37	47	24	11·5	12·6	13·4	14·8	15·9	17·6	19	21	23	26	23	26	28	31	34	39	42	47	52	59	65	75	89	99	117	6·3	2·1	4·3	6·5	8·6	17·2	26	34	43	108	
37	34	44	27	11·6	12·7	13·5	14·9	16	17·7	19	21	23	27	23	26	28	32	35	39	42	48	52	59	65	75	90	100	118	6·4	2·1	4·2	6·4	8·5	17	25	34	42	105	
39	32	42	29	11·6	12·7	13·6	15	16	17·8	19·2	21	23	27	23	26	28	32	35	39	43	48	52	59	66	76	90	100	119	6·5	2·1	4·2	6·3	8·4	16·8	25	34	42	105	
32	39	47	24	12·3	13·6	14·6	16	17·2	19·2	21	23	25	29	25	28	31	35	38	43	46	52	57	65	73	83	99	110	131	7·1	1·9	3·8	5·7	7·6	15·3	23	31	38	95	
37	34	42	29	12·5	13·8	14·7	16·3	17·5	19·4	21	24	26	29	25	29	31	35	38	43	47	53	59	66	74	84	101	112	133	7·3	1·9	3·8	5·6	7·5	15	23	30	38	95	
34	37	44	27	13	14·3	15·3	16·9	18·2	20	22	25	27	31	26	30	33	36	40	45	49	55	60	70	78	88	106	118	140	7·6	1·8	3·6	5·4	7·1	14·3	21	28	36	90	
29	42	47	24	13·9	15·4	16·5	18·3	19·6	22	24	27	29	34	29	33	36	40	44	50	53	61	67	77	86	98	117	130	155	8·5	1·6	3·3	4·9	6·5	13	20	26	33	83	
32	39	44	27	14	15·5	16·6	18·5	19·8	22	24	27	29	34	29	33	36	41	44	50	54	61	67	77	87	99	118	131	157	8·5	1·6	3·2	4·8	6·4	12·7	19·1	25	32	80	
34	37	42	29	14·1	15·6	16·7	18·5	19·9	22	24	27	30	34	29	33	36	41	45	50	54	62	68	78	87	99	119	132	158	8·6	1·6	3·2	4·7	6·3	12·6	18·9	25	32	80	
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24	47	39	32	25	29	31	35	38	43	47	53	58	67	57	66	72	82	90	103	112	128	141	163	181	209	250	279	338	18	·74	1·5	2·2	3	5·9	8·9	11·9	14·8	37	
19	52	44	27	26	30	32	36	39	45	49	55	60	71	61	68	75	85	95	107	117	135	147	170	189	218	260	291	353	19	7	1·4	2·1	2·8	5·6	8·4	11·2	14	35	
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19	52	34	37	44	49	53	60	66	75	82	95	104	123	103	119	130	149	165	189	205	236	260	300	332	385	457	515	625	34	·4	·8	1·2	1·6	3·2	4·8	6·4	8	20	
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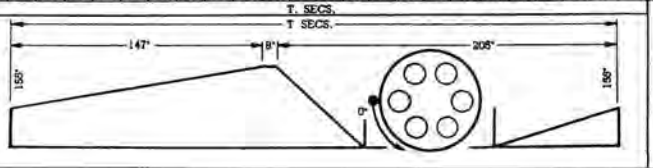
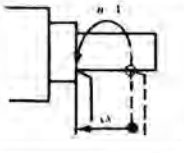
19	52	32	39	48	54	59	67	73	84	92	107	118	137	115	134	146	168	183	210	230	264	290	335	372	430	512	575	701	38	36	71	1·1	1·4	2·9	4·3	5·7	7·1	18	
19	52	29	42	57	63	69	79	86	99	108	125	138	162	136	157	174	197	217	250	272	313	343	398	441	510	607	684	833	45	3	6	9	1·2	2·4	3·6	4·8	6	15	
19	52	27	44	63	71	78	89	97	111	122	140	155	182	153	178	194	223	243	280	307	352	387	447	496	574	682	768	937	51	27	53	8	1·1	2·1	3·2	4·3	5·3	14	
19	52	24	47	74	85	93	106	117	133	147	168	185	216	184	211	232	267	292	335	367	422	464	536	595	690	819	924	1126	61	22	44	67	89	1·8	2·7	3·6	4·4	11	
F	H	J	K	T. SECS.																															

x(0·01 MM.)

x(0·001 INS.)





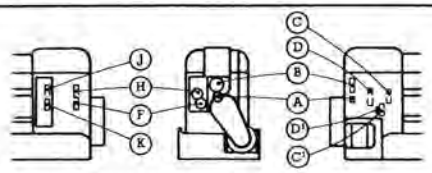
572Y148

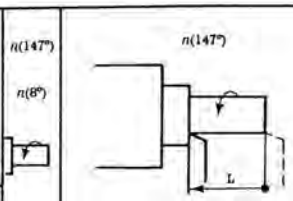
WICKMAN
2¼"-6, 3¼"-4, 4¼"-4, 4½"-6S
Operator's Handbook

Speed and Feed Chart (3¼"-6)

SHEET 4.44

Wickman 3½"-4





				CC¹										DD¹												n(147°)	n(8°)
A				50	47	45	42	40	37	35	32	30	27	55	52	50	47	45	42	40	37	35	32	30	27	24	22		
B				37	40	42	45	47	50	52	55	57	60	32	35	37	40	42	45	47	50	52	55	57	60	63	65		
N/MIN.				786	684	623	543	495	431	392	339	306	262	309	268	244	212	193	168	153	133	121	105	94	81	68	60		
44	27	47	24	8·3	8·9	9·4	10·1	10·7	11·7	12·5	13·8	14·8	16·6	14·7	16·3	17·5	19·5	21	24	25	29	31	38	39	44	52	58	52	3
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37	34	44	27	11·6	12·7	13·5	14·9	16	17·7	19	21	23	27	23	26	28	32	35	39	42	48	52	59	65	75	90	100	93	5
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F	H	J	K	T secs.																							

L

MM.	2·5	5	7·5	10	20	30	40	50	125
INS.	1/10	1/5	3/10	1	2	3	4	5	
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	4·3	8·6	13	17	34	52	69	86	215
	3·6	7·2	11	14	29	43	58	72	180
	3·6	7·2	11	14	29	43	58	72	180
	3·2	6·5	9·7	13	26	39	52	65	163
	3	6	9	12	24	36	48	60	150
	2·7	5·4	8·2	11	21	33	43	54	135
	2·7	5·4	8·2	11	21	33	43	54	135
	2·7	5·4	8·2	11	21	33	43	54	135
	2·4	4·9	7·3	10	19	29	39	49	123
	2·4	4·9	7·3	10	19	29	39	49	123
	2·3	4·5	6·8	9	18	27	36	45	113
	2	4·1	6·1	8	16	24	33	41	103
	2	4·1	6·1	8	16	24	33	41	103
	2	4·1	6·1	8	16	24	33	41	103
	2	4·1	6·1	8	16	24	33	41	103
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	1·8	3·6	5·5	7·3	15	23	29	36	90
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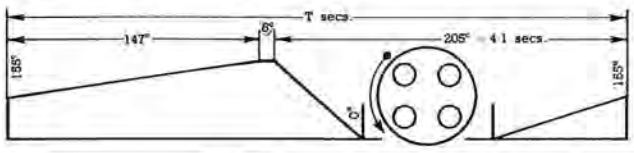
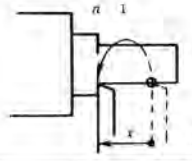
	1·7	3·4	5·1	6·8	14	20	27	34	85
	1·4	2·7	4·1	5·4	11	16	22	27	68
	1·4	2·7	4·1	5·4	11	16	22	27	68
	1·3	2·5	3·8	5·1	10	15	20	25	63
	1·3	2·5	3·8	5·1	10	15	20	25	63
	1·1	2·3	3·4	4·5	9·1	14	18	23	58
	1·1	2·3	3·4	4·5	9·1	14	18	23	58
	1·1	2·3	3·4	4·5	9·1	14	18	23	58
	1·1	2·3	3·4	4·5	9·1	14	18	23	58
	1·1	2·2	3·3	4·3	8·7	13	17	22	55
	1	2	3	4·1	8·1	12	16	20	50
	1	1·9	2·9	3·9	7·7	12	15	19	48
	9	1·9	2·8	3·8	7·5	11	15	19	48
	9	1·8	2·7	3·6	7·2	11	14	18	45
	9	1·7	2·6	3·4	6·8	10	14	17	43
	9	1·7	2·6	3·4	6·8	10	14	17	43
	8	1·6	2·4	3·2	6·4	9·6	13	16	40
	8	1·5	2·3	3·1	6·1	9·2	12	15	38
	7	1·4	2·1	2·9	5·7	8·6	11	14	35
	7	1·4	2	2·7	5·4	8·1	11	14	35
	6	1·3	1·9	2·6	5·1	7·7	10	13	33
	6	1·3	1·9	2·6	5·1	7·7	10	13	33
	6	1·2	1·8	2·4	4·8	7·2	9·6	12	30
	5	1·1	1·7	2·1	4·3	6·4	8·6	11	28
	5	1	1·5	2	4·1	6·1	8·2	10	25
	5	1	1·4	1·9	3·8	5·7	7·6	9·5	24
	5	9	1·4	1·8	3·7	5·5	7·3	9·1	23
	4	8	1·2	1·5	3·1	4·6	6·1	7·8	20
	3	7	1	1·4	2·7	4·1	5·4	6·8	17
	3	6	9	1·1	2·3	3·4	4·5	5·7	15

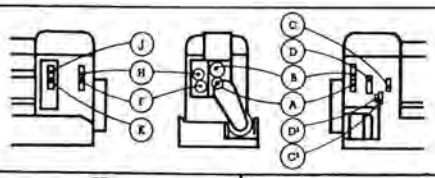
x(0·01 MM.)
x(0·001 INS.)

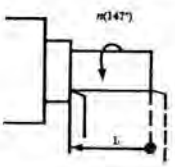




572Y102B

Wickman 4 1/8"-4





				CC¹									DD¹												n(147°)	n(8°)	L										
A				50	47	45	42	40	37	35	32	30	27	55	52	50	47	45	42	40	37	35	32	30	27	24	22			2·5	5	7·5	10	20	30	40	50	125	MM.
B				37	40	42	45	47	50	52	55	57	60	32	35	37	40	42	45	47	50	52	55	57	60	62	65			·25	50	·75	1	2	3	4	5		INS.
N/MIN.				736	694	663	643	605	631	592	539	506	562	509	598	244	212	183	168	153	133	121	105	94	81	68	60											
44	27	47	24	11·9	12·8	13·4	14·5	15·4	16·6	17·9	19·7	21	24	21	24	25	28	30	34	37	41	46	51	55	64	74	83	73	4	3·4	6·8	10·1	13·5	27	41	54	68	170	
42	29	47	24	12·6	13·6	14·4	15·6	16·5	18·1	19·4	22	23	26	23	26	28	31	33	37	40	46	49	56	61	71	83	92	83	5	3	6	9	12	24	36	48	60	150	
39	32	47	24	13·8	15·0	15·9	17·4	18·5	20	22	24	26	30	26	29	32	35	38	43	47	53	57	65	72	83	97	108	98	5	2·5	5·1	7·6	10	20	30	40	51	128	
42	29	44	27	14·0	15·2	16·1	17·6	18·7	21	22	25	27	30	26	30	32	36	39	43	47	53	58	66	72	84	98	109	98	5	2·5	5·1	7·6	10	20	30	40	51	128	
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39	32	44	27	15·5	16·9	18·0	19·7	21	23	25	28	30	35	30	34	37	41	45	51	55	62	68	77	85	98	115	129	118	6	2·1	4·2	6·4	8·5	17	25	34	42	106	
34	37	47	24	16·5	18·1	19·2	21	23	25	27	30	33	37	33	37	40	46	48	56	60	68	74	85	93	108	127	141	130	7	1·9	3·8	5·7	7·6	15	23	31	38	95	
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39	32	42	29	16·7	18·2	19·5	21	23	26	28	31	34	38	33	37	40	46	50	56	61	70	75	87	95	110	130	144	133	7	1·9	3·8	5·7	7·6	15	23	31	38	95	
32	39	47	24	17·7	19·5	21	23	25	28	30	33	36	41	36	40	44	50	54	61	67	75	83	94	104	120	141	158	146	8	1·7	3·4	5·1	6·8	14	20	27	34	85	
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19	52	44	27	38	43	48	53	57	64	70	80	84	101	88	100	106	124	135	155	169	194	212	245	269	315	370	416	393	21	6	1·3	1·9	2·5	5·1	7·6	10	13	32	
29	42	32	39	40	44	48	54	58	67	73	84	88	107	90	104	114	130	142	162	178	204	222	256	283	330	389	437	413	23	6	1·2	1·8	2·4	4·8	7·2	9·6	12	30	
27	44	34	37	40	44	48	54	60	67	74	84	93	107	91	104	114	131	142	163	178	204	223	258	285	332	390	438	415	23	6	1·2	1·8	2·4	4·8	7·2	9·6	12	30	
24	47	37	34	40	46	48	56	60	68	74	86	93	108	91	105	115	132	145	165	181	206	226	262	289	336	396	445	421	23	6	1·2	1·8	2·3	4·7	7	9·4	11	29	
19	52	42	29	41	47	51	58	63	71	78	90	94	114	98	111	121	140	152	174	189	216	238	275	303	363	416	467	442	24	6	1·1	1·7	2·2	4·5	6·7	9	11	28	
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27	44	29	42	51	57	63	71	77	86	96	110	115	141	116	137	151	172	188	215	235	269	296	342	377	440	518	582	552	30	5	9	1·3	1·8	3·6	5·4	7·2	9	23	
24	47	32	39	51	56	63	71	78	86	97	111	121	142	120	138	152	174	189	218	238	272	299	344	380	444	524	589	556	30	4	9	1·3	1·8	3·6	5·4	7·2	9	22	
19	52	37	34	54	61	66	75	81	93	101	117	122	149	124	145	159	182	199	229	250	286	315	363	401	468	551	621	588	32	4	9	1·2	1·7	3·4	5·1	6·8	8·5	21	
24	47	29	42	60	68	74	84	91	104	114	131	128	168	127	164	179	205	225	258	282	323	354	408	451	527	621	699	663	37	4	8	1·1	1·5	3	4·5	6	7·5	19	
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24	47	27	44	67	76	83	94	102	117	128	147	151	188	157	184	201	231	252	289	316	363	397	460	507	592	699	786	746	40	3	7	1	1·4	2·7	4·1	5·4	6·8	17	
19	52	32	39	70	78	88	97	107	121	132	152	161	196	168	192	209	241	263	302	330	379	416	480	528	619	730	820	780	42	3	6	1	1·3	2·6	3·8	5·1	6·4	16	
19	52	29	42	81	93	101	115	125	144	157	181	168	232	195	226	248	285	312	357	391	448	492	569	628	734	868	973	927	51	3	5	8	1·1	2·1	3·2	4·3	5·3	14	
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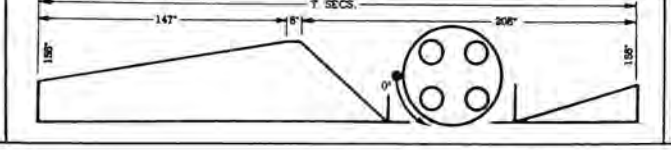
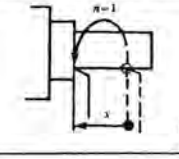
F	H	J	K																																			





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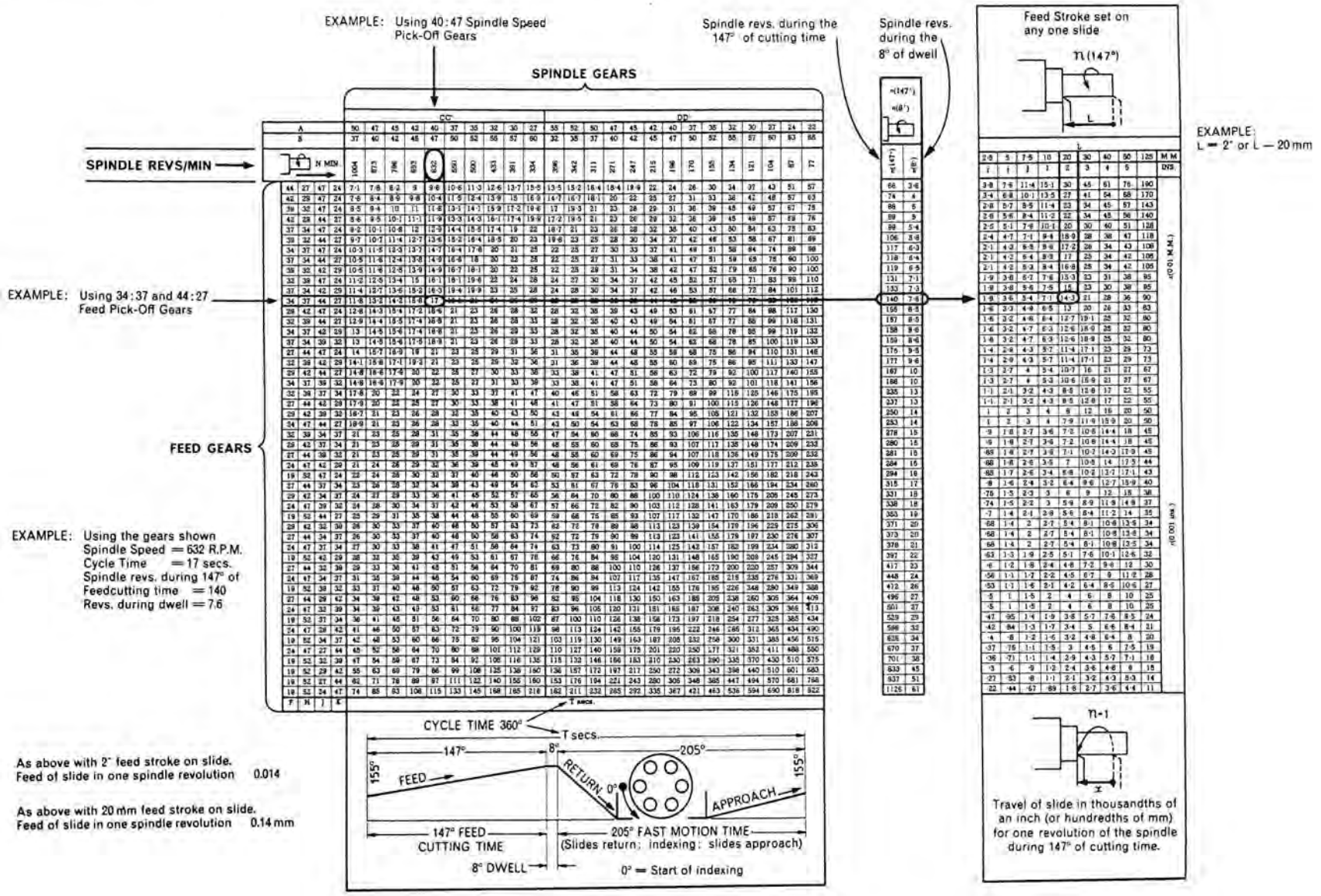
Speed and Feed Chart ($4\frac{1}{8}$"-4)

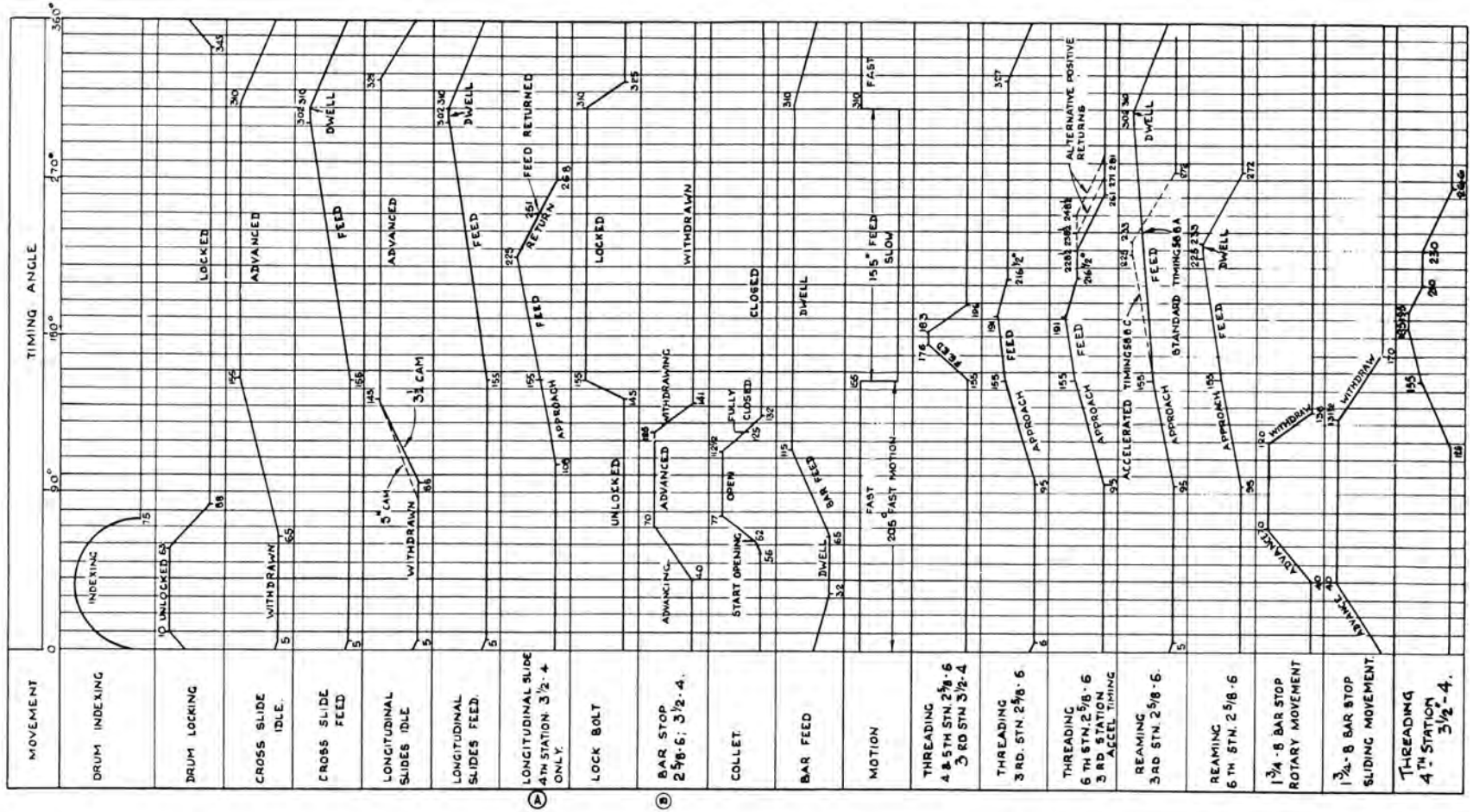
SHEET 4.46



As above with 2" feed stroke on slide.
Feed of slide in one spindle revolution 0.014

As above with 20 mm feed stroke on slide.
Feed of slide in one spindle revolution 0.14 mm

Example of Use of Speed and Feed Chart



Timing Diagram

N/MIN. ↓ DIA. INS.	786	684	623	543	495	431	392	339	306	262	309	268	244	212	193	168	153	133	121	105	94	81	68	60
¼	51	45	41	36	32	28	26	22	20	17	20	18	16	14	13	11	10	8·7	7·9	6·9	6·0	5·3	4·5	3·9
½	103	90	82	71	65	56	51	44	40	34	41	35	32	28	25	22	20	17	16	14	18	11	8·9	7·9
¾	154	134	122	107	97	85	77	67	60	51	61	53	48	42	38	33	30	26	24	21	19	16	13	12
1	206	179	163	142	130	113	103	89	80	69	81	70	64	56	51	44	40	35	32	28	25	21	18	16
1¼	257	224	204	178	162	141	128	111	100	86	101	88	80	69	63	55	50	44	40	34	31	27	22	20
1½	309	269	245	213	194	169	154	133	120	103	121	105	96	83	76	66	60	52	48	41	37	32	27	24
1¾	360	313	285	249	227	198	180	155	140	120	142	123	112	97	88	77	70	61	55	48	43	37	31	28
2	412	358	326	284	259	226	205	178	160	137	162	140	128	111	101	88	80	70	63	55	49	42	36	31
2¼	463	403	367	320	292	254	231	200	180	154	182	158	144	125	114	99	90	78	71	62	55	48	40	35
2½	514	448	408	355	324	282	257	222	200	172	202	175	160	139	126	110	100	87	79	69	62	53	45	39
2¾	566	493	449	391	356	310	282	244	220	189	223	193	176	153	139	121	110	96	87	76	68	58	49	43
3	617	537	489	427	389	339	308	266	240	206	243	211	192	166	152	132	120	105	95	83	74	64	53	47
3½	720	627	571	498	454	395	359	311	280	240	283	246	224	194	177	154	140	122	111	96	86	74	62	55
4	823	716	652	569	518	451	411	355	320	274	324	281	256	222	202	176	160	139	127	110	98	85	71	63

CUTTING SPEED FT/MIN.

DIA. MM.	5	10	15	20	30	40	50	60	70	80	90	100
5	12·4	10·7	9·8	8·5	7·8	6·8	6·2	5·3	4·81	4·12	4·85	4·21	3·83	3·33	3·03	2·64	2·40	2·09	1·90	1·65	1·48	1·27	1·07	·94
10	24·7	21·5	19·6	17·1	15·6	13·5	12·3	10·7	9·6	8·2	9·7	8·4	7·7	6·7	6·1	5·3	4·81	4·18	3·80	3·30	2·95	2·55	2·14	1·89
15	37	32	29	25·6	23·3	20·3	18·5	16·0	14·4	12·4	14·6	12·6	11·5	10·0	9·1	7·9	7·2	6·3	5·7	4·95	4·43	3·82	3·20	2·83
20	49	43	39	34	31	27·1	24·6	21·3	19·2	16·5	19·4	16·8	15·3	13·3	12·1	10·6	9·6	8·4	7·6	6·6	5·9	5·1	4·27	3·77
30	74	65	59	51	47	41	37	32	28·8	24·7	29·1	25·3	23·0	20·0	18·2	15·8	14·4	12·5	11·4	9·9	8·9	7·6	6·1	5·7
40	99	86	78	68	62	54	49	43	39	33	39	34	31	26·6	24·3	21·1	19·2	16·7	15·2	13·2	11·8	10·2	8·6	7·5
50	124	107	98	85	78	68	62	53	48	41	49	42	38	33	30	26·4	24·0	20·9	19·0	16·5	14·8	12·7	10·7	9·4
60	148	129	117	102	93	81	74	64	58	49	58	51	46	40	36	32	28·8	25·1	22·8	19·8	17·7	15·3	12·8	11·3
70	173	150	137	119	109	95	86	75	67	58	68	59	54	47	42	37	34	29·3	26·6	23·1	20·7	17·8	15·0	13·2
80	198	172	157	137	124	108	99	85	77	66	78	67	61	53	49	42	39	33	30	26·4	23·6	20·4	17·1	15·1
90	222	193	176	154	140	122	111	96	87	74	87	76	69	60	55	48	43	38	34	29·7	26·6	22·9	19·2	17·0
100	247	215	196	171	156	135	123	107	96	82	97	84	77	67	61	53	48	42	38	33	29·5	25·5	21·4	18·9

CUTTING SPEED METRES/MIN.

Cutting Speeds Chart 3½"-4, 4⅛"-4

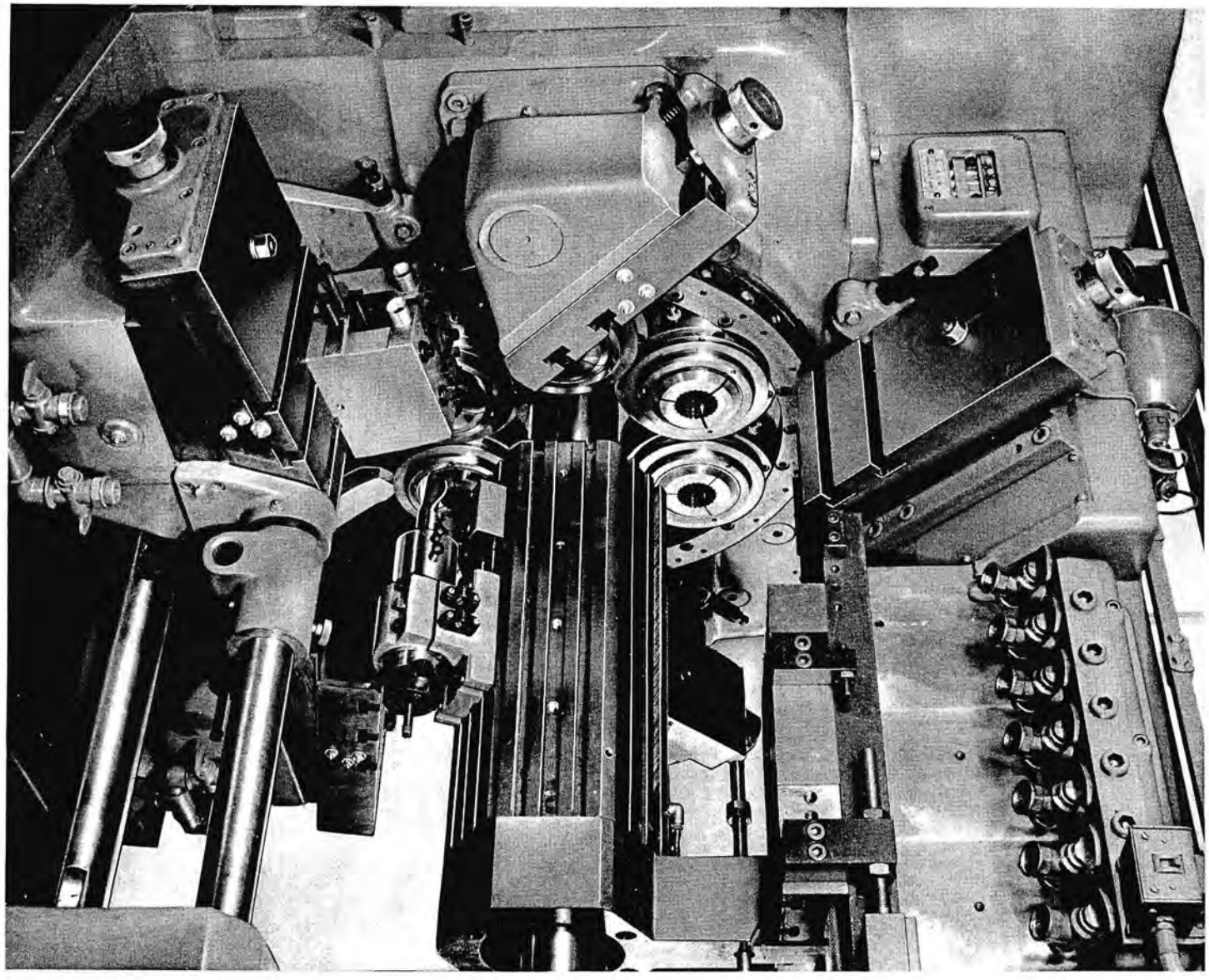
DIA. INS. \ N/MIN.	1004	873	796	693	632	550	500	433	391	334	396	342	311	271	247	215	196	170	155	134	121	104	87	77
¼	66	57	52	45	41	36	33	28	25	21	26	22	20	18	16	14	12	11	10	8·8	7·9	6·8	5·7	5·0
½	131	114	104	90	83	72	65	57	51	44	52	45	41	35	32	28	26	22	20	18	16	14	11	10
¾	197	171	156	136	124	108	98	85	77	66	78	67	61	53	48	42	38	33	30	26	24	20	17	15
1	263	229	208	181	165	144	131	113	102	87	104	90	81	71	65	56	51	44	41	35	32	27	23	20
1¼	329	286	260	227	207	180	164	142	128	109	130	112	102	89	81	70	64	56	51	44	40	34	28	25
1½	394	343	313	272	248	216	196	170	154	131	156	134	122	106	97	84	77	67	61	53	48	41	34	30
1¾	460	400	365	317	290	252	229	198	179	153	181	157	142	124	113	99	90	78	71	61	55	48	40	35
2	526	457	417	363	331	288	262	227	205	175	207	179	163	142	129	113	103	89	81	70	63	54	46	40
2¼	591	514	469	408	372	324	295	255	230	197	233	201	183	160	145	127	115	100	91	79	71	61	51	45
2½	657	571	521	454	414	360	327	283	256	219	259	224	204	177	162	141	128	111	101	88	79	68	57	50
2¾	723	629	573	499	455	396	360	312	282	240	285	246	224	195	178	155	141	122	112	96	87	75	63	55
3	789	686	625	544	496	432	393	340	307	262	311	269	244	213	194	169	154	134	122	105	95	82	68	60
3¼	854	743	677	590	538	468	425	368	333	284	337	291	265	231	210	183	167	145	132	114	103	88	74	66

CUTTING SPEED FT/MIN.

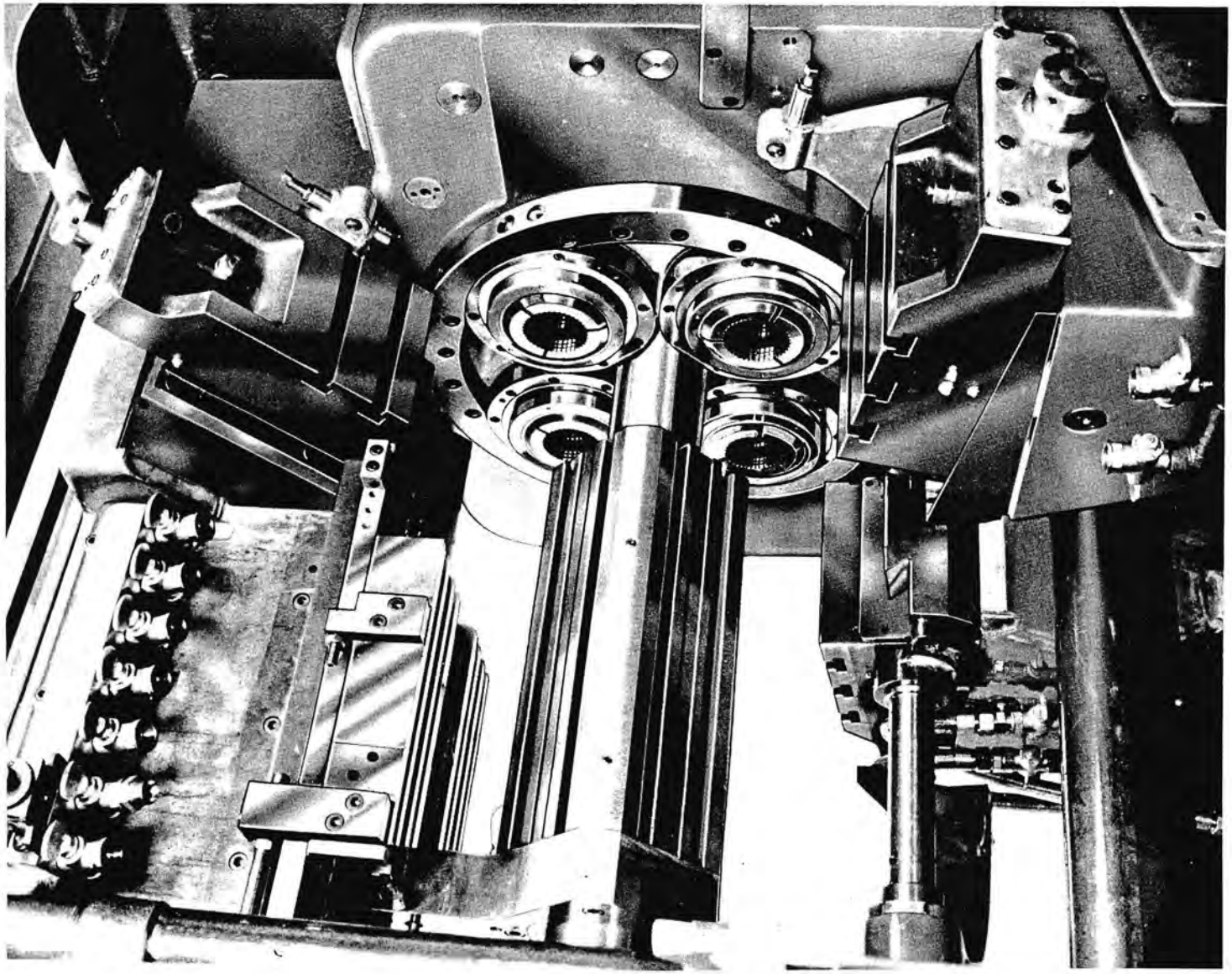
DIA. MM																								
5	15·8	13·7	12·5	10·9	9·9	8·6	7·9	6·8	6·1	5·2	6·2	5·4	4·89	4·26	3·88	3·38	3·08	2·67	2·43	2·10	1·90	1·63	1·37	1·21
10	32	27·4	25·0	21·8	19·9	17·3	15·7	13·6	12·3	10·5	12·4	10·7	9·8	8·5	7·8	6·8	6·2	5·3	4·87	4·21	3·80	3·27	2·73	2·42
15	47	41	38	33	29·8	25·9	23·6	20·4	18·4	15·7	18·7	16·1	14·7	12·8	11·6	10·1	9·2	8·0	7·3	6·3	5·7	4·90	4·10	3·63
20	63	55	50	44	40	35	31	27·2	24·6	21·0	24·9	21·5	19·5	17·0	15·5	13·5	12·3	10·7	9·7	8·4	7·6	6·5	5·5	4·84
30	95	82	75	65	60	52	47	41	37	31	37	32	29·3	25·5	23·3	20·3	18·5	16·0	14·6	12·6	11·4	9·8	8·2	7·3
40	126	110	100	87	79	69	63	54	49	42	50	43	39	34	31	27·0	24·6	21·4	19·5	16·8	15·2	13·1	10·9	9·7
50	158	137	125	109	99	86	79	68	61	52	62	54	49	43	39	34	31	26·7	24·3	21·0	19·0	16·3	13·7	12·1
60	189	165	150	131	119	104	94	82	74	63	75	64	59	51	47	41	37	32	29·2	25·3	22·8	19·6	16·4	14·5
70	221	192	175	152	139	121	110	95	86	73	87	75	68	60	54	47	43	37	34	29·5	26·6	22·9	19·1	16·9
80	252	219	200	174	159	138	126	109	98	84	100	86	78	68	62	54	49	43	39	34	30	26·1	21·9	19·4

CUTTING SPEED METRES/MIN.

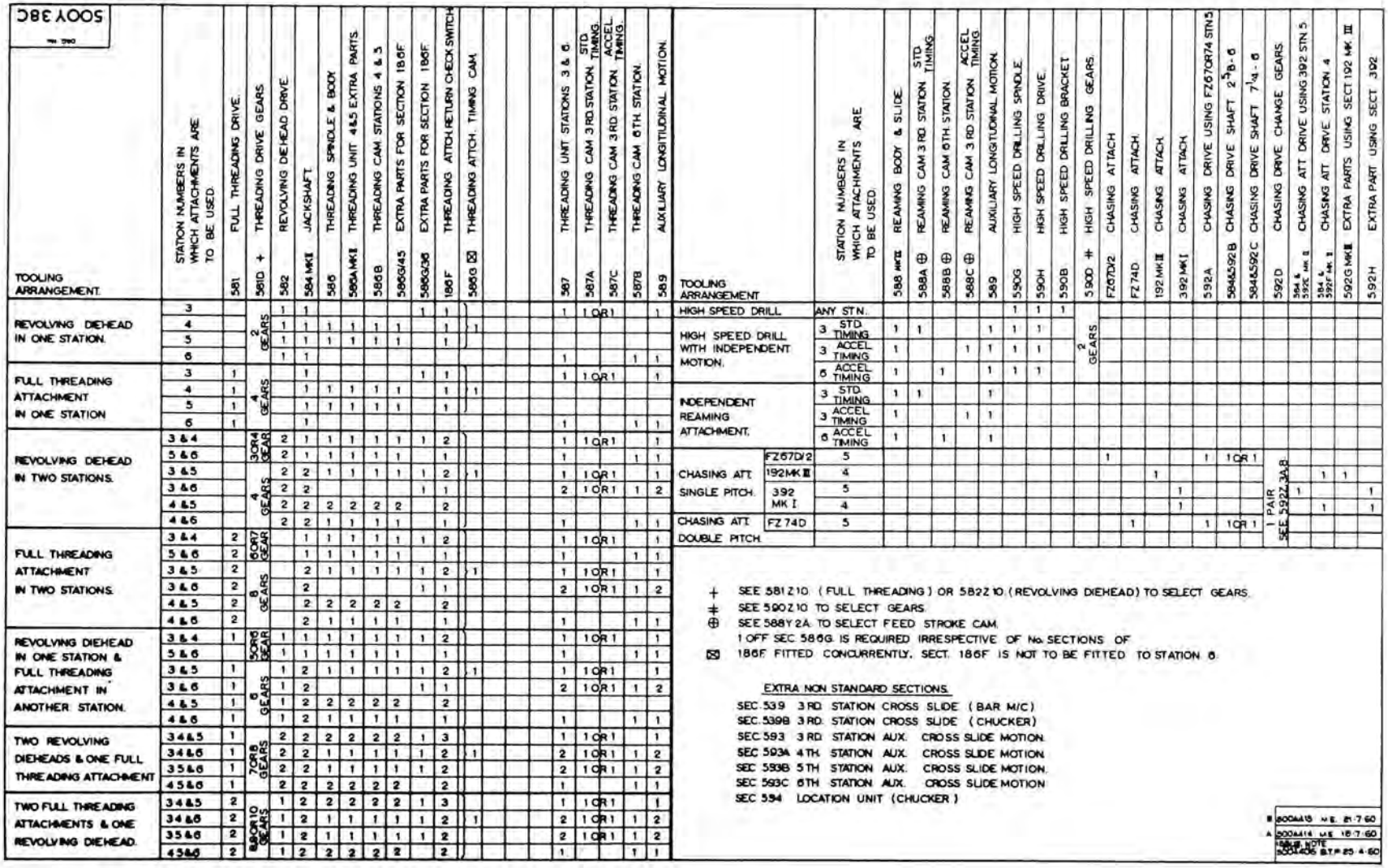
ATTACHMENT ILLUSTRATIONS



Tooling Area (2⅝"-6)

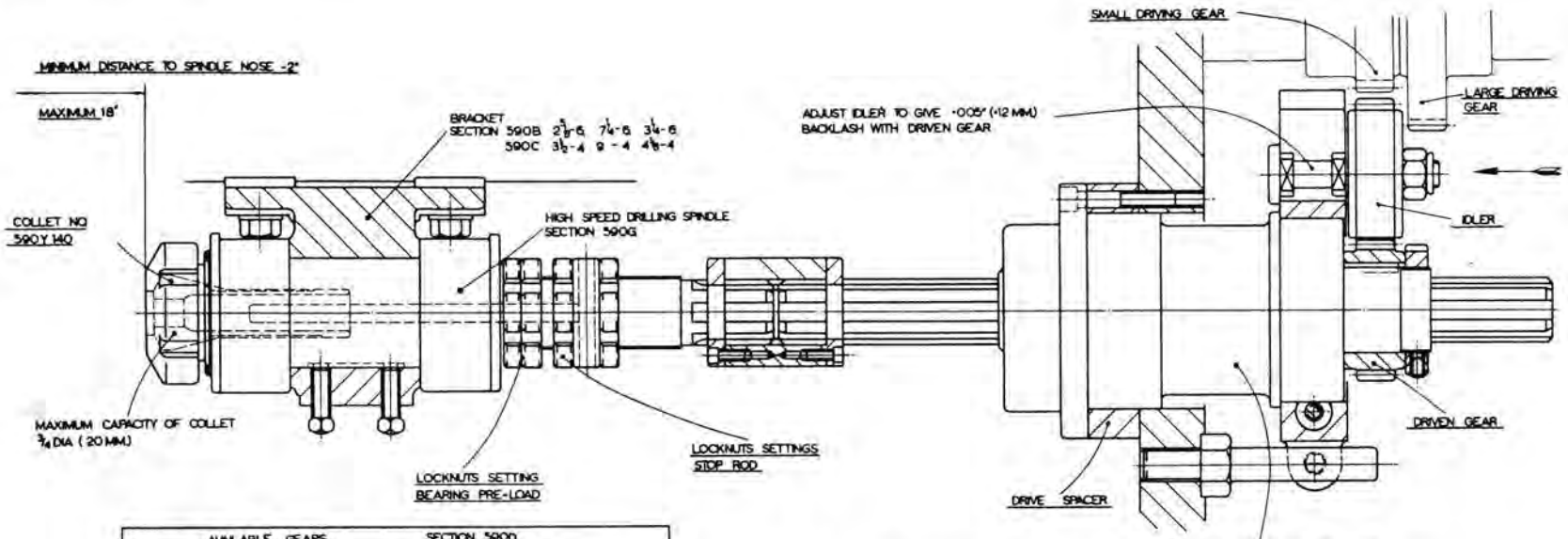


Tooling Area (3½"-4)


TOOLING ARRANGEMENT
STATION NUMBERS IN WHICH ATTACHMENTS ARE TO BE USED.
581 FULL THREADING DRIVE.
581D + THREADING DRIVE GEARS.
582 REVOLVING DIEHEAD DRIVE.
584 MK II JACKSHAFT.
585 THREADING SPINDLE & BODY.
585A MK II THREADING UNIT 4&5 EXTRA PARTS.
586B THREADING CAM STATIONS 4 & 5.
586G/45 EXTRA PARTS FOR SECTION 186F.
586G/56 EXTRA PARTS FOR SECTION 186F.
186F THREADING ATTCH. RETURN CHECK SWITCH.
586G ⊠ THREADING ATTCH. TIMING CAM.
587 THREADING UNIT STATIONS 3 & 6.
587A THREADING CAM 3RD STATION STD. TIMING.
587C THREADING CAM 3RD STATION ACCEL. TIMING.
587B THREADING CAM 6TH STATION.
589 AUXILIARY LONGITUDINAL MOTION.
REVOLVING DIEHEAD IN ONE STATION.
FULL THREADING ATTACHMENT IN ONE STATION
REVOLVING DIEHEAD IN TWO STATIONS.
FULL THREADING ATTACHMENT IN TWO STATIONS.
REVOLVING DIEHEAD IN ONE STATION & FULL THREADING ATTACHMENT IN ANOTHER STATION.
TWO REVOLVING DIEHEADS & ONE FULL THREADING ATTACHMENT
TWO FULL THREADING ATTACHMENTS & ONE REVOLVING DIEHEAD.
2 GEARS
4 GEARS
3 OR 4 GEAR
4 GEARS
6 GEARS
3 OR 6 GEAR
6 GEARS
7 OR 8 GEARS
8 OR 10 GEARS
TOOLING ARRANGEMENT
STATION NUMBERS IN WHICH ATTACHMENTS ARE TO BE USED.
588 MK II REAMING BODY & SLIDE.
588A ⊕ REAMING CAM 3 RD STATION STD. TIMING.
588B ⊕ REAMING CAM 6TH STATION.
588C ⊕ REAMING CAM 3 RD STATION ACCEL. TIMING.
589 AUXILIARY LONGITUDINAL MOTION.
590G HIGH SPEED DRILLING SPINDLE.
590H HIGH SPEED DRILLING DRIVE.
590B HIGH SPEED DRILLING BRACKET
590D # HIGH SPEED DRILLING GEARS.
FZ67D/2 CHASING ATTACH.
FZ74D CHASING ATTACH.
192 MK III CHASING ATTACH.
392 MK I CHASING ATTACH.
592A CHASING DRIVE USING FZ67 OR 74 STN 5
584&592B CHASING DRIVE SHAFT 2 5/8 - 6
584&592C CHASING DRIVE SHAFT 7 1/4 - 6
592D CHASING DRIVE CHANGE GEARS.
SEE 584 & 592 MK II
SEE 5922 3A/B
584 & 592 MK II CHASING ATT DRIVE USING 392 STN 5
584 & 592 MK II CHASING ATT DRIVE STATION 4
592G MK III EXTRA PARTS USING SECT 192 MK III
592H EXTRA PART USING SECT 392
HIGH SPEED DRILL
HIGH SPEED DRILL WITH INDEPENDENT MOTION.
INDEPENDENT REAMING ATTACHMENT.
CHASING ATT. SINGLE PITCH.
CHASING ATT. DOUBLE PITCH.
ANY STN.
3 STD TIMING
3 ACCEL TIMING
6 ACCEL TIMING
FZ67D/2
192 MK III
392 MK I
FZ74D
1 PAIR
+ SEE 581Z10 (FULL THREADING) OR 582Z10 (REVOLVING DIEHEAD) TO SELECT GEARS.
# SEE 590Z10 TO SELECT GEARS.
⊕ SEE 588Y2A TO SELECT FEED STROKE CAM.
1 OFF SEC 586G IS REQUIRED IRRESPECTIVE OF No. SECTIONS OF
⊠ 186F FITTED CONCURRENTLY. SECT. 186F IS NOT TO BE FITTED TO STATION 6.
EXTRA NON STANDARD SECTIONS
SEC 539 3 RD STATION CROSS SLIDE (BAR M/C)
SEC 539B 3 RD STATION CROSS SLIDE (CHUCKER)
SEC 593 3 RD STATION AUX. CROSS SLIDE MOTION.
SEC 593A 4 TH STATION AUX. CROSS SLIDE MOTION.
SEC 593B 5 TH STATION AUX. CROSS SLIDE MOTION.
SEC 593C 6 TH STATION AUX. CROSS SLIDE MOTION
SEC 594 LOCATION UNIT (CHUCKER)
B 5004413 M.E. 21-7-60
A 5004414 M.E. 15-7-60
5004406 B.T.P. 25-4-60

TOOLING ARRANGEMENT	STATION IN WHICH ATTACHMENT IS TO BE USED	581 FULL THREADING DRIVE	581D THREADING DRIVE GEARS	582 REVOLVING DIEHEAD DRIVE	583 DIRECT 5:1 RATIO REVOLVING DIEHEAD DRIVE	585 MK II JACKSHAFT	586 THREADING SPINDLE AND BODY	586B THREADING CAM 3rd STN.	586C THREADING CAM 4th STN	586D THREADING UNIT MK II EXTRA PARTS 3rd AND 4th STNS	590H H.S DRILLING DRIVE	590G H.S. DRILLING SPINDLE	590C H.S. DRILLING BRACKET	590D H.S. DRILLING GEARS SEE 590Z10		186F THREADING ATT. RETURN CHECK SWITCH	EXTRA PARTS TO FIT 586G/34 SEC 186F	586G CAM TIMED LIMIT SWITCH FOR USE WITH SEC 186F							
REVOLVING DIEHEAD WITH 5:1 RATIO DIRECT DRIVE	3				1		1	1		1						1	1	1							
	4				1		1		1	1															
REVOLVING DIEHEAD WITH VARIABLE RATIO DRIVE	3		2 GEARS	1		1	1	1		1						1	1	1							
	4			1		1	1		1	1															
FULL THREADING ATTACHMENT	3	1	4 GEARS			1	1	1		1						1	1	1							
	4	1				1	1		1	1															
HIGH SPEED DRILL	ANY STN										1	1	1	2											

EXTRA NON STANDARD SECTIONS
SEC 593A 3rd STN. AUX. CROSS SLIDE MOTION.
SEC 593B 4th STN. AUX. CROSS SLIDE MOTION.



AVAILABLE GEARS SECTION 590D IDLER GEARS		DRIVEN GEARS			
NUMBER OF TEETH	REFERENCE NUMBER	NUMBER OF TEETH	REFERENCE NUMBER	NUMBER OF TEETH	REFERENCE NUMBER
26	590D.X.1/26	24	590DX.124/24		
27	" 27	28	" 28		
31	" 31	29	" 29		
		32	" 32		
		37	" 37		
		44	" 44		

NOTE:- THE TWO DRIVER GEARS ARE SUPPLIED FITTED TO THE MACHINE

2⅜-6, 3¼-6, 7¼-6 AVAILABLE RATIOS

DRIVER GEAR	IDLER	DRIVEN GEAR	RATIO
36	27	32	1·985
36	31	24	2·36
50	26	28	2·61
50	26	24	2·88
50	27	24	2·88

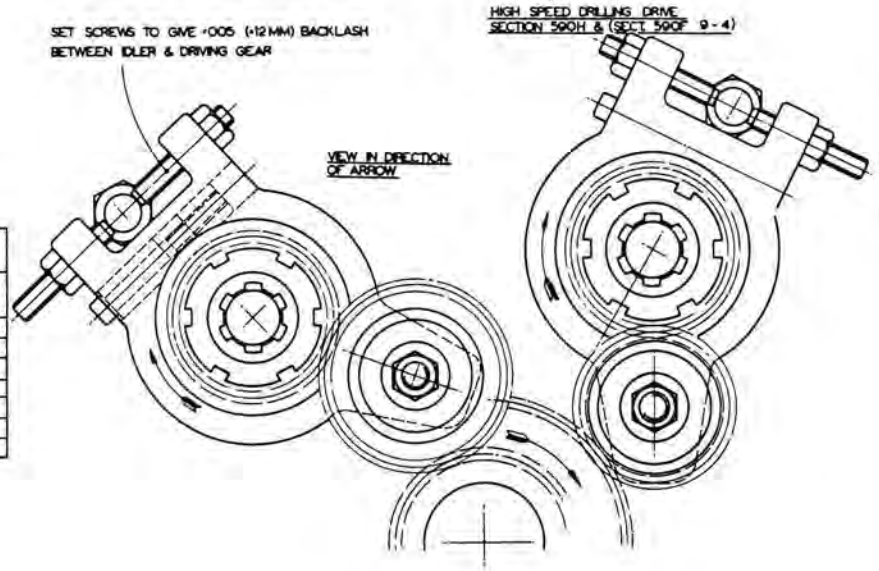
3½-4, 4⅛-4 AVAILABLE RATIOS

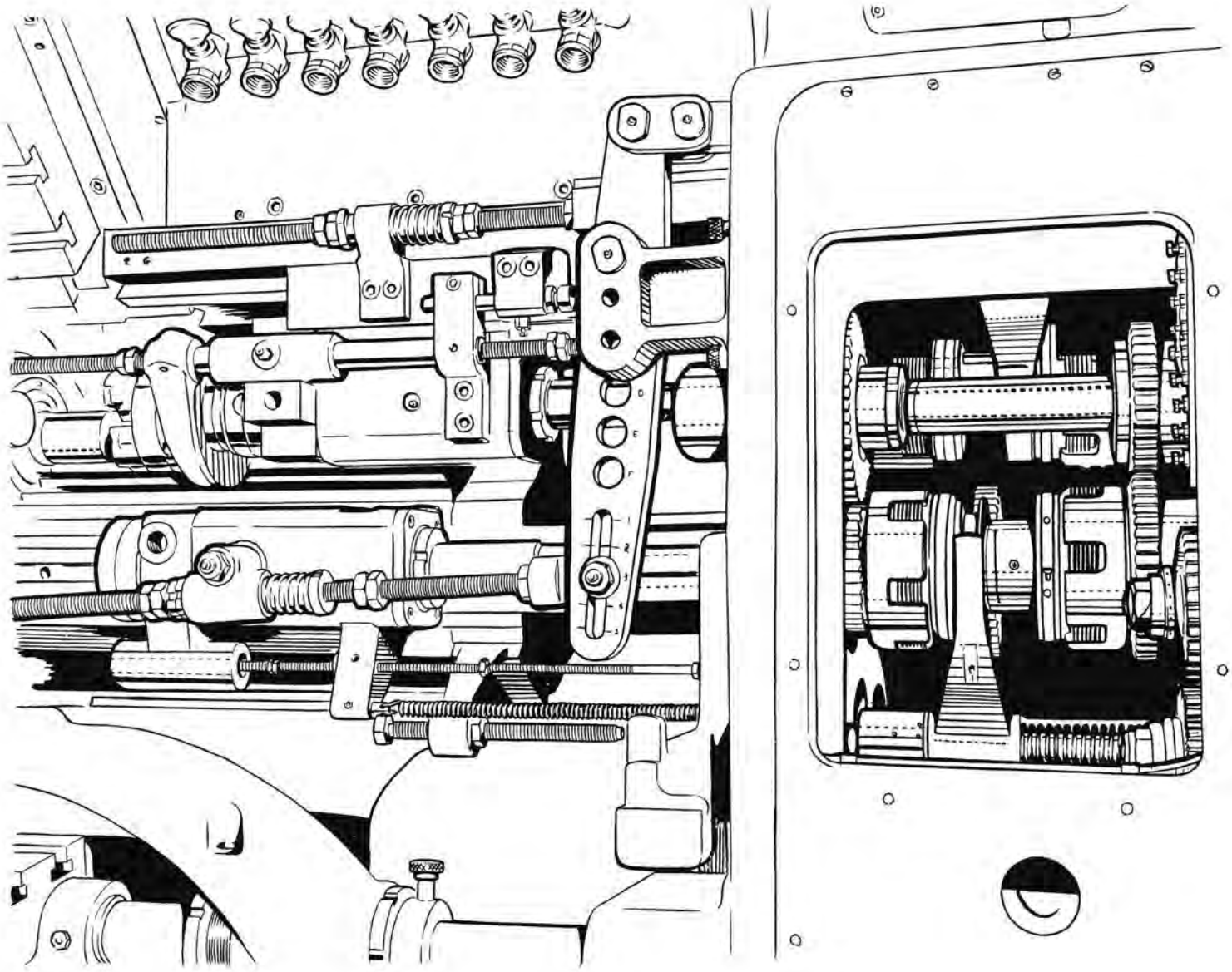
DRIVER GEAR	IDLER	DRIVEN GEAR	RATIO
34	27	37	2
34	31	29	2·27
46	26	37	2·43
46	26	29	2·83

9-4 AVAILABLE RATIOS

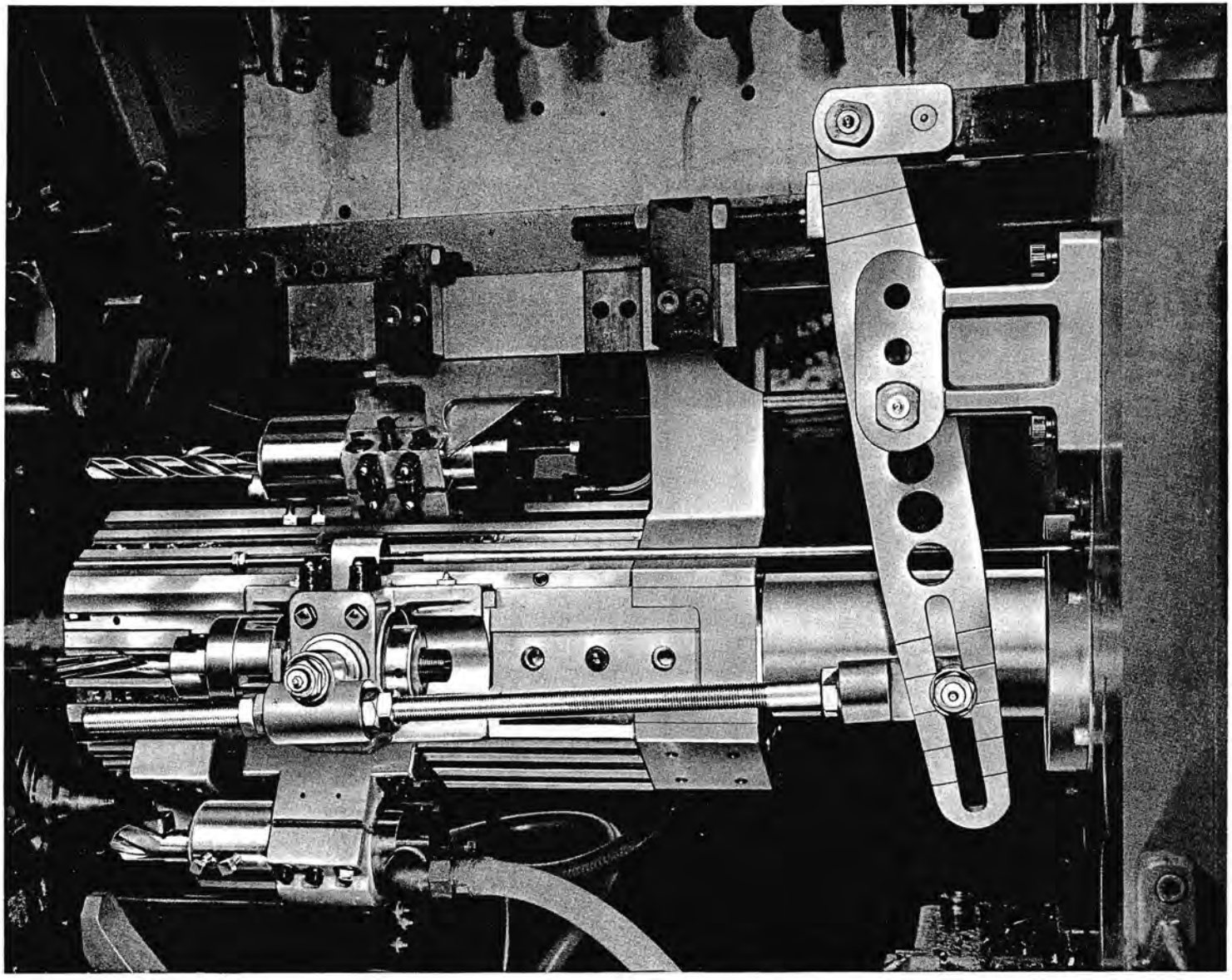
DRIVER GEAR	IDLER	DRIVEN GEAR	RATIO
34	27	44	2·25
37	27	37	2·62
37	31	37	2·62
37	31	29	3·08
37	31	24	3·5

A RATIO OF 2 MEANS THAT THE RELATIVE SPEED OF DRILL TO WORK IS TWICE THE WORK SPINDLE SPEED





Auxiliary Longitudinal Motion



SHEET 5.7

Illustration of Reaming Attachment

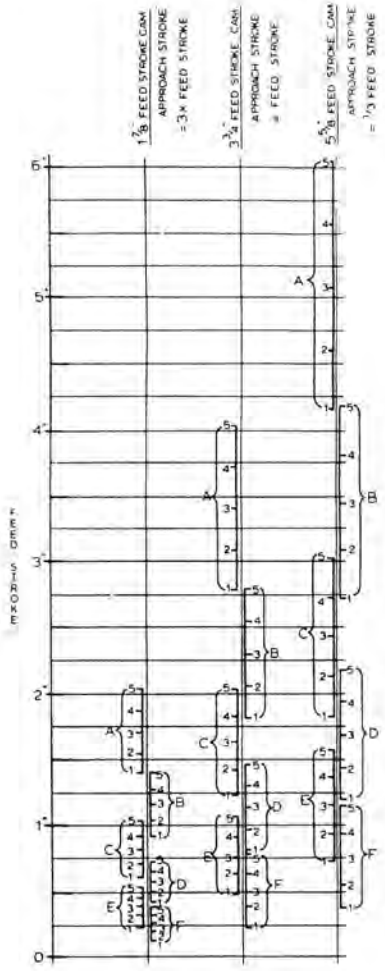
RIGHT HAND REAMERS.

DRIVER	35	36	37	38	39
DRIVEN	53	52	51	50	49
RATIO	2·94	3·27	3·65	4·17	4·9
	*				*

LEFT HAND REAMERS.

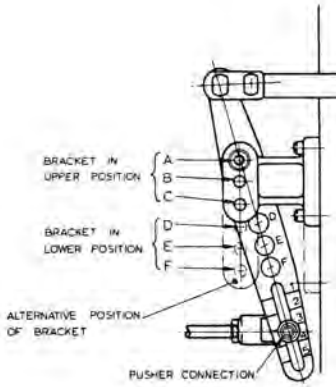
DRIVER	53	52	51	50	49
DRIVEN	35	36	37	38	39
RATIO	1·95	2·26	2·63	3·18	3·92
	*				*

* GEARS NORMALLY IN STOCK.



TO READ CHART

1. ON FEED STROKE SCALE ON LEFT, MARK THE FEED STROKE REQUIRED
2. DRAW A HORIZONTAL LINE ACROSS TO VERTICAL LINE REPRESENTING CAM FITTED (1⅞" 3¾" or 5⅝" STROKE.)
3. WHERE THE HORIZONTAL LINE CUTS THE BRACKETS ON THE VERTICAL LINE GIVES THE PIVOT POSITION (A B ETC.) AND THE RELATIVE POSITION OF THE PUSHER CONNECTION AND THE GRADUATIONS ON THE LOWER END OF THE LEVER (1 2 ETC.)

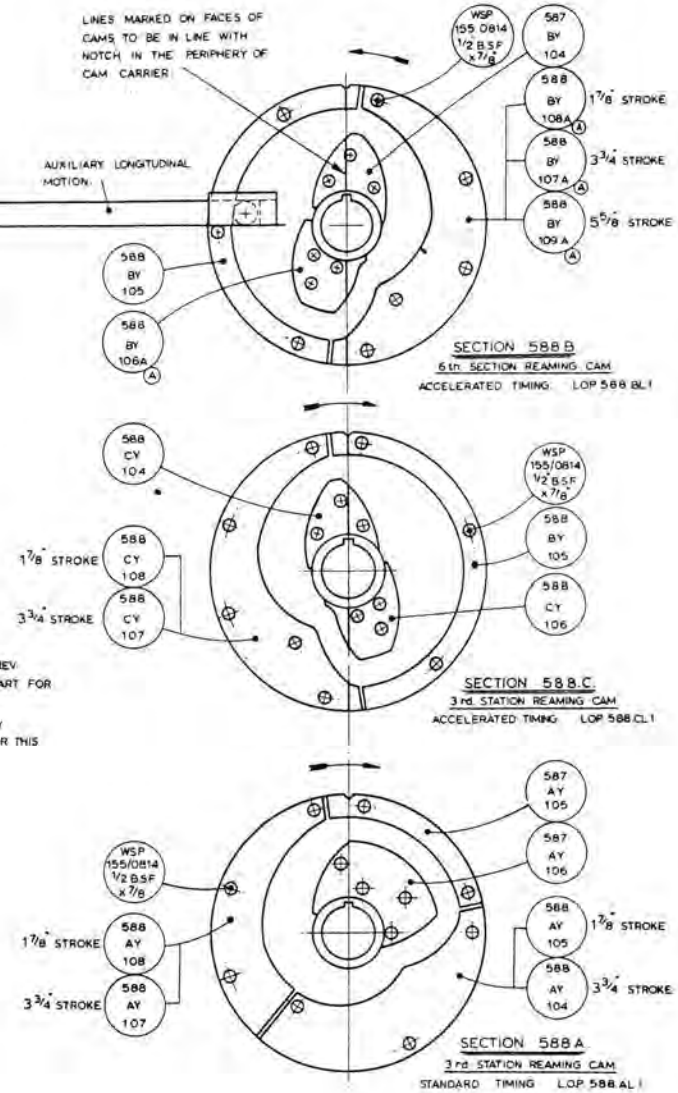


REAMING

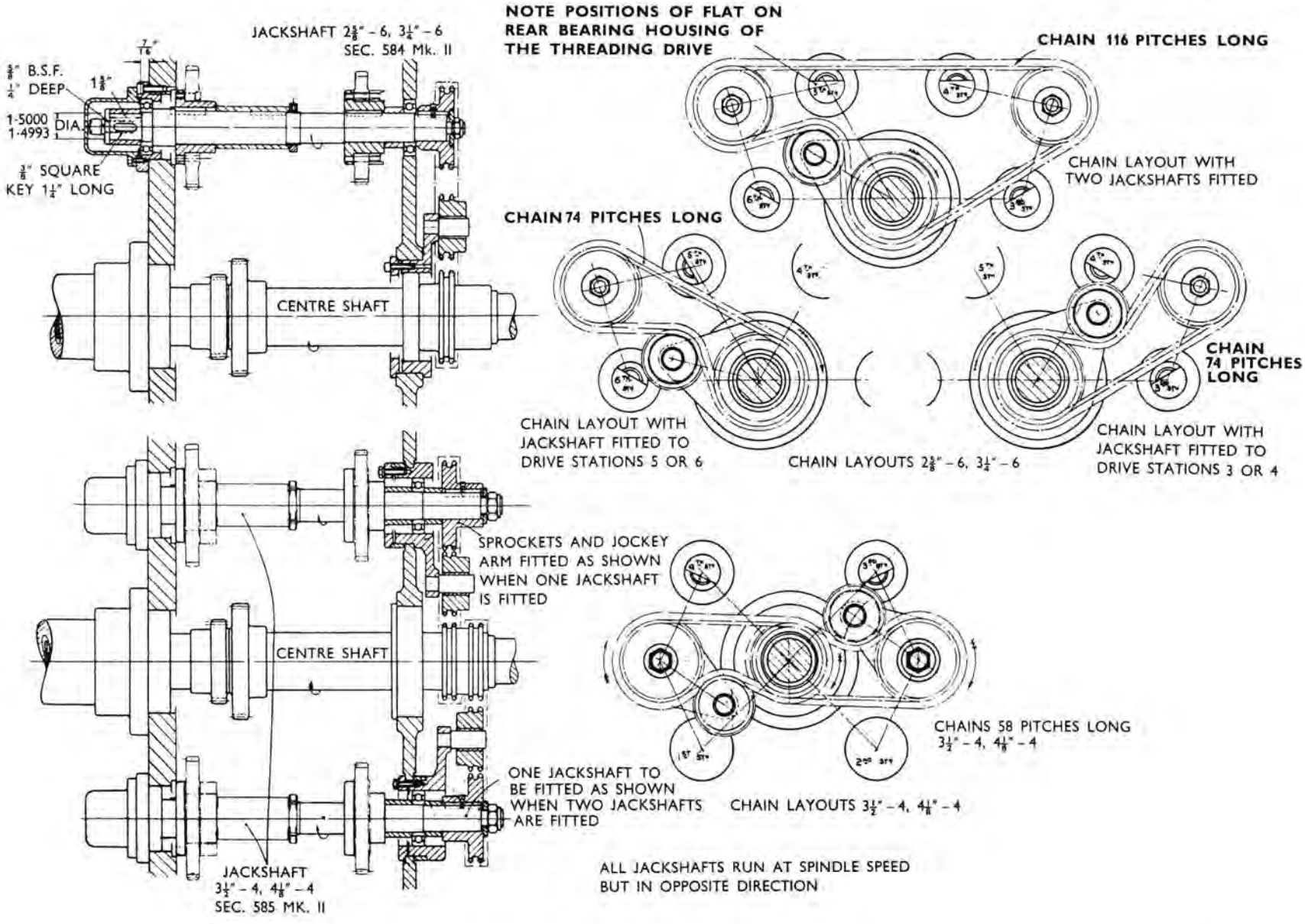
TO OBTAIN FEED PER REV.

STANDARD TIMING CAMS (STATION 3 ONLY.) – FEED PER REV. IS THE SAME AS SHOWN ON THE SPEED AND FEED CHART FOR THE PARTICULAR STROKE IN USE.

ACCELERATED TIMING CAMS. (STATION 3 & 6.) – MULTIPLY ACTUAL STROKE BY TWO AND FIND FEED PER REV. FOR THIS STROKE FROM SPEED AND FEED CHART.



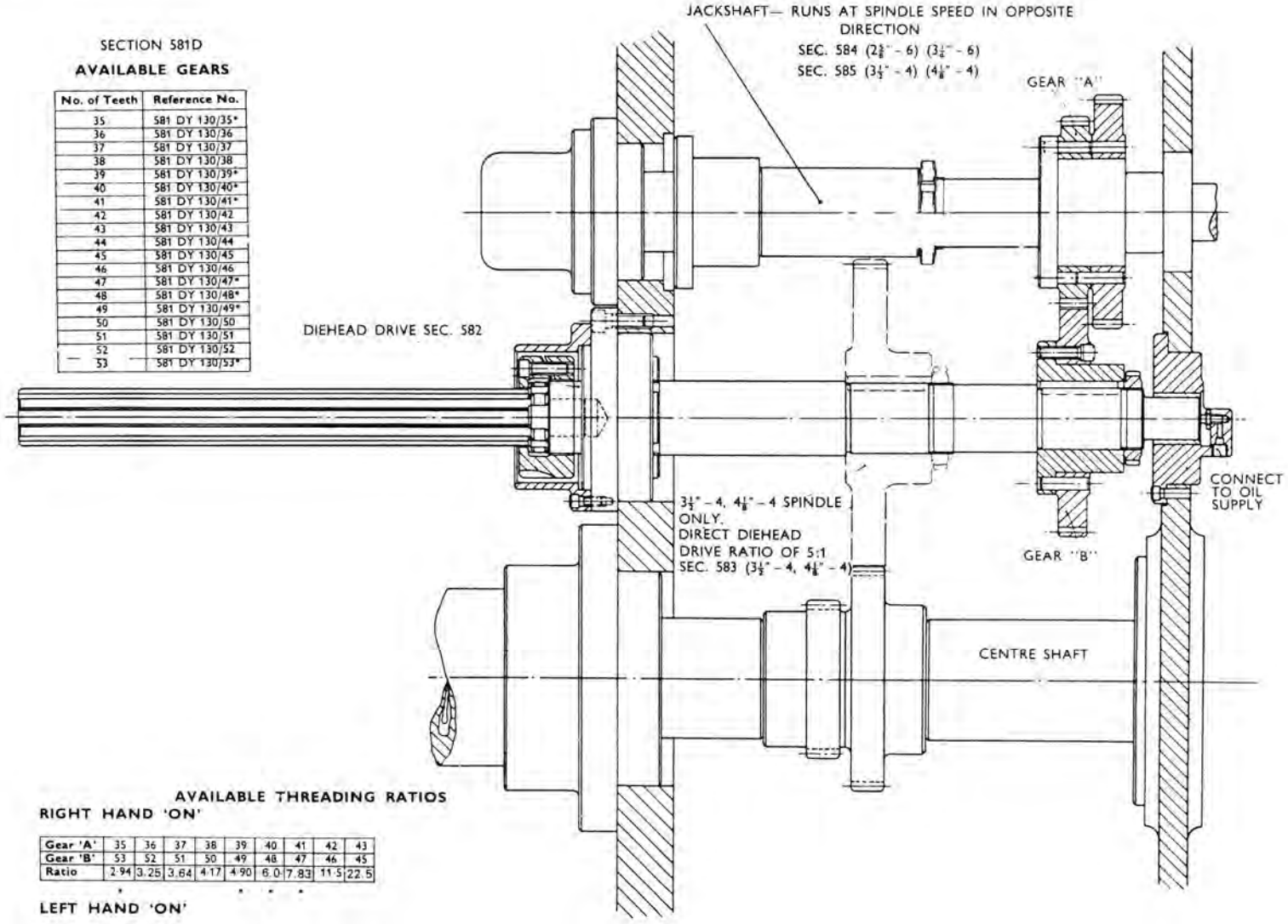
Stroke Diagram for Reaming


JACKSHAFT 2⅞" – 6, 3¼" – 6
SEC. 584 Mk. II
7/16"
⅜" B.S.F.
¼" DEEP
1⅝"
1·5000
1·4993 DIA
⅜" SQUARE
KEY 1¼" LONG
CENTRE SHAFT
NOTE POSITIONS OF FLAT ON
REAR BEARING HOUSING OF
THE THREADING DRIVE
CHAIN 116 PITCHES LONG
CHAIN LAYOUT WITH
TWO JACKSHAFTS FITTED
CHAIN 74 PITCHES LONG
CHAIN 74 PITCHES
LONG
CHAIN LAYOUT WITH
JACKSHAFT FITTED TO
DRIVE STATIONS 5 OR 6
CHAIN LAYOUTS 2⅞" – 6, 3¼" – 6
CHAIN LAYOUT WITH
JACKSHAFT FITTED TO
DRIVE STATIONS 3 OR 4
SPROCKETS AND JOCKEY
ARM FITTED AS SHOWN
WHEN ONE JACKSHAFT
IS FITTED
CENTRE SHAFT
CHAINS 58 PITCHES LONG
3½" – 4, 4⅛" – 4
ONE JACKSHAFT TO
BE FITTED AS SHOWN
WHEN TWO JACKSHAFTS
ARE FITTED
CHAIN LAYOUTS 3½" – 4, 4⅛" – 4
JACKSHAFT
3½" – 4, 4⅛" – 4
SEC. 585 MK. II
ALL JACKSHAFTS RUN AT SPINDLE SPEED
BUT IN OPPOSITE DIRECTION

SECTION 581D

AVAILABLE GEARS

No. of Teeth	Reference No.
35	581 DY 130/35*
36	581 DY 130/36
37	581 DY 130/37
38	581 DY 130/38
39	581 DY 130/39*
40	581 DY 130/40*
41	581 DY 130/41*
42	581 DY 130/42
43	581 DY 130/43
44	581 DY 130/44
45	581 DY 130/45
46	581 DY 130/46
47	581 DY 130/47*
48	581 DY 130/48*
49	581 DY 130/49*
50	581 DY 130/50
51	581 DY 130/51
52	581 DY 130/52
53	581 DY 130/53*



AVAILABLE THREADING RATIOS

RIGHT HAND 'ON'

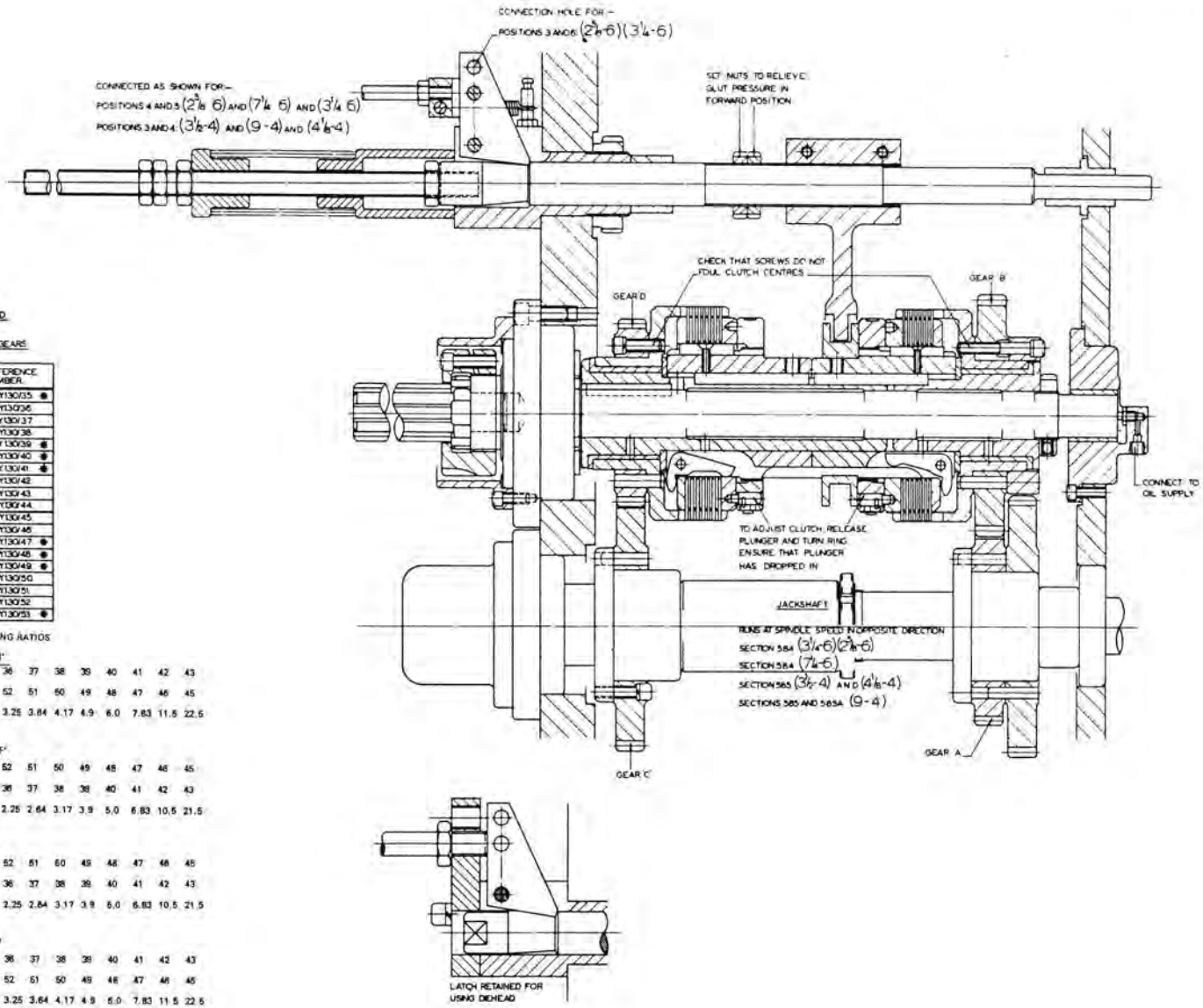
Gear 'A'	35	36	37	38	39	40	41	42	43
Gear 'B'	53	52	51	50	49	48	47	46	45
Ratio	2·94	3·25	3·64	4·17	4·90	6·0	7·83	11·5	22·5
	*				*	*	*		

LEFT HAND 'ON'

Gear 'A'	53	52	51	50	49	48	47	46	45
Gear 'B'	35	36	37	38	39	40	41	42	43
Ratio	1·95	2·25	2·64	3·17	3·90	5·00	6·83	10·5	21·5
	*				*	*	*		

* GEARS NORMALLY CARRIED IN STOCK

Revolving Diehead Drive



SECTION 581D

AVAILABLE GEARS

N-OF TEETH	REFERENCE NUMBER
35	581DY130/35 ●
36	581DY130/36
37	581DY130/37
38	581DY130/38
39	581DY130/39 ●
40	581DY130/40 ●
41	581DY130/41 ●
42	581DY130/42
43	581DY130/43
44	581DY130/44
45	581DY130/45
46	581DY130/46
47	581DY130/47 ●
48	581DY130/48 ●
49	581DY130/49 ●
50	581DY130/50
51	581DY130/51
52	581DY130/52
53	581DY130/53 ●

AVAILABLE THREADING RATIOS

RIGHT HAND 'ON'

GEAR 'A'	35	36	37	38	39	40	41	42	43
GEAR 'B'	53	52	51	50	49	48	47	46	45
RATIO	2.94	3.25	3.64	4.17	4.9	6.0	7.83	11.5	22.5
*									

RIGHT HAND 'OFF'

GEAR 'C'	53	52	51	50	49	48	47	46	45
GEAR 'D'	35	36	37	38	39	40	41	42	43
RATIO	1.95	2.25	2.64	3.17	3.9	5.0	6.83	10.5	21.5
*									

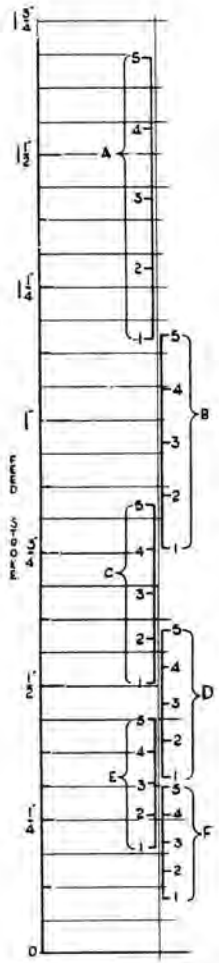
LEFT HAND 'ON'

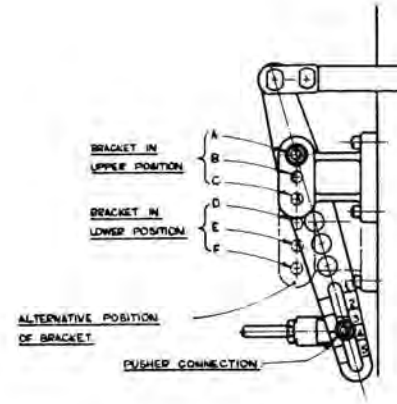
GEAR 'A'	53	52	51	50	49	48	47	46	45
GEAR 'B'	35	36	37	38	39	40	41	42	43
RATIO	1.95	2.25	2.64	3.17	3.9	5.0	6.83	10.5	21.5
*									

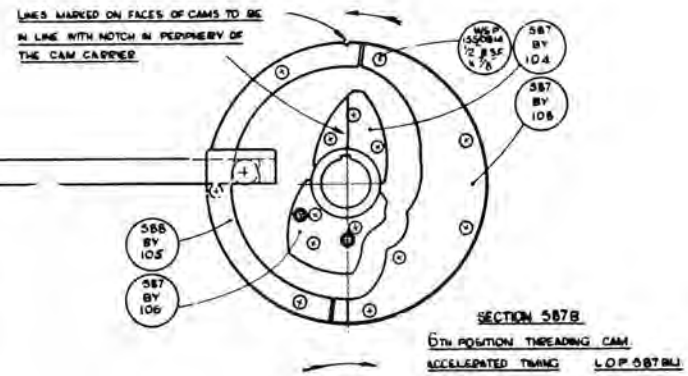
LEFT HAND 'OFF'

GEAR 'C'	35	36	37	38	39	40	41	42	43
GEAR 'D'	53	52	51	50	49	48	47	46	45
RATIO	2.94	3.25	3.64	4.17	4.9	6.0	7.83	11.5	22.5
*									

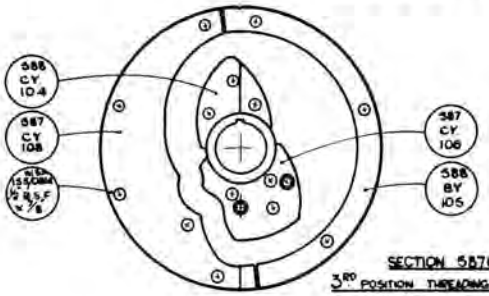
* GEARS NORMALLY CARRIED IN STOCK



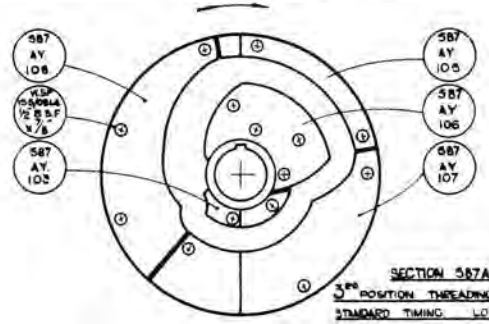




SECTION 587B
6TH POSITION THREADING CAM
ACCELERATED TIMING L.O.P. 587 BL.I



SECTION 587C.
3RD POSITION THREADING CAM.
ACCELERATED TIMING L.O.P. 587 CL.I



SECTION 587A
3RD POSITION THREADING CAM
STANDARD TIMING L.O.P. 587 AL.I

TO OBTAIN STROKE REQUIRED:-

USE THE FOLLOWING FORMULAE TO OBTAIN STROKE REQ'D WITH 3RD & 6TH POS. THREADING CAMS.

$$\text{STROKE REQUIRED} = \frac{\text{AVAILABLE CUTTING REVS}}{4 \times \text{T.P.I.} \times \text{THREADING RATIO 'ON'}}$$

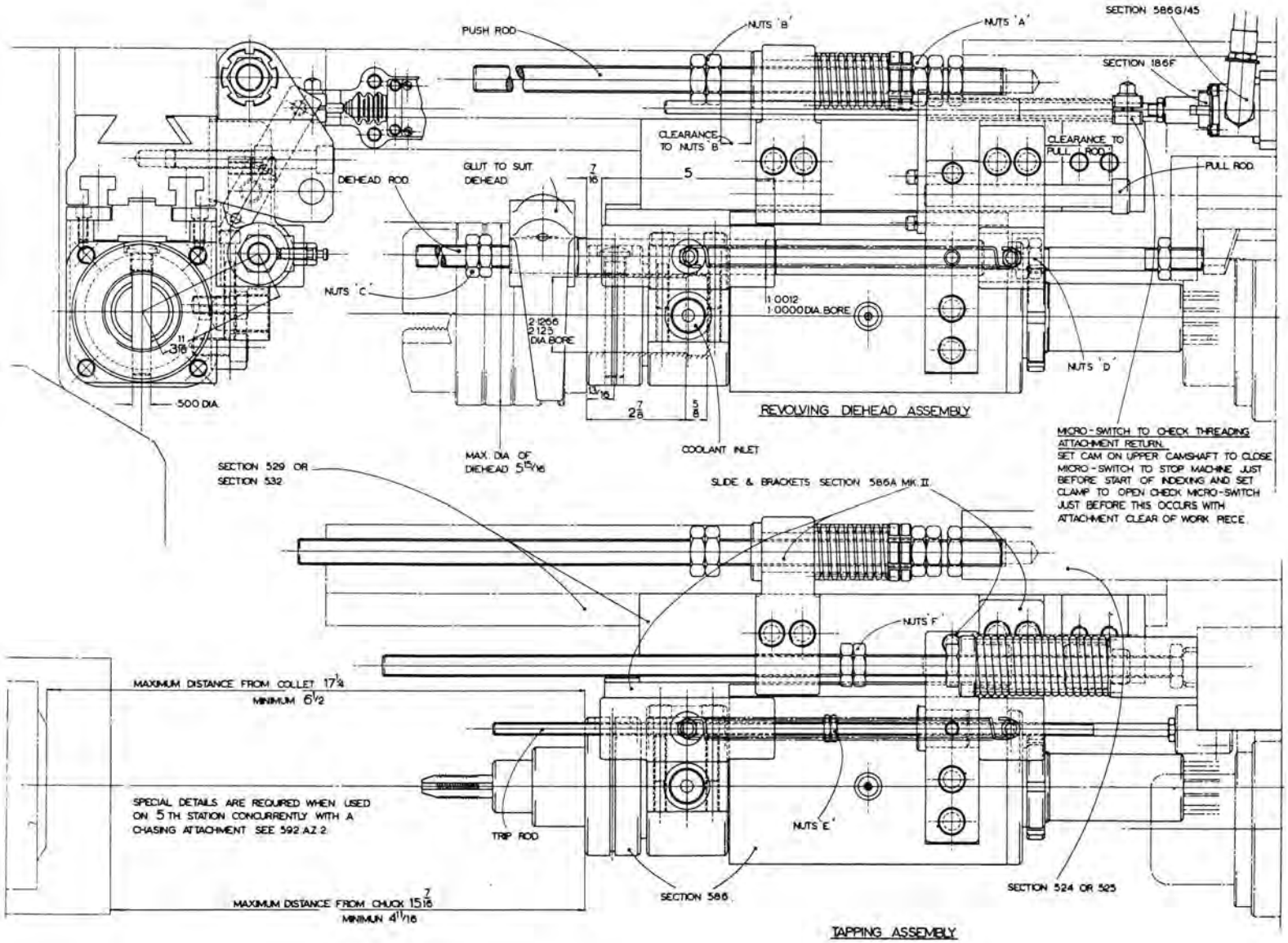
TO FIND STROKE SETTING.

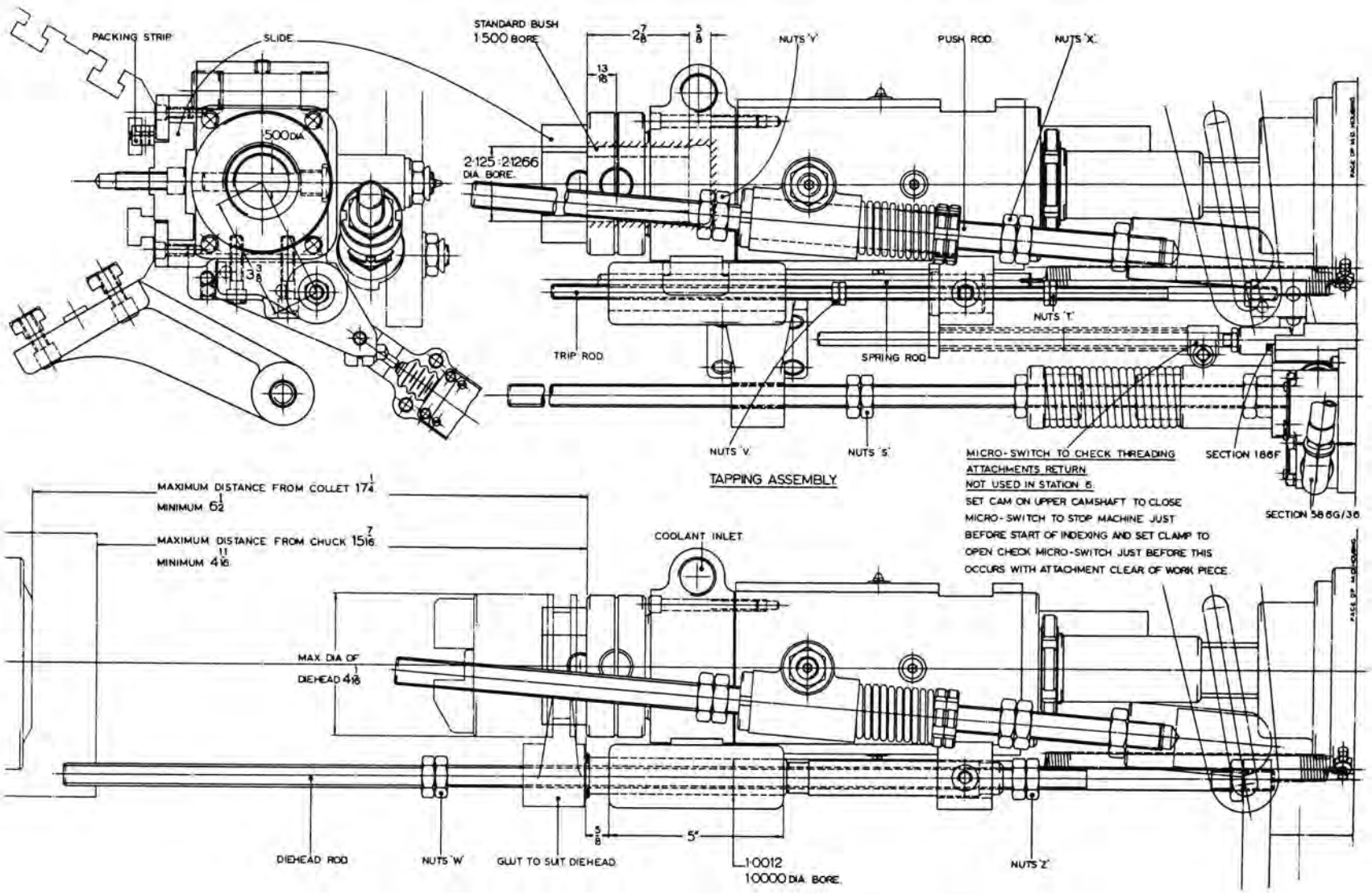
1. ON FEED STROKE SCALE ON LEFT, MARK FEED STROKE REQUIRED (CALCULATED AS ABOVE)
2. DRAW A HORIZONTAL LINE ACROSS TO BRACKETED COLUMN.
3. WHERE THE HORIZONTAL LINE CUTS THE BRACKETS GIVES THE PIVOT POSITION (A,B ETC) & THE RELATIVE POSITION OF THE PUSHER CONNECTION WITH THE GRADUATIONS ON THE LOWER END OF THE LEVER (1,2 ETC)

APPROACH STROKE = 3.75 X FEED STROKE

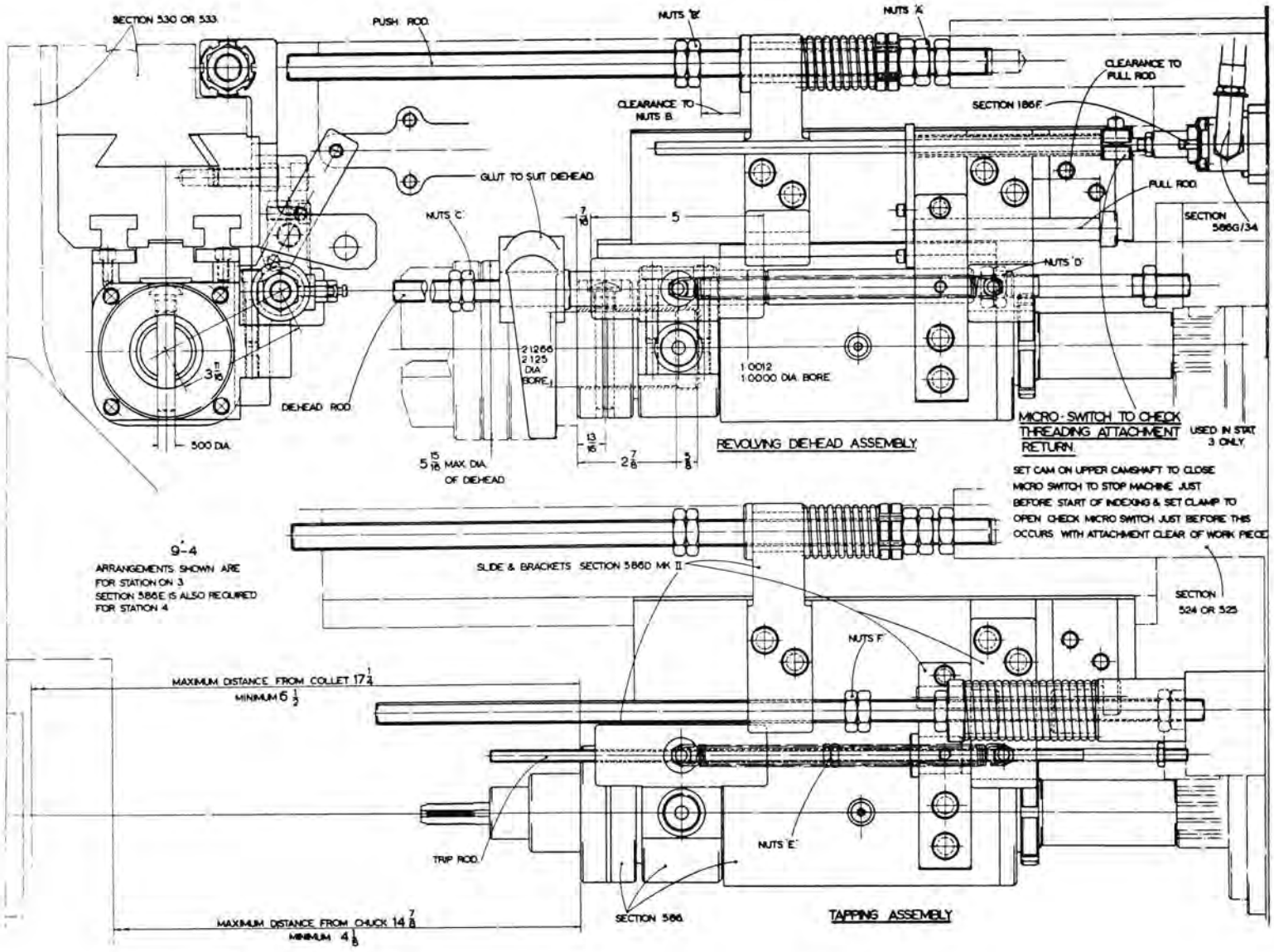
IN SOME CASES REAMING CAMS MAY BE USED WITH DIEHEADS OR COLLAPSING TAPS SEE 588Y2A

Setting Diagram for 3rd and 6th Threading Cams


PUSH ROD
NUTS 'B'
NUTS 'A'
SECTION 586G/45
SECTION 186F
CLEARANCE TO NUTS 'B'
CLEARANCE TO PULL ROD
PULL ROD
DIEHEAD ROD
GLUT TO SUIT DIEHEAD
7/16
5
NUTS 'C'
1.0012
1.0000 DIA. BORE
2.1266
2.125
DIA. BORE
11 3/16
500 DIA.
NUTS 'D'
13/16
2 7/8
5/8
REVOLVING DIEHEAD ASSEMBLY
MAX. DIA OF DIEHEAD 5 15/16
COOLANT INLET
MICRO-SWITCH TO CHECK THREADING ATTACHMENT RETURN.
SET CAM ON UPPER CAMSHAFT TO CLOSE MICRO-SWITCH TO STOP MACHINE JUST BEFORE START OF INDEXING AND SET CLAMP TO OPEN CHECK MICRO-SWITCH JUST BEFORE THIS OCCURS WITH ATTACHMENT CLEAR OF WORK PIECE.
SECTION 529 OR SECTION 532
SLIDE & BRACKETS SECTION 586A MK. II
NUTS 'F'
MAXIMUM DISTANCE FROM COLLET 17¼
MINIMUM 6½
SPECIAL DETAILS ARE REQUIRED WHEN USED ON 5TH STATION CONCURRENTLY WITH A CHASING ATTACHMENT SEE 592 A2 2
TRIP ROD
NUTS 'E'
SECTION 586
SECTION 524 OR 525
MAXIMUM DISTANCE FROM CHUCK 15 7/16
MINIMUM 4 11/16
TAPPING ASSEMBLY



Threading Attachment Stations 3 & 6 $2\frac{5}{8}$" – 6


SECTION 530 OR 533
PUSH ROD
NUTS 'B'
NUTS 'A'
CLEARANCE TO NUTS B
CLEARANCE TO PULL ROD
SECTION 186F
PULL ROD
SECTION 586G/34
GLUT TO SUIT DIEHEAD
NUTS 'C'
NUTS 'D'
DIEHEAD ROD
.500 DIA
2.1266
2.125 DIA BORE
1.0012
1.0000 DIA BORE
REVOLVING DIEHEAD ASSEMBLY
MICRO-SWITCH TO CHECK THREADING ATTACHMENT RETURN
USED IN STAT 3 ONLY
SET CAM ON UPPER CAMSHAFT TO CLOSE MICRO SWITCH TO STOP MACHINE JUST BEFORE START OF INDEXING & SET CLAMP TO OPEN CHECK MICRO SWITCH JUST BEFORE THIS OCCURS WITH ATTACHMENT CLEAR OF WORK PIECE
9-4
ARRANGEMENTS SHOWN ARE FOR STATION ON 3
SECTION 586E IS ALSO REQUIRED FOR STATION 4
SLIDE & BRACKETS SECTION 586D MK II
SECTION 524 OR 525
NUTS 'F'
MAXIMUM DISTANCE FROM COLLET 17¼
MINIMUM 6½
TRIP ROD
NUTS 'E'
SECTION 586
MAXIMUM DISTANCE FROM CHUCK 14⅞
MINIMUM 4⅛
TAPPING ASSEMBLY

$2^{5}/_{8}$-6, $3^{1}/_{4}$-6. UPPER FRONT. STN.5. SEC.593.B. REAR. STN.4. SEC.593.A. $3^{1}/_{2}$-4, $4^{1}/_{8}$-4. UPPER FRONT. STN.4. SEC.593.B. REAR. STN.3. SEC.593.A.	
HOLE POSITION	RATIO OF CROSS SLIDE STROKE TO CAM MOVEMENT ADJUSTABLE FROM:-
A	·975 TO 1·3
B	·487 TO ·65
RADIUS 'R'. MAX. $6^{1}/_{4}$" MIN. $3^{1}/_{8}$" $3^{1}/_{8}$" CAM MOVEMENT.	

BEGINS M/C INSP Nº	
$2^{5}/_{8}$-6, $3^{1}/_{4}$-6. INTER FRONT STN.6. SEC.593.C. INTER REAR STN.3. SEC.593.	
HOLE POSITION	RATIO OF CROSS SLIDE STROKE TO CAM MOVEMENT ADJUSTABLE FROM:-
* A	·65 TO ·81
B	·4 TO ·55
RADIUS 'R' POSITION 'B' MAX. $6^{1}/_{4}$. MIN. $3^{1}/_{8}$ ($3^{1}/_{8}$ CAM MOVEMENT.) * POSITION A. MAX. $6^{1}/_{4}$ MIN. $3^{13}/_{16}$" ($2^{7}/_{16}$ CAM MOVEMENT.)	

BEFORE M/C INSP Nº
RATIO OF INTERMEDIATE CROSS SLIDE STROKE TO CAM MOVEMENT. ADJUSTABLE FROM 1·0 TO 1·325

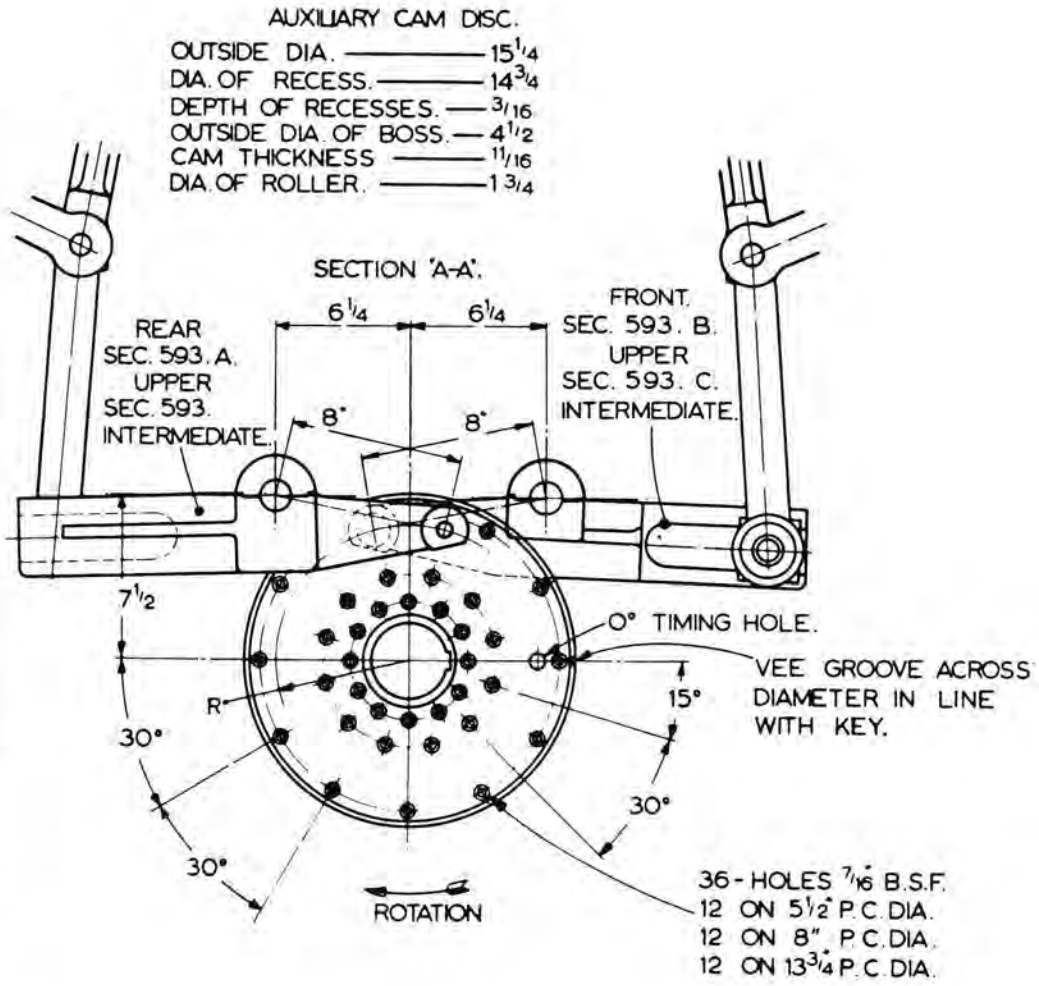
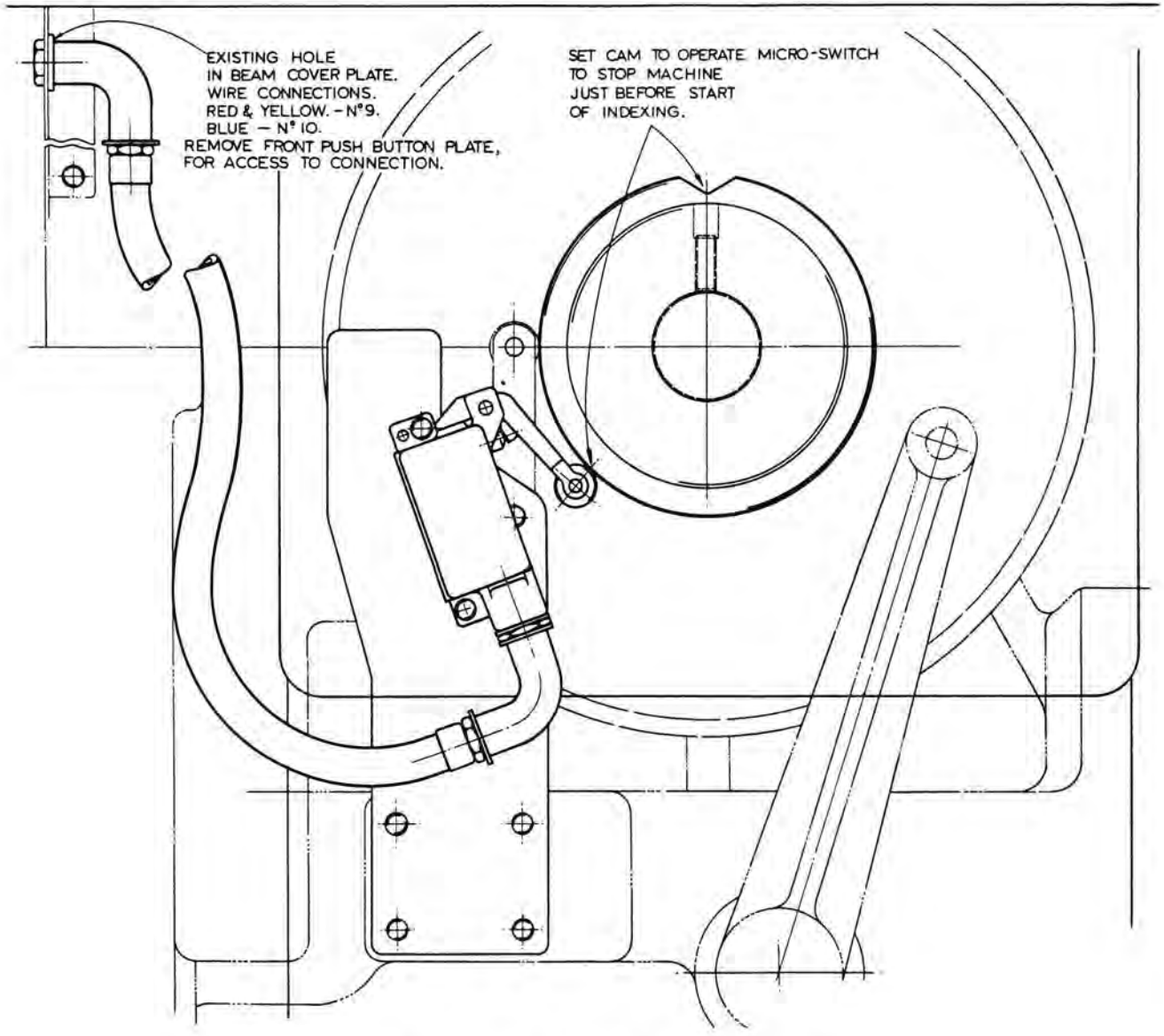
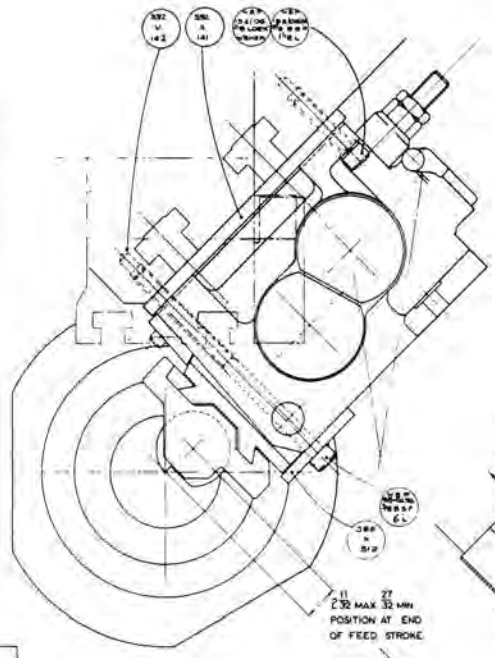


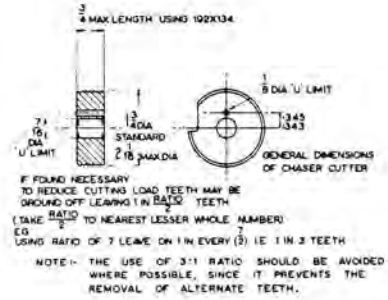
Diagram of Auxiliary Motion

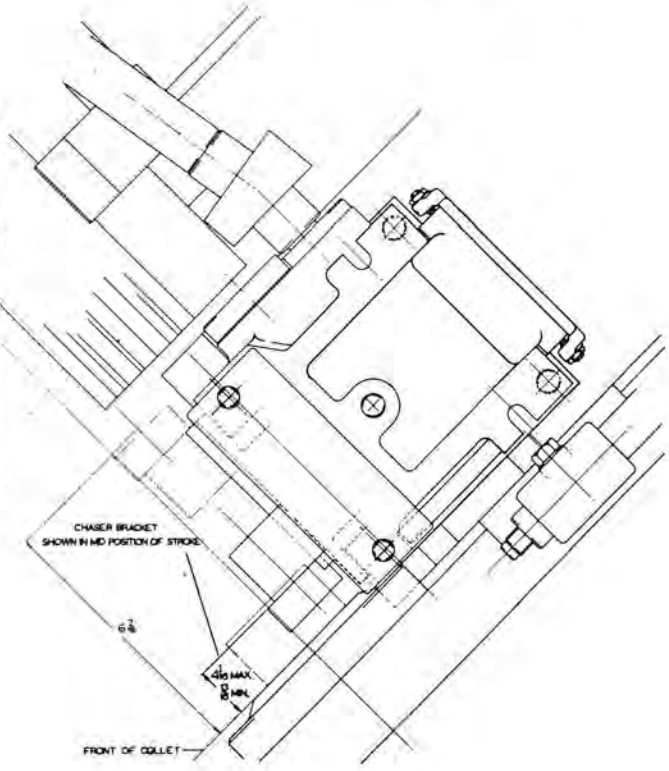


Application Drawing for Extra Micro Switch for Threading Attachment Return Check Switch

MINIMUM WIDTH OF UNDERCUT	LEAD CAMS		
	CAM LEAD	RIGHT HAND THREADS DRG No.	LEFT HAND THREADS DRG No.
0.47×1 PITCH	1/2	192 BY 148/12	192 BY 151/12
0.28×1 PITCH	3/7	192 BY 148/37	192 BY 151/37
0.25×1 PITCH	1/4	192 BY 148/25	192 BY 151/25
0.27×1 PITCH	4/11	192 BY 148/411	192 BY 151/411
0.29×1 PITCH	1/3	192 BY 148/13	192 BY 151/13
0.29×1 PITCH	3/13	192 BY 148/413	192 BY 151/413
0.29×1 PITCH	3/11	192 BY 148/311	192 BY 151/311
0.27×1 PITCH	5/19	192 BY 148/519	192 BY 151/519
0.33×1 PITCH	1/4	192 BY 148/14	192 BY 151/14
0.30×1 PITCH	1/5	192 BY 148/15	192 BY 151/15
0.17×1 PITCH	1/6	192 BY 148/16	192 BY 151/16
0.18×1 PITCH	2/13	192 BY 148/213	192 BY 151/213
0.15×1 PITCH	1/7	192 BY 148/17	192 BY 151/17
0.14×1 PITCH	1/8	192 BY 148/18	192 BY 151/18
0.13×1 PITCH	1/9	192 BY 148/19	192 BY 151/19
DW×1 PITCH	8/11	192 BY 148/27	192 BY 151/27
M/M			
0.33×1 PITCH	2.5mm	192 BY 148/25mm	192 BY 151/25mm
0.37×1 PITCH	3mm	192 BY 148/3mm	192 BY 151/3mm
0.38×1 PITCH	3.5mm	192 BY 148/35mm	192 BY 151/35mm
0.44×1 PITCH	4mm	192 BY 148/4mm	192 BY 151/4mm
0.51×1 PITCH	5mm	192 BY 148/5mm	192 BY 151/5mm
0.59×1 PITCH	6mm	192 BY 148/6mm	192 BY 151/6mm
0.66×1 PITCH	7mm	192 BY 148/7mm	192 BY 151/7mm
0.73×1 PITCH	8mm	192 BY 148/8mm	192 BY 151/8mm
0.80×1 PITCH	9mm	192 BY 148/9mm	192 BY 151/9mm
0.88×1 PITCH	10mm	192 BY 148/10mm	192 BY 151/10mm
1.05×1 PITCH	12mm	192 BY 148/12mm	192 BY 151/12mm







LEAD TO BE CUT	CAM LEAD	RATIO			
.5 mm	CAM LEAD	2½mm	3mm		
	RATIO	5	6		
.7 mm	CAM LEAD	3½mm			
	RATIO	5			
.75 mm	CAM LEAD	3mm			
	RATIO	4			
1 mm	CAM LEAD	4mm			
	RATIO	5			
1 mm	CAM LEAD	4mm	5mm	6mm	
	RATIO	4	5	6	
1.25 mm	CAM LEAD	5mm			
	RATIO	4			

LEAD TO BE CUT	CAM LEAD	RATIO		
1.5 mm	CAM LEAD	6mm		
	RATIO	4		
1.75 mm	CAM LEAD	7mm		
	RATIO	4		
2 mm	CAM LEAD	8mm	10mm	12mm
	RATIO	4	5	6
2.5 mm	CAM LEAD	10mm		
	RATIO	4		
3 mm	CAM LEAD	12mm		
	RATIO	4		
	CAM LEAD			
	RATIO			

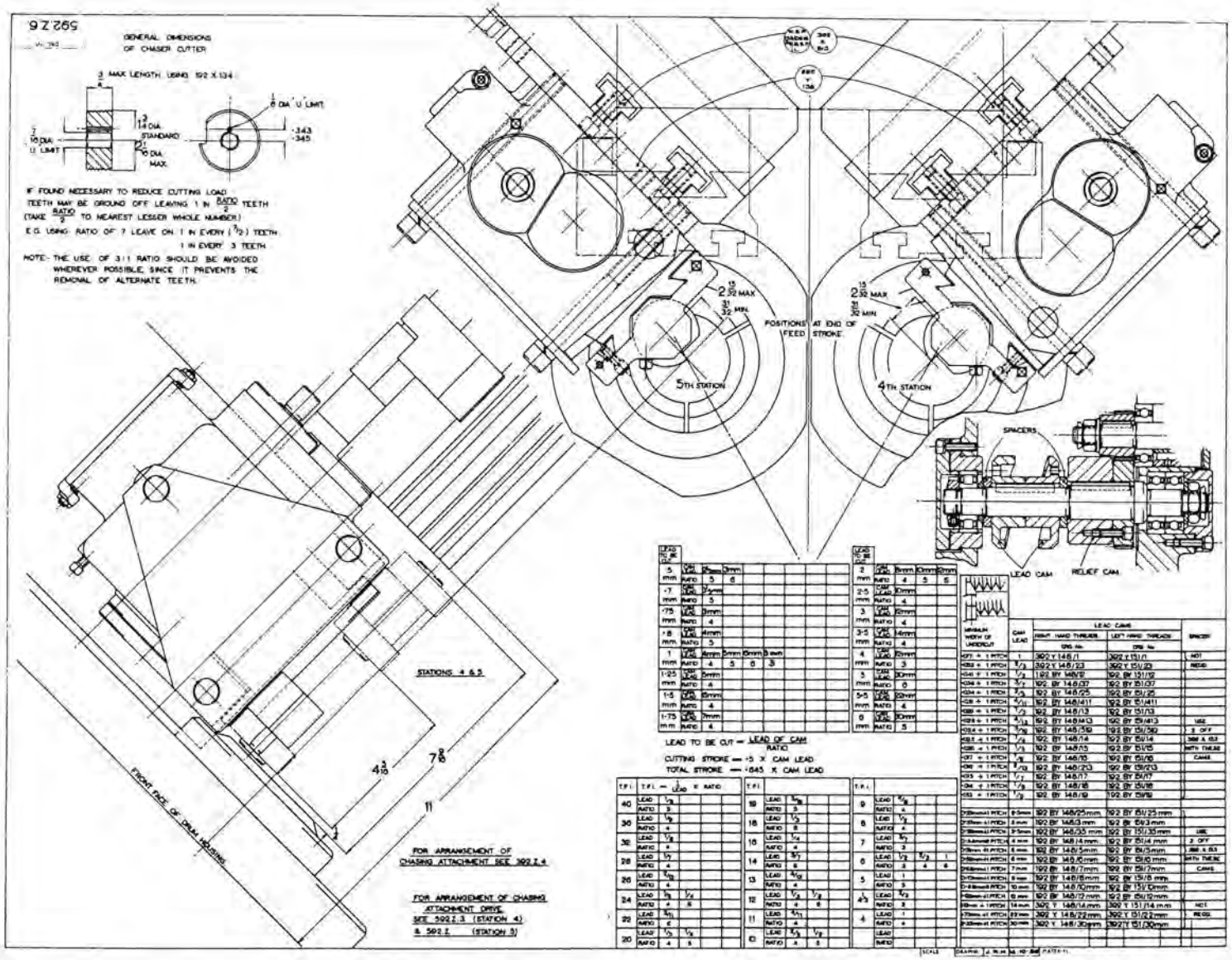
LEAD TO BE CUT = LEAD OF CAM / RATIO
CUTTING STROKE = .5× CAM LEAD
TOTAL STROKE = .645× CAM LEAD

TPI	TPI × 1/LEAD = RATIO		
40	LEAD		1/8
	RATIO		5
36	LEAD		1/8
	RATIO		4.5
32	LEAD	1/8	
	RATIO	4	
28	LEAD	1/7	
	RATIO	4	
26	LEAD	3/13	
	RATIO	4	
24	LEAD	1/4	1/8
	RATIO	6	3
22	LEAD		3/11
	RATIO		6

TPI	TPI × 1/LEAD = RATIO		
20	LEAD	1/4	1/5
	RATIO	5	4
19	LEAD	5/19	
	RATIO	5	
18	LEAD	1/3	
	RATIO	6	
16	LEAD	1/4	
	RATIO	4	
14	LEAD		3/11 3/13
	RATIO		6 4
13	LEAD	4/13	
	RATIO	4	
12	LEAD	1/3	1/4
	RATIO	4	3

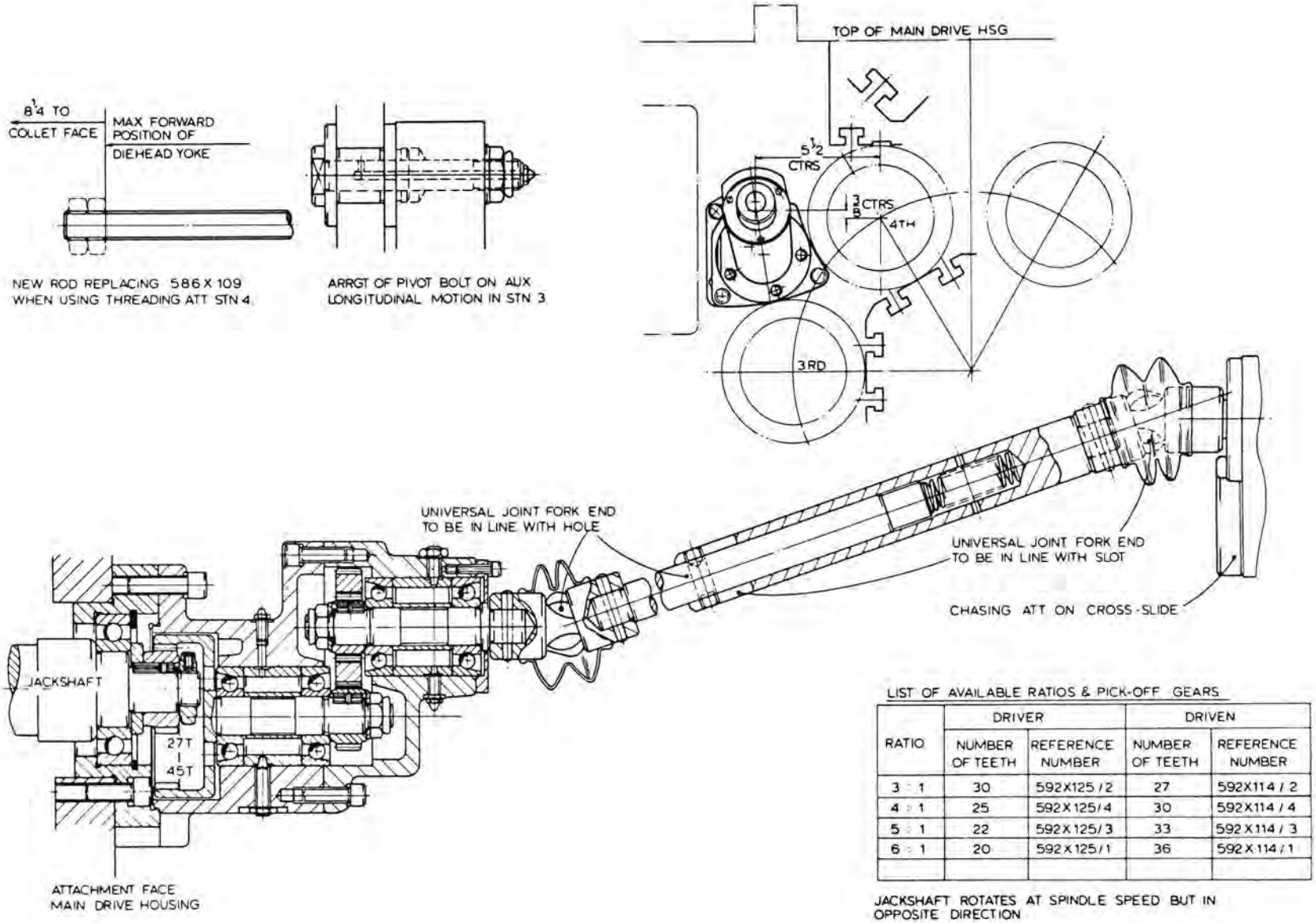
TPI	TPI × 1/LEAD = RATIO		
11	LEAD	4/11	3/11
	RATIO	4	3
10	LEAD	2/5	1/2
	RATIO	4	5
9	LEAD	4/9	
	RATIO	4	
8	LEAD	1/2	
	RATIO	4	

Chasing Attachment (Section 192 Mk. III)



Chasing Attachment (Section 392)

SHEET 5.20

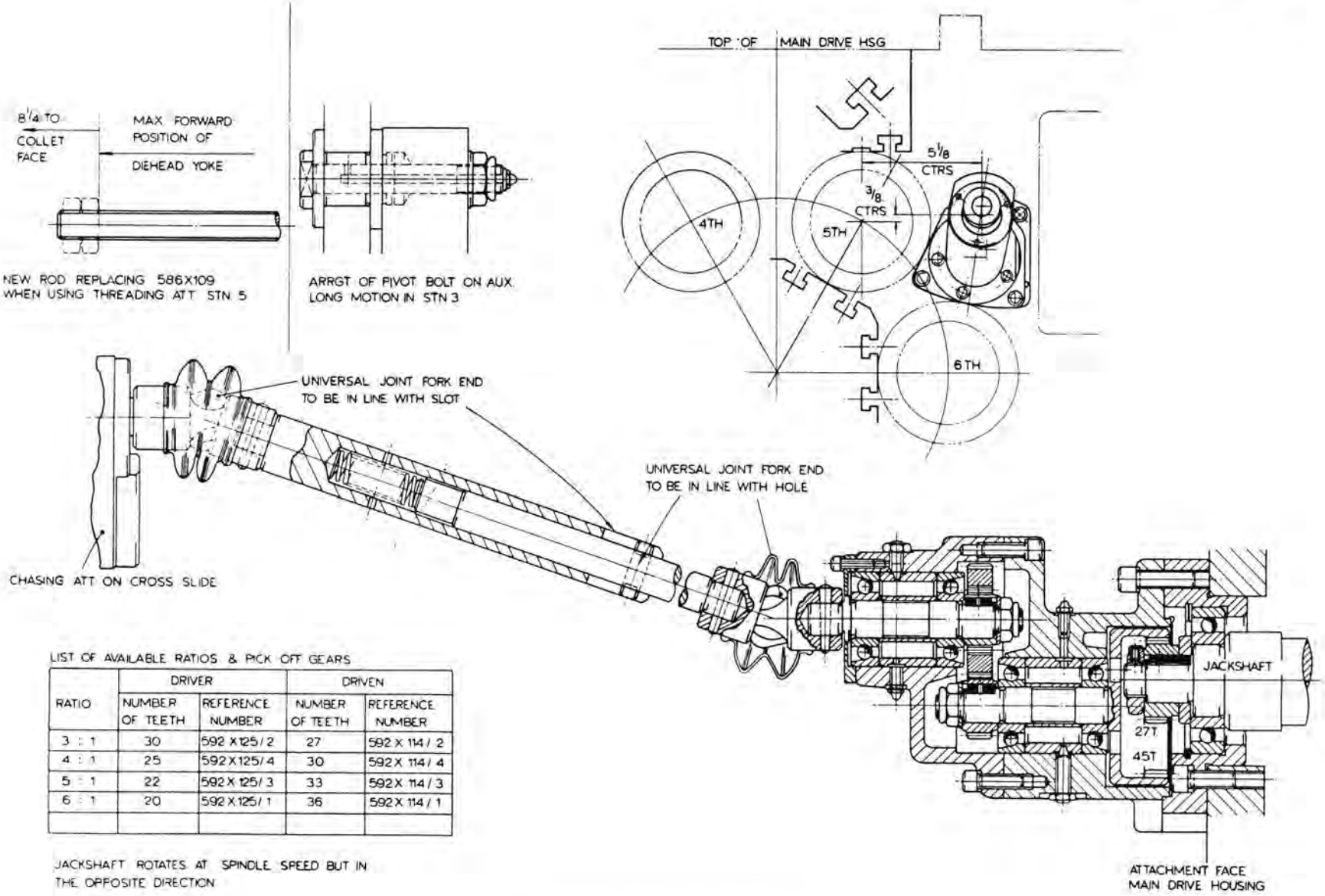


LIST OF AVAILABLE RATIOS & PICK-OFF GEARS

RATIO	DRIVER		DRIVEN	
	NUMBER OF TEETH	REFERENCE NUMBER	NUMBER OF TEETH	REFERENCE NUMBER
3 : 1	30	592X125 / 2	27	592X114 / 2
4 : 1	25	592X125/4	30	592X114 / 4
5 : 1	22	592X125/3	33	592X114 / 3
6 : 1	20	592X125/1	36	592X114/1

JACKSHAFT ROTATES AT SPINDLE SPEED BUT IN OPPOSITE DIRECTION

Chasing Drive 4th Station

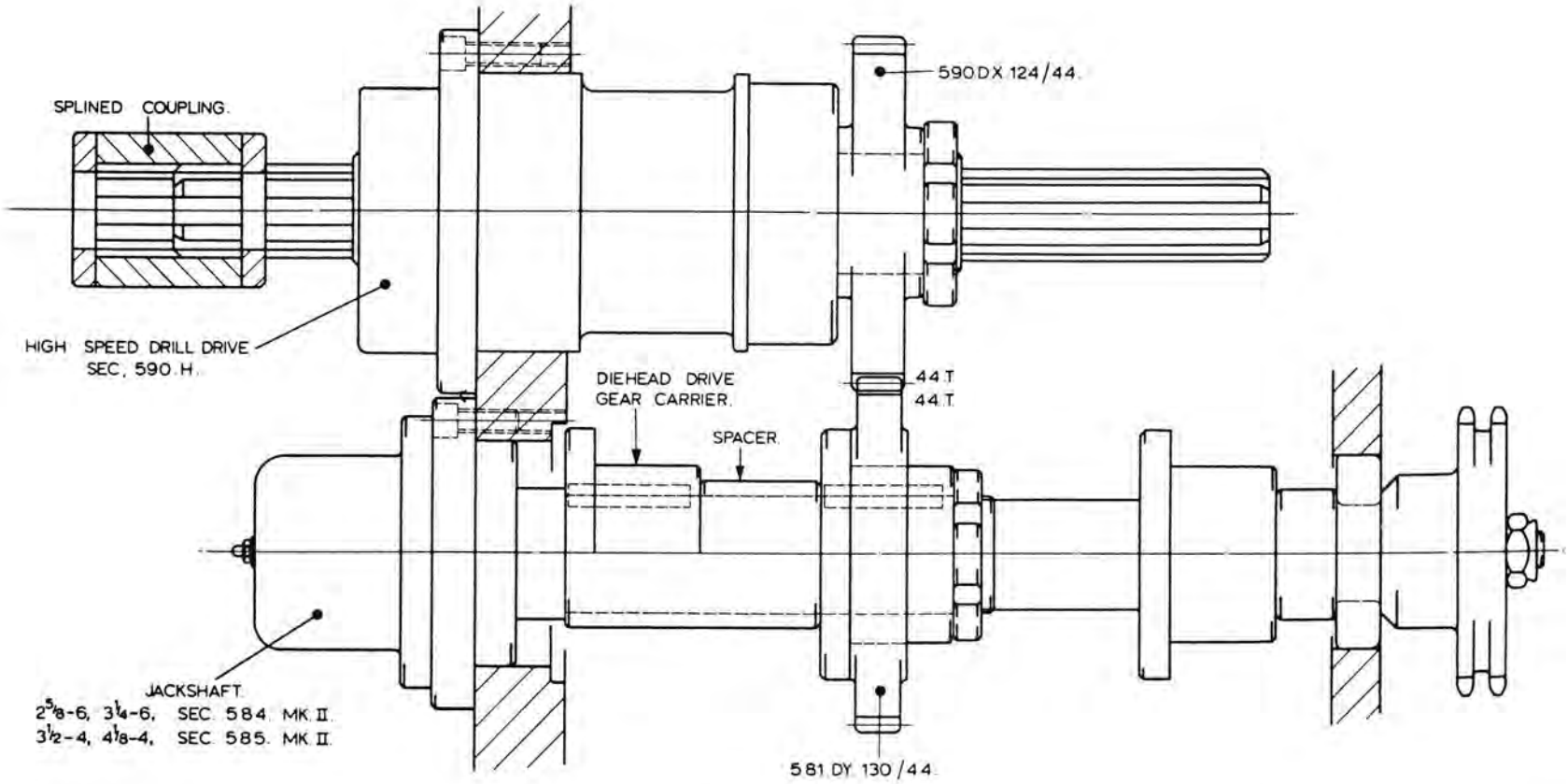


LIST OF AVAILABLE RATIOS & PICK OFF GEARS

RATIO	DRIVER		DRIVEN	
	NUMBER OF TEETH	REFERENCE NUMBER	NUMBER OF TEETH	REFERENCE NUMBER
3 : 1	30	592 X 125 / 2	27	592 X 114 / 2
4 : 1	25	592 X 125 / 4	30	592 X 114 / 4
5 : 1	22	592 X 125 / 3	33	592 X 114 / 3
6 : 1	20	592 X 125 / 1	36	592 X 114 / 1

JACKSHAFT ROTATES AT SPINDLE SPEED BUT IN THE OPPOSITE DIRECTION

Chasing Drive 5th Station



SIX SPINDLE MACHINES :-

SYNCHRONOUS	DRIVE	IN	6th	PREVENTS	FULL	THREADING	IN	5th	DIEHEAD	THREADING	IN	5th	REQUIRES
"	"	"	5th.	"	"	"	"	6th	"	"	"	6th	"
"	"	"	4th.	"	"	"	"	3rd	"	"	"	3rd	"
"	"	"	3rd	"	"	"	"	4th	"	"	"	4th	"

{ EXTRA GEAR CARRIER 584 X 104
KEY 3/8 SQ. 1¾ LG
& A SPACER

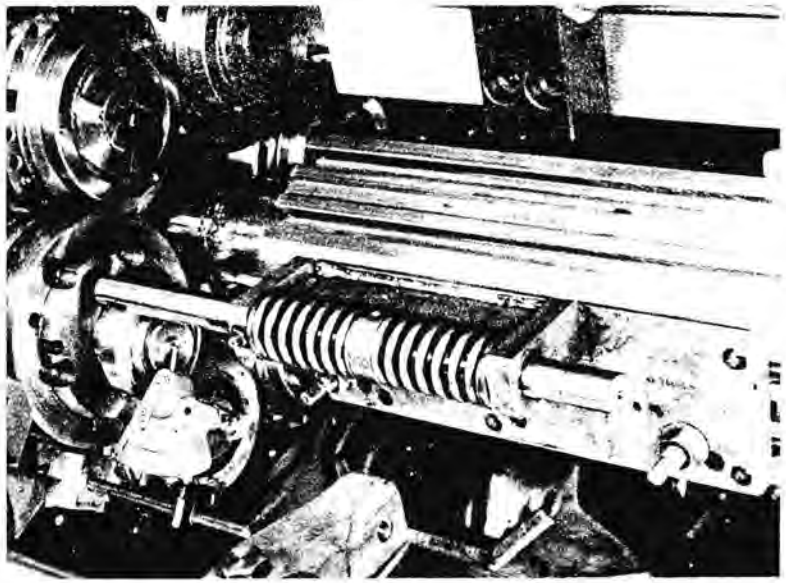
Synchronous Drive

Instructions for examination and adjustment of spindles end-float on machines fitted with Timken Taper Roller Bearings.

(1¼"-6, 2¼"-6, 2⅝"-6, 3¼"-6, 3½"-4, 4⅛"-4, 7¼"-6 and 9"-4 machines)

From time to time it may become necessary to examine and adjust the Timken Taper Roller Bearings which form ans integral part of the Work Spindle Assemblies fitted to Wickman Multi Spindle Automatics.

Concise instructions and the procedure to be followed is given in the following text which will permit adjustments to be made to Machines in the field.



Equipment Required

Loading Attachment, MP 16660.
Lownes Precision Indicator complete with Mounting Rod and Magnetic Base.

1. Work Spindles to be fitted with bar-stock. End of bar-stock to be set flush to Collet face.
2. Collet Tubes to be adjusted to give normal tension when closed by hand mechanism.
3. Ensure that Allen Cap Screws in Spindle Front Bearing Locknuts are secured otherwise incorrect readings will be obtained.
4. Set Main Drive Housing Gears insslow-range and fit Speed Gears to give a Spindle speed between 150-200 r.p.m.
5. Set Centre Quadrant to give Centre Block, at least 2 in. (50 mm.) Stroke and handwind Centre Block halfway through feed stroke.
6. Attach Faceplate of Endfloat Adjustment Equipment to the Spindle in 6th station.
7. Secure Loading Mechanism to 6th Station face of Centre Block, with claw located over deep groove bearing of Faceplate.
8. Run Workspindle and apply load to Spindle Bearings by winding Centre Block forward to expose the loading mark engraved on the shank of the Claw. Do not overwind the loading mark otherwise excessive pressure will be applied to the bearings.
9. Attach Lownes Indicator to the face of the Spindle Drum or Stop Ring using the Magnetic Base. **(Important:** The Magnetic Bases must not be attached to the Drum Housing.)
   Set Stylus of Indicator on centre button of Faceplate and adjust pointer of Indicator to Zero position. Check that the pointer remains steady with maximum total swing not exceeding 0·0002 in. as Work Spindle revolves. Excessive swing denotes incorrect seating of bearings or error in parallelism of spacers in the Spindle Assembly.
10. With Work Spindles revolving, apply load to Work Spindle in opposite direction by retracting Centre Block to expose the forward loading line; Note reading on Scale of Lownes Indicator.
11. Stop Machine, release Allen Cap Screw in Spindle Front Bearing Locknut and adjust, in small increments, to obtain 0·0009 in./0·0011 in. endfloat in Bearings. Ensure that Allen Cap Screw is secured after each movement of Locknut. Re-check endfloat after each adjustment.

Supplement to
Wickman Multi-Spindle Automatics
Operators Handbook

Oil Grade Ref.	Application	B.P.	Shell	Texaco	Duckham	Petrofina	Castrol	Remarks
1	Light Spindle Oil	Energol HL.40	Tellus 15	Spintex 60	Zircon 1	Cirkan 15	Hyspin AWS.10	MTIRA.4
2	Air Line Lubrication	Energol HL.50	Tellus 23	Spintex 100	Zircon 3	Hydran 21	Hyspin AWS.22	Use in colder climates
3	Air Line Lubrication	Energol HL.65 or HLP.65	Tellus 27	Rando HD.A	Zircon 4	Hydran 31	Hyspin AWS.32	Use in warmer climates MTIRA.6
4	Magnetic Clutch Drive Air Line Lubrication Hyd. Chuck Operation Bijur System. General Lub. Spindle Bearings	Energol HLP.80	Tellus 29	Rando HD.B	Zircon 5	Hydran 31	Hyspin AWS.46	General oil for colder climates
5	General Lubrication Bijur System Spindle Bearings	Energol HLP.100	Tellus 33	Rando HD.C	Zircon 6	Hydran 37	Hyspin AWS.68	General oil for warmer climates MTIRA.7
6	Reduction Units	Energol CS.300	Vitrea 71	Regal GR & O	Galrex 9	Solna 58	Alpha 417	Use in conveyor reduction box
7	Slideways	Energol HP.20-C	Tonna 33 or Vitrea 75	Way Lub.D	Adglide 6	Artac 37	Magna BD	MTIRA.11
Grease Grade								
1	Electric Motors	Ener-grease LS.3	Alvania R2 and R3	Regal Starfak Prem'm 3	Admax 13	Marson HTL.3	Spheerol AP.3	MTIRA.3
2	Spindle Nose Cap	Ditto	Ditto	Ditto	Ditto	Ditto	Ditto	

SUMMARY OF SUPPLIERS' COMPARABLE LUBRICANTS FOR WICKMAN AUTOMATICS

Where alternative grade references are given use the 'lighter' grade (lower number) unless oil consumption is excessive.

Slideways, Grade 5 suitable with oil base coolants, Grade 7 with water or oil base coolants.

Continued.....

Oil Grade Ref.	Application	Mobil	Vaughan	Esso	Gulf	Century	Remarks
1	Light Spindle Oil	Velocite Oil No. 6	KSO.5L	Nuto H36	Harmony 34AW	P79A	MTIRA.4
2	Air Line Lubrication	Velocite Oil No. 10	KSO.No. 1	Nuto H40	Harmony 40AN	P313	Use in colder Climates (U.K.)
3	Air Line Lubrication	DTE Oil Light or DTE.24	Evco Med. Hyd. or Hydrodrive HP.150	Nuto H44	Harmony 43AW	PWLA	Use in warmer climates MTIRA.6
4	Magnetic Clutch Drive Air Line Lubrication Hyd. Chuck Operation Bijur System. General Lub. Spindle Bearings	DTE Oil Medium or DTE 25	Evco Heavy Hyd. or Hydrodrive HP.200	Nuto H48	Harmony 48AW	PWLB PWLB	General oil for colder climates (U.K.)
5	General Lubrication Bijur System Spindle Bearings	DTE Oil Heavy Med. or DTE.26	Evco Extra Heavy Hyd. or Hydrodrive HP.300	Nuto H54	Harmony 54AW	PWLC	General oil for warmer climates MTIRA.7
6	Reduction Units	DTE Oil BB	Cosmolubric EHC	Esstic 78	Mechanism LP 85	WLP	Use in conveyor reduction box
7	Slideways	Vactra Oil No.2	Way Lubricant 297	Febis K.73	Gulfway 52 or Slideway 52	428AP	MTIRA.3
Grease Grade							
1	Electric Motors	Mobilplex 48	Evco BB No. 3 Grease	Beacon 2 or 3	Gulfcrown No. 3	Lupus 3	MTIRA.3
2	Spindle Nose Cap	Ditto	Cosmolube * No. 4 Grease	Beacon 2 or 3	Gulfcrown No. 3	Lupus 3	

SUMMARY OF SUPPLIERS' COMPARABLE LUBRICANTS FOR WICKMAN AUTOMATICS

* Cosmolube No. 4, use sparingly and only in nose cap seals.

'INTERLUBE' AUTOMATIC LUBRICATORS

(OPTIONAL EXTRA)

formerly

TECALEMIT-BIJUR

LUBRICATION
INTERLUBE CYCLIC METERED SYSTEM (FORMERLY DESCRIBED AS "BIJUR")
(OPTIONAL EXTRA)

The Interlube pump which has a discharge cycle time of approximately 7½ minutes is mounted above the main motor drive and is belt driven from the constant speed main pulley shaft. The pump is immersed in an oil reservoir of 6 pints (3.5 litres) capacity which should be filled with clean oil to Wickman Grade 4 up to the high mark on the vertical sight glass.

The pump has been set to give (a) the correct quantity of oil at each discharge and (b) the correct number of discharges per hour. The setting is shown on the pump drive arrangement.

The pump setting should not be altered, but the discharge volume may be adjusted by means of the by-pass valve, the slotted head of which is accessible after removing the cover plate next to the filler cap. Clockwise rotation of the by-pass screw increases, and anti-clockwise decreases pressure. The pressure gauge, mounted on the machine end bracket will give a reading when the pump discharges and should read between approximately 20 - 35 lbsf/in^2 (1.4 - 2.6 Kgf/cm^2) depending on conditions.

On systems fitted with pressure switches the pressure should reach at least 20 lbsf/in^2 (1.4 Kgf/cm^2) when the oil is warm.

A pressure switch at the end of the circuit is set to open on a rising pressure of 20 lbsf/in^2 (1.4 Kgf/cm^2) approximately and to close on a falling pressure of 14 lbsf/in^2 (1.0 Kgf/cm^2) approximately. Each time the pump discharges pressure rises, the pressure switch contacts open and de-energising the timer motor clutch relay which resets the timer mounted in the control panel. The timer is set to a 10 minute interval approximately. (Consult wiring diagram). As pressure drops due to discharge through the meter valves, the switch closes, energises the timer motor clutch relay thus starting the timer.

Failure to reach a pressure of 20 lbsf/in^2 (1.4 Kgf/cm^2) during the 10 minute setting of the timer will cause the machine to stop at the end of cycle and a red warning light mounted on the control panel door to illuminate.

To restart the machine the cause of the fault must first be rectified. The control panel disconnect switch must be turned to the "OFF" position and then to the "ON" position to reset the timer, after which, normal starting procedure is followed.

If the machine has been standing idle for some hours it is advisable on re-starting to depress the instant feed button on the Bijur pump for approximately 15 seconds. If the machine has stood idle for a week or more, the instant feed button should be depressed for approximately 5 minutes. This will prime the system and ensure lubrication to points which may have drained dry of oil.

In the event of a serious pressure drop the following procedure should be adopted:-

1. Check level of oil in reservoir.
2. Bleed off any air by loosening pressure gauge and pressure switch connections.
3. With a pressure gauge screw directly to the pump outlet run the pump and depress the instant-feed button. The gauge should register approximately 200 lbsf/in^2 (14 Kgf/cm^2). On releasing the button this reading should remain constant. Should the pressure drop quickly, the seating of the outlet valve should be checked.
4. Check for damaged pipe lines, especially flexibles.
5. Check pump drive belt.

Should the pressure switch be replaced, ensure that the switch is filled with oil prior to connection to the piping.

When pressure checking is fitted to the metered system, it is also fitted to the continuous lubrication system. In which case the continuous pressure is preset to run at approximately 30 lbsf/in^2 (2 Kgf/cm^2). On starting the machine if this pressure is not reached before the main machine motor contacts change from "STAR" to "DELTA" (Approximately 15 seconds delay), the main motor will be de-energised and a red warning light on the control panel door will illuminate.

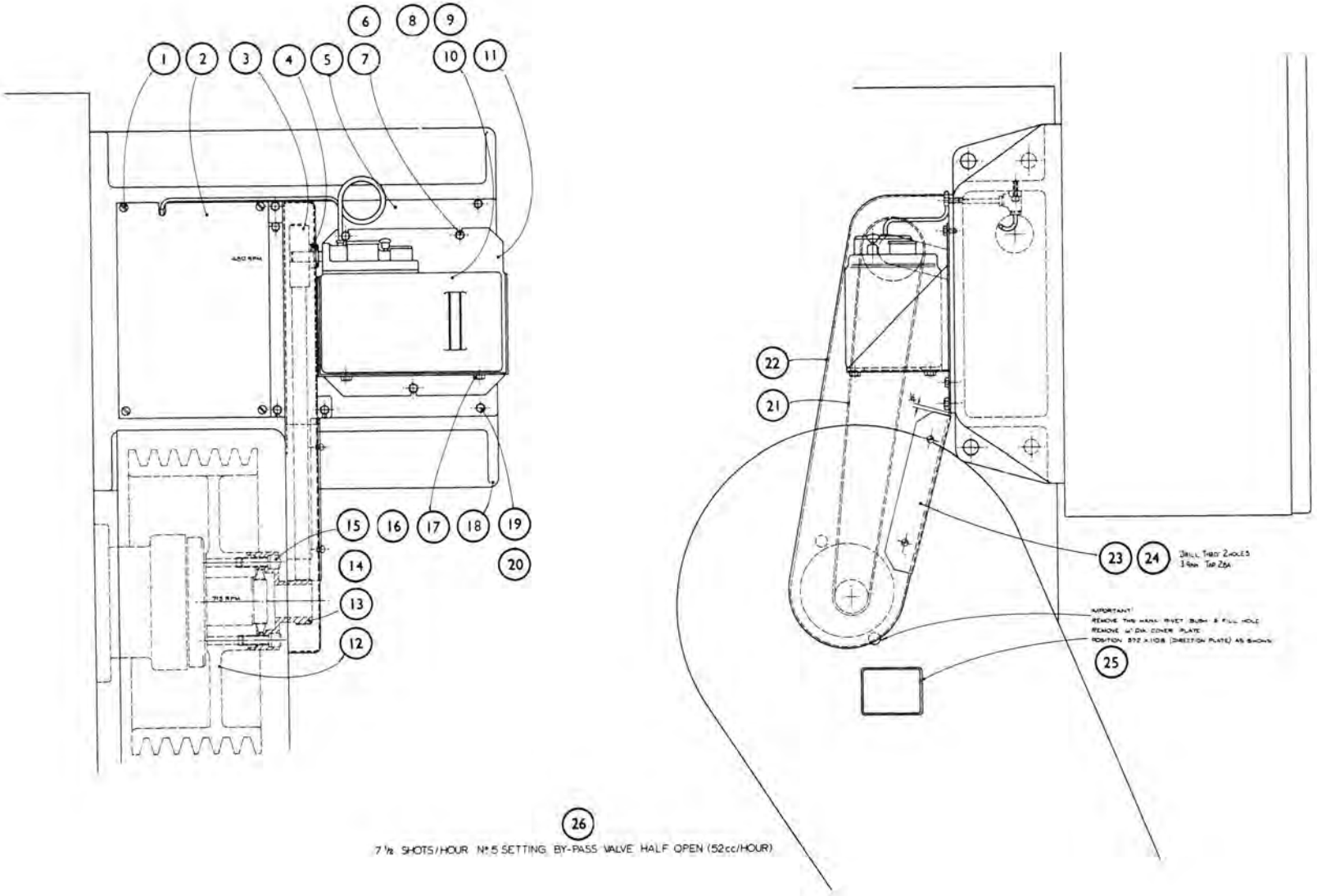
In this circumstance, re-start the machine in an attempt to obtain the required pressure. If the pressure is still inadequate and also if the pressure fails during running, proceed as follows:-

1. Check oil level in machine sump.
2. Bleed off any at pressure switch.
3. Check for broken or flattened main line lubrication pipes.

For identification of pressure switches, timer etc., see relevant machine electrical wiring diagram.

1	164/0408	1/4 B.S.F. ROUND HEAD SCREW 1/4" LONG
2	568V.507	COVER PLATE
3	568X.537	DRIVEN PULLEY
4	176/0406	1/4 B.S.F. SOCKET SET SCREW 3/8" LONG, CUP POINT
5	568Y.539	COVER PLATE
6	198/8	1/4 DIA. LOCKWASHER
7	169/0408	1/4 B.S.F. HEXAGON HEAD SET SCREW 1/2" LONG
8	AH 5014	PUMP
9	AH 1517	RESERVOIR
10	N64 X R	BIJUR - TECALAMIT HIGH PRESSURE PUMP & 6 PINT RESERVOIR
11	568V.541	PUMP BRACKET
12	568V.504	PULLEY
13	568X.538	DRIVE PULLEY
14	154/08	1/2 DIA. SPRING WASHER
15	155/0824	1/2 B.S.F. SOCKET HEAD CAP SCREW 1.1/2" LONG
16	198/10	9/32 DIA. LOCKWASHER
17		5/16 U.N.C. HEXAGON HEAD SCREW 1/2" LONG
18	568Y.503	BRACKET
19	167/0412	1/4 B.S.F. HEXAGON HEAD SCREW 3/4" LONG
20	130/04	1/4 DIA. FLAT WASHER
21	TYPE L	HEVAFLEX BELT 20mm WIDE X 1160 mm LONG
22	568Y.540	BELT GUARD
23	368X.555	COVER PLATE
24	165/204	2 BA ROUND HEAD SCREW 1/4" LONG
25		IMPORTANT! REMOVE THIS HANK RIVET BUSH & FILL HOLE REMOVE 6" DIA. COVER PLATE POSITION 572 X 110 (DIRECTION PLATE) AS SHOWN
26		PLEASE NOTE! 7.1/2 SHOTS/HOUR NO.5 SETTING BY-PASS VALVE HALF-OPEN (52 CC/HOUR)

568 Z 533A ARRANGEMENT OF PUMP DRIVE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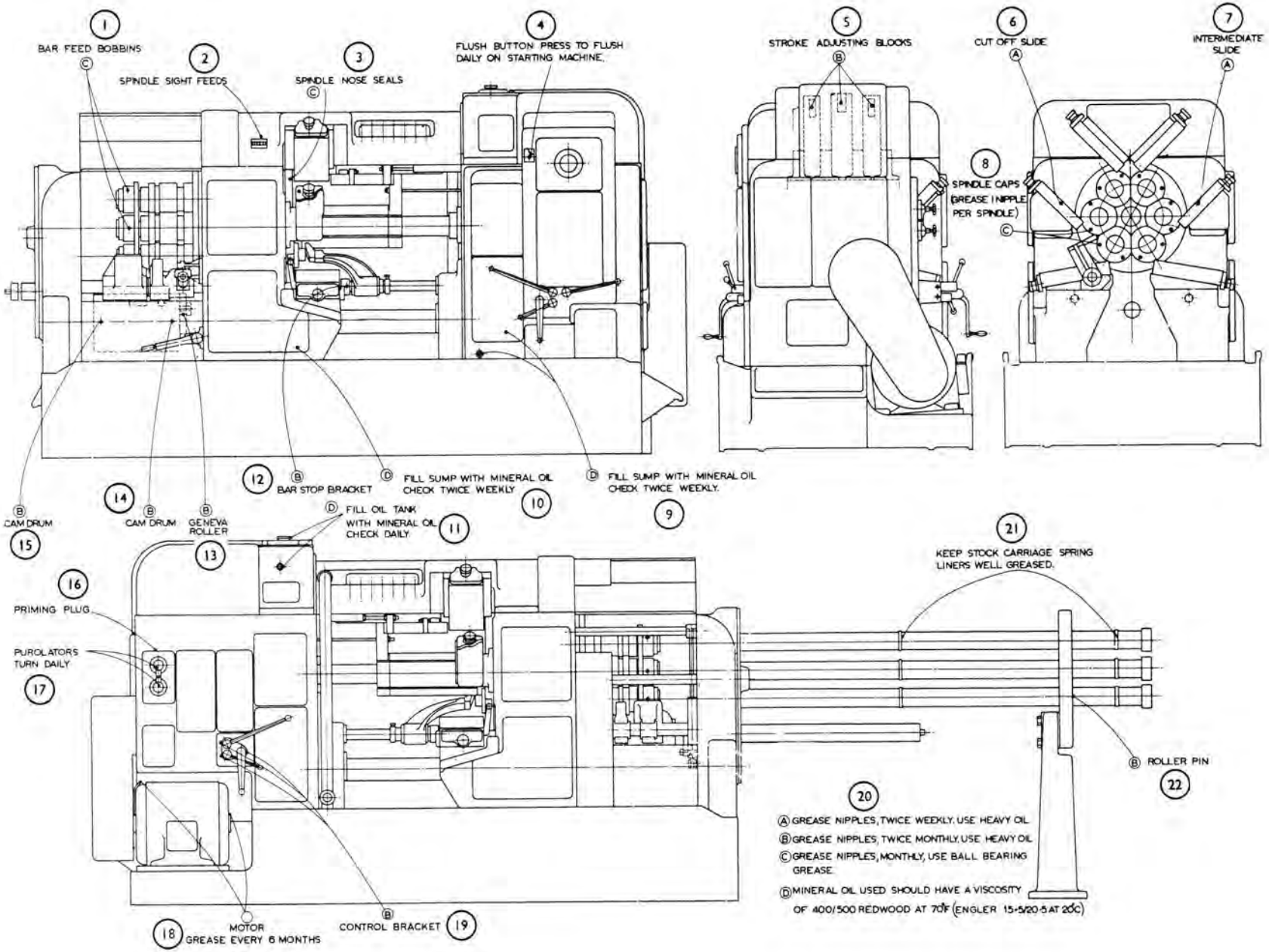
7 ½ SHOTS/HOUR N°5 SETTING BY-PASS VALVE HALF OPEN (52cc/HOUR)

1 (C) BAR FEED BOBBINS
2 SPINDLE SIGHT FEEDS
3 (C) SPINDLE NOSE SEALS
4 FLUSH BUTTON PRESS TO FLUSH DAILY ON STARTING MACHINE
5 (B) STROKE ADJUSTING BLOCKS
6 (A) CUT OFF SLIDE
7 (A) INTERMEDIATE SLIDE
8 (C) SPINDLE CAPS (GREASE 1 NIPPLE PER SPINDLE)
9 (D) FILL SUMP WITH MINERAL OIL CHECK TWICE WEEKLY
10 (D) FILL SUMP WITH MINERAL OIL CHECK TWICE WEEKLY
11 (D) FILL OIL TANK WITH MINERAL OIL CHECK DAILY
12 (B) BAR STOP BRACKET
13 (B) GENEVA ROLLER
14 (B) CAM DRUM
15 (B) CAM DRUM
16 PRIMING PLUG
17 PUROLATORS TURN DAILY
18 MOTOR GREASE EVERY 6 MONTHS
19 (B) CONTROL BRACKET
20 (A) GREASE NIPPLES, TWICE WEEKLY, USE HEAVY OIL
(B) GREASE NIPPLES, TWICE MONTHLY, USE HEAVY OIL
(C) GREASE NIPPLES, MONTHLY, USE BALL BEARING GREASE
(D) MINERAL OIL USED SHOULD HAVE A VISCOSITY OF 400/500 REDWOOD AT 70°F (ENGLER 15-5/20-5 AT 20°C)
21 KEEP STOCK CARRIAGE SPRING LINERS WELL GREASED
22 (B) ROLLER PIN

568 Z 515 LUBRICATION CHART


1 BAR FEED BOBBINS Ⓒ
2 SPINDLE SIGHT FEEDS
3 SPINDLE NOSE SEALS Ⓒ
4 FLUSH BUTTON PRESS TO FLUSH DAILY ON STARTING MACHINE.
5 STROKE ADJUSTING BLOCKS Ⓑ
6 CUT OFF SLIDE Ⓐ
7 INTERMEDIATE SLIDE Ⓐ
8 SPINDLE CAPS (GREASE NIPPLE PER SPINDLE) Ⓒ
9
10 Ⓓ FILL SUMP WITH MINERAL OIL CHECK TWICE WEEKLY.
11 Ⓓ FILL OIL TANK WITH MINERAL OIL CHECK DAILY.
12 Ⓑ BAR STOP BRACKET
13 Ⓑ GENEVA ROLLER
14 Ⓑ CAM DRUM
15 Ⓑ CAM DRUM
16 PRIMING PLUG
17 PUROLATORS TURN DAILY
18 MOTOR GREASE EVERY 6 MONTHS
19 Ⓑ CONTROL BRACKET
20
Ⓐ GREASE NIPPLES, TWICE WEEKLY. USE HEAVY OIL
Ⓑ GREASE NIPPLES, TWICE MONTHLY, USE HEAVY OIL
Ⓒ GREASE NIPPLES, MONTHLY, USE BALL BEARING GREASE.
Ⓓ MINERAL OIL USED SHOULD HAVE A VISCOSITY OF 400/500 REDWOOD AT 70°F (ENGLER 15-5/20-5 AT 20°C)
21 KEEP STOCK CARRIAGE SPRING LINERS WELL GREASED.
22 Ⓑ ROLLER PIN

568 Z 515

AUTOMATIC LUBRICATORS TYPE "CG32"

AH.5010 – AH.5019, Issue 5.

INTRODUCTION

1. The Interlube Type CG32 lubricator units described in this publication are high pressure, self-lubricating gear pumps fitted with cycle valve mechanism. All models are designed for installation in the sump of the machine to be lubricated or in a separate reservoir and the drive is taken from a rotating shaft on the parent machine or from an electric motor.
This instruction Sheet refers only to the lubricator units listed in Table 1 below:

TABLE 1 – LUBRICATOR DATE

Type Symbol	Catalogue No.	Drive Shaft R.P.M.			Direction of Drive
		Min.	Normal	Max.	
CG32 LUBRICATORS:					
	AH.5010 AH.5011	45	67	110	L.H. R.H.
	AH.5012 AH.5013	100	150	250	L.H. R.H.
	AH.5014 AH.5015	400	600	1000	L.H. R.H.
	AH.5018 AH.5019	650	1000	1650	L.H. R.H.
	AH.5016 AH.5017	1200	1800	3000	L.H. R.H.

DESCRIPTION

2. The lubricator comprises a pump body which is suspended from a cover plate and fitted at its lower end with a base (14) containing a filter pad (19), screen (18) and screen support (17) retained within the base by a clamping ring (20) and a snap ring (21). The pump gears (22) and (23) are housed in a gear chamber plate fitted between the base and the pump body and are driven through reduction gearing by a drive shaft (5) and a vertical shaft (31).

A cycle valve installed in the pump chamber is linked by a follower arm, (27) to a rotary cam assembly (30) driven through a worm shaft (29) by the vertical shaft. The cam is adjustable and the setting selected determines the delivery cycle of the lubricator and the volume of oil discharged per cycle.

An 'instant feed' button on top of the cover plate permits manual closing of the cycle valve, irrespective of the cam position, when priming the distribution system and a non-return valve (34) is connected to the lubricator outlet tube (33) to prevent reverse flow from system when the machine is idle. A pressure relief valve (32) set to operate at approximately 200 p.s.i. is also fitted.

Secondary adjustment of the discharge volume is provided by a by-pass valve installed at the pump chamber outlet. The valve is manually adjusted by means of a threaded valve stem (13), accessible when the cover plate lid (9) is removed.

OPERATION

3. As the pump gears rotate oil is drawn through the filter and into the pump chamber. The chamber has two outlets; one leads directly to the distribution system and the other to the cover plate via an overflow tube, flow being alternated between the two outlets by the action of the cycle valve. When the cam follower is riding on the major diameter of the cam, the cycle valve is open and oil passes up the overflow tube to lubricate the drive shaft gearing, returning to the reservoir through a drilled hole in the cover plate. When the follower is riding in a cam notch the cycle valve is closed by spring pressure and the oil is forced through the outlet tube and check valve into the distribution system.

LUBRICANT

4. Use only a clean straight mineral oil of a type and viscosity recommended by the machine manufacturer; do not use compounded oils.

PRIMING THE SYSTEM

5. To prime the distribution system on a new machine or one that has stood idle for a long period, fill the sump or reservoir with oil, start the machine and hold down the "instant feed" button until oil shows freely at all bearings.

ADJUSTING THE OIL VOLUME

6. To ensure adequate lubrication of a new machine the lubricator may be adjusted by the machine manufacturer to deliver the maximum volume of oil. If over-oiling occurs when the machine is fully run in and operating at the correct temperature the lubricator should be adjusted as follows:-

CAM ADJUSTMENT

6(a). The cam is a two-part assembly, the outer member of which engages with the inner member through a driving pin. The outer member has eight locating holes and these are so spaced that changing the location of the driving pin also changes the contour of the cam, increasing or decreasing the length of the cam notch and, similarly, the time that the cycle valve will remain closed. Discharge per cycle is independent of the lubricator drive speed and discharge per hour is proportional to the drive speed. The cycle time is inversely proportional to the drive speed. The discharge figures given below are at normal drive speed with the by-pass valve closed.

To adjust the cam, remove the lubricator from its mounting as in para. 9 and note the number of the hole in which the driving pin is located. Pull out the knob and locate the pin in the hole of the next HIGHER number to INCREASE the delivery and in the next LOWER number to DECREASE it.
CAUTION: Do not adjust the cam by more than one hole at a time and do not make further adjustment for several days.

TABLE 2 – CAM SETTING, CYCLE TIME AND DISCHARGE

Cam Setting	Cycle Time	Average Discharge per Cycle	Average Discharge per Hour	Average Time for One Pint Discharge
8	6¼ mins.	32 cu. cm.	300 cu. cm.	1½ hrs.
7	6¼ mins.	21 cu. cm.	200 cu. cm.	2½ hrs.
6	6¼ mins.	14 cu. cm.	140 cu. cm.	3½ hrs.
5	6¼ mins.	10 cu. cm.	90 cu. cm.	5½ hrs.
4	25 mins.	21 cu. cm.	50 cu. cm.	9½ hrs.
3	25 mins.	14 cu. cm.	35 cu. cm.	14 hrs.
2	25 mins.	11 cu. cm.	25 cu. cm.	19 hrs.
1	25 mins.	8 cu. cm.	20 cu. cm.	24 hrs.

6(b) *By-Pass Valve.* Where delivery requirements are critical secondary adjustment of the lubricator discharge volume can be obtained by regulating the by-pass valve installed in the pump chamber. When opened the valve bleeds oil from the chamber and reduces delivery down to 50% of the figures quoted in Table 2, thus enabling very precise adjustments to be made.

To adjust the valve setting remove the cover plate lid (9) and turn the valve stem (13) CLOCKWISE to INCREASE the delivery and ANTI-CLOCKWISE to DECREASE. It is not necessary to stop the machine when making this adjustment.
CAUTION:- The valve is normally set in the closed position by the machine manufacturer and should be opened ONLY if the required delivery cannot be obtained by cam adjustment. Do not alter the valve setting by more than one-sixth of a turn at a time and make no further adjustment for several days.

MAINTENANCE

7. The lubricator requires very little routine maintenance but regular attention to the following points is important in order that a high standard of performance is maintained with correspondingly efficient lubrication of the parent machine.

7(a). *Oil Level.* Check the oil level daily and refill the sump or reservoir as necessary. Ensure that the filler cap breather hole is not obstructed.

7(b). *Filter.* At least once a year dismantle the filter assembly and wash all items in clean petrol, renewing where necessary.

To dismantle the filter remove the lubricator from its mounting (para 9), prise out the snap ring (21) and remove the clamp ring (20), filter disc (19), filter screen (18) and screen support (17) in that order. After cleaning reassemble the filter in the reverse order to dismantling.

7(c). *Distribution System.* At intervals of approximately one month inspect the system for leakage caused by loose connections or damaged tubing, tightening or replacing as necessary.

REPAIR FACILITIES

8. Where circumstances permit, a lubricator which develops a fault in service should be returned, carriage paid, to Interlube Systems Ltd. where full repair and testing facilities are available. If return of the lubricator is not possible, or if the fault requiring attention is of a minor nature only, repairs may be carried out on site following the instructions below.

DISMANTLING THE LUBRICATOR

9. No special tools are required to dismantle the lubricator. The unit must first be removed from its mounting by releasing the distribution line bushing (7) and cone (6), removing the drive shaft coupling and removing the four cover plate screws. Then proceed as follows:-

9(a). *Drive Shaft Assembly (5):* Remove the drive shaft retaining plate (2) and the cover plate lid (9), together with their gaskets (3) and (10). Drive out the pin securing the worm or gear and withdraw the drive shaft, collecting the thrust washer (4). Removal of the thrust collar is not necessary.

9(b). *Vertical Shaft Assembly (31).* Remove the drive shaft as in para. 9(a) above and the filter assembly as in para. 7(b). Remove the four screws (16) and washers (15) securing the pump base (14) and remove the base and pump gears (22) and (23). Drive out the pins securing the gear or worm and the thrust collar, withdraw the shaft.

9(c). *Cam shaft Assembly (30).* Remove the cam follower (27), drive out the pin securing the cam shaft worm gear and remove the gear and thrust washer. Withdraw the cam shaft.

9(e). *Worm Shaft Assembly (29).* Remove the cam shaft(s) as described above drive out the pin securing the worm gear, remove the gear and thrust washer and withdraw the shaft.

9(f). *Outlet Valve (34) and Pressure Relief Valve (32).* These valves cannot be dismantled and if faulty must be removed from the irrespective positions and renewed.

9(g). *By-Pass Valve Stem (13).* Failure to obtain correct delivery requirements when adjusting the by-pass valve may be due to a scored or otherwise damaged valve stem. This is removed by unscrewing it from the by-pass valve but the valve itself is pressed into the pump body and cannot be removed.

FAULT DIAGNOSIS

FAULT	CAUSE	REMEDY
1. INSUFFICIENT oil at ALL bearings.	1(a). Low oil level in reservoir. 1(b). Dirty filter disc (19). 1(c). Cam adjustment incorrect or by-pass valve open. 1(d). Loose connection or damaged tubing. 1(e). Faulty outlet valve (34).	1(a). Fill Reservoir 1(b). Clean or renew disc. 1(c). Adjust cam or by-pass valve setting. 1(d). Rectify as necessary. 1(e). Renew valve.
2. EXCESS oil at ALL bearings.	2(a). Cam adjustment incorrect.	2(a). Adjust cam setting.
3. EXCESS or INSUFFICIENT oil at ONE bearing.	3(a). Faulty or incorrect flow unit fitted.	3(a). Fit replacement flow unit

TABLE 3 – SPARE PARTS LIST

Item No.	Description	Part No.
	LUBRICATOR UNIT, TYPE.....	
	SEALING GASKETS.....	
3	1 off, gasket, retaining plate (173140)	
10	1 off, gasket, cover plate (173197)	
12	1 off, gasket, lubricator mounting (173198)	
5	Drive shaft assembly	
11	Filler cap assembly.....	44141
	FILTER ASSEMBLY	
17	1 off, support, filter (175403)	
18	1 off, screen, filter (175404)	
19	1 off, disc, filter (141291)	
20	1 off, ring, clamp (121145)	
21	1 off, ring, snap (175039)	
	.....	–
27	Follower, cam	165076
28	Secondary cam shaft assembly	–
29	Worm shaft assembly	71161
30	Cam shaft assembly	71162
31	Vertical shaft assembly	
32	Valve, pressure relief	49077
34	Valve, outlet	49076

TABLE 4 – DRIVE SHAFT AND VERTICAL SHAFT ASSEMBLIES

Lubricator		Drive Shaft Item (5)	Vert. Shaft Item (31)
AH.5010		71151	71138
AH.5011		71152	71139
AH.5012		71153	71140
AH.5013		71154	71141
AH.5014		71155	71142
AH.5015		71156	71143
AH.5016		71159	71146
AH.5017		71160	71147
AH.5018		71157	71144
AH.5019		71158	71145

ORDERING SPARE PARTS

1. Only those items listed in Tables 3 and 4 above are supplied as spare parts.
2. Items comprising Spares Packs and Sub-Assemblies are not supplied separately.
3. Order by Description, Part No. and Quantity - specifying the Lubricator, Cat. No. and Serial No. – THIS IS IMPORTANT.
4. Flow units and junctions are shown in publications 253 & 254.

REASSEMBLY

10. Reassembly of the lubricator is a reversal of the dismantling procedure. All items must be thoroughly cleaned and inspected for wear or damage, paying particular attention to the by-pass valve stem (13), the gears (22) and (23) and the gear chamber plate. When replacing the lubricator fit a new mounting gasket (12) and ensure that the drive coupling is firmly secured.

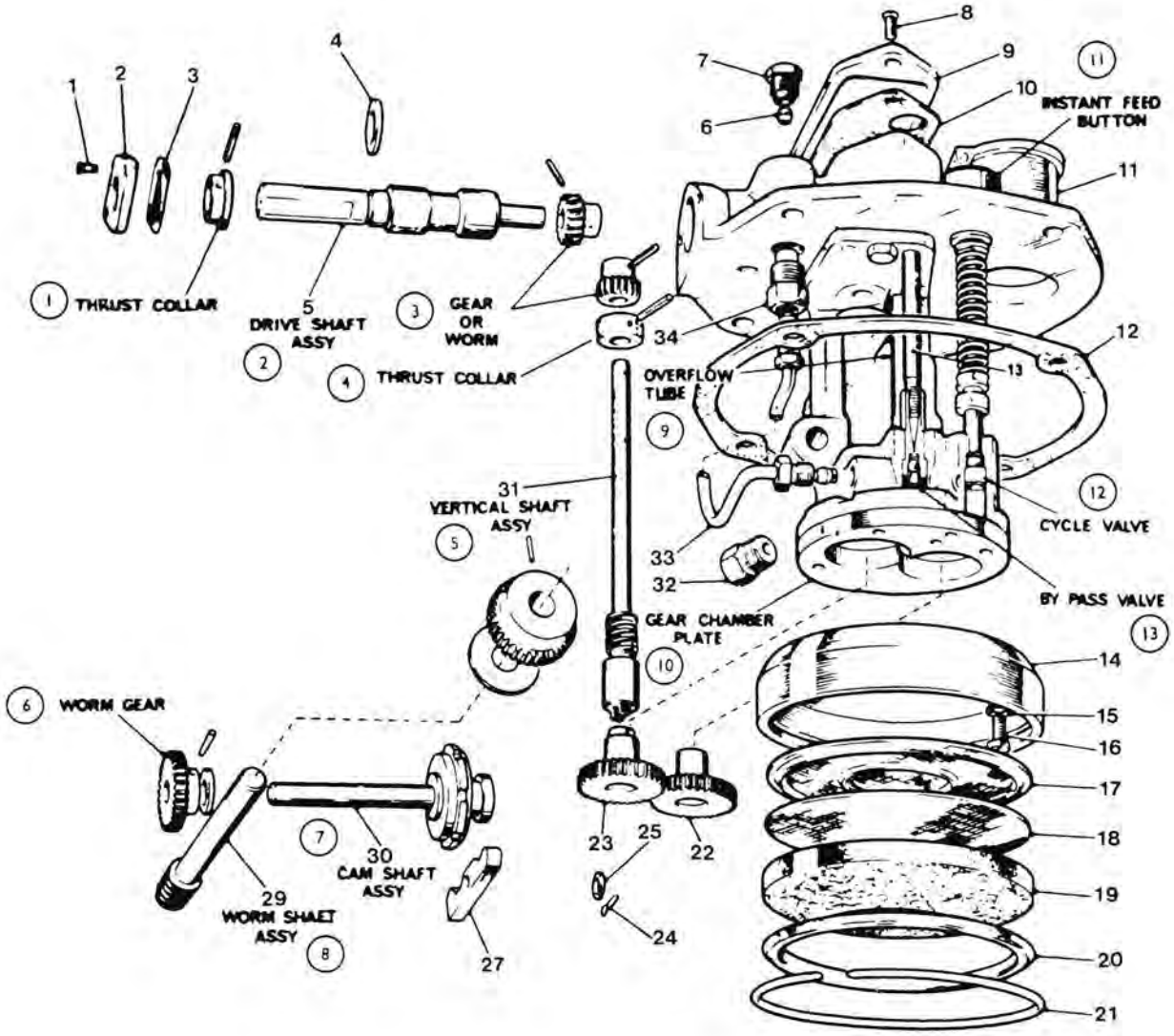
FLOW UNITS

11. Each bearing served by the lubricator is fitted with a flow unit, a precision fitting which apportions a specified volume of oil to the bearing sufficient to maintain a constant oil film. The flow unit is non-adjustable and requires no cleaning, inspection or other form of maintenance.

If the volume of oil delivered TO A SINGLE BEARING appears incorrect remove the flow unit and replace it with one of the next HIGHER flow rate to INCREASE the volume and of the next LOWER flow rate to DECREASE it. Note: Each increase in flow rate number doubles the volume of oil delivered.

LUBRICATION PUMP CG32

1. THRUST COLLAR
2. DRIVE SHAFT ASSEMBLY
3. GEAR OR WORM
4. THRUST COLLAR
5. VERTICAL SHAFT ASSEMBLY
6. WORM GEAR
7. CAM SHAFT ASSEMBLY
8. WORM SHAFT ASSEMBLY
9. OVERFLOW TUBE
10. GEAR CHAMBER PLATE
11. INSTANT FEED BUTTON
12. CYCLE VALVE
13. BYPASS VALVE



TYPE CG 32 LUBRICATOR UNIT