4 NOV 1978

THIS MANUAL

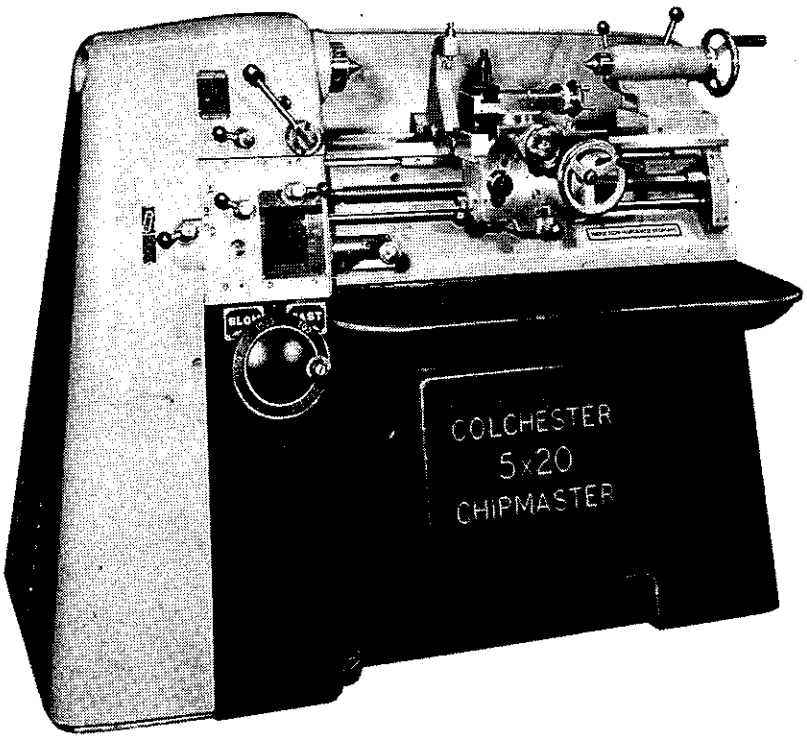
applies to the Colchester 5in x 20in (127 x 508mm) Chipmaster high speed precision lathe.

A full understanding of the contents will help you obtain the best results from the machine and achieve the standards of accuracy available.

Our Technical Service Department is at your disposal to discuss problems concerning the application of Colchester Lathes and their attachments. Our aim is to ensure that you obtain the maximum satisfaction from your machine.

The serial number will be found on a red disc on each major assembly and MUST be quoted in all communications regarding your lathe. Due to the Company's policy of continuous improvement, designs may be modified or changed at any time and this manual applies only to the machine with which it is issued.

THE SERIAL NUMBER OF YOUR MACHINE IS.....



ONE COPY OF THIS MANUAL IS SUPPLIED FREE WITH EACH MACHINE

INDEX

BRIEF SPECIFICATION

CAPACITIES		
Height of centres	5⅝ in	143 mm
Swing		
Over bed	11¼ in	286 mm
Over cross slide	7 in	178 mm
Distance between centres	20 in	508 mm
Diameter of faceplate	10⅞ in	276 mm
Diameter of driving plate	6 in	152 mm
Capacity of travelling steady	1⅜ in	35 mm
Overall length	59¼ in	1505 mm
Overall width	29 in	737 mm
Approximate weight	1148 lb	521 kg.
HEADSTOCK		
Spindle bore (Max. bar dia.)	1⅜ in	35 mm
Spindle nose, Camlock	3 in D.1.	
Taper in spindle nose bush	No. 3 M.T.	
Spindle speeds – infinitely variable	35–3000 r.p.m.	
CARRIAGE		
Total travel of cross slide	6⅜ in	162 mm
Total travel of top slide	3⅝ in	92 mm
Height from top of topslide to centre line of spindle	1⅝ in	41 mm
Max. tool shank size	½ in × 1 in	12·5 mm × 25·4 mm
THREADS AND FEEDS		
Pitch of leadscrew	4 t.p.i.	
Number of threads – Whitworth	44	
Range	2–120 t.p.i.	
Number of threads – Metric	14	
Range	0·5 mm–12 mm	
Number of feeds	27	
Range per rev. of spindle –		
Longitudinal	0·001 in–0·008 in	0·025–0·20 mm
Cross	0·0005 in–0·004 in	0·0125–0·10 mm
TAILSTOCK		
Spindle travel (No. 3 M.T. Centre fitted)	4 in	102 mm
Spindle travel (Standard tang drill fitted)	3½ in	89 mm
Taper in spindle	No. 3 M.T.	

DRIVE

2 h.p. continuously rated single speed motor driving Kopp variable speed unit of 9 : 1 ratio.

STANDARD EQUIPMENT SUPPLIED WITH THE MACHINE

for details of accessories see page 16

One 10" diameter faceplate
One 6" diameter driving plate
Two No. 3 Morse taper centres
Centre bush
Travelling steady
Spanners and keys

INTRODUCTION

An obvious feature of the Chipmaster lathe is that the basic form of the machine departs from the conventional. This new shape was decided after careful study because it was best adapted to the increased cutting loads resulting from the use of carbide and ceramic tools. The second outstanding feature of the Chipmaster is the arrangement of the drive to the headstock and gearbox, coupled with the fact that it offers infinitely variable spindle speeds from 35 r.p.m. up to the maximum of 3000 r.p.m.

As far as the operator is concerned, one of the great advantages of infinitely variable speeds is that spindle speed can be changed while the lathe is cutting. This feature gives the operator precise and accurate control over cutting speeds at all times.

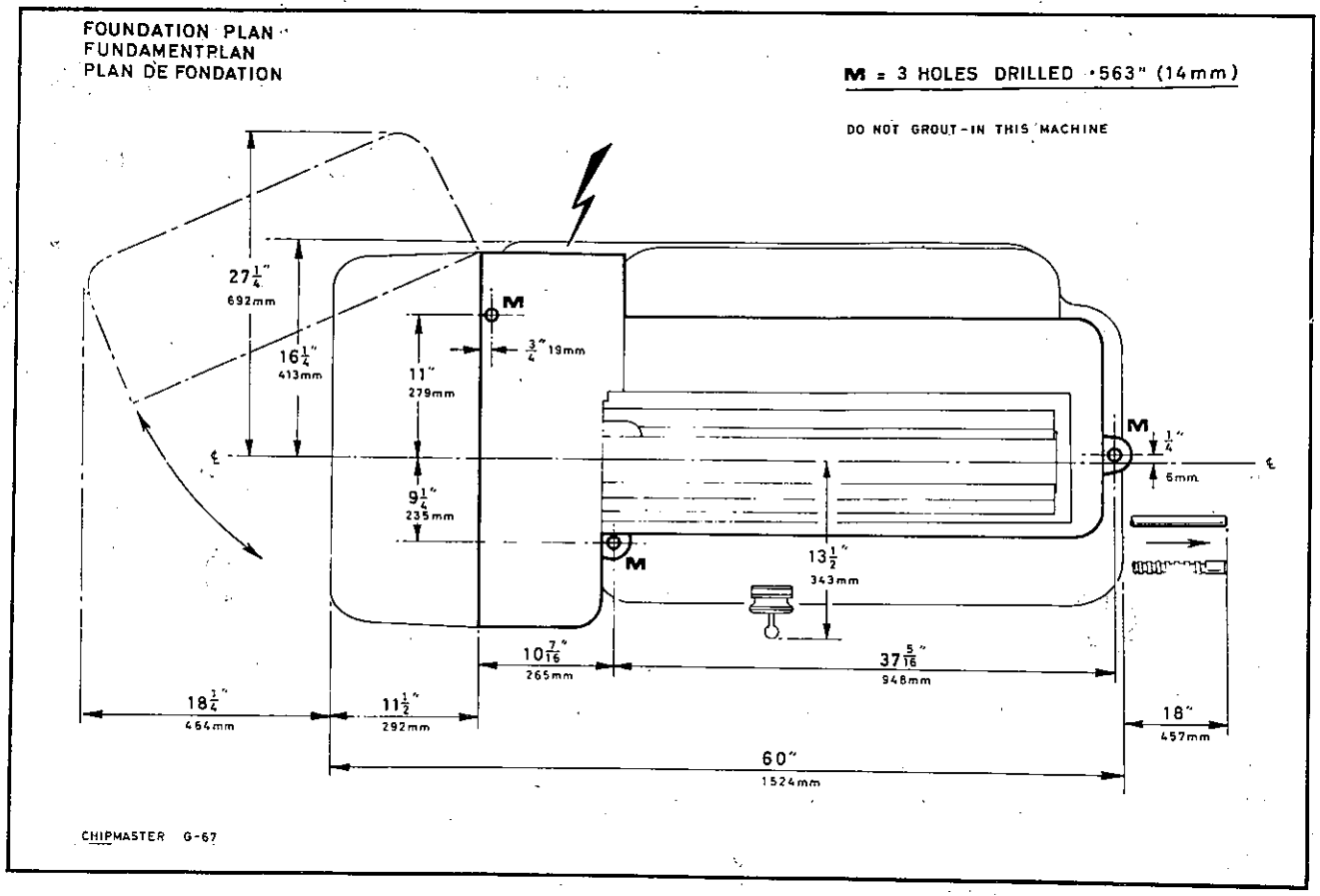
The machine incorporates a single speed motor coupled to the speed variator by a toothed rubber timing belt. Drive from the variator to the Matrix clutch is by twin vee belts. For the lower spindle speeds from 35-300 r.p.m., drive from the clutch is by conventional high tensile hardened and honed headstock gearing. For the higher spindle speeds from 320-300 r.p.m. the headstock gearing and gear drive to the feed gearbox are disengaged, and automatically replaced by toothed rubber timing belts. The absence of gearing in the final drive at high speeds eliminates vibration and makes it possible to achieve remarkably fine surface finishes.

To this is now added the fact that continuous research and development coupled to improvements in manufacturing techniques has resulted in the already high accuracy of the Chipmaster being further enhanced. Every Chipmaster lathe, in common with the other machines in the Colchester range, is now guaranteed to turn round within 0·0001" and a test graph is supplied with each machine showing the accuracy of a test piece turned under shop conditions on the particular lathe. The average deviation from a true circle of the test pieces from all machines is in the region of only 70 millionths of an inch!

In the Colchester Chipmaster accuracy of the highest order is allied to versatility, for a comprehensive range of additional equipment is available to increase even further the efficiency of this remarkable machine. Notable attachments include hydraulic copying units, a taper turning attachment and a 5-station hand operated capstan unit obtainable complete with pneumatic bar feed and lever-operated collet chuck.

A product of Europe's largest factory devoted solely to the manufacture of centre lathes, the Chipmaster is built on the unit construction principle, and full advantage has been taken of a unique system of jigs, fixtures and gauging units in order to provide complete interchangeability of assemblies. A replacement assembly may be fitted without the specialized fitting and mating up of parts normally associated with machine tools of this accuracy. This is backed up by a specialized Service Division to ensure that down time due to maintenance of the machine is reduced to a minimum.

Colchester lathes are designed and manufactured by specialists in the most up-to-date lathe factory in the world—details of the full range of machines and equipment will gladly be sent on request.

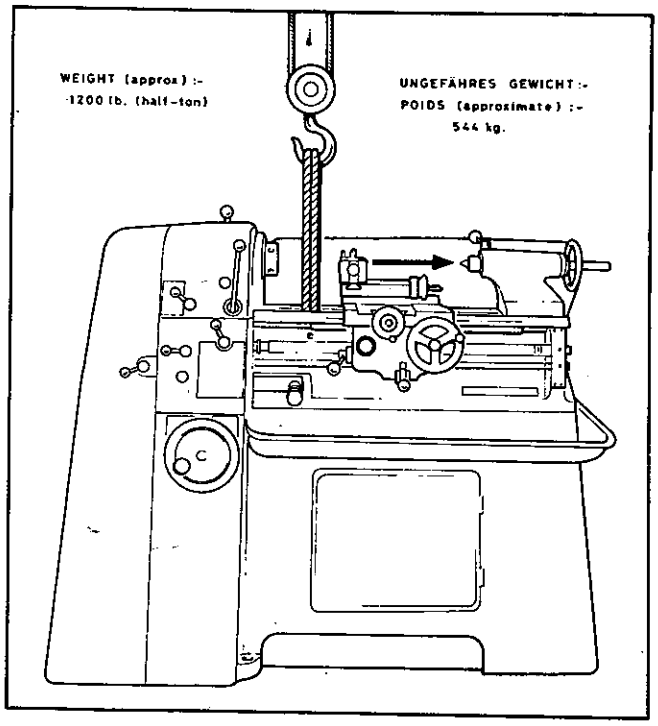


LOCATION

No special foundations or bolt holes are normally required. Provided that the floor is firm, level and able to bear the weight of the machine, the lathe can be installed in any convenient position.

It must be borne in mind, however, that since removal of swarf is from the back of the machine and, also, access to the end gears is gained by swinging back the end guard, a reasonable working space must be allowed all round the machine.

The main dimensions and recommended minimum area for efficient operation and servicing of the lathe are shown in the foundation plan opposite.



LIFTING

Lifting should be carried out with the greatest care, since the machine is heavy at the headstock end. Immediately in front of the headstock will be found a cross bar and full use should be made of this in manoeuvring the machine. UNDER NO CIRCUMSTANCES should a pinch bar be used. Proper equipment should be available for lifting the machine.

CLEANING

When the lathe is delivered all bright machined surfaces are covered by a heavy protective coating. This must be removed with white spirit or kerosene before attempting to use the machine. DO NOT USE CELLULOSE SOLVENTS AS THESE WILL DAMAGE THE PAINTWORK.

Particular attention should be paid to the slides and spindle nose, and it is essential that the end guard is opened and the assemblies covered by this carefully cleaned. All traces of the cleaning agent should then be removed and the bright surfaces given a light coating of Shell Tellus 33 Oil.

POSITIONING

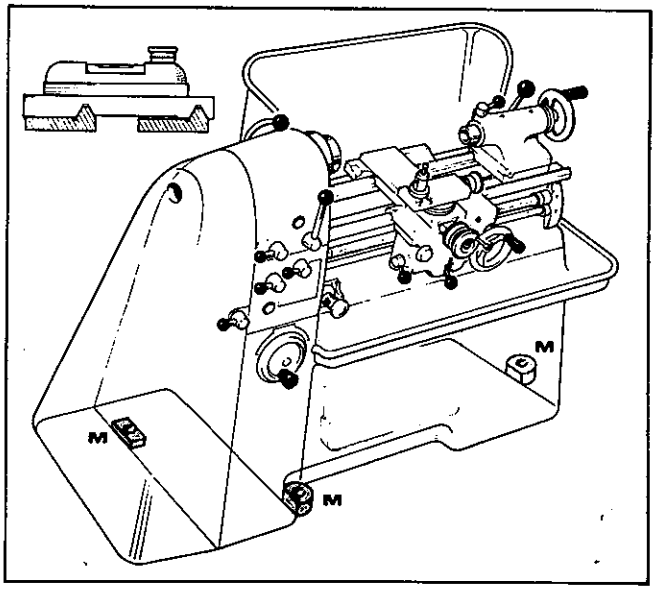
When the machine has been moved into position it should be raised and the compound rubber pads provided set under the mounting bosses (see below). THE MACHINE SHOULD NOT BE GROUTED IN.

As the lathe normally stands on three mounting pads no further levelling should be required.

When the machine is bolted to the foundation, the pads must be pierced before placing them in position. This is to permit the mounting bolts to pass through the pads and retain them in position whilst bolting down.

A precision engineers' level should be used on the bedways to ensure that the machine remains true and level when bolted down.

POSITION OF MOUNTING PADS

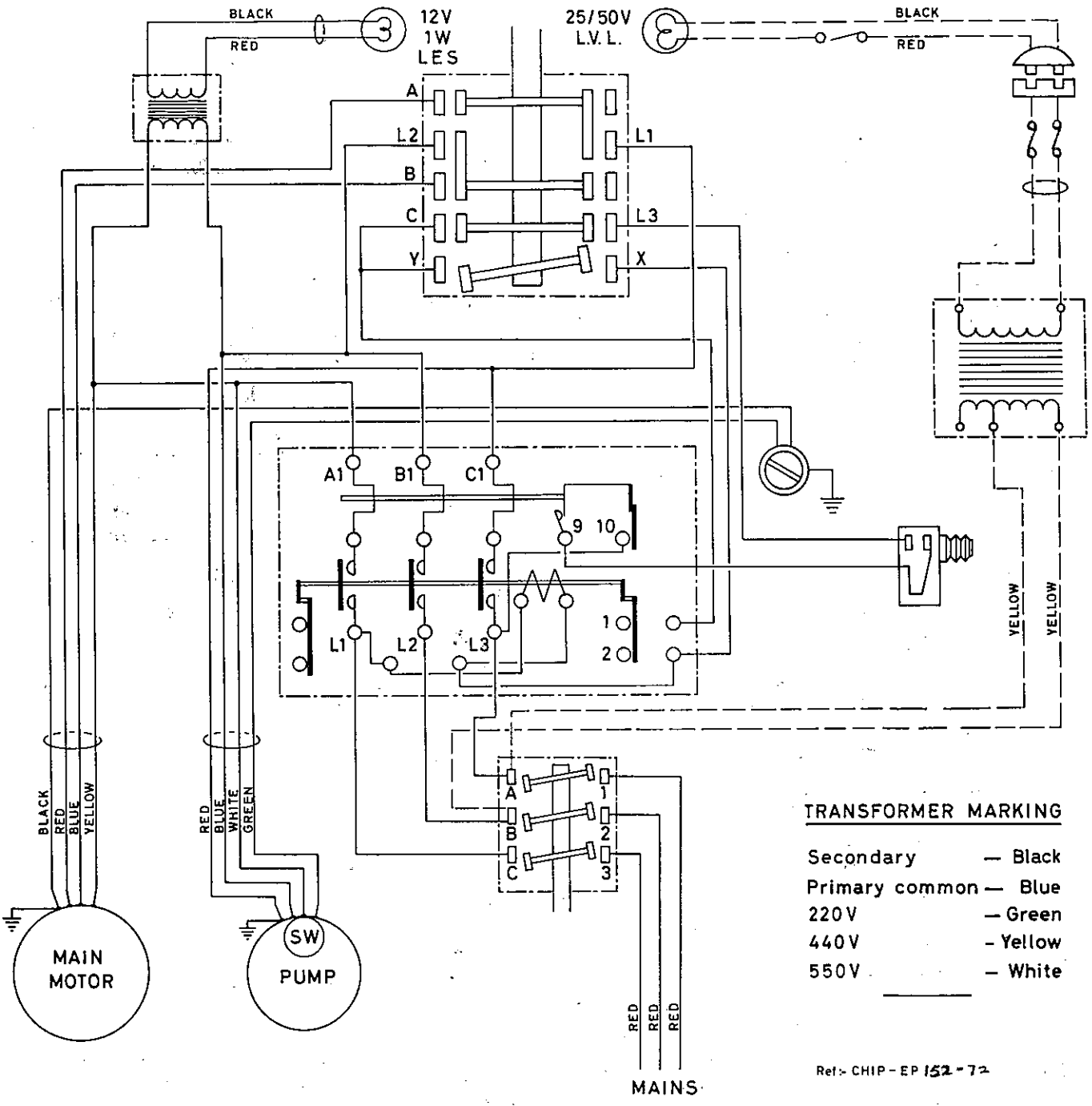


ELECTRICAL WIRING

The external wiring of the machine to the mains supply should be carried out by a competent electrician and all wiring should be of a permanent character. It is essential that a really efficient earth is provided in the installation as shown in the wiring diagram.

The main spindle must rotate in the forward direction with the starting lever set to the right. If this is not so the rotation is reversed by interchanging any two of the input wires.

The safety electrical control panel incorporates a no-volt release system and thermal overloads. The main switch controls both forward and reverse rotation of the motor. A micro switch in the end guard isolates the motor circuit when the guard is opened for attention to the drive.



TRANSFORMER MARKING

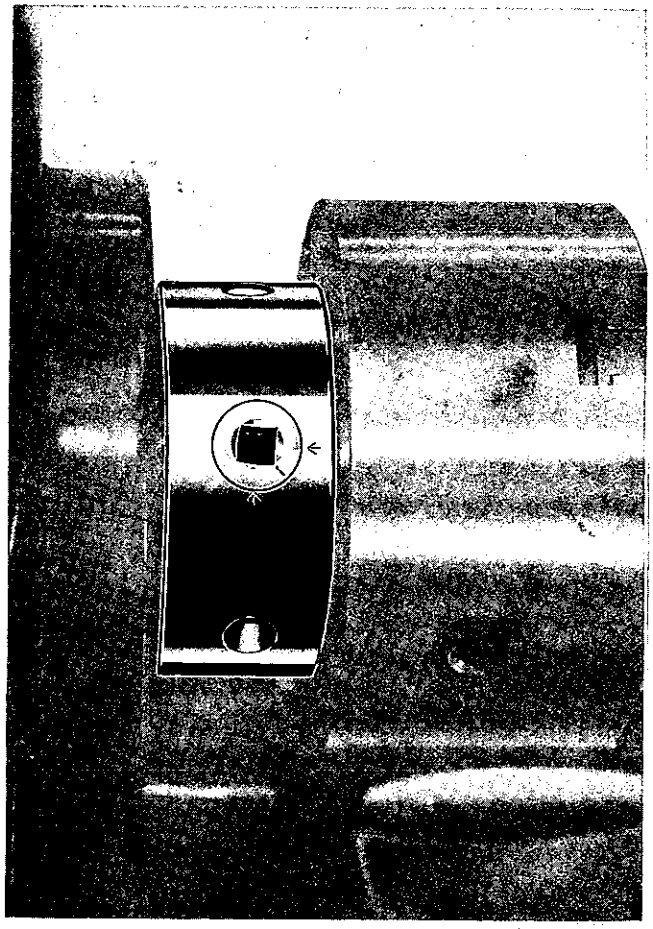
Secondary	— Black
Primary common	— Blue
220V	— Green
440V	— Yellow
550V	— White

Ref:- CHIP - EP 152-72

CHUCK MOUNTING

The American type D1-3 in Camlock spindle nose has been selected to overcome the danger of chucks or faceplates becoming detached whilst rotating. However, care must be taken to ensure that each spindle nose cam is fully secured in order to obtain maximum grip. It may be necessary to re-set the camlock studs in any new accessories which are to be mounted on the spindle nose.

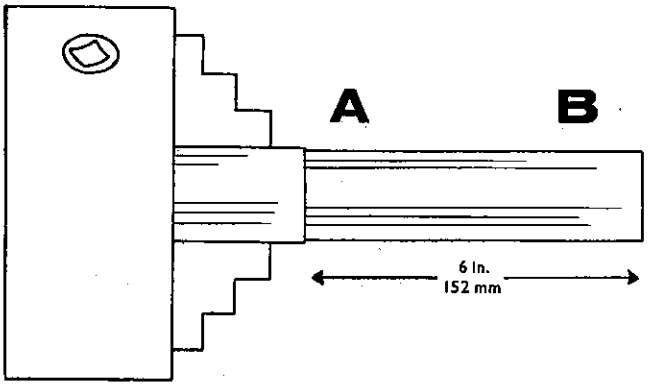
To do this remove the cap head screws locking the studs and set each stud so that the scribed datum lines are as close to the rear face of the accessory as possible without being below the surface, with the grooves lining up with the locking screw holes. Mount the accessory on the spindle nose and tighten the three camlocks in turn. These should be fully tightened when the datum line on the camlock is between the two arrows on the spindle nose. If any of the camlocks do not tighten within the limits of the arrows remove the accessory and turn the stud concerned through 360° in a clockwise direction. (This will bring the scribed line on the stud below the rear face of the accessory.) Re-mount and check the locking action again and repeat the above procedure until all three camlocks tighten within the limiting arrows. Finally, replace the locking screws beside each stud.



ALIGNMENT CHECKS

When the machine has been completely installed it is advisable to check the alignment of the headstock and tail stock. All machines are accurately aligned before despatch but transit shocks may necessitate adjustments.

HEADSTOCK ALIGNMENT TEST

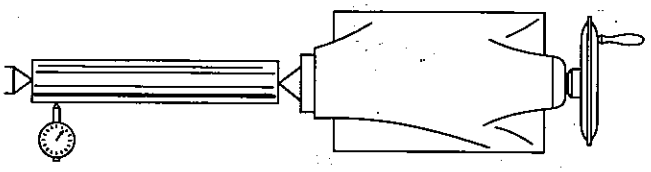


Headstock Alignment:

Place a length of mild steel bar in the chuck and take a light cut over the o.d. for about 6 in of its length. (Do not use the tailstock centre as a steady during this test). Micrometer readings at the two ends of the turned diameter (A and B in the sketch) should be the same. If the readings differ the head stock may easily be re-aligned as follows:

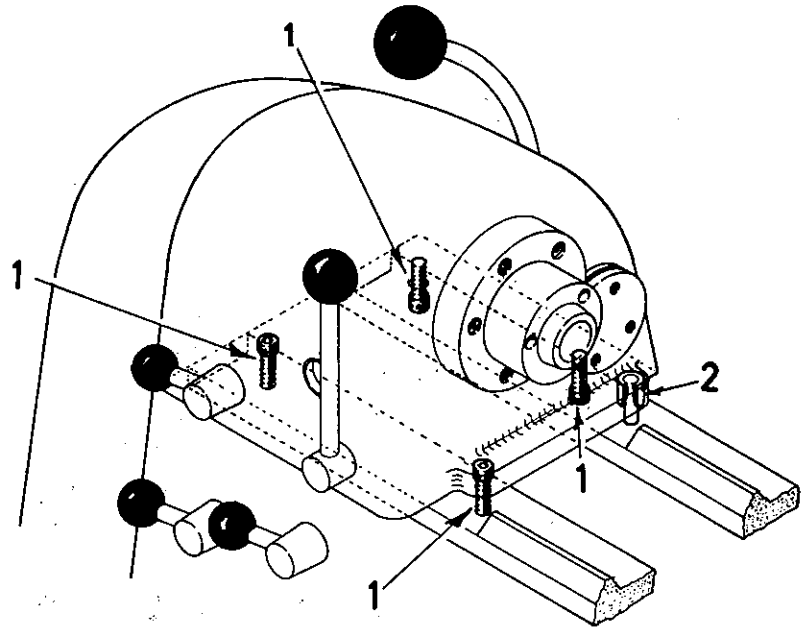
Slacken off the headstock holding-down bolts (1) until they are only finger tight, which will allow the headstock to pivot round the locating dowel (2). A light tap with the palm of the hand in the required direction is all that is necessary to affect an adjustment. As a guide, with a dial indicator set against point B of the test piece it will be necessary to swing the headstock approximately $2\frac{1}{2}$ times the difference in micrometer readings between point A and point B. It is important that if any adjustments have been made, all holding-down bolts are securely tightened.

TAILSTOCK ALIGNMENT TEST



Tailstock Alignment:

Place a 12 in long ground steel bar between centres. Fix a dial gauge to the topslide with its anvil running along the horizontal centre line of the bar. By traversing the saddle along the bed an accurate check on alignments may be made. If any error is found it may be rectified by adjustment of the two set-over screws in the base of the tailstock.



ADJUSTMENT OF HEADSTOCK ALIGNMENT

LUBRICATION

The accuracy and life of the machine depend on correct lubrication. All oiling points should be properly lubricated and the oil levels of the headstock, gearbox and variator checked before the machine is used.

The lubrication chart gives information and guidance on the points needing periodic attention. It cannot be too-strongly emphasised that all points marked with a black circle should receive attention every working day in order to ensure efficient operation.

When carrying out the weekly check on the headstock and gearbox always stop the machine to allow the oil to settle so that a true reading is obtained. If this precaution is not taken there is a risk of overfilling which will result in the generation of excessive heat and the loss of oil by leakage.

After the machine has been in operation for an initial period of 160 hours or four weeks (whichever is the shorter) the headstock, gearbox and variator should be drained and flushed with clean flushing oil then refilled to the correct level with the appropriate oil. This procedure should be repeated every 500 hours of operation or at least every three months (whichever period is reached first).

The variator should be topped-up weekly to the level of the sight glass. Use only the correct grade of oil: wrong grades can cause serious loss of efficiency or permanent damage. Capacity when correctly filled is 1 pint.

Leave the unit for 30 minutes after use before checking contents; this permits the oil level to settle. Avoid overfilling.

When the machine is despatched from the works the headstock, gearbox and variator are filled with the recommended grade of oil as follows:

Headstock: Shell Tellus Oil 15 = Shell Morlina 10
Gearbox: Shell Tellus Oil 33 = Shell Tellus 68 (150)
Variator: Shell Vitrea Oil 21 Use Tellus 10 or Morlina 10

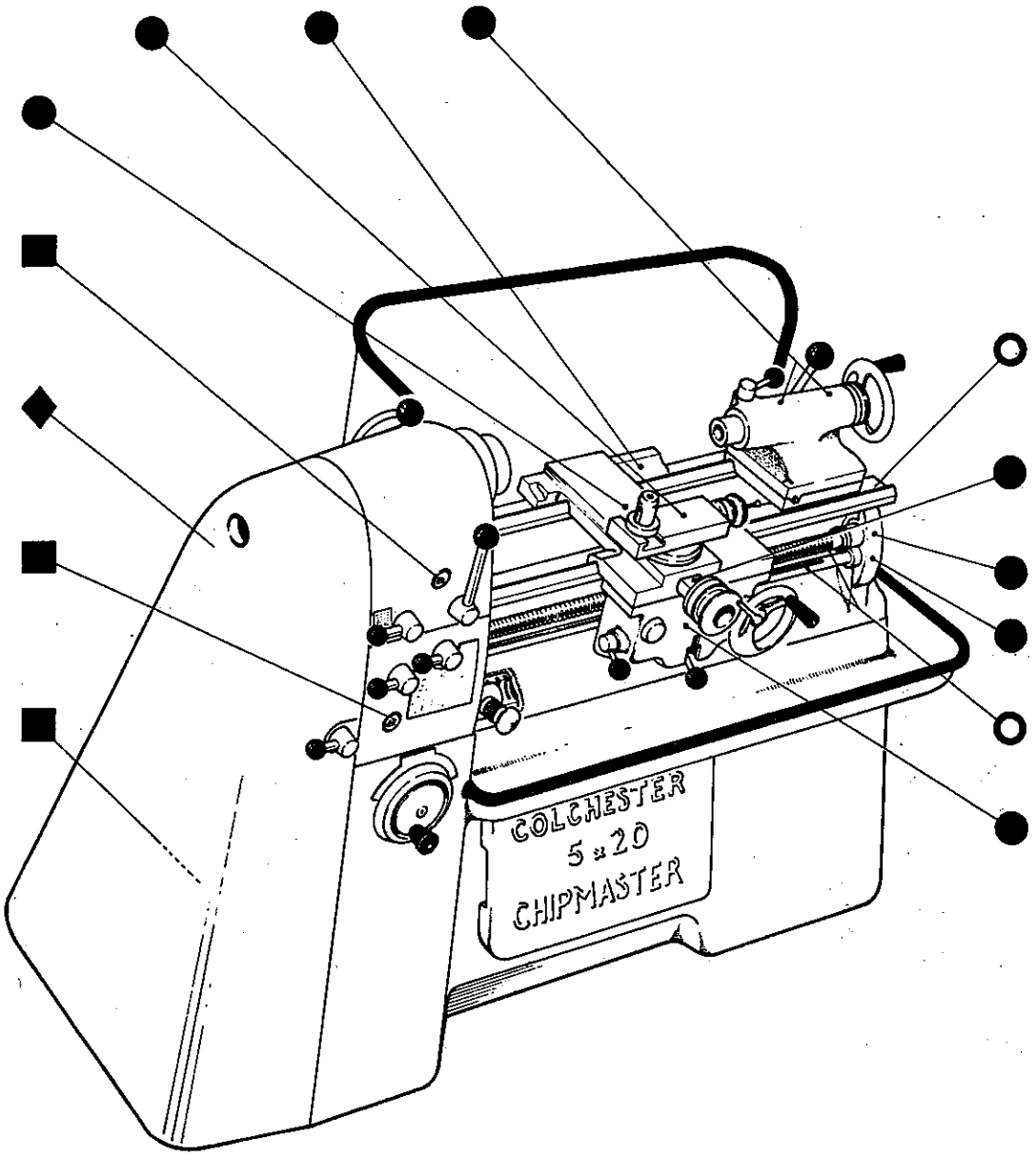
These oils may be obtained from Shell Oil Companies throughout the world but in case difficulty is experienced in obtaining these particular grades the physical properties are given below:

	Shell Tellus Oil 15	Shell Tellus Oil 33	Shell Vitrea Oil 21
Specific Gravity at 60°F	0·845	0·876	0·855
Flash point closed	300°F	410°F	320°F
Pour point	—20°F	—20°F	—20°F
Viscosity Redwood No. 1:			
70°F	100 secs	750 secs	160 secs
140°F	42 secs	112 secs	50 secs
200°F	—	52 secs	—

THE USE OF AN INCORRECT GRADE OF OIL IS LIABLE TO CAUSE OVERHEATING AND POSSIBLE DAMAGE.

The Matrix machine tool clutch should be greased every three months. The bearings of the pump motor (where this is supplied) should also be greased periodically and for both of the above applications we recommend Shell Alvania 3 Grease. The motor bearings should also occasionally be checked to ensure that they have an adequate supply of the grade of grease recommended by the manufacturer.

LUBRICATION CHART



- ○ CLEAN AND OIL EVERY DAY
- ■ TOP UP EVERY WEEK WITH APPROVED OIL
- ● OIL ONCE EACH WEEK
- ◆ GREASE MATRIX CLUTCH PERIODICALLY

OPERATION

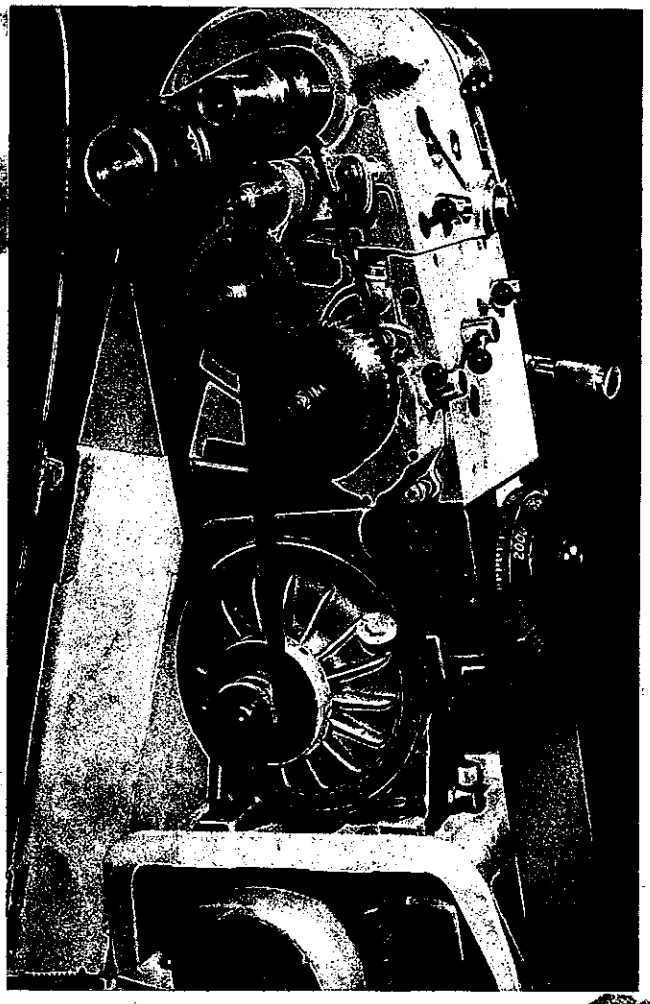
DRIVE

The headstock is driven by a single speed motor coupled to a Kopp variable speed unit by a toothed rubber timing belt, the motor being mounted on the underside of the variator plate to form a compact unit. From the variator vee belts transmit the drive to a Matrix machine tool clutch.

Spindle speeds are controlled by a graduated handwheel on the front of the cabinet base beneath the headstock. A slipping clutch device is fitted to avoid damage to the variator should the handwheel be moved when the motor is not running.

When correctly tensioned the vee belts should have approximately $\frac{3}{4}$ in (19 mm) free side movement in either direction under light pressure.

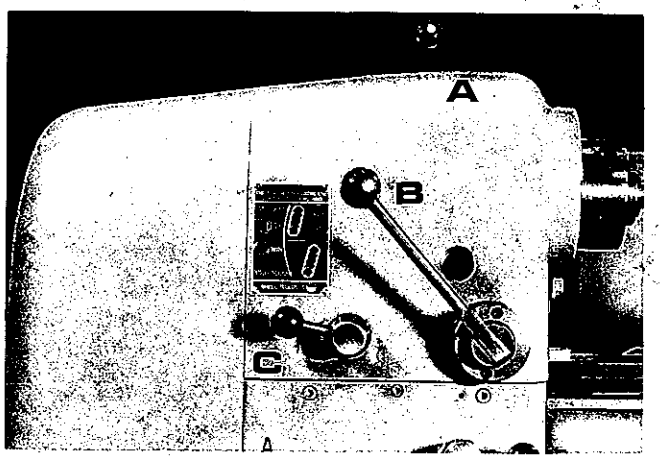
The motor is controlled by the illuminated lever (A). With this in the central position the motor is stationary. If the machine is correctly wired (see page 6) and with the clutch engaged, the spindle will rotate in the forward direction with the lever to the right and in the reverse direction with the lever to the left.



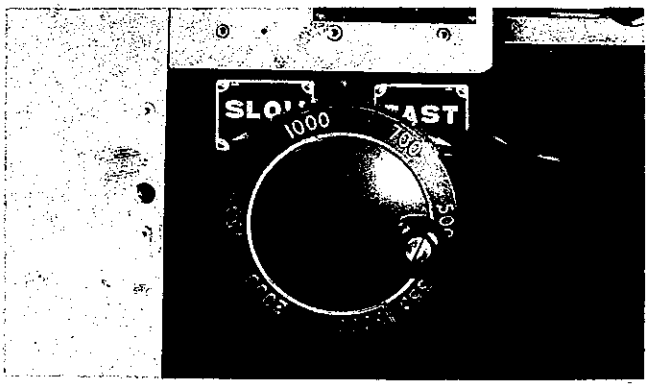
HEADSTOCK

Lever (B) on the front of the headstock controls the movement of the spindle through the Matrix clutch and brake. With the lever in the vertical position the spindle is stationary. By moving the lever to the right drive is taken up by the clutch and the spindle rotates. Instantaneous braking is achieved by returning the lever to the neutral position and applying pressure in the reverse direction, to the left.

Lever (C) selects the speed range required and MUST NOT BE MOVED WHEN THE SPINDLE IS RUNNING. In the lower speed range drive to the spindle is through the headstock gearing. In the higher speed range this gearing is disengaged and the spindle is driven direct from the clutch by a toothed timing belt. By using this belt for high speeds and eliminating the gearing, finishes of the highest order can be obtained.



HEADSTOCK CONTROLS



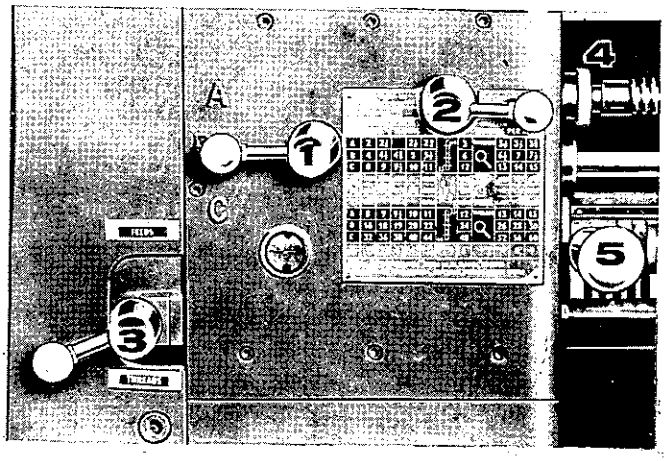
VARIATOR HANDWHEEL

GEARBOX

Control of the gearbox is by three levers and a tumbler shaft as illustrated. The tumbler shaft (5) incorporates a spring loaded plunger which engages in the slotted tumbler-bearing extension (location bar) to give positive positioning and locking.

All available threads and feeds from the gearbox can be obtained by setting the tumbler shaft in conjunction with the selector lever (1) in accordance with the data shown on the machine feed and thread plate illustrated. Lever (3) is used in conjunction with the speed range selector (C) of the headstock controls to engage the end gear train. In order to cut coarse, multi-start or special threads the lower speed range must be used with the lever (3) in the lower position (as shown). Standard fine threads up to 16 t.p.i. single start may be cut using the higher speed range; that is, with lever (3) in the up position. Lever (2) is used to reverse the direction of rotation of leadscrew and feedshaft and a dog clutch (4) is provided so that the leadscrew may be disengaged. The leadscrew should never be allowed to revolve except when screw-cutting. It should be cleaned and lightly oiled each time before use.

THE SPINDLE AND HEAD-STOCK GEARING MUST BE STOPPED BEFORE ANY OF THE LEVERS CONTROLLING THE GEAR BOX ARE MOVED.



GEARBOX CONTROLS

SLIDING FEEDS IN INCHES — SURFACING ½ SLIDING

ENGLISH THREADS PER INCH

	32-440 / 220-3000									32-440 / 220-3000			
	A	B	C	A	B	C	A	B	C	A	B	C	
1	2	4	8	8	16	32	16	32	64	.008	.004	.002	1
2	2¼	4½	9	9	18	36	18	36	72				2
3		4¾	9½	9½	19	38	19	38	76	.007	.0035	.0017	3
4	2½	5	10	10	20	40	20	40	80				4
5	2¾	5½	11	11	22	44	22	44	88	.0065	.0032	.0016	5
6	3	6	12	12	24	48	24	48	96	.006	.003	.0015	6
7	3¼	6½	13	13	26	52	26	52	104	.005	.0025	.0012	7
8	3½	7	14	14	28	56	28	56	112				8
9	3¾	7½	15	15	30	60	30	60	120	.004	.002	.001	9

66 / 33 THREADS — 33 / 66 THREADS — THREADS — FEEDS

FILL WITH SHELL TELLUS OIL 33 TO MARK ON GLASS
OBTAINABLE FROM SHELL OIL COMPANIES THROUGHOUT THE WORLD

FEED AND THREAD PLATE

TABLE OF METRIC PITCHES AVAILABLE FROM STANDARD BOX

GEAR	LEVER	HOLE IN LOCATION BAR									
		1	2	3	4	5	6	7	8	9	
66 / 65 / 55 / 33	A				12 MM		10 MM			8 MM	
	B				6 MM		5 MM			4 MM	
	C				3 MM		2·5 MM			2 MM	
33 / 65 / 55 / 66	A				3 MM		2·5 MM			2 MM	
	B				1·5 MM		1·25 MM			1 MM	
	C				·75 MM					·5 MM	
		1	2	3	4	5	6	7	8	9	

OIL CHANGE GEARS AND SLEEVE WITH SHELL TELLUS 33
OBTAINABLE FROM SHELL COMPANIES THROUGHOUT THE WORLD

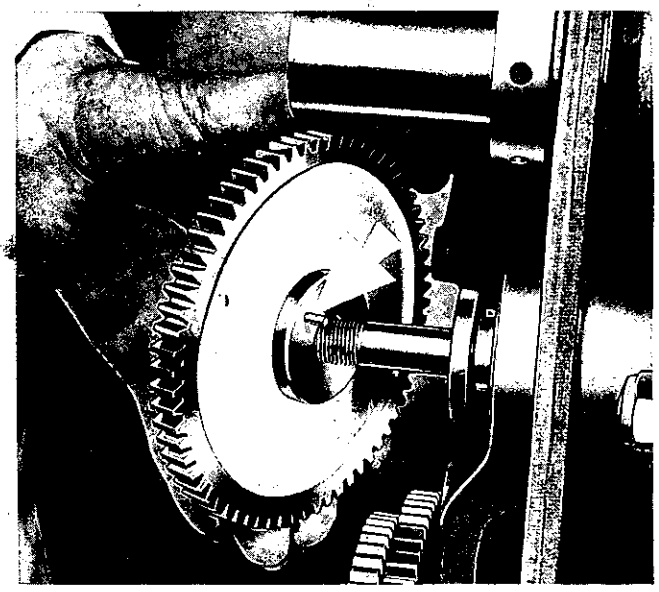
THE COLCHESTER LATHE CO.LTD.
HYTHE, COLCHESTER.ENGLAND.

METRIC THREAD PLATE

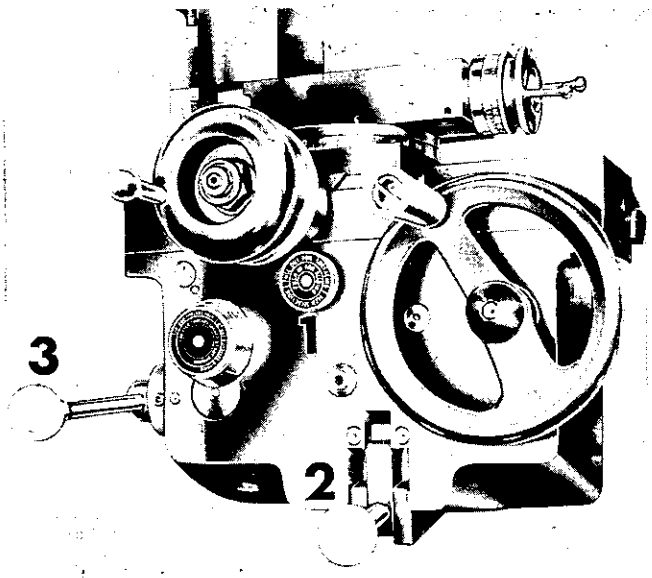
SHEAR PIN DEVICE

A shear pin device is fitted as a precautionary measure to protect the leadscrew against overload in the low speed range. A broken pin can easily be replaced by removing the top gear in the end train and then the splined sleeve which carries the gear. The broken pin can then be tapped out of the sleeve. To remove the remainder of the pin rotate the shaft until the pin hole is opposite the slot in the housing. This can now be knocked through and will drop out through the slot. A new pin may now be fitted and the change gear sleeve re-assembled.

In case of difficulty in obtaining new shear pins they may be manufactured from $\frac{1}{8}$ in. mild steel rod to British Standard EN1A (shear strength 20 tons per sq. in.) No other material should be used.



SHEAR PIN DEVICE



APRON CONTROLS

APRON

Surfacing and sliding feeds are selected by a plunger (1). Surfacing feeds are obtained with the plunger fully extended and sliding feeds with the plunger fully depressed. The feeds are engaged by lever (2) which incorporates a safety device to prevent overloading. This device also allows the use of feed stops which automatically disengage the feed mechanism on contact with a pre-set limit stop.

When screw cutting the lead nut is controlled by lever (3).

THREAD CUTTING

1. Threads available from the gearbox

The screw-cutting dial on the front face of the apron has four numbered divisions and four sub-divisions. To cut an even number of threads—i.e., 12 t.p.i.—the leadscrew may be engaged at any division. For odd-numbered threads—i.e., 13 t.p.i.—the leadscrew may be engaged at any numbered division, and for fractional threads—i.e., $11\frac{1}{2}$ t.p.i.—the leadscrew must be engaged at the same mark at each pass.

For metric threads, the dial indicator cannot be used. The nut must be closed over the leadscrew and the machine reversed by the reversing switch over the headstock after each cut and tool withdrawal. The nut must not be released until the thread is complete.

2. Threads not available from the gearbox.

To cut special and multi-start threads where special change gears may be required, the following formula is used:

$$\frac{\text{Drivers}}{\text{Driven}} = \frac{X}{Y \times \text{threads per inch}}$$

Where X=hole in location strip=16, 18, 19, 20, 22, 24, 26, 28, 30.

and Y=lever position—i.e., A=4, B=2, C=1.

Example.

It is required to cut $11\frac{1}{2}$ t.p.i.

Choose X=22.

Then $\frac{22}{4 \times 11\frac{1}{2}} = \frac{11}{23} = \frac{33}{69}$

33T is the standard change wheel, therefore a 69T gear will be required.

3. Multi start threads

These can be cut in one of three ways.

1. By repositioning the compound slide one pitch forward for each start. It will be realised, however, that the accuracy of this method depends upon the operator.

2. By using an accurately divided driver plate and turning the workpiece one division forward for each start.

3. By advancing the driver gear a calculated number of turns to advance the spindle by one pitch of the

thread to be cut. The accuracy of this method is that of the machine.

The ratio between spindle and driver gear shaft is 2 : 1, i.e., for 1 revolution of the spindle the driver gear shaft rotates 2 revolutions. To use this method, therefore, the number of teeth in the driver gear must be divisible by the number of starts being cut. The driver gear is then advanced by twice this number of teeth to cut each thread start.

Example

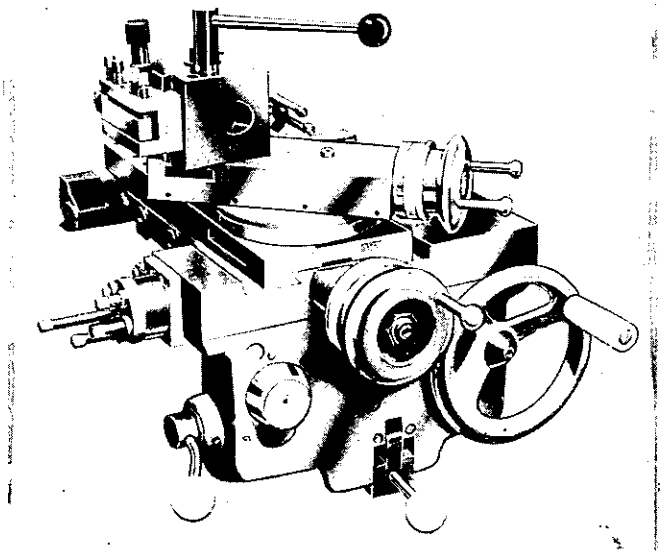
It is required to cut a 3 start thread.

Cut 1 start. Mark meshing teeth on all gears. Count number of teeth in driver gear; if there are, say 33 teeth, mark the 22nd tooth $\frac{(33 \times 2)}{3}$ from the original mark. Remove the idler. Turn driver to mark on 22nd tooth and remesh the idler. Check marks. Cut the next start and repeat process for remaining start.

It will be appreciated that although this is the best method to use, in certain cases the number of starts may not be a factor of the number of teeth in the driver gear.

SADDLE AND SLIDES

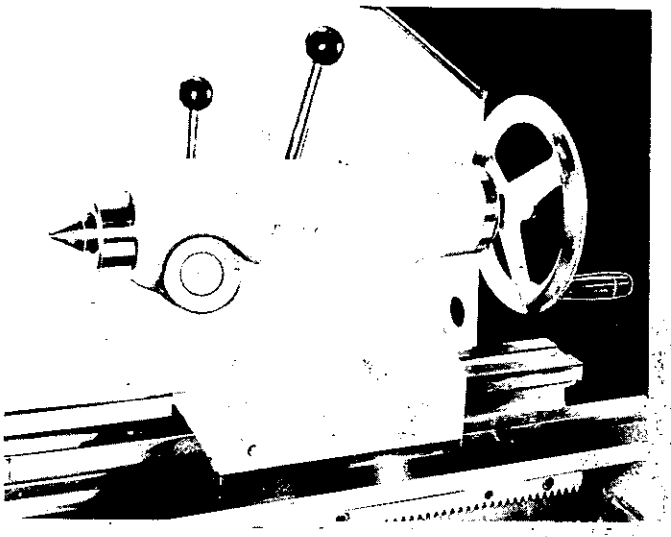
The saddle is secured to the bed by adjustable gibs at the front and rear and can be locked on the bed in any position. The slides carry large diameter micrometer dials graduated in 0·001 in divisions. The cross slide is radially graduated 90°-0°-90° each side for accurate setting of the compound slide. The American pillar type toolpost is fitted as standard suitable for $\frac{1}{2}$ in×1 in tools. As an alternative the multi-type toolpost is available as additional equipment.



SADDLE AND SLIDES

THE TAILSTOCK

The barrel is graduated in inch and metric divisions and induction hardened both in the No. 3 morse taper bore and on the outside diameter. All standard tang drills are driven by the tang and eject at zero graduation. A tool height indicator line is stamped onto the front face of the nose chamfer to assist in setting tools to the correct centre height when a workpiece is being held between centres. There are two parts to the tailstock casting, the base proper which slides along the bedways and the tailstock body, which may



be moved laterally on the base. This movement or 'setting over' allows shallow tapers to be turned without the need of a special taper-turning attachment. The tailstock is set over by first releasing the bedway clamp lever and adjusting the two set-over screws fitted for this purpose. THE TWO SPRING-LOADED SHOULDER BOLTS HOLDING THE BASE TO THE MAIN CASTING DO NOT REQUIRE SLACKING OFF AT ANY TIME. Quick lever clamping is employed to lock the assembly in position on the bedways. The tailstock barrel is locked by a lever operated clamp.

THE BED

The bed is a seasoned casting with all bearing surfaces induction hardened and precision ground. The pyramid construction gives great rigidity under the heaviest cutting conditions and the ported openings provide for easy fall of chips and coolant to the rear of the machine. The front wall of the bed is shaped and recessed to provide maximum protection for the leadscrew and feedshaft. A ground pad with tapped holes is provided on the rear face for the mounting of either a taper turning attachment or hydraulic profiling unit without the need for skilled fitting. The bed casting is mounted on a heavy cabinet base, also of pyramid design, which incorporates a suds tray and two-shelf cupboard and housing the drive unit.

ALTERNATIVE SPECIFICATION OF LATHES INCORPORATING CONTINENTAL GEARBOX

The Continental Gearbox available for this lathe has been designed to provide a comprehensive range of standard metric and module pitches and, in addition, English threads which will give full coverage of all practical requirements. The brief specification given below shows the range of feeds and thread pitches available.

FEEDS

Number of Feeds	10
Range per rev. of spindle	
Longitudinal	0.28 mm — 0.04 mm
Cross	0.14 mm — 0.02 mm

THREADS

Number of Pitches — Metric	29
Range	0.35 mm — 12.0 mm
Number of Pitches — Module	15
Range	0.4 — 3.0
Number of Threads — English	31
Range	3 — 60 threads per in.
Pitch of Leadscrew	6 mm

A screw-cutting dial is fitted on front of the apron on standard machines, but is not fitted on the Continental version.

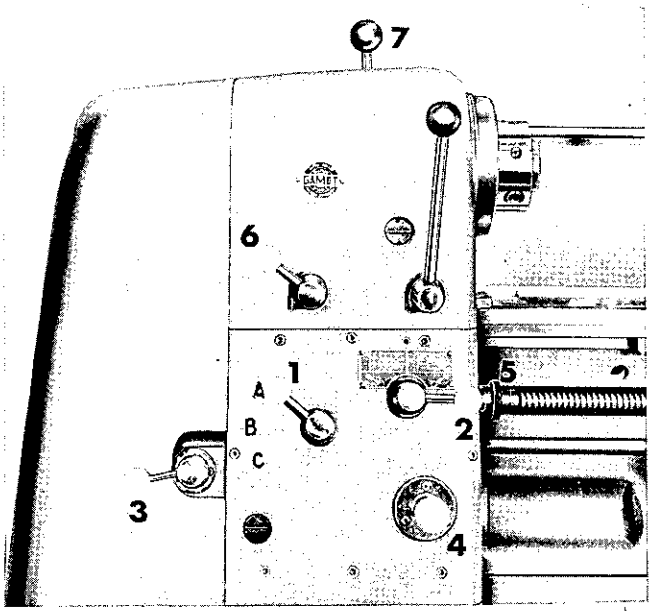
GEARBOX

Control of the lathe fitted with Continental gearbox is by means of the hand levers accessible from the front of the machine, as illustrated. By the correct setting of these levers and the fitting of appropriate change gears the full range of threads and feeds available with this machine is obtained. As shown on the thread data plates, a range of 29 metric pitches, 15 module pitches and 10 longitudinal and cross feeds is available. In addition, a range of English threads can be cut on the machine, as described separately.

Lever (1) is a selector lever having three positions, marked A, B and C, and is used in conjunction with the six-position control lever (4) as listed on the data plates for each thread pitch.

Lever (3) is a two-position control used in conjunction with the speed range selector lever (6) on the headstock. When cutting coarse or multi-start pitches (see below) the lower speed range is employed, with the lever (3) in the lower position. Standard fine pitches, up to 1.5 mm pitch (single start) may be cut using the higher speed range; that is, with the lever (3) in the top position.

Lever (2) is used to control the direction of rotation of the leadscrew and feed shaft, forward or reverse. A dog clutch (5) is provided to enable the leadscrew to be disengaged since it must not be permitted to revolve except during screwcutting. SPINDLE AND HEADSTOCK GEARING MUST BE STOPPED BEFORE ANY OF THE GEARBOX CONTROL LEVERS ARE MOVED.



THREAD CUTTING WITH CONTINENTAL GEARBOX

1. Threads available from the gearbox.

When cutting metric, module and English thread pitches, the nut must be closed over the leadscrew (by means of the lever on the left side of the apron) and it must not be released until the thread is completed. After each pass and tool withdrawal, the machine should be reversed by means of the illuminated lever (7) on the top of the headstock until the tool has returned to the correct position for the next pass. Setting up the machine for thread cutting is accomplished by fitting the appropriate change gears in conjunction with the selection of the correct positions for the gearbox control levers. These correct settings and change-wheel combinations are shown for each thread requirement on the machine data plates.

2. Threads NOT available from the gearbox.

To cut threads which are not available from the gearbox ratios as shown on the data plate, it may be necessary to use special change gears. These are available as extra equipment in a range suitable for all probable requirements. To obtain the number of teeth in the required change gear wheel, the following formulae should be used:-

Metric Pitches

$$\frac{\text{DRIVER}}{\text{DRIVEN}} = \frac{14P}{3VZ}$$

Where P = Pitch required to be cut.

V = 12	for lever position	1	Z = 4	for lever setting	A
11	" "	2	2	" "	B
10	" "	3	1	" "	C
9	" "	4			
8	" "	5			
7	" "	6			

Example:
When it is required to cut 11 mm pitch:-
The values of V and Z may be chosen from any of the numbers given in the index above, there being no rule as to the choice. If the values selected give an impossible number of teeth, however, try other value of V and Z listed until a practicable result is obtained. Thus, for an 11 mm pitch;

$$\frac{\text{DRIVER}}{\text{DRIVEN}} = \frac{14\times11}{3\times11\times4} = \frac{7}{6} = \frac{42}{36}$$

Module Pitches:

$$\frac{\text{DRIVER}}{\text{DRIVEN}} = \frac{44M}{37VZ}$$

Where M=Module to be cut and V and Z have the same values as for Metric Pitches.

Example:

It is required to cut 1.2 module:

$$\frac{\text{DRIVER}}{\text{DRIVEN}} = \frac{44M}{3VZ} = \frac{44\times1.2}{3\times12\times2} = \frac{11}{15} = \frac{44}{60}$$

English Threads (per inch).

$$\frac{\text{DRIVER}}{\text{DRIVEN}} = \frac{144}{VZT}$$

Where V and Z have the same values as for metric pitches and T=Threads per inch required to be cut.

Example:

It is required to cut 15 threads per inch (t.p.i.)

$$\frac{\text{DRIVER}}{\text{DRIVEN}} = \frac{144}{VZT} = \frac{144}{12\times1\times15} = \frac{4}{5} = \frac{48}{60}$$

This $\frac{\text{DRIVER}}{\text{DRIVEN}}$ is always used with the 56T/68T compounded idler gear and is set thus: $\frac{48\times56}{68\times60}$

3. Multi-start threads

Multi-start threads may be cut in any of three ways.

a. By repositioning the compound slide one pitch forward for each start. It will be realised, however, that the accuracy of this method rests solely upon the operator.

b. By using an accurately divided driver plate and turning the workpiece forward by one division for each start.

c. By advancing the driver gear a calculated number of teeth in order to advance the spindle by one pitch of the thread to be cut. The accuracy of this method is that of the machine. When using this method select a driver wheel in which the number of teeth is a factor of the number of starts to be cut.

To use method (c) proceed by cutting one start, then mark the meshing tooth on all gears and remove the idler gear. Turn the driver gear through the calculated number of teeth and refit the idler gear, making sure that the meshing marks on the gears correspond exactly. Now cut the next start. Repeat for each start required.

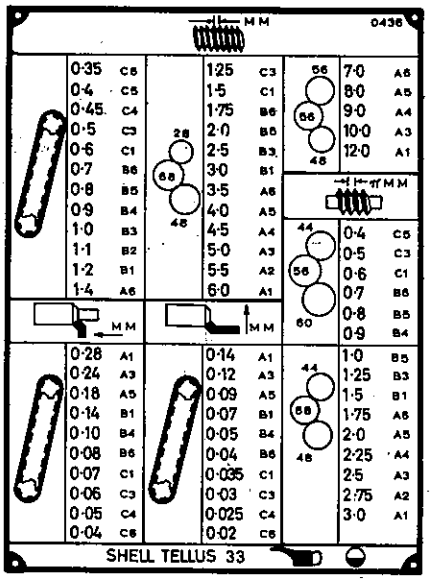
NOTE: Whichever method is used, the leadnut should be engaged to cut the first thread and must not be released until all starts have been completed.

4. English threads

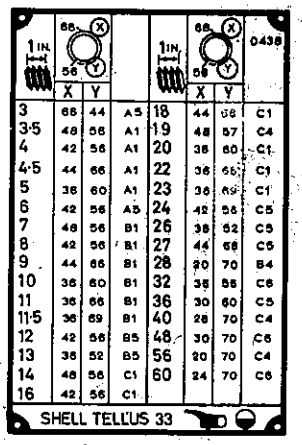
By fitting additional change gear wheels in place of those supplied as standard with the machine, a full range of English threads from 3 to 60 threads per inch may be cut. The appropriate change wheels and lever positions are shown on the English thread data plate. All additional gears are available as extra equipment.

The setting up for cutting English threads is accomplished in the normal manner, as already described.

METRIC THREAD & FEED PLATE



ENGLISH THREAD DATA PLATE



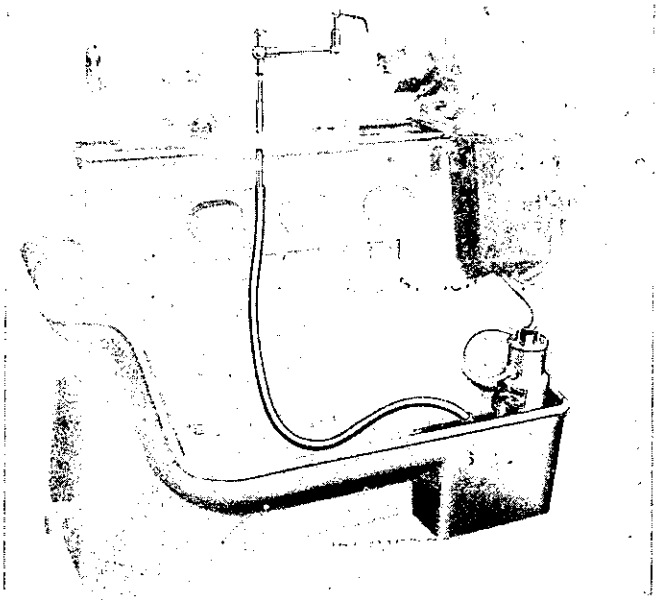
ACCESSORIES

A comprehensive range of accessories is available for the Colchester Chipmaster lathe, specifically designed for the machine and engineered for simplicity, robustness and reliability.
A briet list of these is given below and more detailed information on certain items is given in subsequent pages. All these accessories can be fitted to the machine after it has left the works.

THE COOLANT SYSTEM

The bed is so designed that coolant and swarf will fall away into the disposal area at the back of the cabinet at the headstock end of which is a coolant sump. A perforated cover incorporating the pump mounting is supplied with the coolant system to fit over the sump, preventing the entry of swarf. Coolant is fed to any required position by the fully universal delivery assembly which is attached to the back of the saddle by a simple clamp and connected to the pump by strong polythene tubing. The supply is controlled by a ball type valve.

An electric pump of robust design incorporates an independent switch on top of the motor housing, power being supplied from the main electrical panel. (See wiring diagram.) The pump motor MUST be switched off if the sump is dry or coolant not used for long periods. The sump MUST be cleaned at frequent intervals and the overflow hole kept clear. Also coolant MUST NOT be splashed over the pump when refilling. By taking these precautions damage to and subsequent failure of the pump will be avoided. The whole unit has been designed to eliminate the leaks which are usually inherent in coolant systems.



Soluble oil emulsions

For most work a soluble oil emulsion should be chosen, since this will almost always be adequate for the work in hand and will be preferred by the machine operator.

When screwing with a die head, tapping, or reaming, some extra coolant applied locally may be required. If much work of this type is contemplated, it may be better to use an emulsion of an extreme pressure soluble oil in the machine sump. A good quality oil of this type will give results equal to neat cutting oil whilst retaining the cleanliness of soluble oil.

Good quality soluble oil should always be chosen and mixed in accordance with the suppliers' recommendations. The following grades have been tested and used in our own works with complete satisfaction.

Shell Dromus Oil B—conventional milky soluble oil mixed with water in the ratio 25/30:1.

Shell Dromus Oil D—translucent soluble oil mixed with water in the ratio 40:1.

Shell Dromus Oil F—extreme pressure oil mixed with water in the ratio 10/15:1.

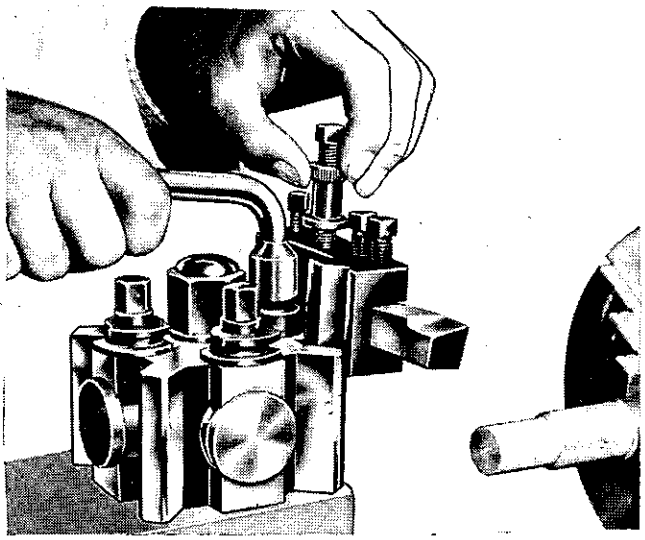
Soluble oils and machine maintenance

No soluble oil, however good, can completely prevent rust without help from the operator. The machine should therefore be cleaned down regularly and the bright parts wiped over with machine oil. It should never be left, especially over weekends or holidays, with wet swarf on the bed or slides. When the work in hand requires the saddle or slides to be clamped in position for long periods it is advisable to spread a little machine oil on the bed beforehand to ensure a film of oil between the surfaces.

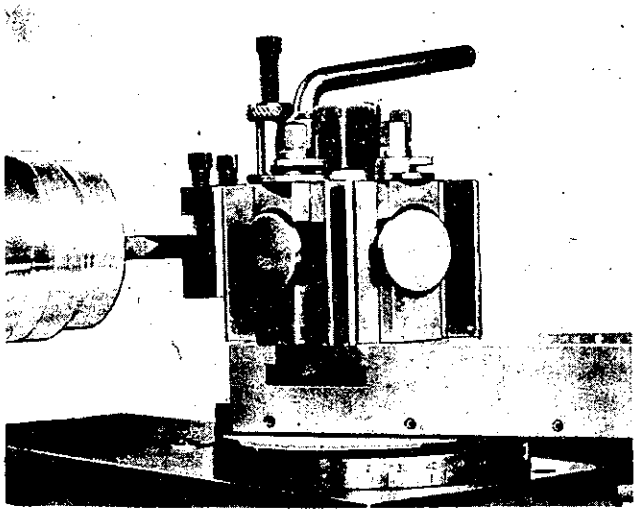
The sump should be emptied, cleaned out and refilled with newly mixed soluble oil at regular intervals.

COLCHESTER QUICK CHANGE TOOLPOST

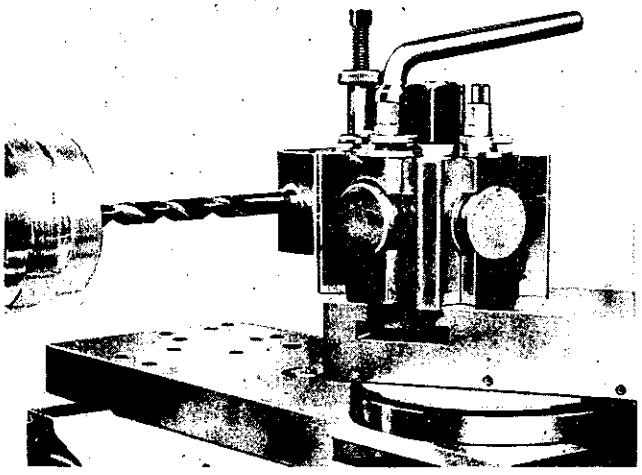
This type of toolpost may be fitted to existing standard slotted topslides without alteration. It enables any number of toolholders to be used and any lathe operation to be carried out. Designed to cut down time on repetition work, the Colchester Quick Change Toolpost



is outstanding in its versatility and ease of use. It consists of a basic clamping head to which a variety of toolholders may be fitted.



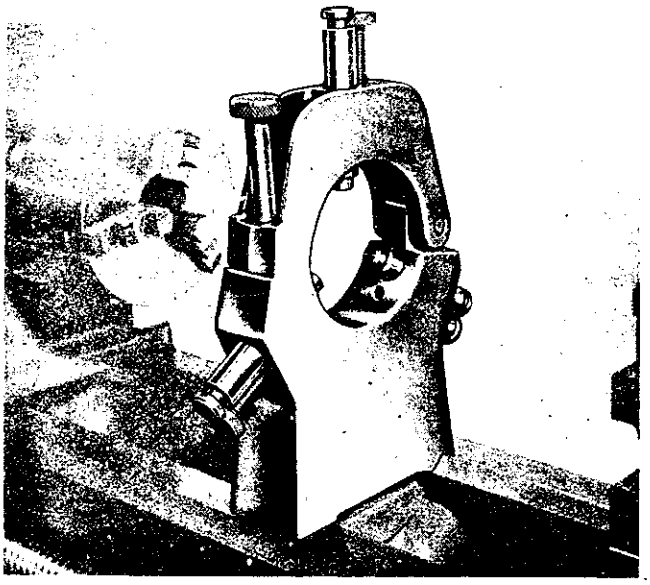
Three types of toolholder are available.
The standard toolholder will accommodate all normal types of tool up to a maximum size of $\frac{3}{4}$ in. x $\frac{1}{2}$ in. (19 mm x 12.5 mm). The vee toolholder will accommodate boring tools with parallel shanks up to $\frac{5}{8}$ in. (16 mm) diameter. A morse taper holder is also available suitable for all tools having a No. 1 M.T. shank.



Each toolholder has a vertical adjusting screw and when a tool in its holder has been set to centre height it may be removed and replaced any number of times in the sure knowledge that the tool will be at exact centre height each time it is returned to the clamping head.

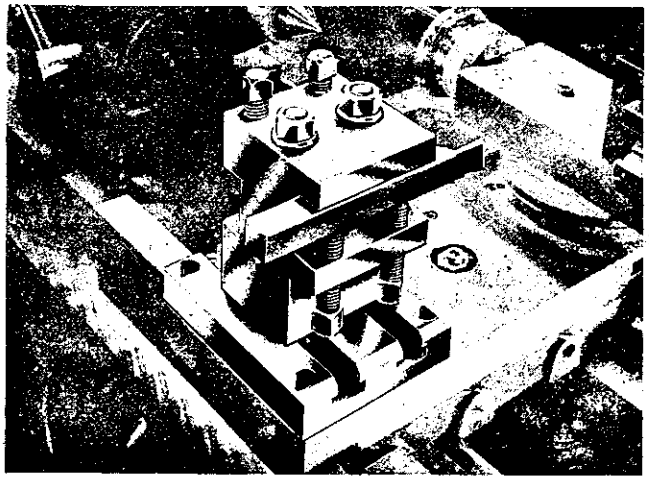
STATIONARY STEADY

Of extremely rigid design and having a maximum capacity of 4 in bar diameter, this attachment is rapidly clamped on to the bed by a plate and bolt and easily removed when not required.
The top section is locked by a knurled screw and the adjustable fingers are fitted with replaceable sintered bronze press fit inserts.



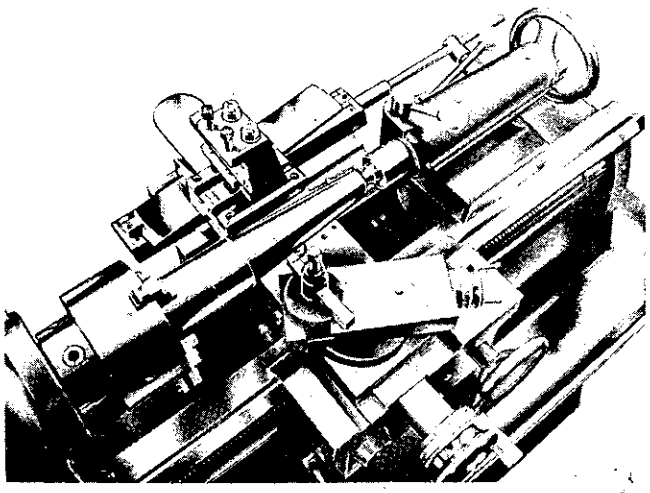
REAR TOOLPOST

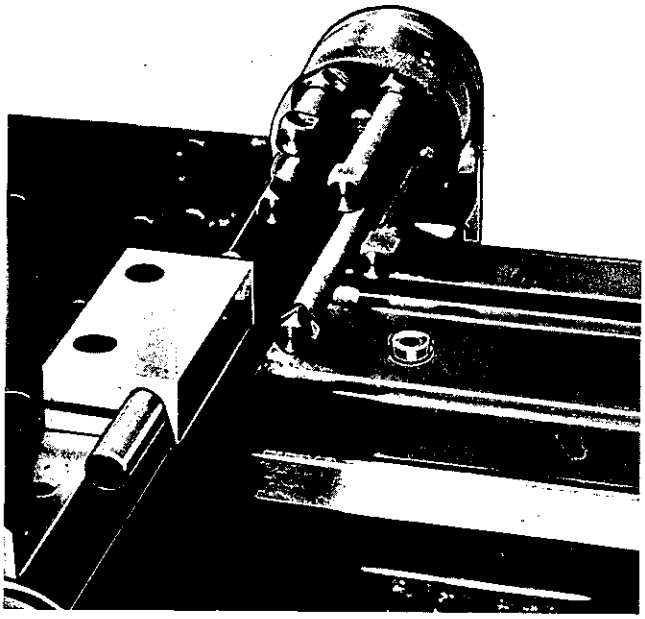
As an aid to production, a rear toolpost is available for fitting direct to the cross slide, which is drilled and tapped ready to receive it.
Two tool positions are provided so that the tool may be fitted in the conventional manner or in the inverted position.
Using this toolpost (with the tool fitted in the conventional manner) left-hand threads can be very easily cut.
Supplied complete with all the necessary fixing screws, the only fitting required is the physical bolting of the base pad to the cross slide. Tee slots are provided in the base pad so that the toolpost may be adjusted in position on the base. Maximum tool depth that can be accommodated in either position is $\frac{5}{8}$ in.
The standard Allen keys and spanners supplied with the machine will fit all the nuts and screws in this assembly.

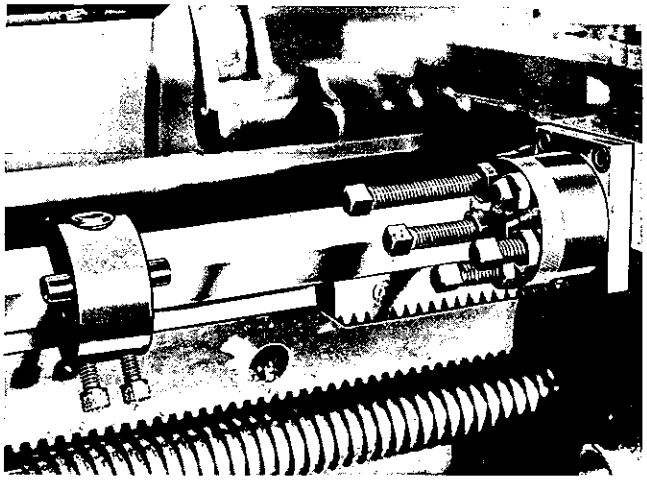


FEED STOPS

To provide an accurate and reliable means of repeating shoulder lengths single type or five-position type feed stops are available. A five-position stop can also be supplied for repeating diameters.
With these units the saddle or cross slide can be stopped in any desired position, the feed mechanism in the apron disengaging immediately contact is made.







TELESCOPIC TAPER ATTACHMENT

This attachment can be used for producing tapers up to 10° in either direction.
It can be mounted directly onto the rear of the saddle without any modification other than the fitting of a new saddle screw and nut which is supplied with the unit.

The swivel slide is graduated in $\frac{1}{4}°$ of arc and in $\frac{1}{8}$ in taper per foot and great sensitivity of control is obtained when setting a taper by the use of the micro adjustment screw.

The cross slide handwheel is always used to control the tool and the base slide can be adjusted along the bed so that the taper may be cut in any position.
The attachment will deal with a length of 12 in of taper at any one setting.

After attaching to the machine, all that is required to prepare the taper turner for use is the clamping of the connecting rod in the anchor bracket by means of the knurled thumb-screw.

The fitting of this attachment in no way detracts from the use of the machine as a normal centre lathe. Change over can be simply accomplished by loosening the connecting rod clamping screw and traversing the saddle towards the headstock to disengage the connecting rod from the clamp. Then remove the anchor bracket from the bed so that there is no obstruction to foul the connecting rod. By replacing the bracket and engaging the connecting rod the taper turner is rapidly reset for use.

Great care should be taken when readjusting or altering the fit of the base slide in the taper turner bracket, as any slackness will result in incorrect tapers.

To fit the taper attachment

1. The saddle and cross slide are ready drilled to receive the attachment, the necessary holes being drilled and tapped during manufacture.
2. Clean down the rear end of the saddle to receive the taper turner bracket.
3. Release the locknut in the centre of the cross slide handwheel.
4. Slide the cross slide to the rear of the saddle.
5. Remove the saddle screw nut fixing bolt and withdraw the screw and nut from the rear.
6. Insert the taper turner saddle screw and nut and secure the nut with the fixing bolt.
7. Pull the cross slide forward and engage the saddle screw in the handwheel pinion. (Note: The lock nut from the original saddle screw is not replaced, but should be retained in case it is needed when refitting the original screw.)
8. The slide block assembly can now be fitted to the thrust block on the rear of the saddle screw assembly. Engage the slides in the bracket and the slide block assembly on the slides. This will enable the bracket to be bolted to the rear of the saddle using the pre-tapped holes provided.
9. Finally, bolt the bottom slide extension piece to the rear of the bottom slide. Fit the connecting rod to the taper turner slide and the connecting rod clamp to the machined face on the back of the bed.

LOW-VOLT LIGHTING UNIT

The 'Angle poise' light is a rigid 50 volt unit with the transformer separately located in the switch panel of the machine. It can be fitted without difficulty as follows:

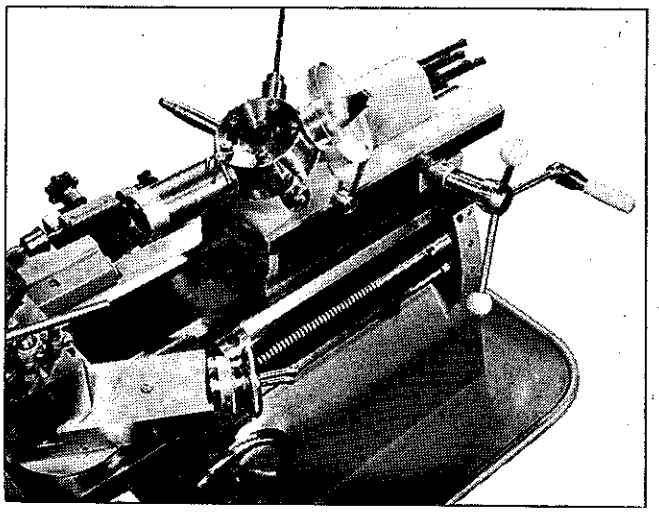
1. Isolate electric panel and remove splash guard.
2. Open panel and fit transformer on the pads on rear wall of box.
3. Wire up transformer for correct voltage as indicated on diagram in lid of panel.
4. Connect transformer secondary (output) winding to the existing socket using the cable provided in the panel.
5. Close panel and move isolator switch to 'on' position.
6. Replace splash guard.
7. Assemble lamp standard into the socket provided on top edge of splash guard, and secure with spring washer and nuts, and insert the bulb.
8. Insert plug in socket at base of electric panel and operate lamp 'On' or 'Off' from switch in lamp holder.

THE COLCHESTER CAPSTAN ATTACHMENT

The five station, manually operated, inclined head capstan attachment is built on a base plate which utilises the existing tailstock ways on the bed and requires no fitting prior to use.

Having a maximum working stroke of $4\frac{1}{2}$ in, the length of travel can be adjusted for each station by setting the stop screws and the turret slide may be locked in any position by a lever situated at the rear of the attachment. Standard single spindle auto toolholders with $\frac{3}{4}$ in shanks (or 20 mm shanks if the attachment is supplied with metric bores) are accommodated in the turret, which is positioned and locked after each indexing to an accuracy of 0.0002 in (0·005 mm) three inches (76 mm) from the turret face.

Whilst indexing is normally achieved by returning the slide fully to the right by the handwheel the turret can be rotated by hand if required.



NOTE—
Tooling should be obtained through your usual supplier

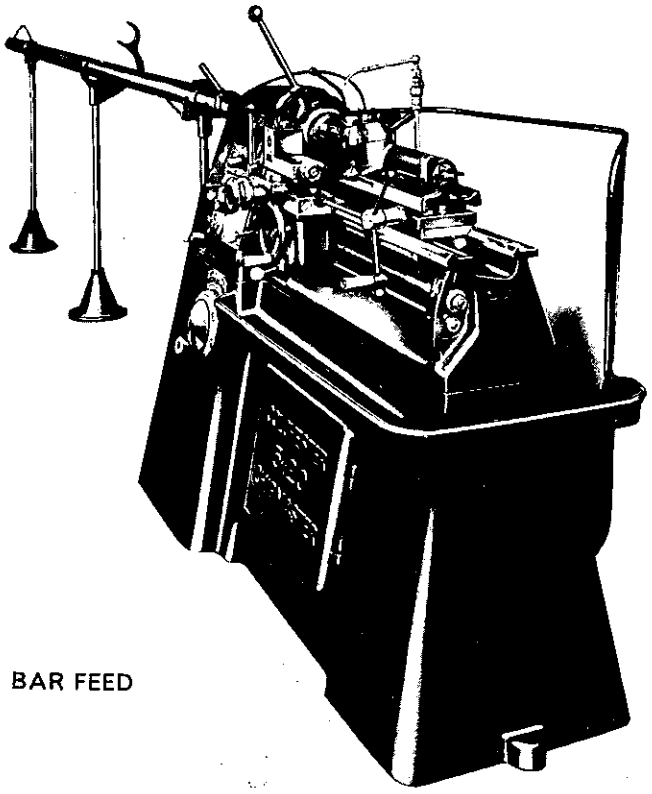
BAR FEED

This is the Puckert air operated swing forward type accommodating 10 ft bars from $\frac{1}{2}$ in to $1\frac{3}{8}$ in diameter. Operated by an air pressure of 5 to 15 lbs/sq in, a reducing valve is included for use where the available supply pressure is higher.

The mechanism consists of an inner air cylinder and an outer supporting cylinder carried on three stands. Two of these allow angular and end movement for loading purposes; the third, placed nearest to the lathe, has an interlocking clamp which prevents the cylinder being moved to the loading position without the air supply being cut off and exhausted.

Air pressure is controlled by a handle fitted to the inner cylinder operating a taper-plug valve and incorporates a warning whistle which blows when reloading is necessary.

To do this the cylinder is lifted on to the antler support on the centre stand and the piston and feed rod pushed back into the inner cylinder and the bar fed in.
It is essential that the feed is accurately aligned with the spindle in both the horizontal and vertical plane and the support stands bolted to the floor before this equipment is used.



BAR FEED

THE COLCHESTER SERIES 300 HYDRAULIC PROFILING UNIT

Designed for faster and more accurate profiling the standard equipment comprises a profile slide assembly, a rear beam assembly for round or flat masters, a free standing hydraulic power unit and a set of connecting hoses housed in a single flexible armoured conduit.
This equipment can be fitted to Chipmaster Lathes, Serial No. G2376 and above without modification.

The Profile Slide Assembly

Mounted on the cross slide of the lathe, this is an integral unit consisting of the operating cylinder, cartridge type servo valve, stylus lever mechanism and a swivelling Colchester Multi-type Toolpost complete with one turning toolholder.
The cylinder has a 3 in. (76 mm) stroke and a maximum approach/retraction speed of 110 ins. (279 cm.) per minute. The low stylus pressure of 6 oz. (170 g.) allows soft masters to be used if necessary, and the in-feed rate is lever controlled.
A swivelling Colchester Multi-type Toolpost allows tooling to be pre-set and enables tool changes to be made without re-setting the slide assembly. Sufficient height adjustment is provided to allow the tool to be set for forward or reverse cutting.
The assembly can be set at five alternative angles to the axis of the machine—either 90°, 60°, 30°, 0° or −30°, depending on the work to be produced and a copying accuracy of ±·0005 ins. can be achieved. The change in copy diameter at 90° is 5½ in. and at 60° 5 in.

The Rear Beam Assembly

The beam fixes directly to the rear face of the lathe bed and provides a rigid datum surface for carrying the master parallel to the axis of the machine.
Two beam brackets slide on the rear beam and provide a locating surface for the tailstocks which accommodate round masters or flat templates. The tailstocks are adjustable for the micrometer setting of the master or template.

The Hydraulic Power Unit

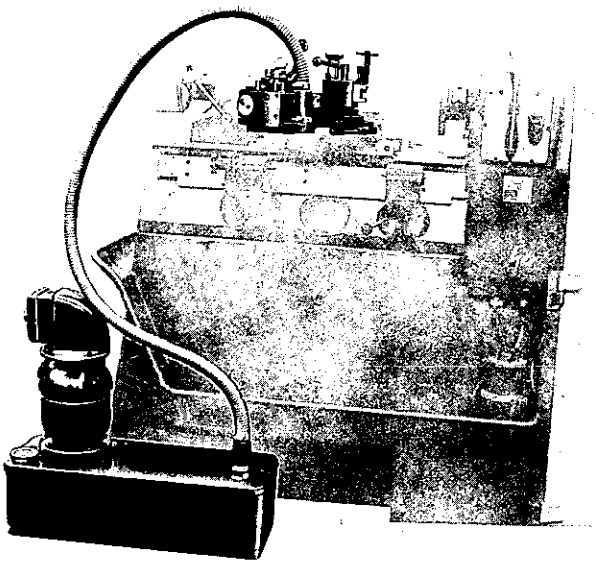
A free standing unit, designed to fit neatly at the rear of the lathe, has a ½ H.P. pump producing a working pressure of 300 lbs/sq. in. A pressure gauge is fitted and independent switch gear is also incorporated.
The pump and oil filter can be removed as an assembly for inspection.

Turret Stop

An indexing turret stop is available as an optional extra to enable progressive in-feed to be applied between roughing cuts. Six stops provide for five roughing cuts and one finishing cut to be pre-set. Progressive settings of the turret stop enable roughing cuts to be taken at uniform depth. The final cut follows the full form of the copy master.

Facing Beam

A facing beam is also available as an optional extra. Designed for flat templates, it is secured to the saddle of the machine and incorporates micrometer lateral adjustment.



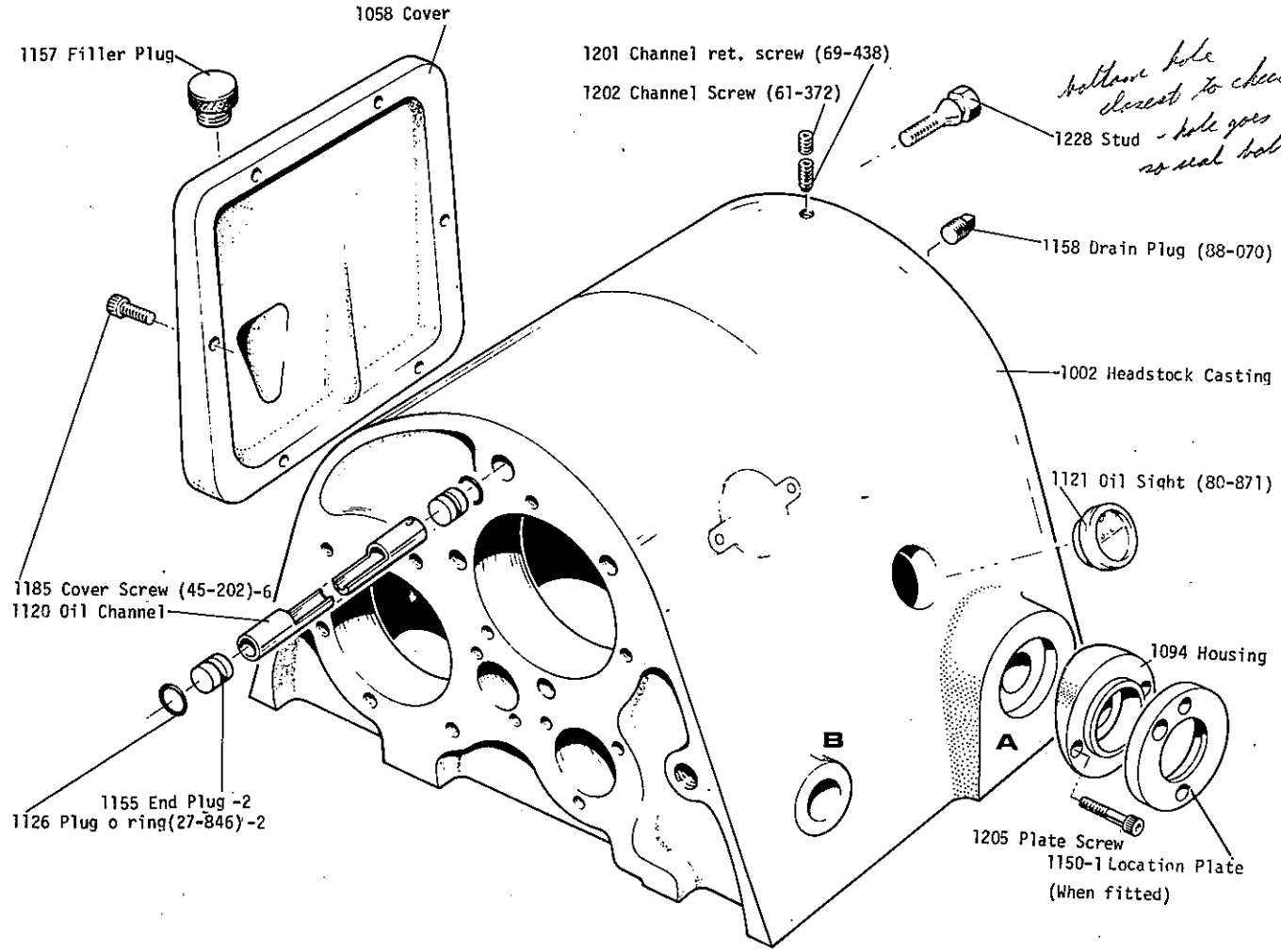
Printed in England

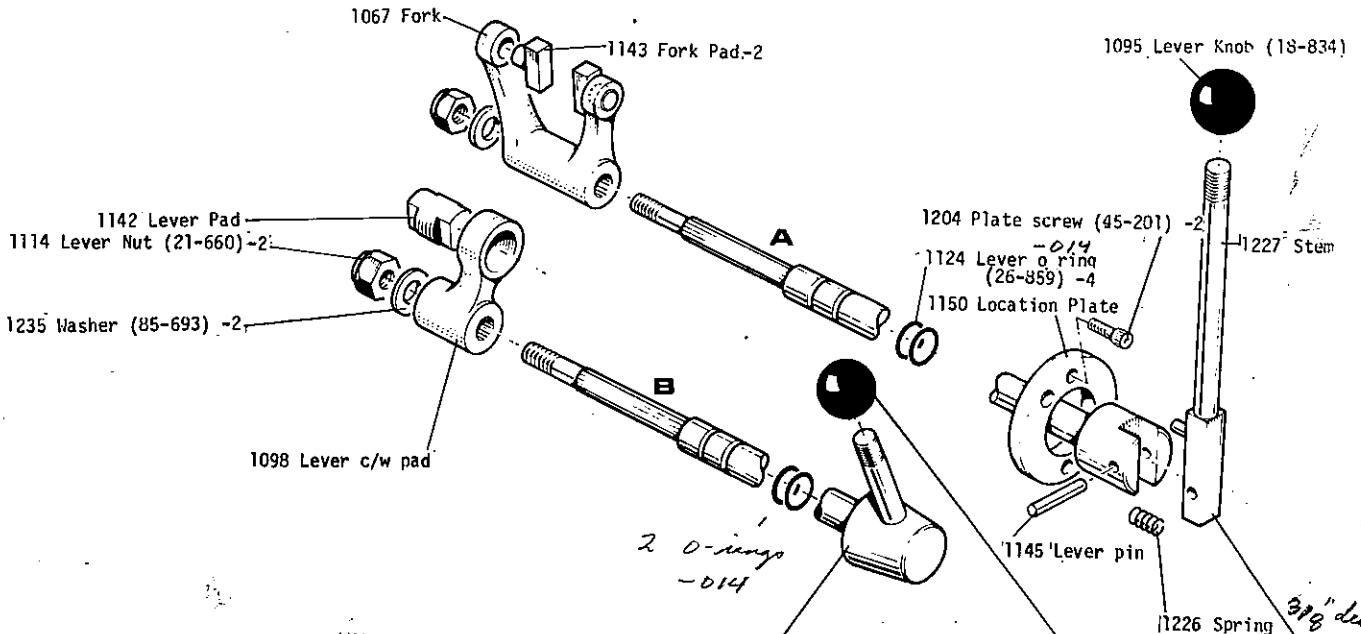
SPARE PARTS SECTION

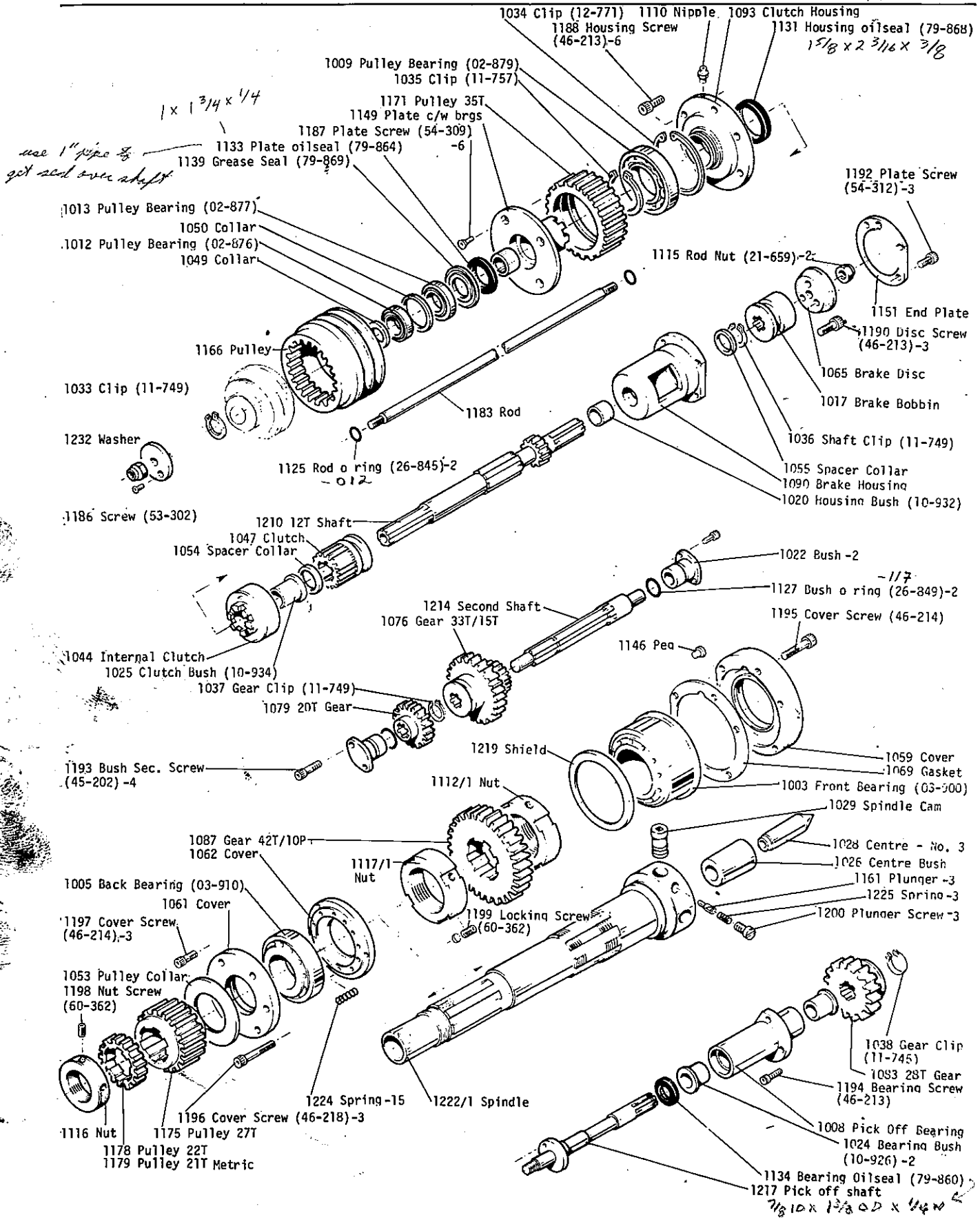
When ordering spares for your Colchester Lathe, it is essential to quote the Serial Number, stamped on the bed at the tailstock end. This will ensure rapid service.

HEADSTOCK; CASTING & LEVERS

FROM SER. NO. 4977
TO SER. NO.

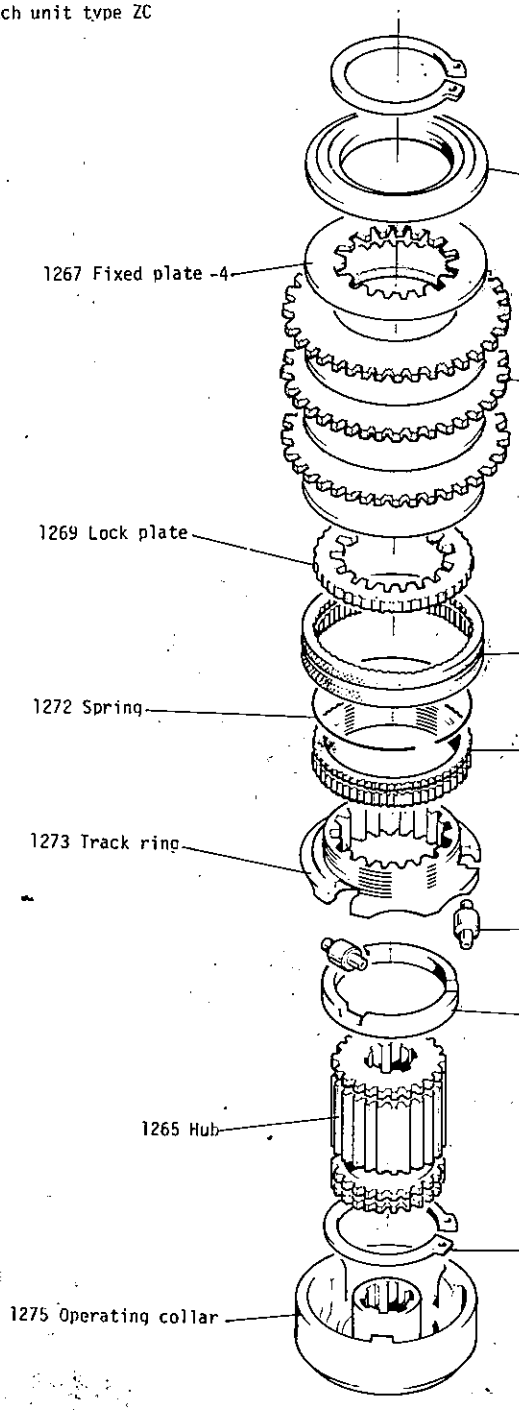


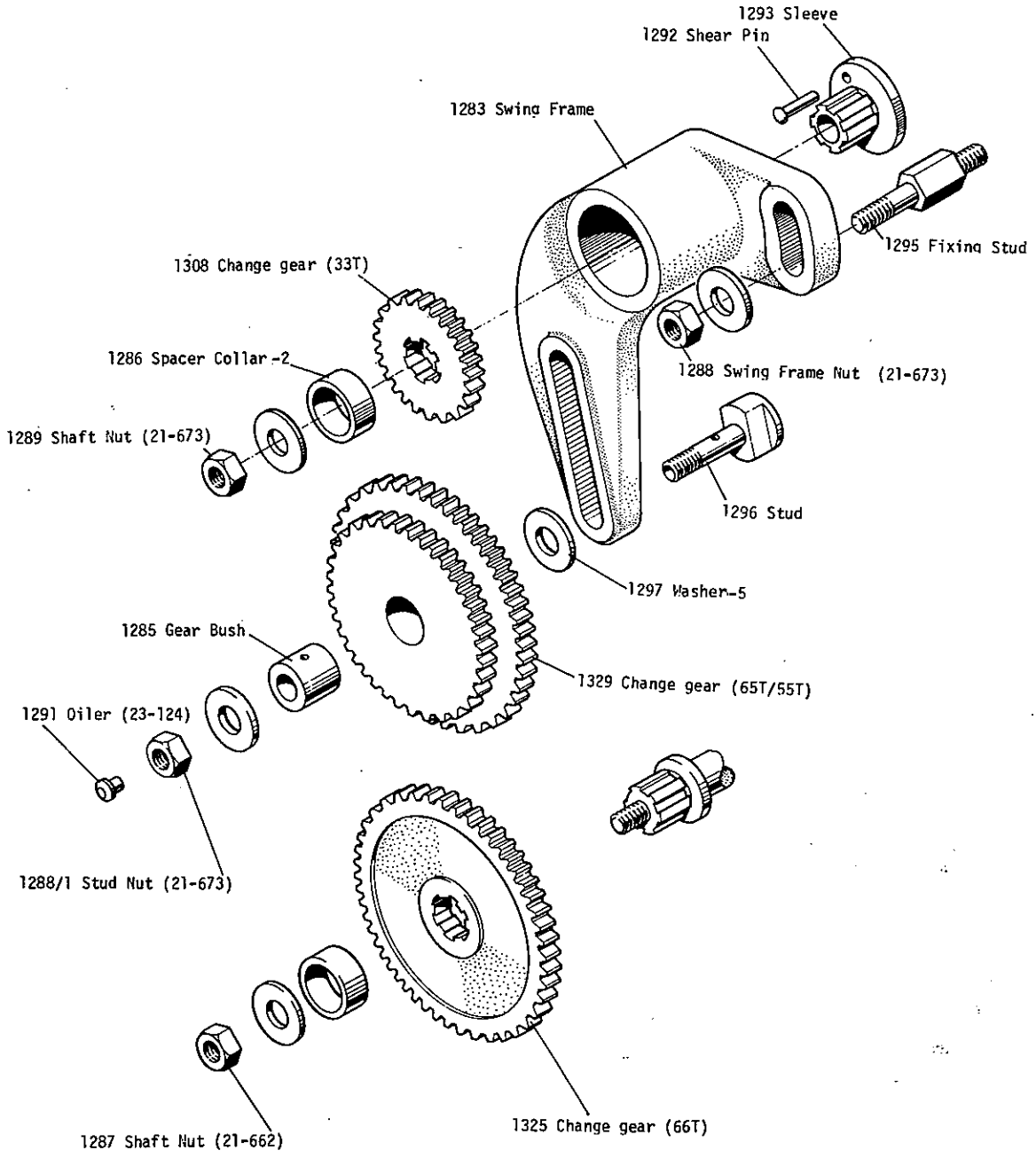


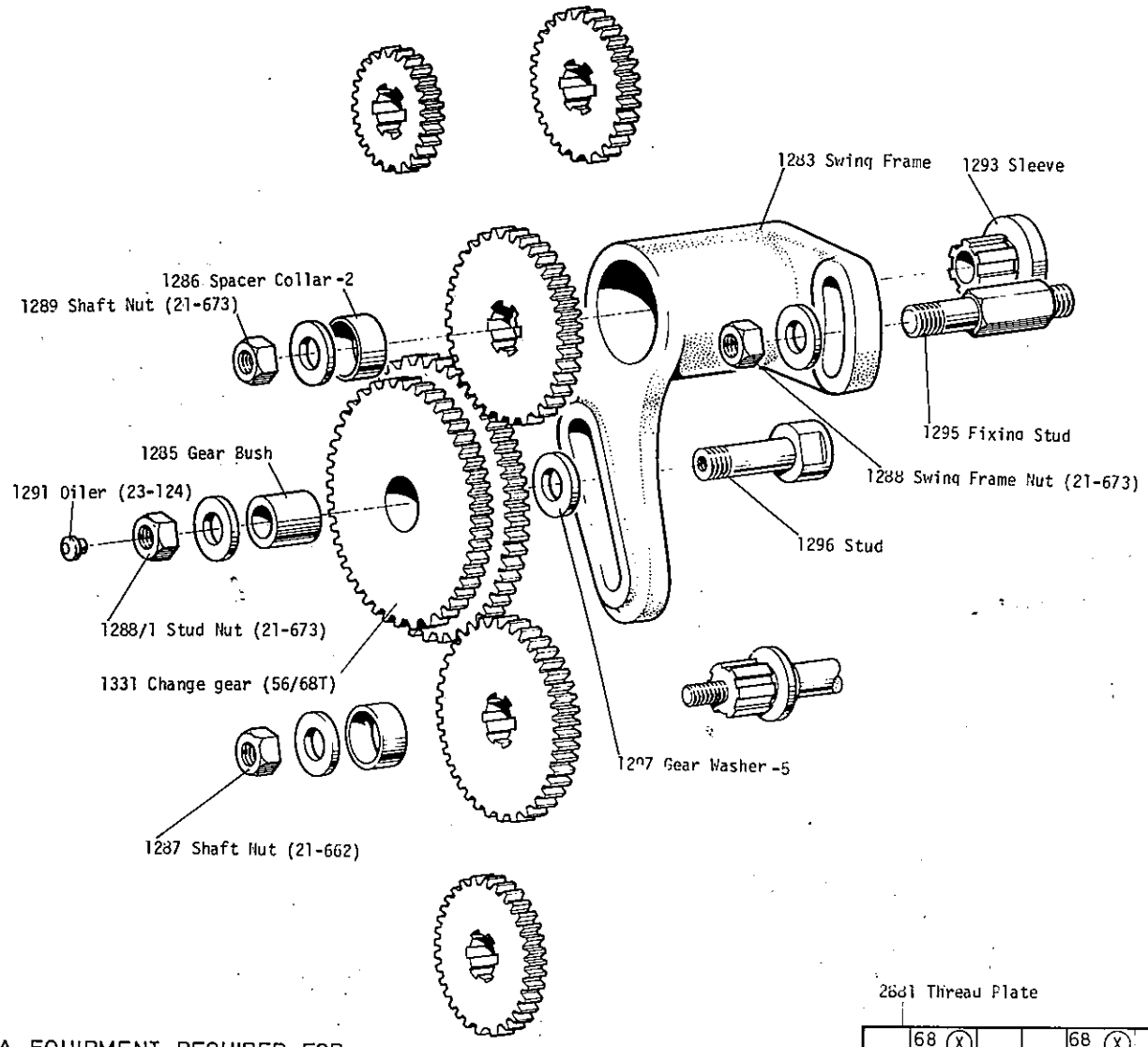

1034 Clip (12-771)
1110 Nipple
1093 Clutch Housing
1188 Housing Screw (46-213)-6
1131 Housing oilseal (79-868)
1009 Pulley Bearing (02-879)
1035 Clip (11-757)
1171 Pulley 35T
1149 Plate c/w brgs
1187 Plate Screw (54-309) -6
1133 Plate oilseal (79-864)
1139 Grease Seal (79-869)
1192 Plate Screw (54-312)-3
1013 Pulley Bearing (02-877)
1050 Collar
1012 Pulley Bearing (02-876)
1049 Collar
1115 Rod Nut (21-659)-2
1151 End Plate
1190 Disc Screw (46-213)-3
1166 Pulley
1065 Brake Disc
1033 Clip (11-749)
1017 Brake Bobbin
1183 Rod
1232 Washer
1036 Shaft Clip (11-749)
1125 Rod o ring (26-845)-2
-012
1055 Spacer Collar
1090 Brake Housing
1020 Housing Bush (10-932)
1186 Screw (53-302)
1210 12T Shaft
1047 Clutch
1054 Spacer Collar
1022 Bush -2
-117
1127 Bush o ring (26-849)-2
1214 Second Shaft
1076 Gear 33T/15T
1195 Cover Screw (46-214)
1146 Peg
1044 Internal Clutch
1025 Clutch Bush (10-934)
1037 Gear Clip (11-749)
1079 20T Gear
1219 Shield
1059 Cover
1069 Gasket
1003 Front Bearing (03-900)
1193 Bush Sec. Screw (45-202) -4
1112/1 Nut
1029 Spindle Cam
1087 Gear 42T/10P
1062 Cover
1028 Centre - No. 3
1026 Centre Bush
1117/1 Nut
1161 Plunger -3
1005 Back Bearing (03-910)
1225 Spring -3
1061 Cover
1199 Locking Screw (60-362)
1200 Plunger Screw -3
1197 Cover Screw (46-214)-3
1053 Pulley Collar
1198 Nut Screw (60-362)
1038 Gear Clip (11-745)
1093 28T Gear
1194 Bearing Screw (46-213)
1008 Pick Off Bearing
1024 Bearing Bush (10-926)-2
1224 Spring -15
1222/1 Spindle
1196 Cover Screw (46-218)-3
1116 Nut
1175 Pulley 27T
1178 Pulley 22T
1179 Pulley 21T Metric
1134 Bearing Oilseal (79-860)
1217 Pick off shaft
7/8 ID x 1 3/8 OD x 1/4 W
1 x 1 3/4 x 1/4
use 1" pipe to get seal over shaft
1 5/8 x 2 3/16 x 3/8

CHIP–02–70

1264 Clutch unit type ZC




1293 Sleeve
1292 Shear Pin
1283 Swing Frame
1295 Fixing Stud
1308 Change gear (33T)
1286 Spacer Collar-2
1288 Swing Frame Nut (21-673)
1289 Shaft Nut (21-673)
1296 Stud
1297 Washer-5
1285 Gear Bush
1329 Change gear (65T/55T)
1291 Oiler (23-124)
1288/1 Stud Nut (21-673)
1325 Change gear (66T)
1287 Shaft Nut (21-662)



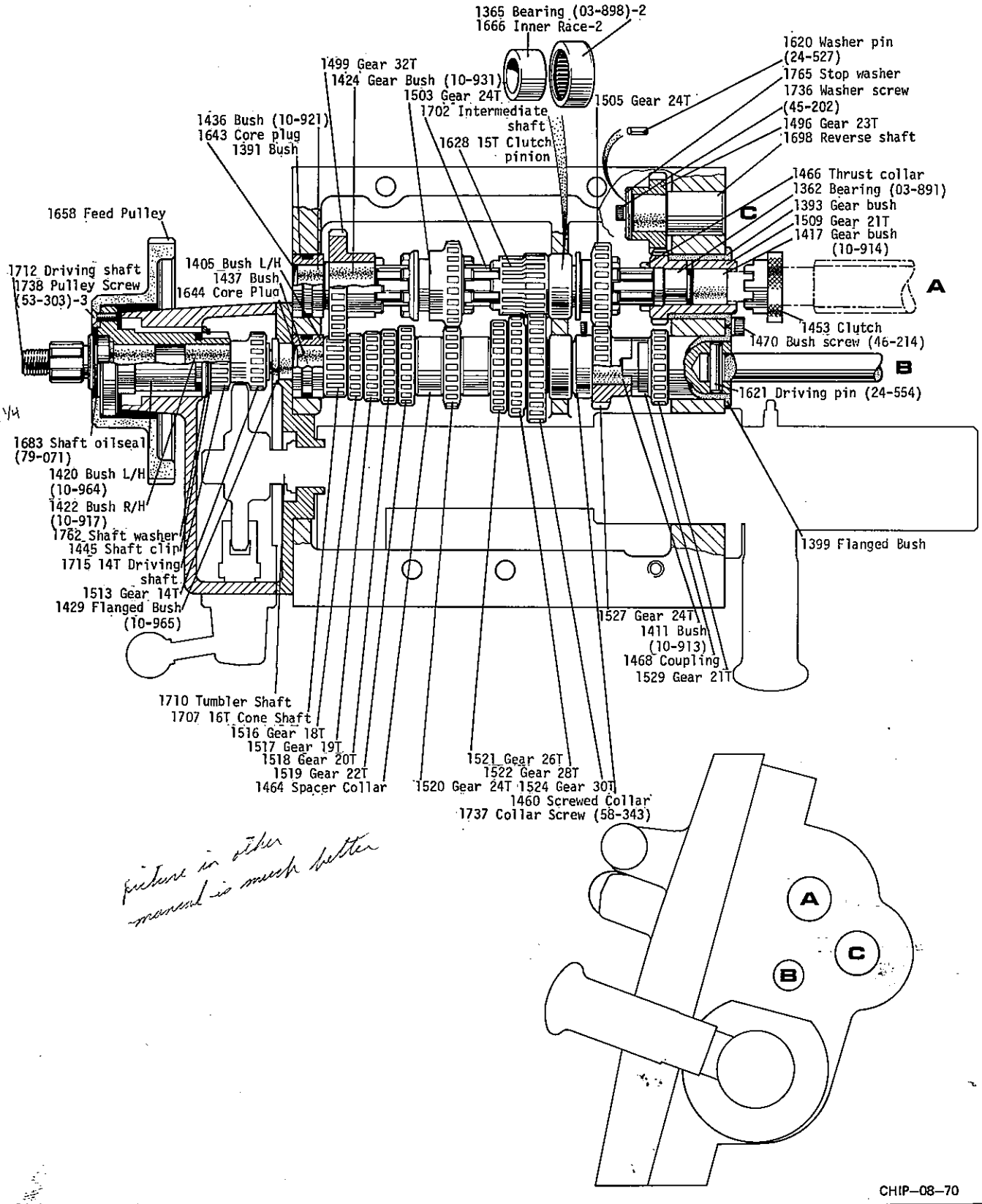
EXTRA EQUIPMENT REQUIRED FOR CUTTING ENGLISH THREADS:-

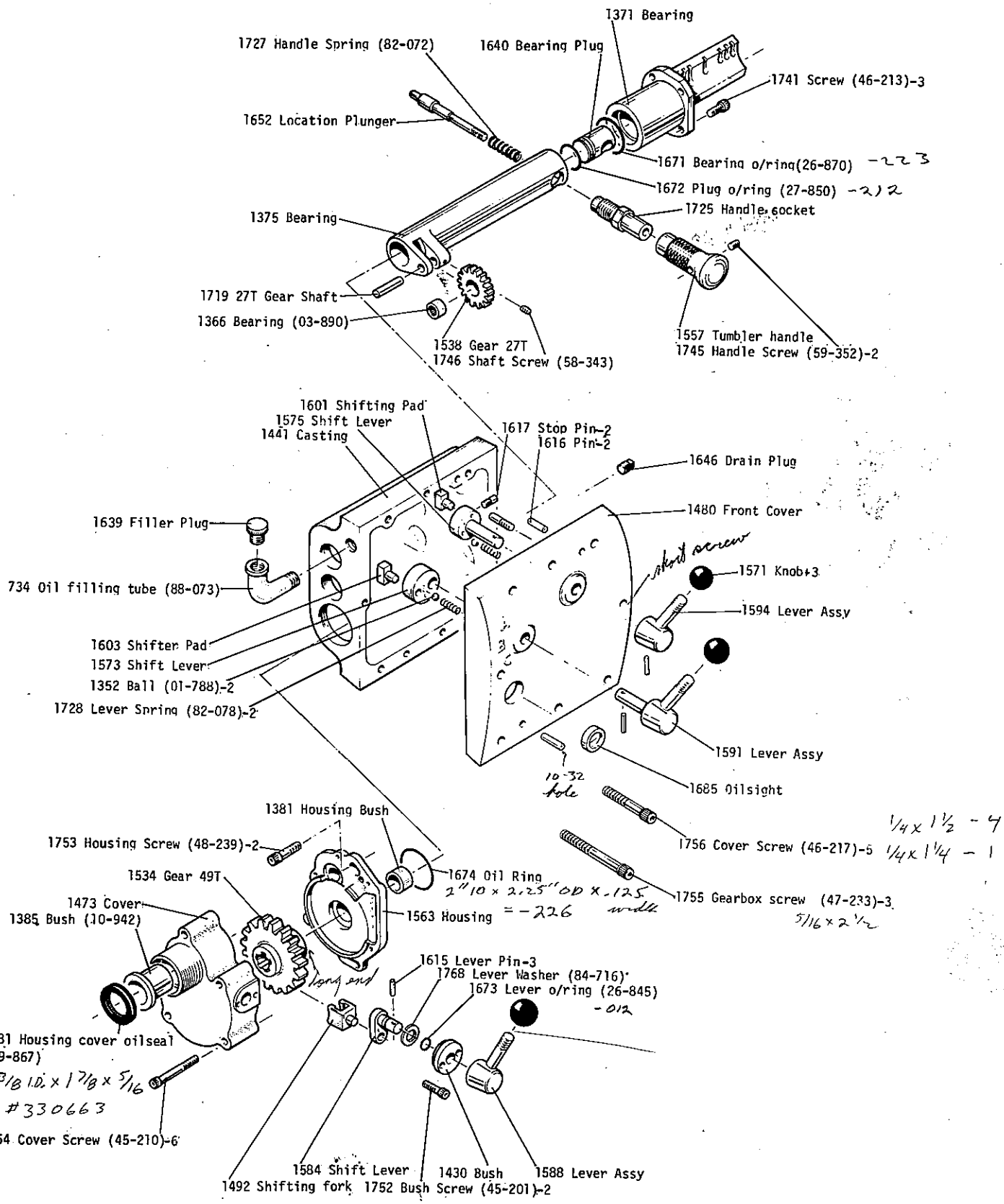
1301 Change gear 20T
1303 Change gear 24T
1305 Change gear 28T
1306 Change gear 30T
1310 Change gear 36T
1311 Change gear 42T
1312 Change gear 44T
13. Change gear 48T
1317 Change gear 52T
1319 Change gear 56T
1320 Change gear 57T
1321 Change gear 60T
1325 Change gear 66T
1326 Change gear 69T
1327 Change gear 70T

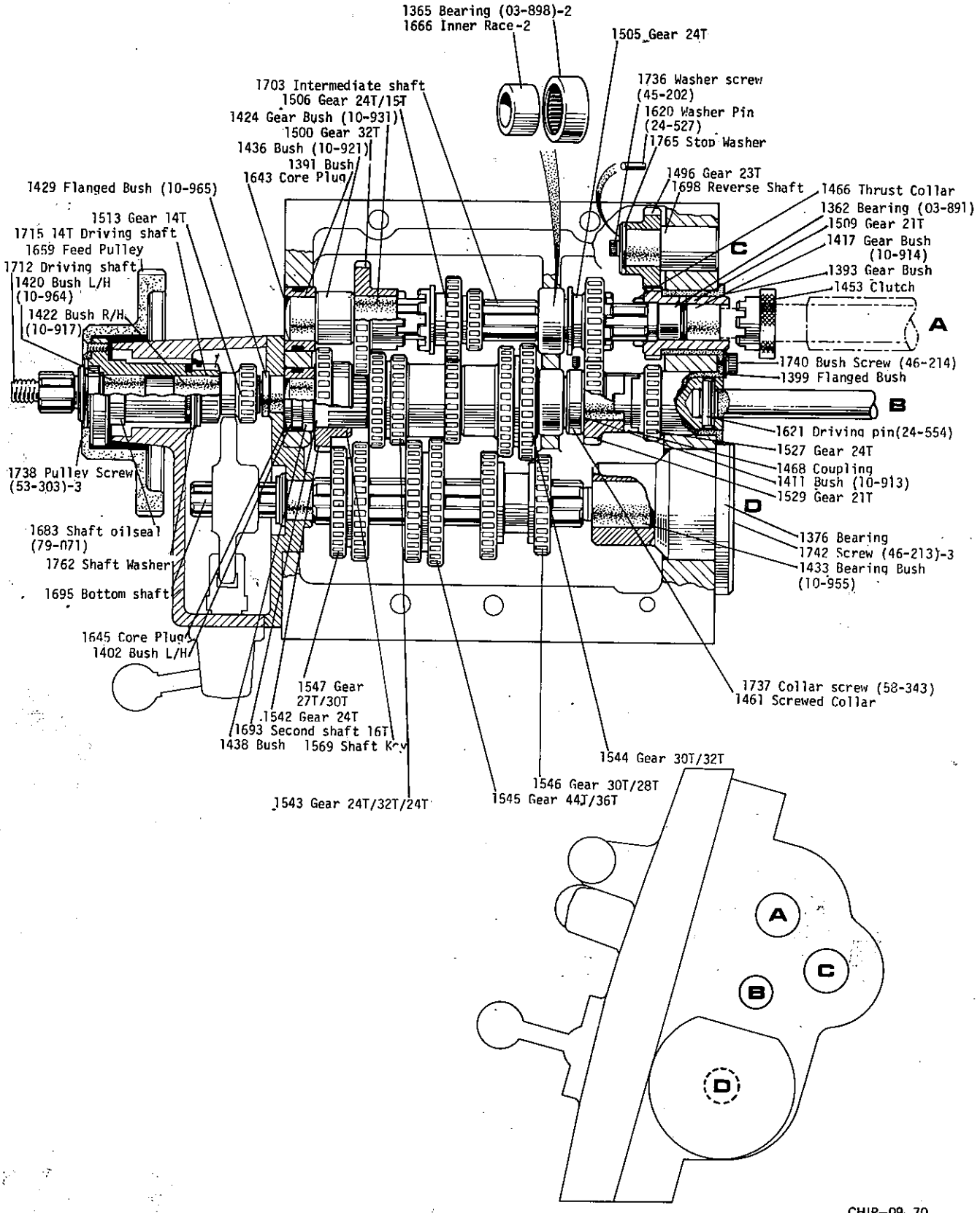
2681 Thread Plate

1in.	68 X / 56 Y			1in.	68 X / 56 Y		
	X	Y			X	Y	
3	66	44	A5	18	44	66	C1
3·5	48	56	A1	19	48	57	C4
4	42	56	A1	20	36	60	C1
4·5	44	66	A1	22	36	66	C1
5	36	60	A1	23	36	69	C1
6	42	56	A5	24	42	56	C5
7	48	56	B1	26	36	52	C5
8	42	56	B1	27	44	66	C5
9	44	66	B1	28	20	70	B4
10	36	60	B1	32	36	56	C6
11	36	66	B1	36	30	60	C5
11·5	36	69	B1	40	28	70	C4
12	42	56	B5	48	30	70	C6
13	36	52	B5	56	20	70	C4
14	48	56	C1	60	24	70	C6
16	42	56	C1				

SHELL TELLUS 33


1365 Bearing (03-898)-2
1666 Inner Race-2
1620 Washer pin (24-527)
1765 Stop washer
1736 Washer screw (45-202)
1496 Gear 23T
1698 Reverse shaft
1499 Gear 32T
1424 Gear Bush (10-931)
1503 Gear 24T
1702 Intermediate shaft
1505 Gear 24T
1436 Bush (10-921)
1643 Core plug
1391 Bush
1628 15T Clutch pinion
1466 Thrust collar
1362 Bearing (03-891)
1393 Gear bush
1509 Gear 21T
1417 Gear bush (10-914)
1658 Feed Pulley
1712 Driving shaft
1738 Pulley Screw (53-303)-3
1405 Bush L/H
1437 Bush
1644 Core Plug
C
A
1453 Clutch
1470 Bush screw (46-214)
B
1621 Driving pin (24-554)
3/4" x 1 1/4" x 1/4
1683 Shaft oilseal (79-071)
1420 Bush L/H (10-964)
1422 Bush R/H (10-917)
1762 Shaft washer
1445 Shaft clip
1715 14T Driving shaft
1513 Gear 14T
1429 Flanged Bush (10-965)
1399 Flanged Bush
1527 Gear 24T
1411 Bush (10-913)
1468 Coupling
1529 Gear 21T
1710 Tumbler Shaft
1707 16T Cone Shaft
1516 Gear 18T
1517 Gear 19T
1518 Gear 20T
1519 Gear 22T
1464 Spacer Collar
1521 Gear 26T
1522 Gear 28T
1520 Gear 24T
1524 Gear 30T
1460 Screwed Collar
1737 Collar Screw (58-343)
picture in other manual is much better
A
C
B

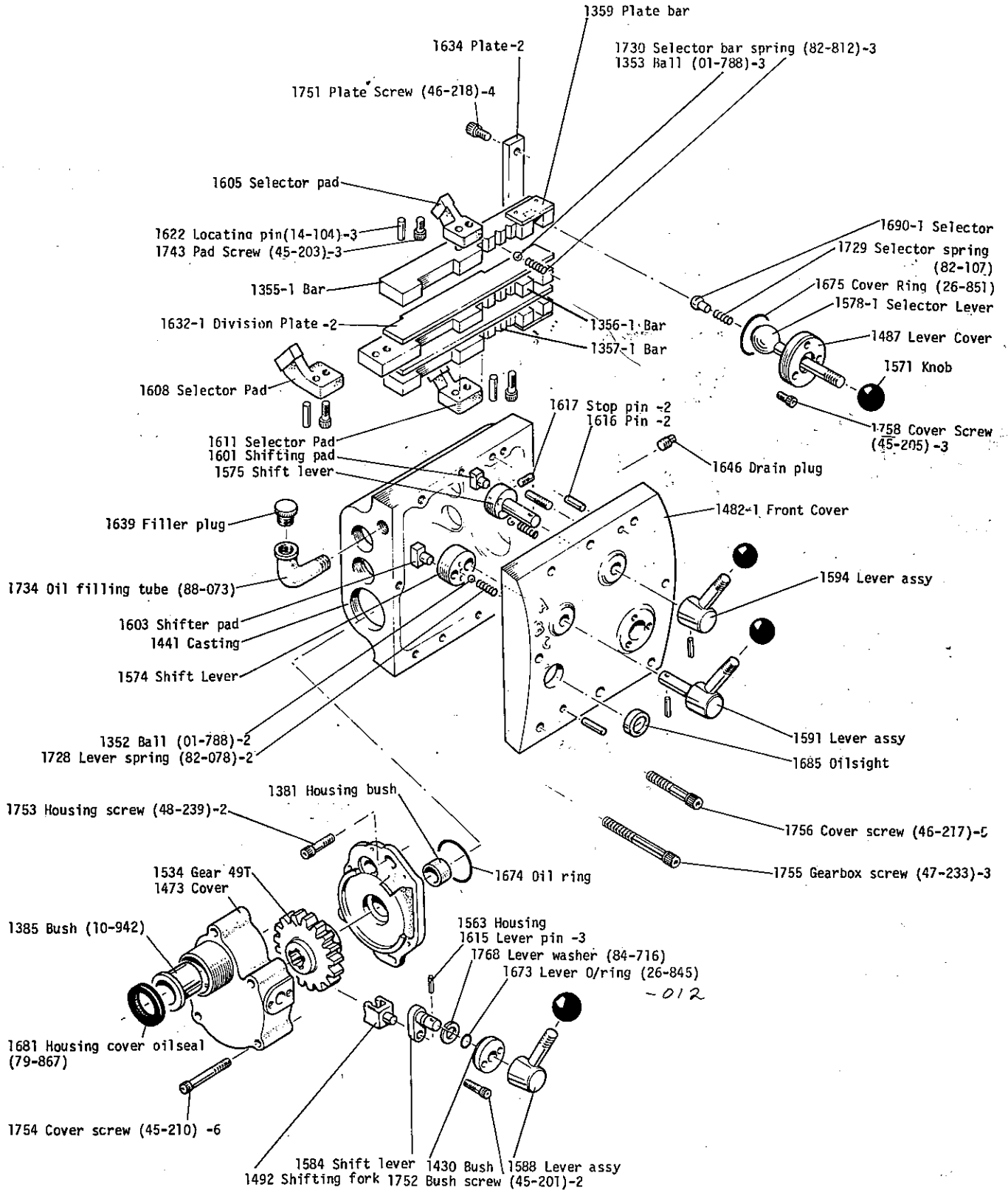

1371 Bearing
1727 Handle Spring (82-072)
1640 Bearing Plug
1741 Screw (46-213)-3
1652 Location Plunger
1671 Bearing o/ring(26-870) -223
1672 Plug o/ring (27-850) -212
1725 Handle socket
1375 Bearing
1719 27T Gear Shaft
1366 Bearing (03-890)
1538 Gear 27T
1746 Shaft Screw (58-343)
1557 Tumbler handle
1745 Handle Screw (59-352)-2
1601 Shifting Pad
1575 Shift Lever
1441 Casting
1617 Stop Pin-2
1616 Pin-2
1646 Drain Plug
1639 Filler Plug
1480 Front Cover
1571 Knob+3
734 Oil filling tube (88-073)
1594 Lever Assy
1603 Shifter Pad
1573 Shift Lever
1352 Ball (01-788)-2
1728 Lever Spring (82-078)-2
1591 Lever Assy
10-32 hole
1685 Oilsight
1381 Housing Bush
1753 Housing Screw (48-239)-2
1/4 x 1 1/2 - 4
1/4 x 1 1/4 - 1
1674 Oil Ring
2" ID x 2.125" OD x .125 width = -226
1534 Gear 49T
1473 Cover
1385 Bush (10-942)
1563 Housing
1755 Gearbox screw (47-233)-3
5/16 x 2 1/2
1615 Lever Pin-3
1768 Lever Washer (84-716)
1673 Lever o/ring (26-845) -012
long end
1681 Housing cover oilseal (79-867)
1 3/8 I.D. x 1 7/8 x 5/16
#330663
1754 Cover Screw (45-210)-6
1584 Shift Lever
1430 Bush
1588 Lever Assy
1492 Shifting fork
1752 Bush Screw (45-201)-2


1365 Bearing (03-898)-2
1666 Inner Race-2
1505 Gear 24T
1736 Washer screw (45-202)
1620 Washer Pin (24-527)
1765 Stop Washer
1703 Intermediate shaft
1506 Gear 24T/15T
1424 Gear Bush (10-931)
1500 Gear 32T
1436 Bush (10-921)
1391 Bush
1643 Core Plug
1496 Gear 23T
1698 Reverse Shaft
1466 Thrust Collar
1362 Bearing (03-891)
1509 Gear 21T
1417 Gear Bush (10-914)
1393 Gear Bush
1453 Clutch
1429 Flanged Bush (10-965)
1513 Gear 14T
1715 14T Driving shaft
1659 Feed Pulley
1712 Driving shaft
1420 Bush L/H (10-964)
1422 Bush R/H (10-917)
C
A
1740 Bush Screw (46-214)
1399 Flanged Bush
B
1621 Driving pin(24-554)
1527 Gear 24T
1468 Coupling
1411 Bush (10-913)
1529 Gear 21T
D
1738 Pulley Screw (53-303)-3
1683 Shaft oilseal (79-071)
1762 Shaft Washer
1695 Bottom shaft
1376 Bearing
1742 Screw (46-213)-3
1433 Bearing Bush (10-955)
1645 Core Plug
1402 Bush L/H
1737 Collar screw (58-343)
1461 Screwed Collar
1547 Gear 27T/30T
1542 Gear 24T
1693 Second shaft 16T
1438 Bush
1569 Shaft Key
1544 Gear 30T/32T
1546 Gear 30T/28T
1545 Gear 44T/36T
1543 Gear 24T/32T/24T
A
C
B
D

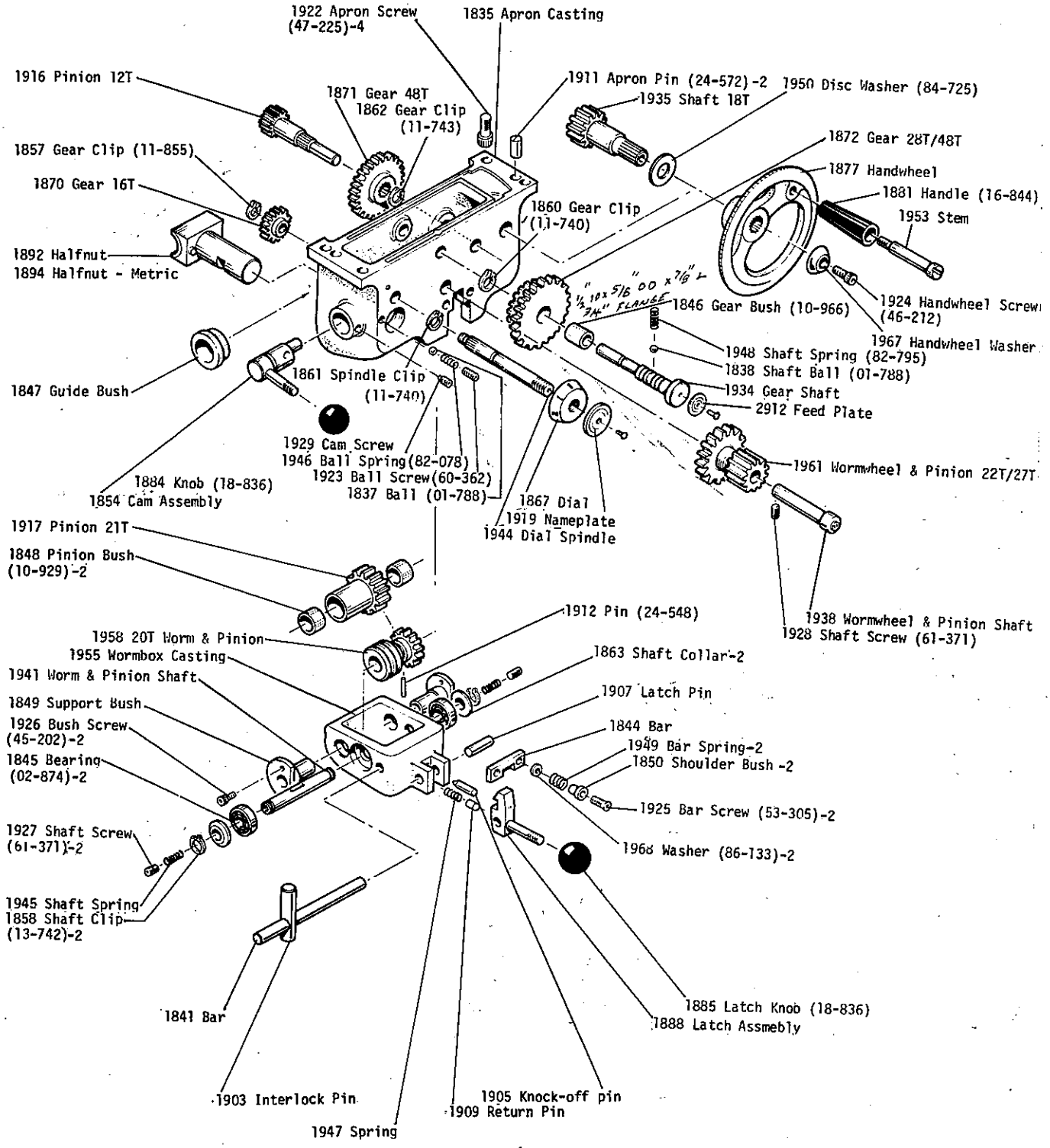
CHIP--09--70

GEARBOX; CASTING & LEVERS CONTINENTAL

FROM SER. NO. 5286
TO SER. NO.

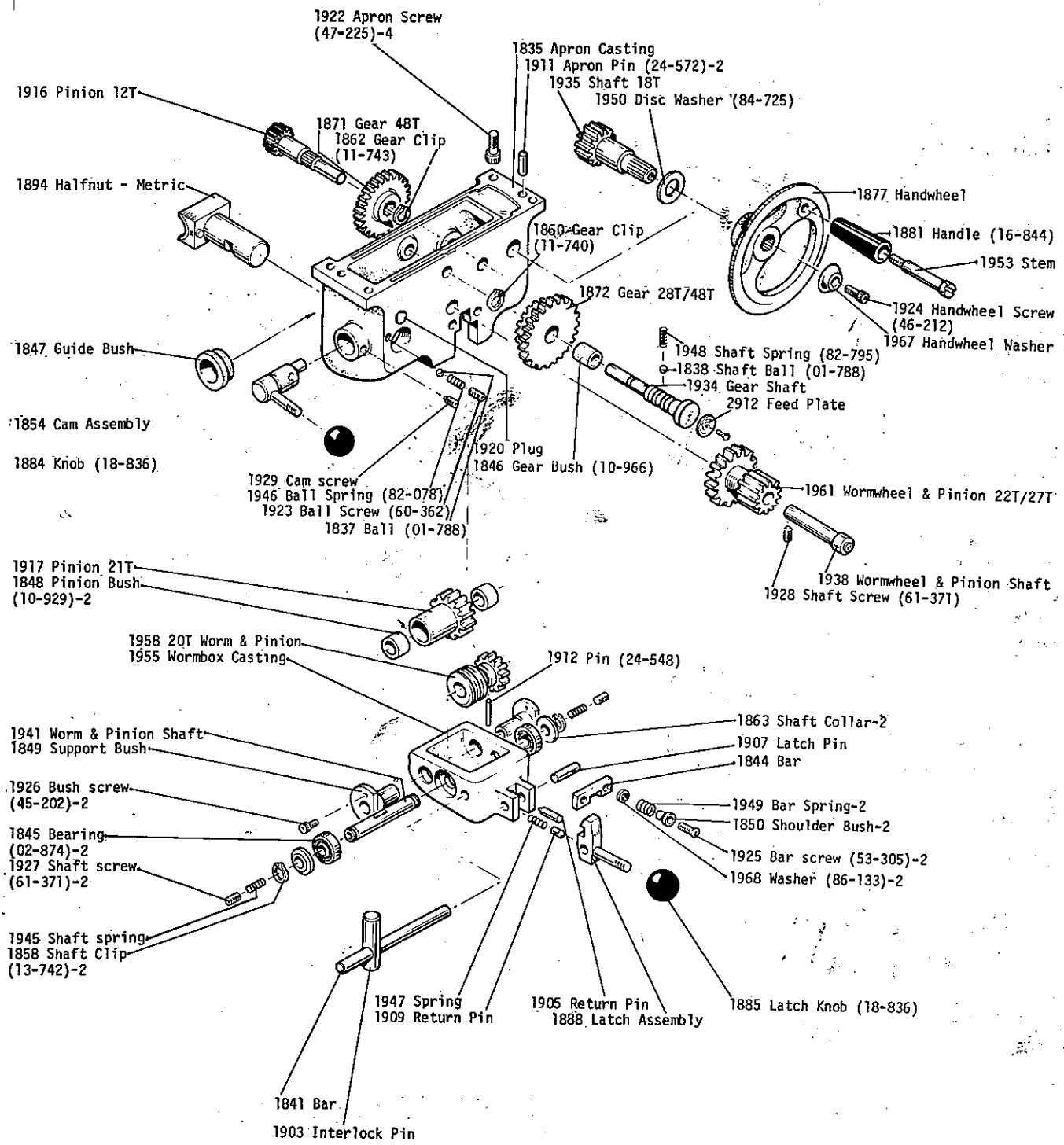


CHIP–07–71


1922 Apron Screw (47-225)-4
1835 Apron Casting
1916 Pinion 12T
1871 Gear 48T
1862 Gear Clip (11-743)
1911 Apron Pin (24-572)-2
1950 Disc Washer (84-725)
1935 Shaft 18T
1872 Gear 28T/48T
1857 Gear Clip (11-855)
1877 Handwheel
1870 Gear 16T
1881 Handle (16-844)
1860 Gear Clip (11-740)
1953 Stem
1892 Halfnut
1894 Halfnut - Metric
1846 Gear Bush (10-966)
1924 Handwheel Screw (46-212)
1967 Handwheel Washer
1948 Shaft Spring (82-795)
1838 Shaft Ball (01-788)
1847 Guide Bush
1861 Spindle Clip (11-740)
1934 Gear Shaft
2912 Feed Plate
1929 Cam Screw
1946 Ball Spring (82-078)
1923 Ball Screw (60-362)
1837 Ball (01-788)
1884 Knob (18-836)
1854 Cam Assembly
1867 Dial
1919 Nameplate
1944 Dial Spindle
1961 Wormwheel & Pinion 22T/27T
1917 Pinion 21T
1848 Pinion Bush (10-929)-2
1912 Pin (24-548)
1938 Wormwheel & Pinion Shaft
1928 Shaft Screw (61-371)
1958 20T Worm & Pinion
1955 Wormbox Casting
1863 Shaft Collar-2
1941 Worm & Pinion Shaft
1907 Latch Pin
1849 Support Bush
1844 Bar
1926 Bush Screw (45-202)-2
1949 Bar Spring-2
1845 Bearing (02-874)-2
1850 Shoulder Bush -2
1925 Bar Screw (53-305)-2
1927 Shaft Screw (61-371)-2
1968 Washer (86-133)-2
1945 Shaft Spring
1858 Shaft Clip (13-742)-2
1885 Latch Knob (18-836)
1888 Latch Assmebly
1841 Bar
1903 Interlock Pin
1905 Knock-off pin
1909 Return Pin
1947 Spring

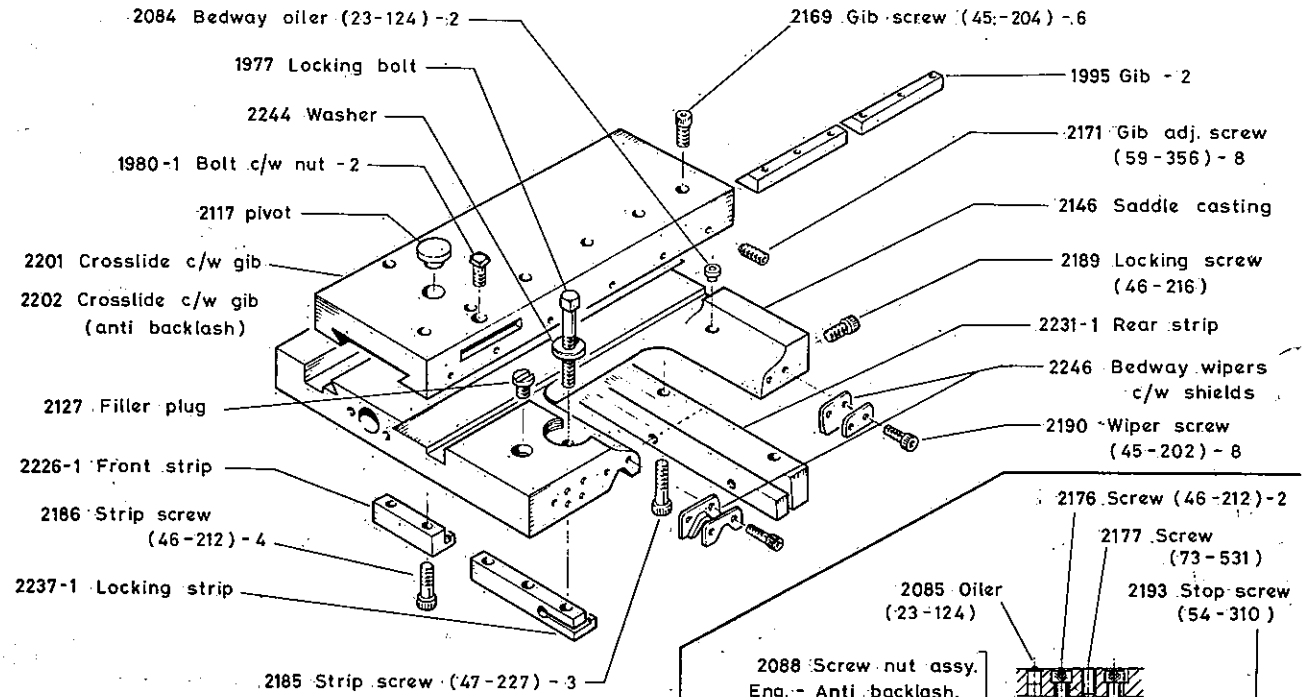
APRON - CONTINENTAL

FROM SER. NO. 3022
TO SER. NO.

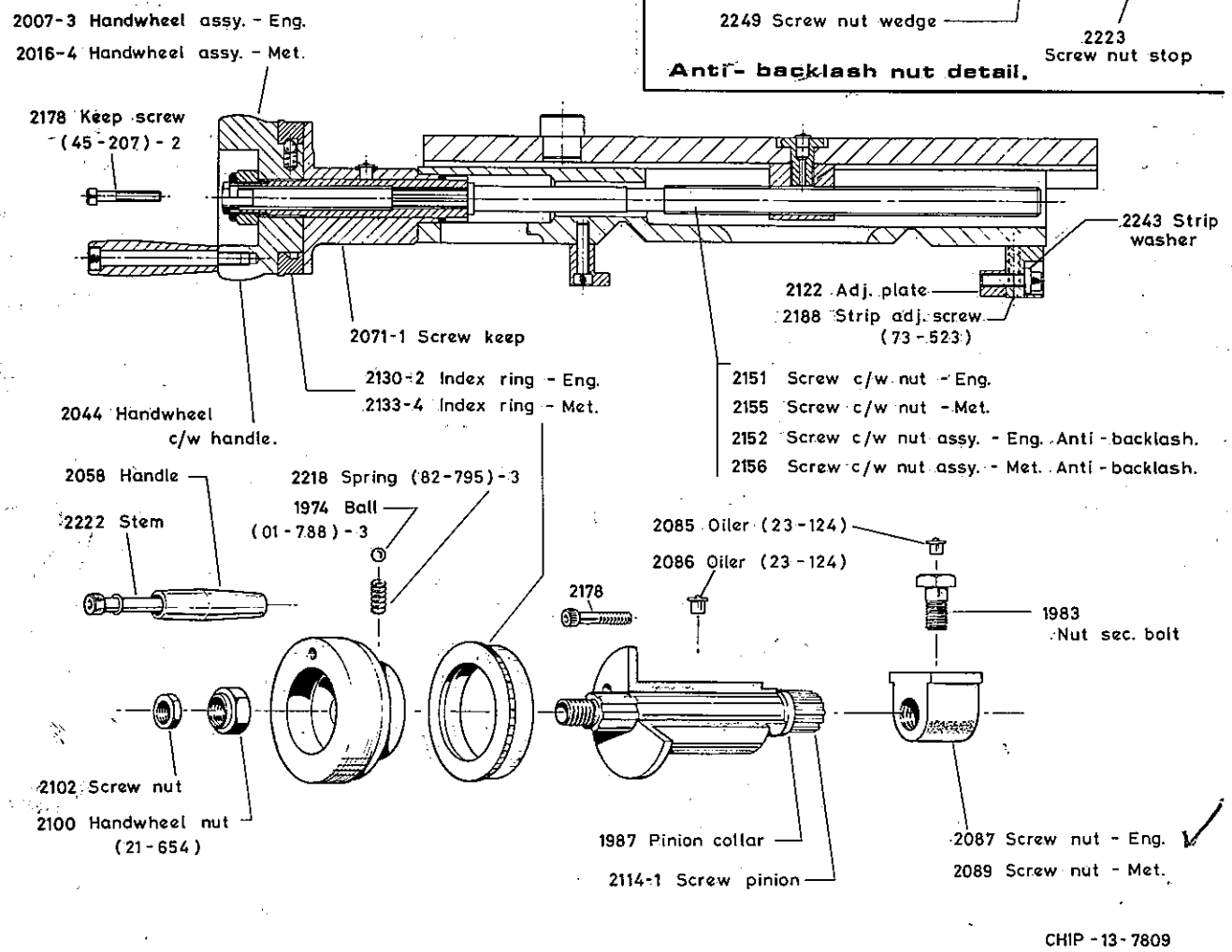


SADDLE & CROSSLIDE

FROM SER. NO. 6994
TO SER. NO.



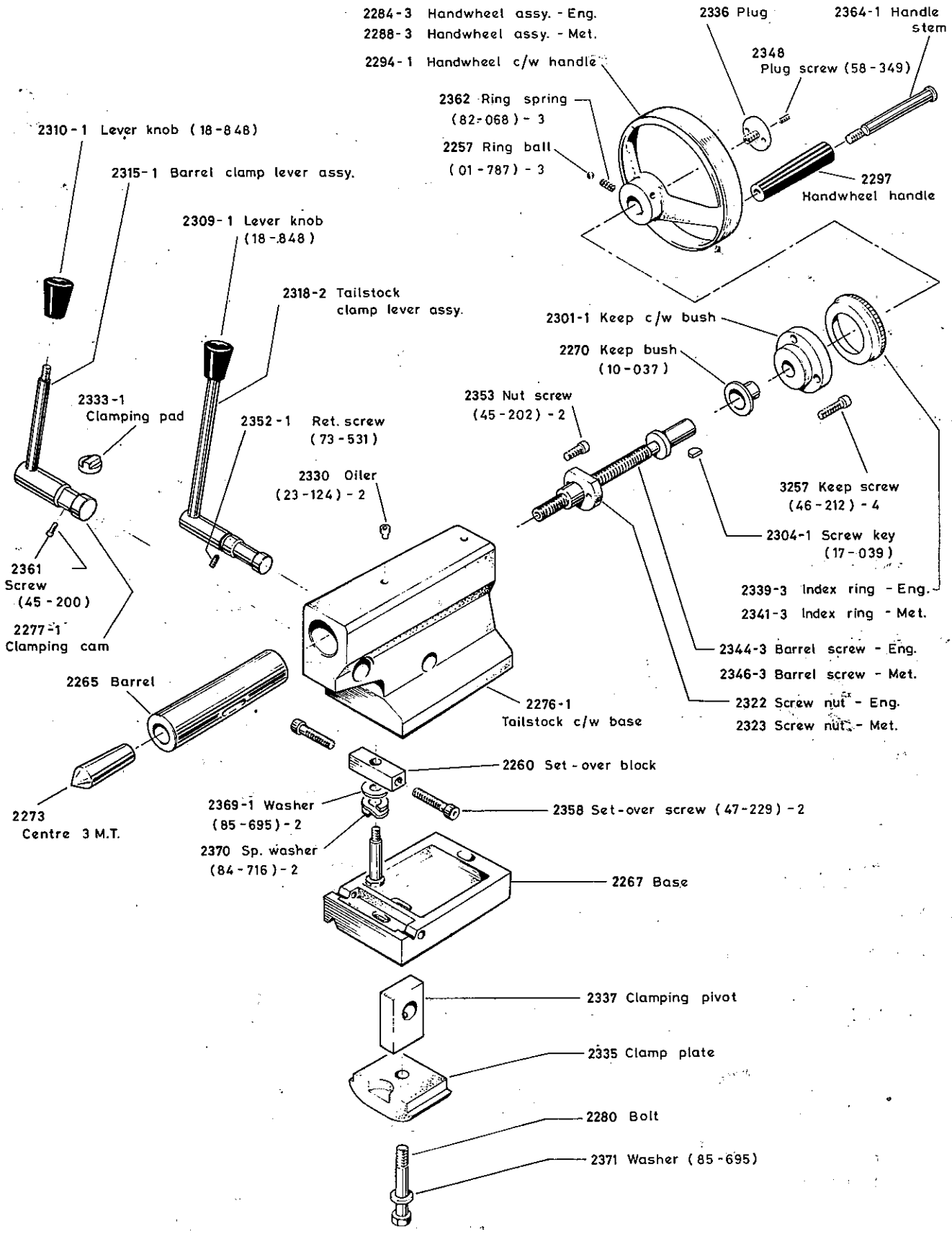
Anti- backlash nut detail.



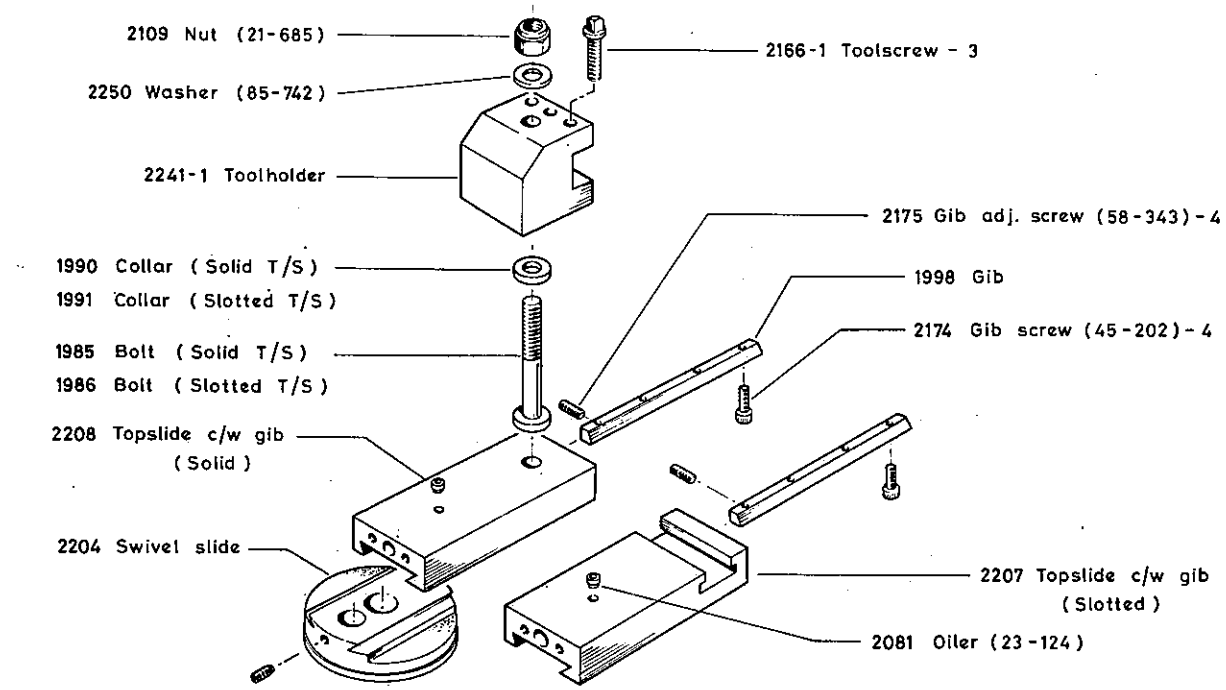
CHIP-13-7809

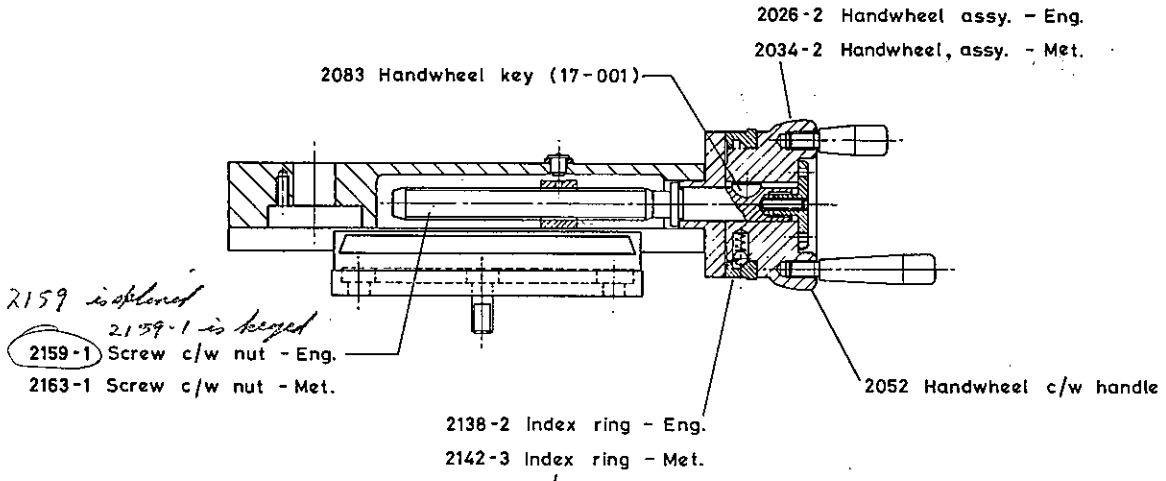
TAILSTOCK

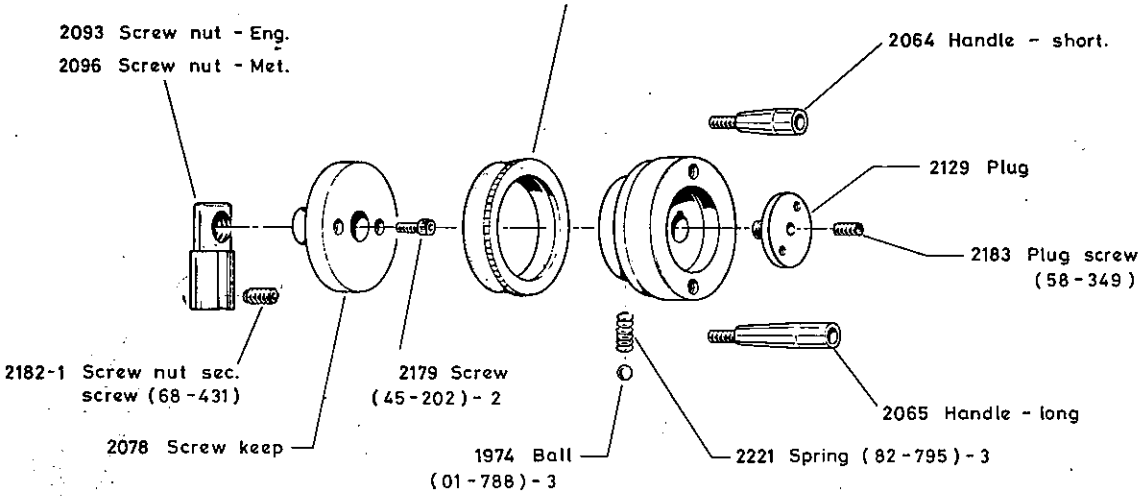
FROM SER. NO. 6994
TO SER. NO.



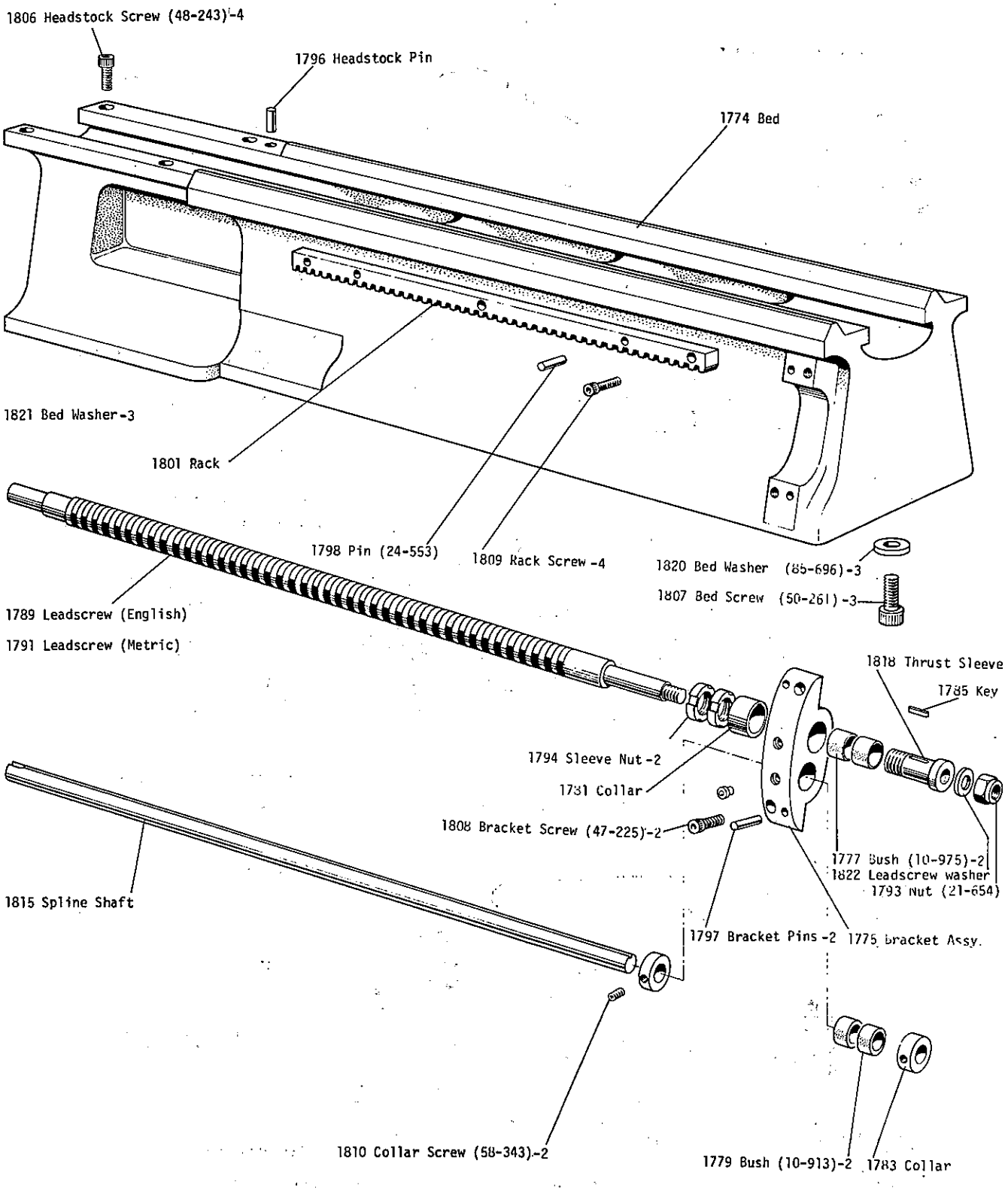
TOPSLIDE ASSEMBLIES



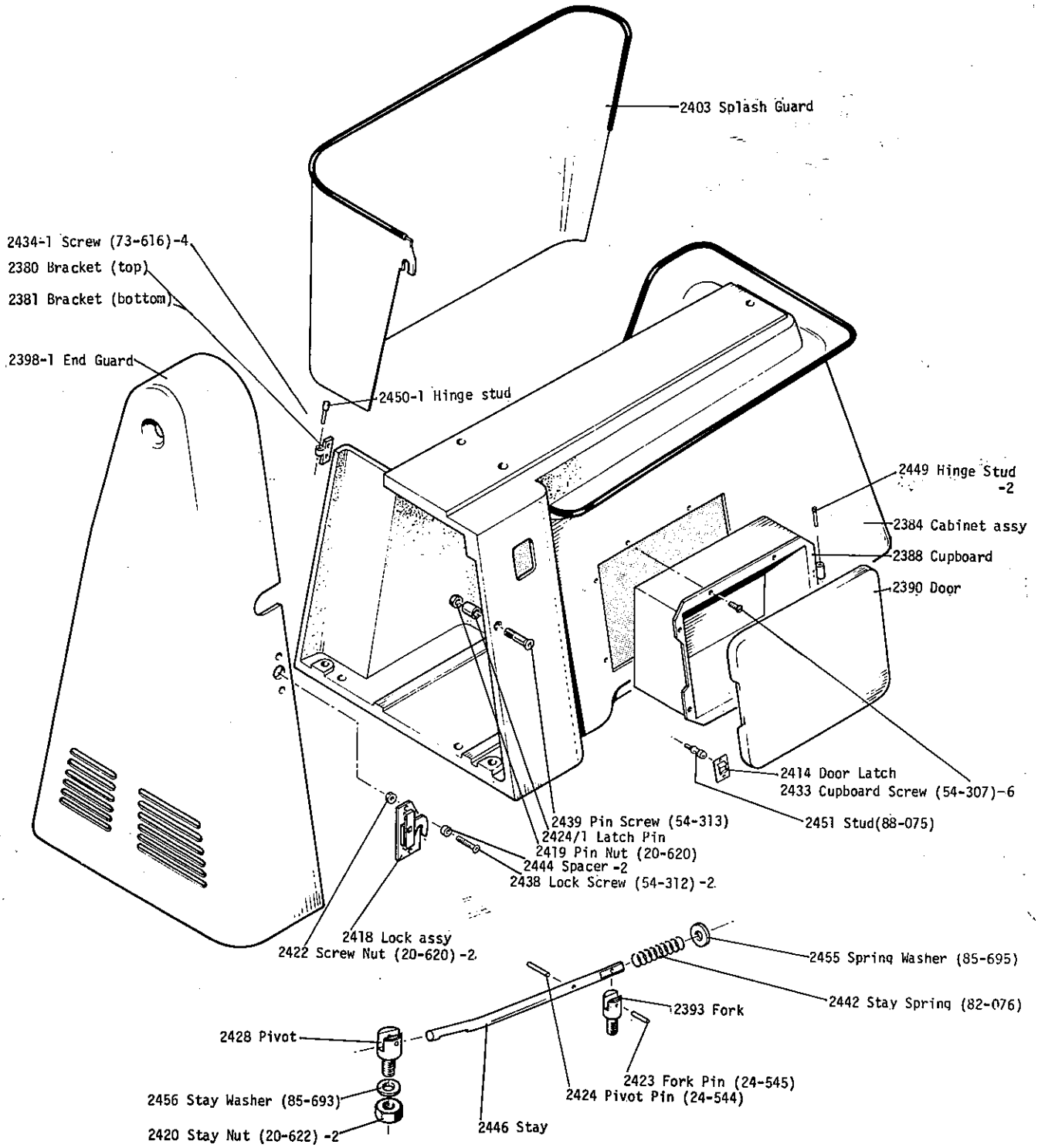




CHIP - 13A - 7809

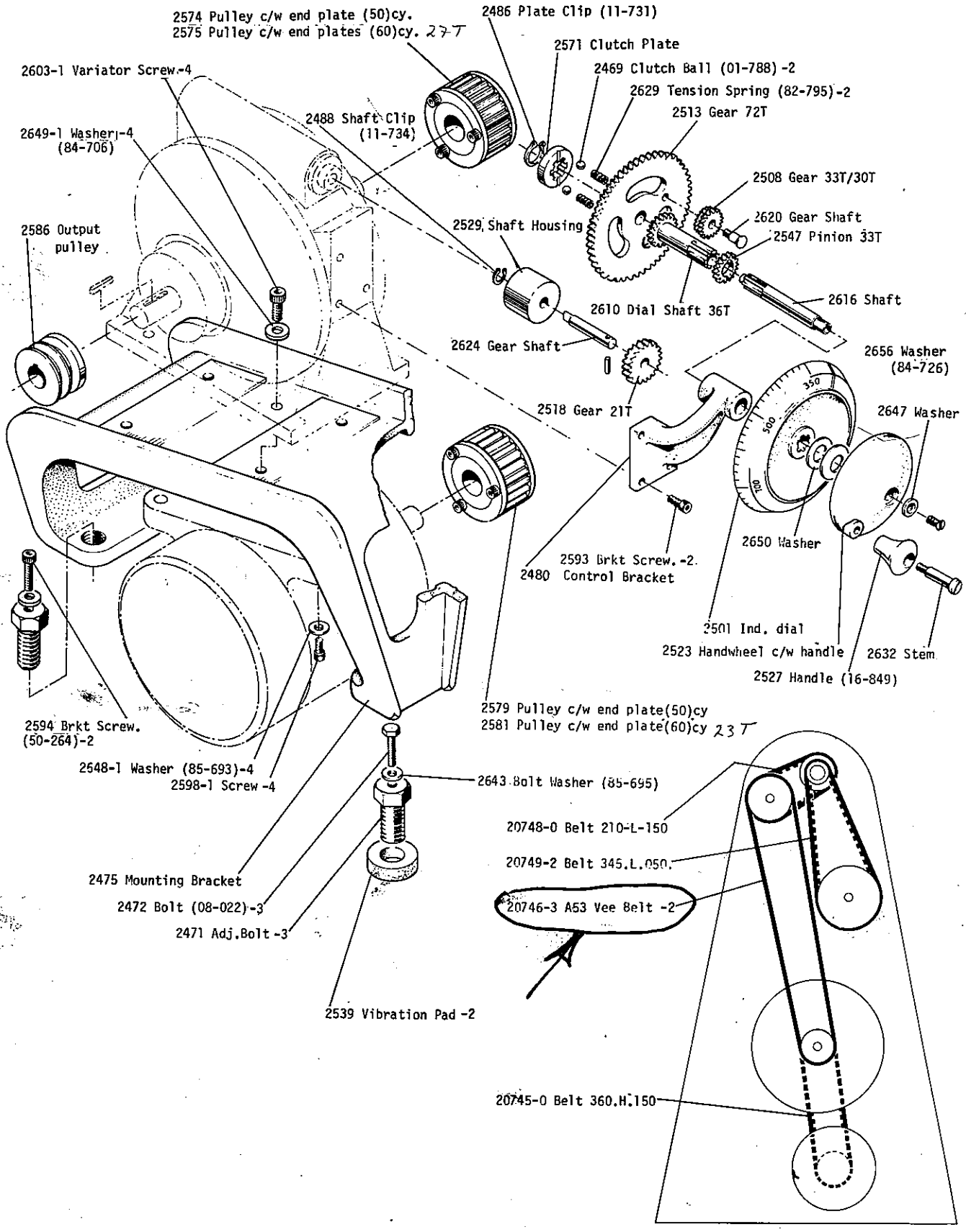

1806 Headstock Screw (48-243)-4
1796 Headstock Pin
1774 Bed
1821 Bed Washer-3
1801 Rack
1798 Pin (24-553)
1809 Rack Screw-4
1820 Bed Washer (85-696)-3
1807 Bed Screw (50-261)-3
1789 Leadscrew (English)
1791 Leadscrew (Metric)
1818 Thrust Sleeve
1785 Key
1794 Sleeve Nut-2
1731 Collar
1808 Bracket Screw (47-225)-2
1777 Bush (10-975)-2
1822 Leadscrew washer
1793 Nut (21-654)
1815 Spline Shaft
1797 Bracket Pins-2
1775 Bracket Assy.
1810 Collar Screw (58-343)-2
1779 Bush (10-913)-2
1783 Collar

CABINET ASSEMBLY



TRANSMISSION ASSEMBIY

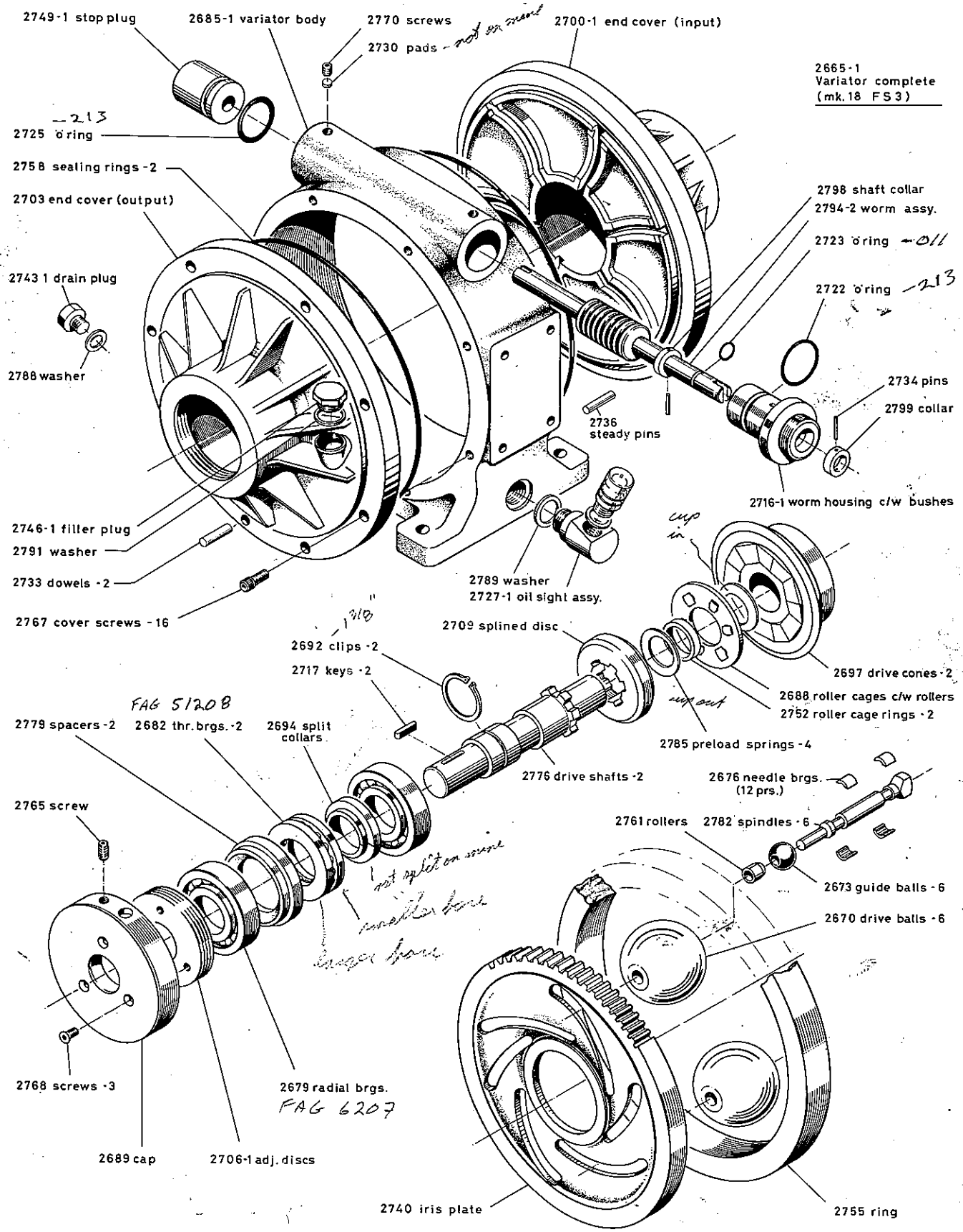
FROM SER. NO. 4835
TO SER. NO.



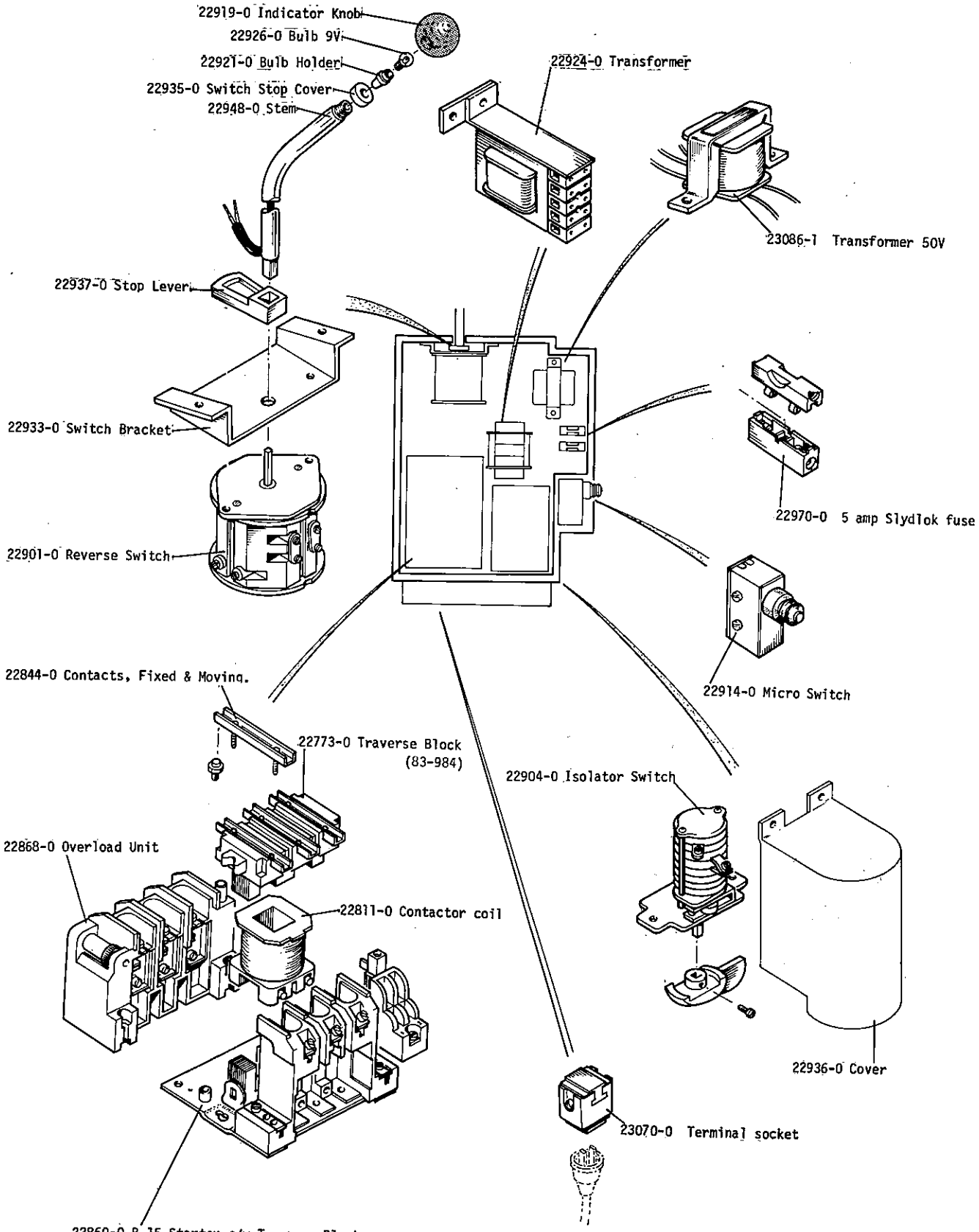
CHIP—16—70

VARIATOR

FROM SER. No. 6188
TO SER. No. .....



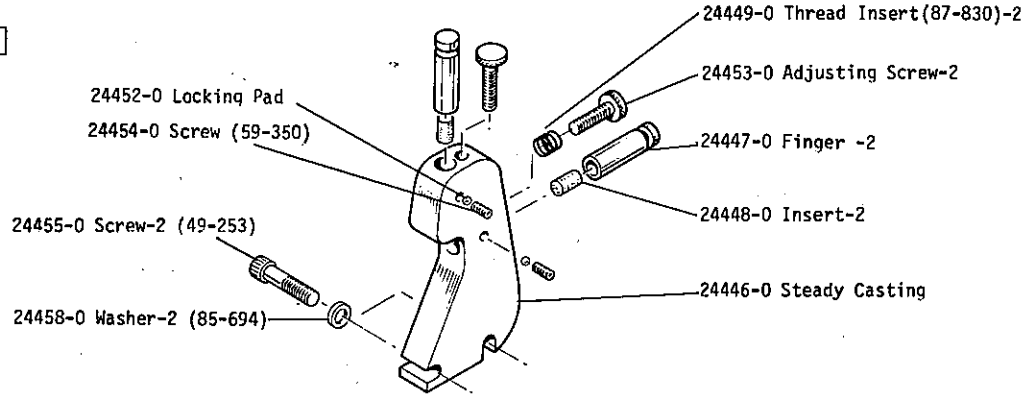
AA-14-7308


22919-0 Indicator Knob
22926-0 Bulb 9V
22921-0 Bulb Holder
22935-0 Switch Stop Cover
22948-0 Stem
22924-0 Transformer
23086-1 Transformer 50V
22937-0 Stop Lever
22933-0 Switch Bracket
22901-0 Reverse Switch
22970-0 5 amp Slydlok fuse
22914-0 Micro Switch
22844-0 Contacts, Fixed & Moving.
22773-0 Traverse Block
(83-984)
22904-0 Isolator Switch
22868-0 Overload Unit
22811-0 Contactor coil
22936-0 Cover
23070-0 Terminal socket
22860-0 B.15 Starter c/w Traverse Block

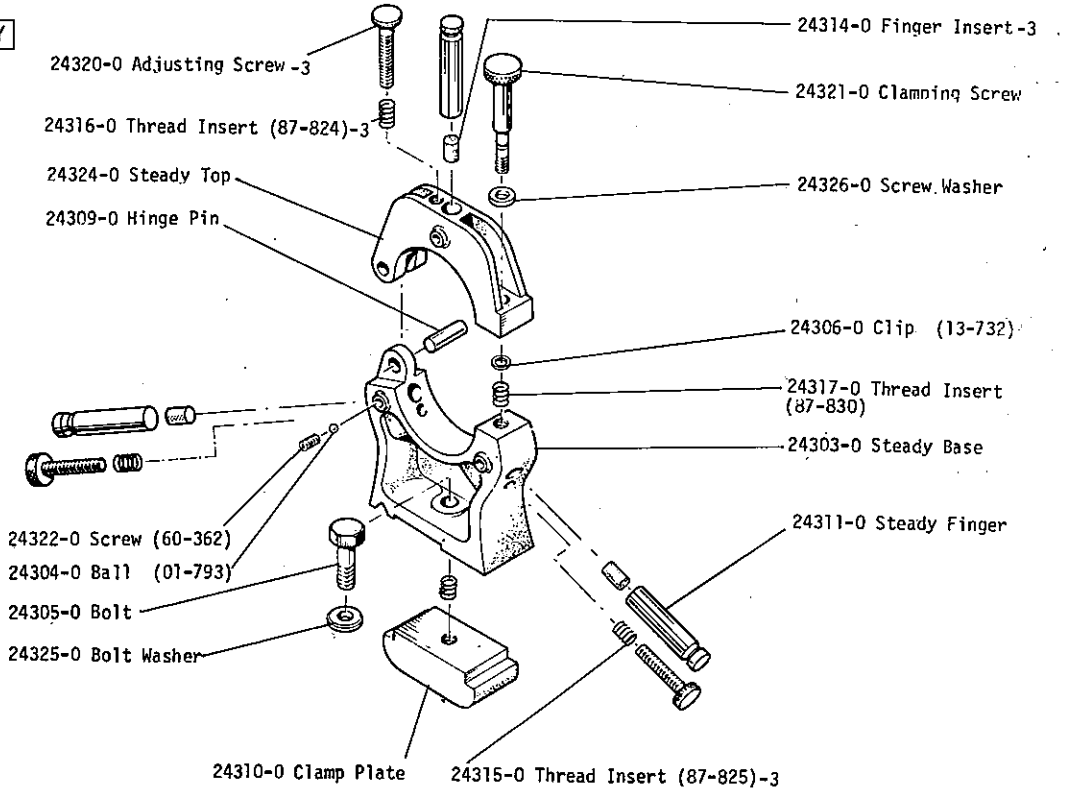
CHIP—18—70

STEADIES; TRAVELLING/STATIONARY

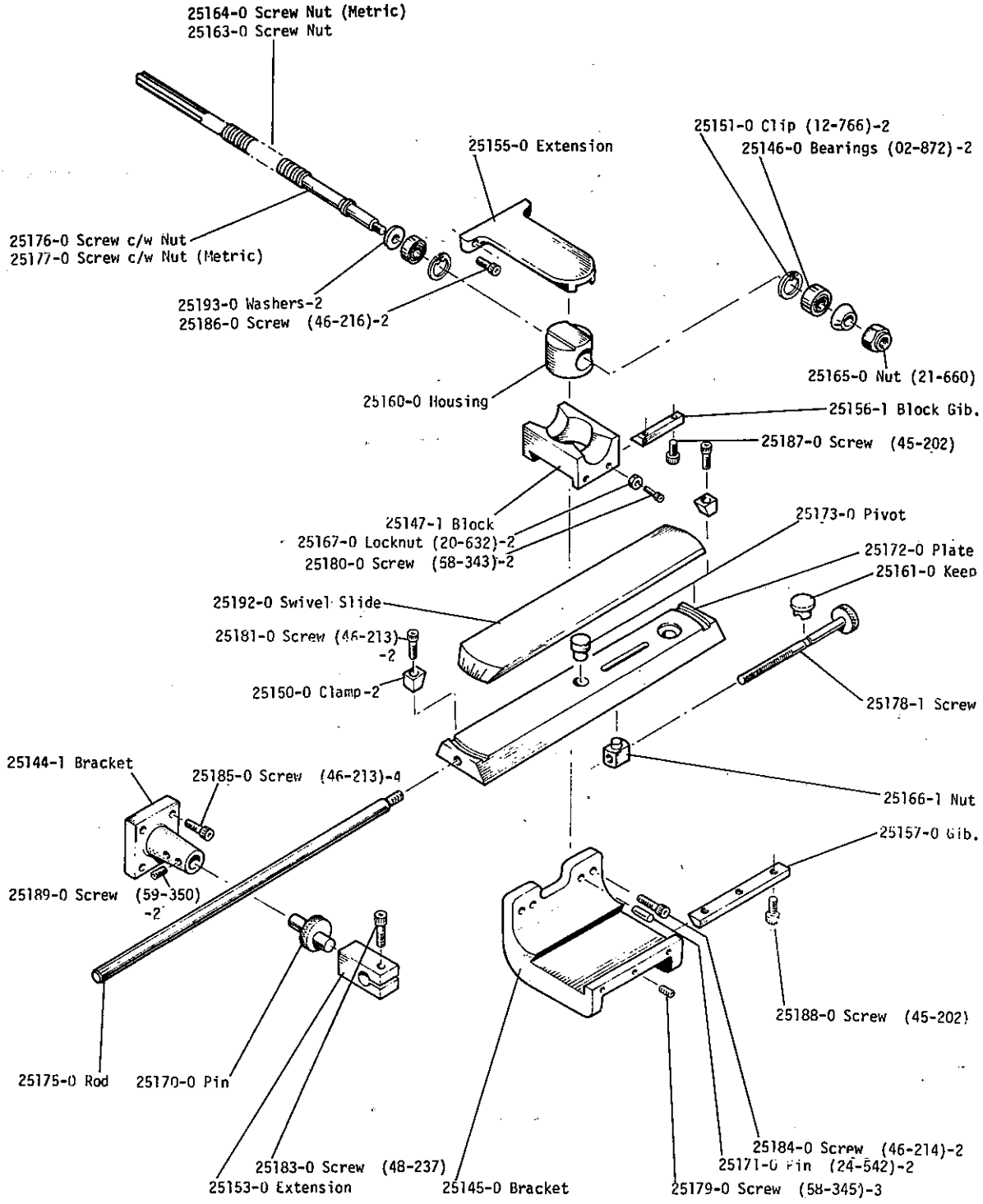
TRAVELLING



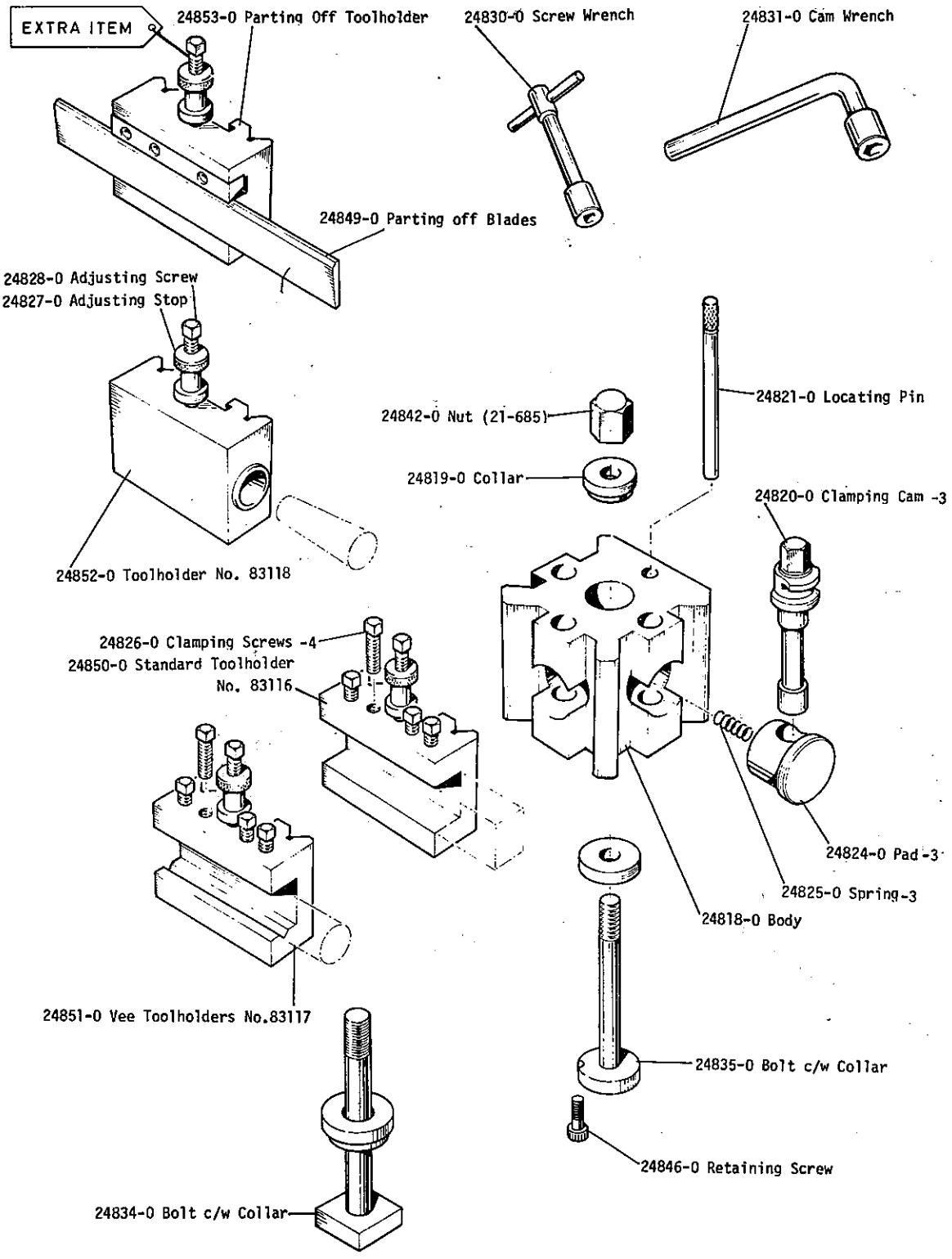
STATIONARY



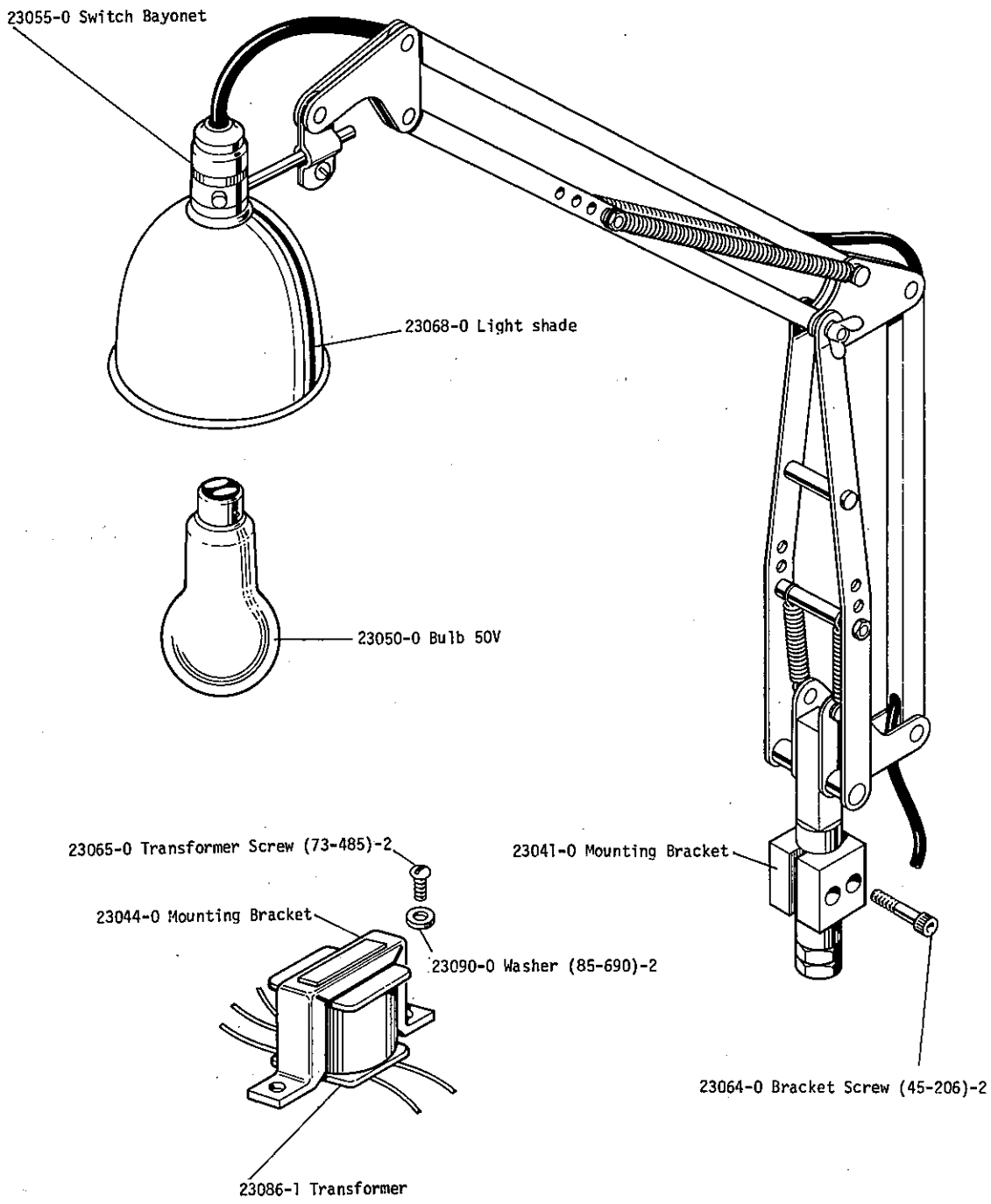
TAPER TURNER ATTACHMENT



QUICK CHANGE TOOLPOST

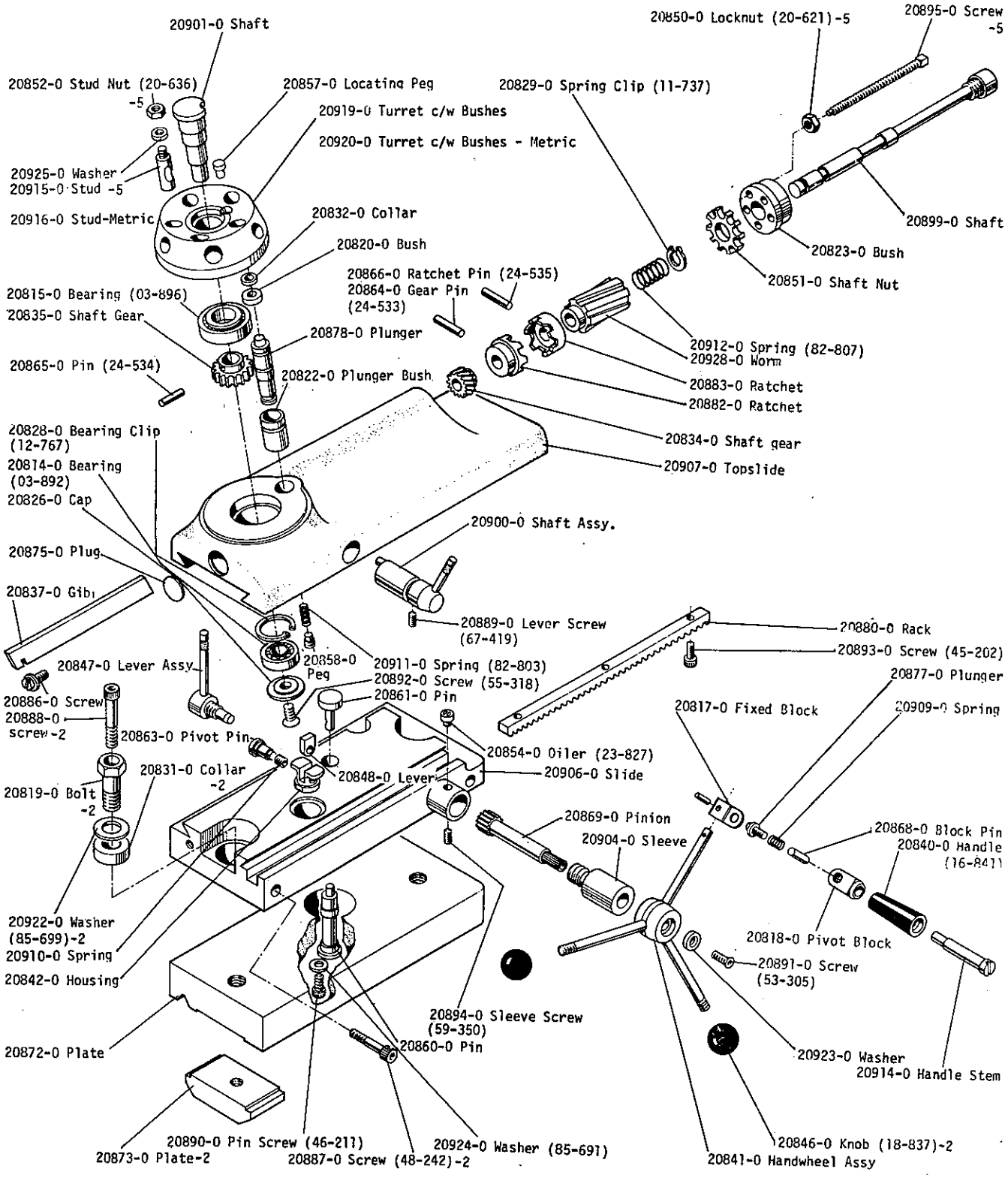


LOW VOLT LIGHT



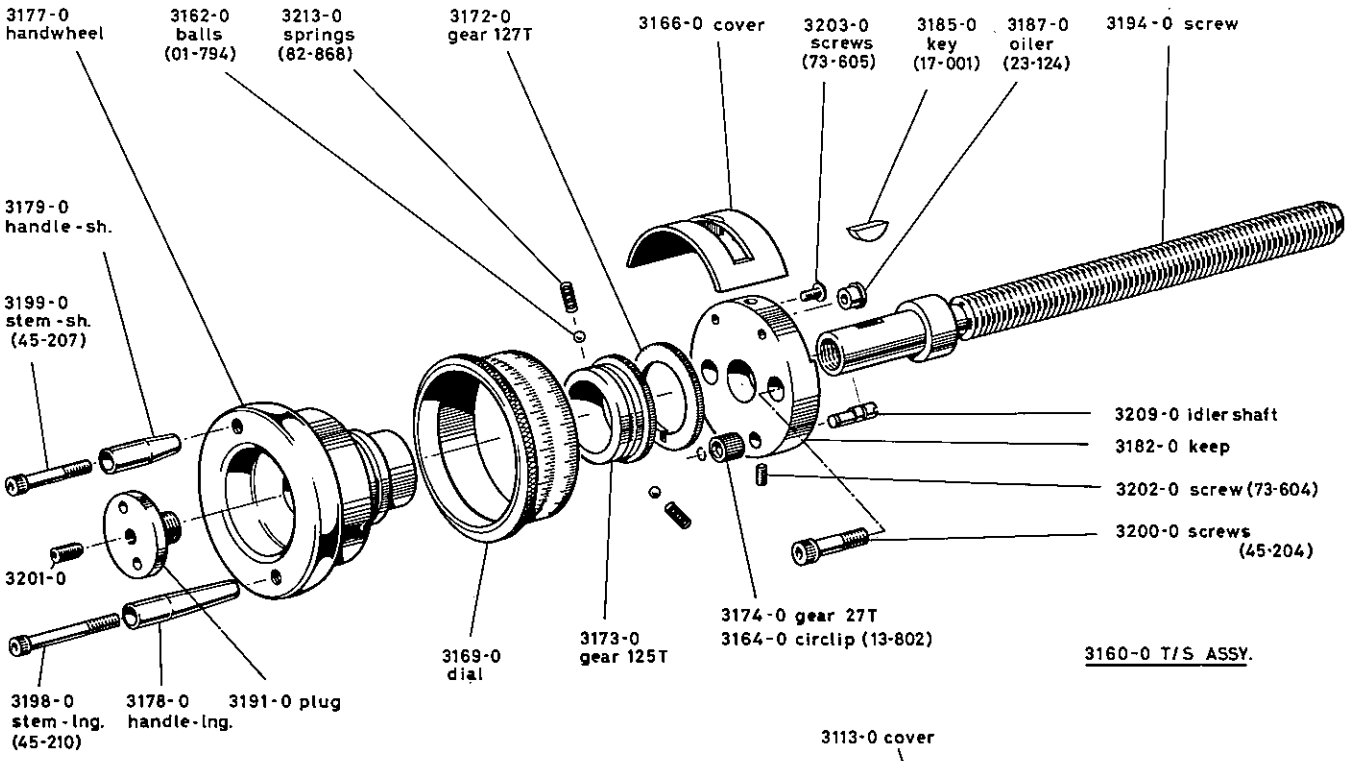
CAPSTAN ATTACHMENT

FROM SER. NO. 4209
TO SER. NO.



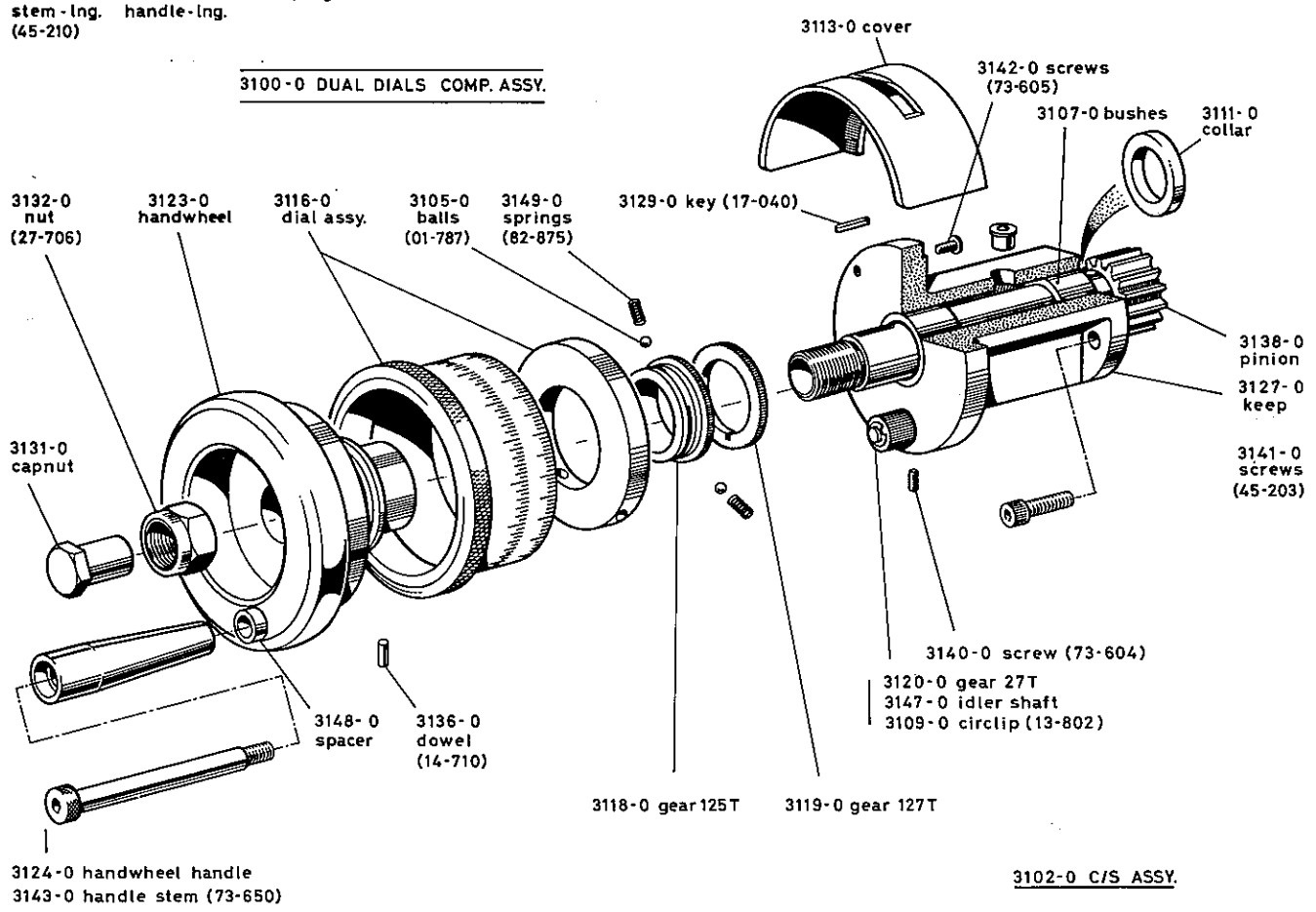
DUAL DIALS

FROM SER. No. 00001
TO SER. No. .....

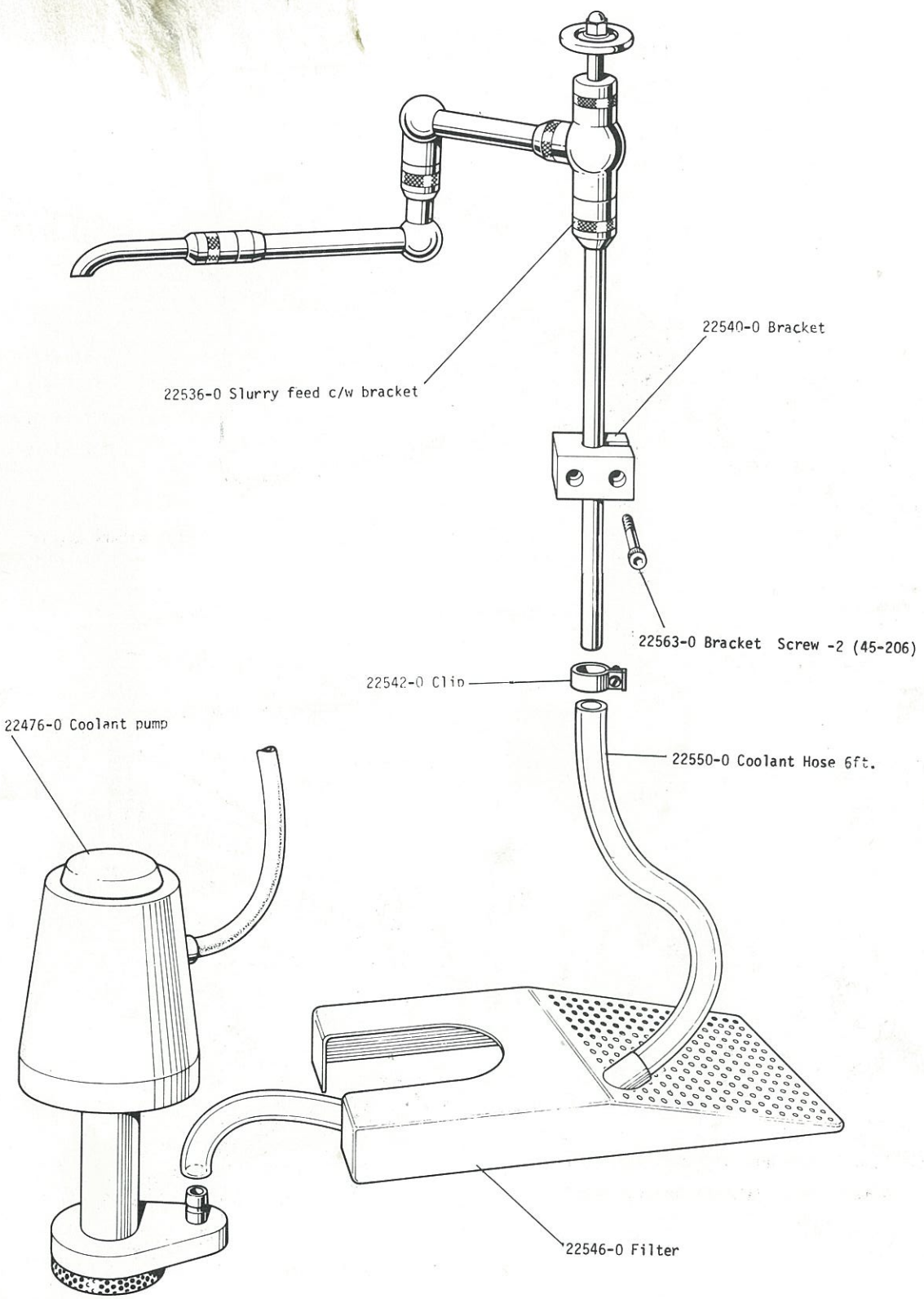


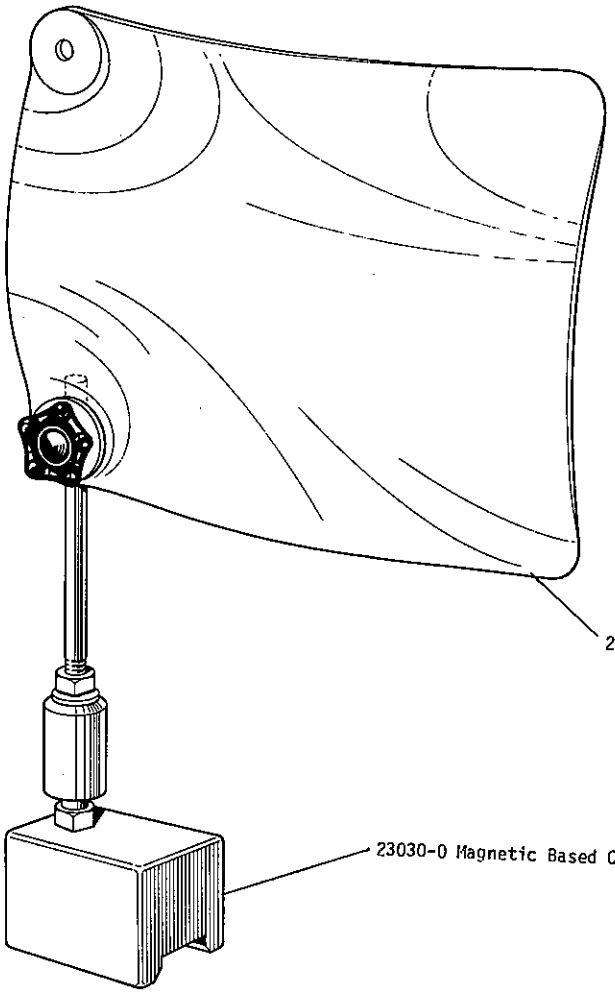
3160-0 T/S ASSY.

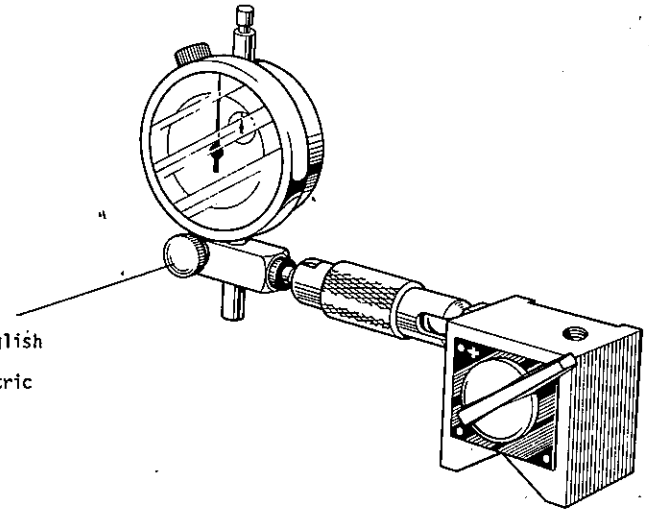
3100-0 DUAL DIALS COMP. ASSY.



3102-0 C/S ASSY.

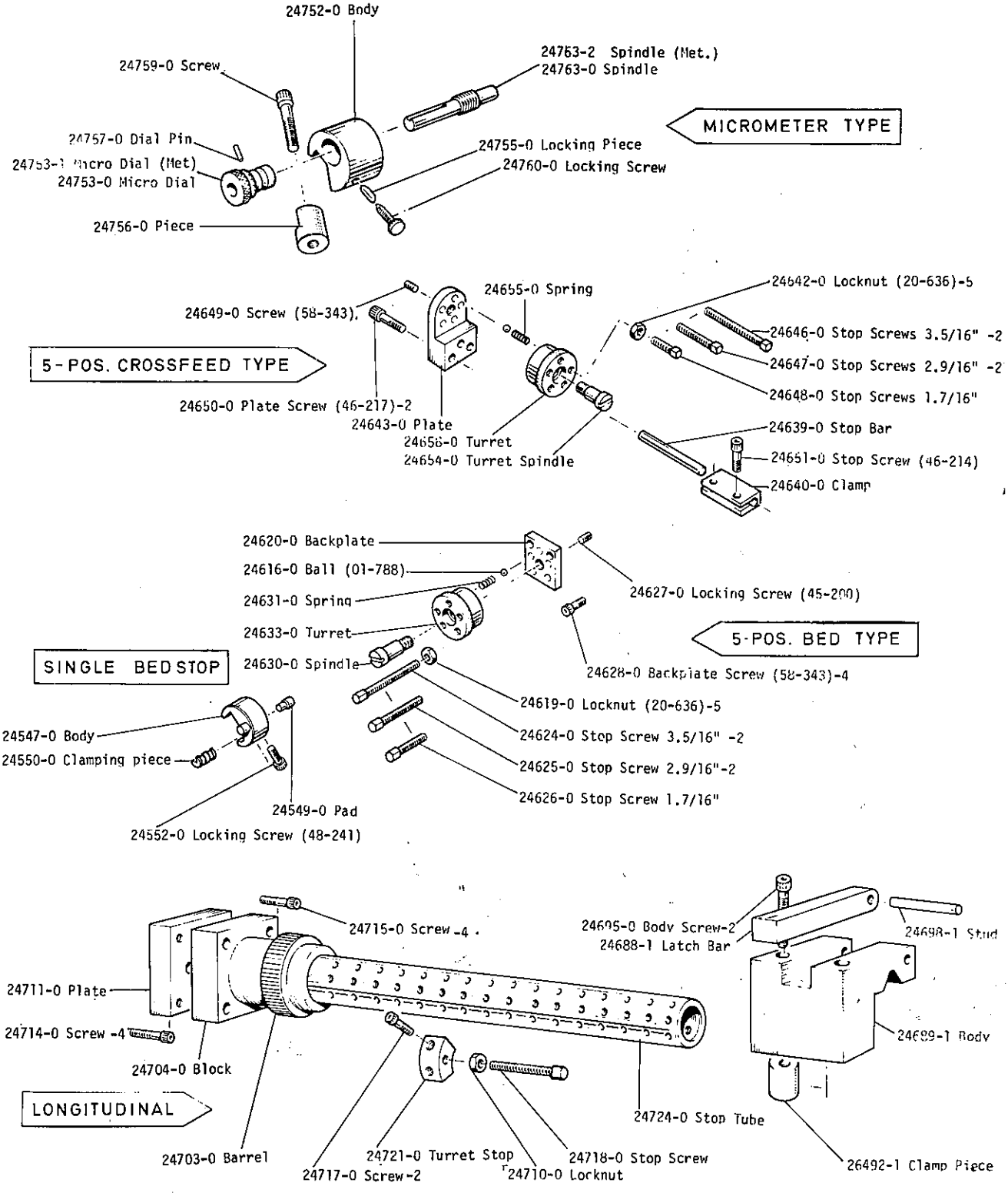

22536-0 Slurry feed c/w bracket
22540-0 Bracket
22563-0 Bracket Screw -2 (45-206)
22542-0 Clip
22476-0 Coolant pump
22550-0 Coolant Hose 6ft.
22546-0 Filter

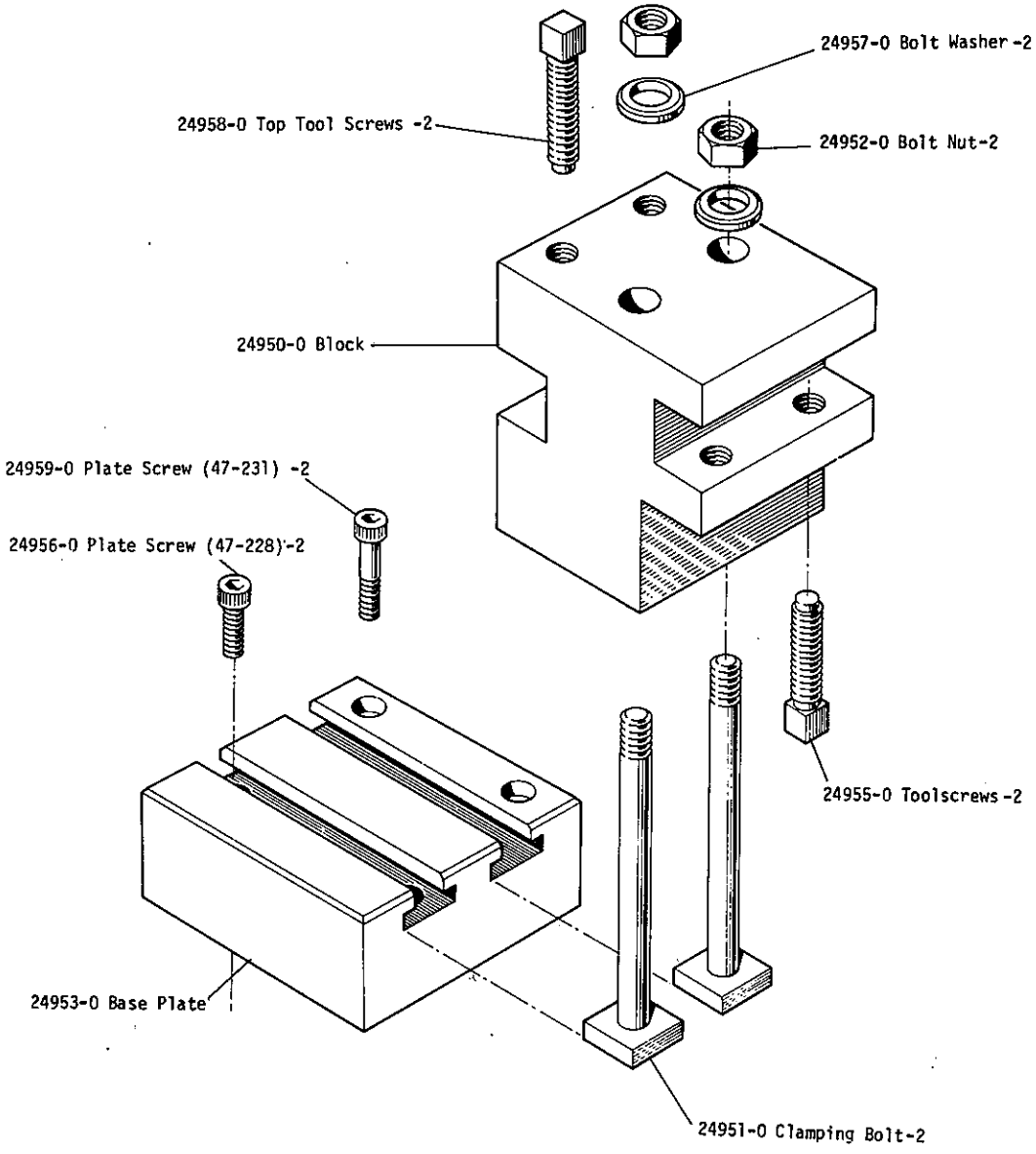




23032-0 Magnetic Based Dial Indicator Assy/English

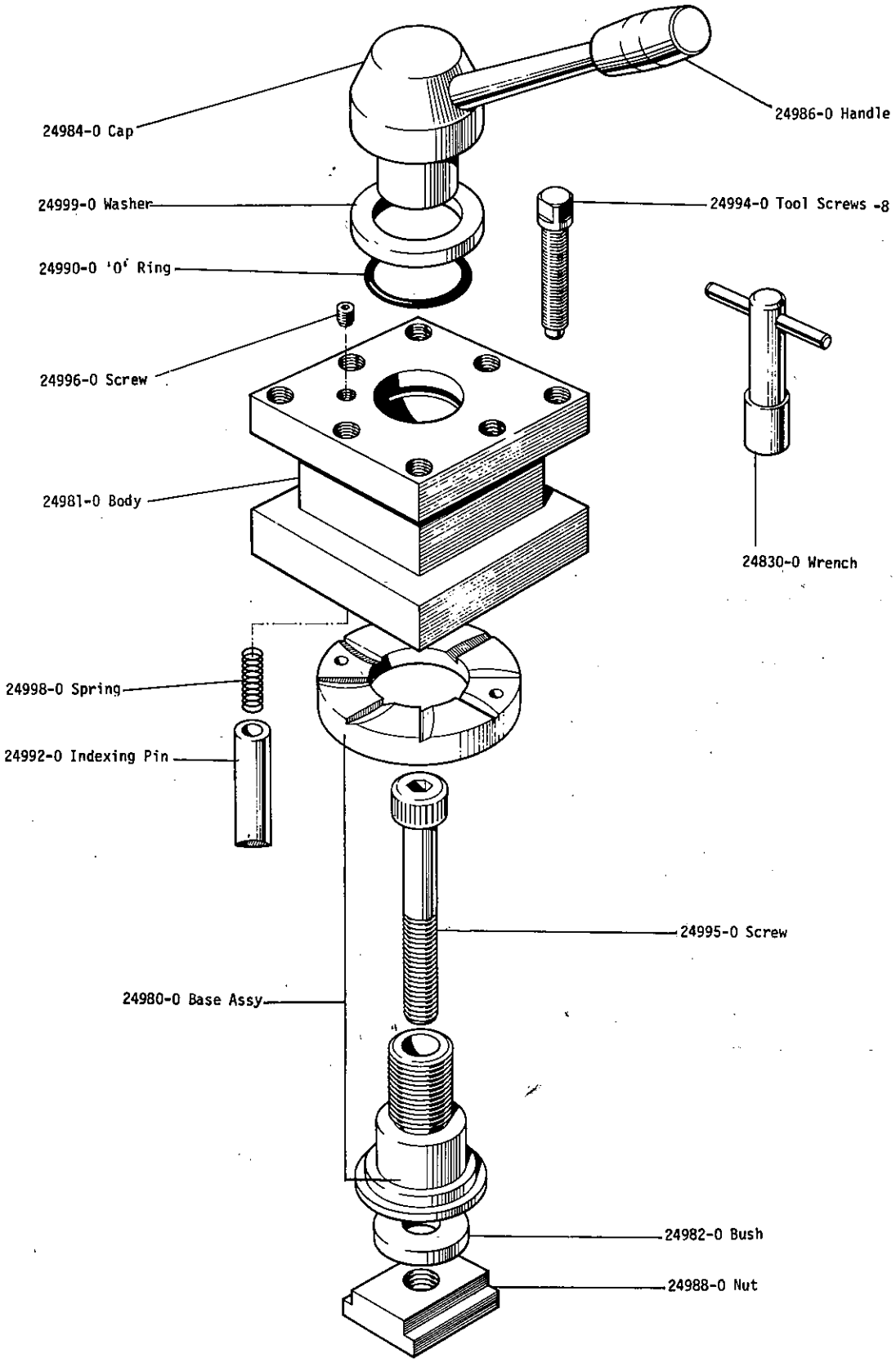
23033-0 Magnetic Based Dial Indicator Assy/Metric


24752-0 Body
24759-0 Screw
24763-2 Spindle (Met.)
24763-0 Spindle
MICROMETER TYPE
24757-0 Dial Pin
24753-1 Micro Dial (Met)
24753-0 Micro Dial
24755-0 Locking Piece
24760-0 Locking Screw
24756-0 Piece
24655-0 Spring
24649-0 Screw (58-343)
24642-0 Locknut (20-636)-5
24646-0 Stop Screws 3.5/16" -2
24647-0 Stop Screws 2.9/16" -2
24648-0 Stop Screws 1.7/16"
5-POS. CROSSFEED TYPE
24650-0 Plate Screw (46-217)-2
24643-0 Plate
24658-0 Turret
24654-0 Turret Spindle
24639-0 Stop Bar
24651-0 Stop Screw (46-214)
24640-0 Clamp
24620-0 Backplate
24616-0 Ball (01-788)
24631-0 Spring
24633-0 Turret
24630-0 Spindle
24627-0 Locking Screw (45-200)
5-POS. BED TYPE
24628-0 Backplate Screw (58-343)-4
SINGLE BED STOP
24619-0 Locknut (20-636)-5
24624-0 Stop Screw 3.5/16" -2
24625-0 Stop Screw 2.9/16"-2
24626-0 Stop Screw 1.7/16"
24547-0 Body
24550-0 Clamping piece
24549-0 Pad
24552-0 Locking Screw (48-241)
24715-0 Screw -4
24695-0 Body Screw-2
24688-1 Latch Bar
24698-1 Stud
24711-0 Plate
24714-0 Screw -4
24704-0 Block
24699-1 Body
LONGITUDINAL
24724-0 Stop Tube
24703-0 Barrel
24721-0 Turret Stop
24718-0 Stop Screw
24717-0 Screw-2
24710-0 Locknut
26492-1 Clamp Piece


24957-0 Bolt Washer -2
24958-0 Top Tool Screws -2
24952-0 Bolt Nut-2
24950-0 Block
24959-0 Plate Screw (47-231) -2
24956-0 Plate Screw (47-228) -2
24955-0 Toolscrews -2
24953-0 Base Plate
24951-0 Clamping Bolt-2

8 POSITION TOOLPOST

FROM SER. NO.
TO SER. NO.



APPENDIX 1 - SPECIFICATIONS OF STANDARD PARTS.

Item.		
17-002	Woodruff Key	No. 9.
08-022	Hex. Head Bolt	1/2" UNC. x 3.1/2"
27-028	Oilring - Pioneer P.O. 20017513	1.7341" Dia. x .139" Thick.
031	3.1/2" Coventry Matrix Clutch Unit	
82-063	Compression Spring - Flexo 163208	1" F.L. over 11/32" rod
82-066	Compression Spring	.237" O/D x 1.1/8" Free length
79-069	Oilseal - Weston 913708225	
88-070	Solid Gas Plug	3/8"
79-071	Oilseal - Angus MS 012	3/4" ID x 1.1/4" OD x 1/4"
88-073	Tecalamit No. 4336-2 90° M & F Elbow	
88-074	Spire SRV 1590 (A) Door Latch	
88-075	Spire SBV 1691 Door Latch Stud	
82-076	Compression Spring	.500" I/D x 3" F.L.
84-077	Terrys Belville Washer No.10	
83-083	4 OW. Stepdown Transformer	Primary 220/440/550V.
15-084	Fuse Holder	Slydlok 5 amp.
83-085	Underwood Transformer 1/BIAR	Input 250/500V.
		Output 9V. 1.1/2 amp.
83-086	Micro Switch	Burgess MK.3BR. 600V. 2 amp.
83-087	Crabtree Moving Contact	16000/13
83-088	Crabtree Fixed Contact	16000/11
83-089	Crabtree Cable Clamp Assembly	16000/19
15-090	9V. 1.1/2 amp. Screw Type Bulb	
15-091	Bulb Holder	Bulgin L.E.S. 1-1 MOD.
83-092	Crabtree Overload Release Unit	16007
83-093	Crabtree Magnet Coil	
	200/220V.	16000/1A
	220/240V.	16000/2B
	240/265V.	16000/3C
	275/300V.	16000/4D
	330/365V.	16000/5E
	365/400V.	16000/6F
	380/420V. (Standard)	16000/9J
	400/440V.	16000/7G
	440/480V.	16000/10K
	500/550V.	16000/8H
83-094	Crabtree Air Brake Starter	Interior Type B.15
		16107/3/J
83-095	Crabtree Moving Contact Assembly	28011
83-096	Crabtree Auxilary Contact Assembly	16021
84-097	Tag Washer	4 B.A.
84-098	Shakeproof Washer	3/16"
84-099	Solder Tag Washer	3/16"
83-100	Crabtree Magnet Assembly	16000/20
15-101	Two Pin Socket	TM 316
14-104	Split Dowel Pin	1/8" dia. x 3/4" long
82-105	Compression Spring	Flexo. 82504
82-107	Compression Spring	Flexo 62604
23-124	Oil Cup	Springwell 1/4"
45-201	Socket Cap Head Screw	No.10. 24 t.p.i. x 1/4"
45-202	Socket Cap Head Screw	No.10. 24 t.p.i. x 1/2"
45-203	Socket Cap Head Screw	No.10. 24 t.p.i. x 5/8"
45-204	Socket Cap Head Screw	No.10. 24 t.p.i. x 3/4"
45-207	Socket Cap Head Screw	No.10. 24 t.p.i. x 1.1/4"
45-210	Socket Cap Head Screw	No.10. 24 t.p.i. x 2"

SPECIFICATIONS OF STANDARD PARTS (CONTINUED)

Item.		
24-525	Mills Pin G.P.3.	1/8" Dia. x 9/16"
24-526	Mills Pin G.P.3.	1/8" Dia. x 5/8"
24-527	Mills Pin G.P.4	1/8" Dia. x 3/8"
24-531	Mills Pin G.P.3.	5/32" Dia. x 3/8"
24-532	Mills Pin G.P.3.	5/32" Dia. x 1/2"
24-533	Mills Pin G.P.3.	5/32" Dia. x 3/4"
24-534	Mills Pin G.P.3.	5/32" Dia. x 1"
24-535	Mills Pin G.P.3.	5/32" Dia. x 1.1/4"
24-538	Mills Pin G.P.1.	3/16" Dia. x 1.1/8"
24-548	Mills Pin G.P.11.	3/16" Dia. x 1.1/16"
24-553	Mills Pin G.P.2.	1/4" Dia. x 1"
25-561	Mills Pin G.P.5.	1/4" Dia. x 3/4"
24-572	Mills Pin G.P.3.	5/16" Dia. x 1"
14-605	Grover Spring Valve Pin	3/16" Dia. x 3/4"
14-606	Grover Pin	3/16" Dia. x 7/8"
20-620	Standard Nut - Steel	1/4" UNC
20-621	Standard Nut - Steel	5/16" UNC
20-622	Standard Nut - Steel	3/8" UNC
20-623	Standard Nut - Steel	7/16" UNC
20-632	Standard Nut - Steel	No. 10-24 t.p.i.
20-634	Standard Nut - Steel	2 B.A.
20-636	Standard Nut - Steel	3/8" UNC
20-637	Thin Locknut	3/8" UNC
21-651	Nyloc Nut	7/16" UNF
21-654	Nyloc Nut	5/8" UNF
21-659	Simmonds Aero Nut	5/16" UNC
21-660	Simmonds Aero Nut	3/8" UNC
21-662	Nyloc Nut NT/N166	1/2" UNC
21-665	Standard Self-Locking Nut	5/8" UNC
21-673	Locking Nut	1/2" UNF Simmonds type NT/D146
85-690	B.S. Steel Washer	3/16" I/D
85-691	B.S. Steel Washer	1/4" I/D
85-693	B.S. Steel Washer	3/8" I/D
85-695	B.S. Steel Washer	1.1/2"I/D
85-696	B.S. Steel Washer	1/2" I/D
85-699	B.S. Steel Washer	3/4" I/D
84-716	Double Coil Spring Washer-Light-Series	1/2" I/D
84-727	Tab Washer	3.3/4"O/D x 2.260" I/D x .169"
13-732	External Circlip-Type 700/37A-Anderton.	3/8" Dia.
11-736	External Circlip-Type 1400-Anderton	1/2" Dia.
11-737	External Circlip-Type 1500-E.396-Anderton	1/2" Dia.
11-740	External Circlip-Seager	1/2" Dia.
13-742	External Circlip-Type 5101/56-Salter-Bowed External.	9/16" Dia.
11-743	External Circlip-Type 1400-Anderton	5/8" Dia.
11-745	External Circlip-Type 5101/66-Salter	3/4" Dia.
11-746	External Circlip-Type 1500/E520	3/4" Dia.
11-747	External Circlip-Seager	3/4" Dia.

SPECIFICATIONS OF STANDARD PARTS (CONTINUED)

Item.		
46-211	Socket Cap Head Screw	1/4" UNC x 3/8"
46-212	Socket Cap Head Screw	1/4" UNC x 1/2"
46-213	Socket Cap Head Screw	1/4" UNC x 5/8"
46-214	Socket Cap Head Screw	1/4" UNC x 3/4"
46-215	Socket Cap Head Screw	1/4" UNC x 7/8"
46-216	Socket Cap Head Screw	1/4" UNC x 1"
46-217	Socket Cap Head Screw	1/4" UNC x 1.1/4"
46-218	Socket Cap Head Screw	1/4" UNC x 1.1/2"
47-227	Socket Cap Head Screw	5/16" UNC x 1"
47-228	Socket Cap Head Screw	5/16" UNC x 1.1/4"
47-230	Socket Cap Head Screw	5/16" UNC x 1.3/4"
47-231	Socket Cap Head Screw	5/16" UNC x 2"
47-233	Socket Cap Head Screw	5/16" UNC x 2.1/2"
48-239	Socket Cap Head Screw	3/8" UNC x 7/8"
48-240	Socket Cap Head Screw	3/8" UNC x 1"
48-243	Socket Cap Head Screw	3/8" UNC x 1.3/4"
48-249	Socket Cap Head Screw	3/8" UNC x 4"
49-253	Socket Cap Head Screw	7/16" UNC x 2"
50-259	Socket Cap Head Screw	1/2" UNC x 1.1/4"
50-264	Socket Cap Head Screw	1/2" UNC x 3.1/2"
53-302	Socket Countersunk Head Screw	No. 10-24 t.p.i. x 3/8"
53-303	Socket Countersunk Head Screw	No. 10-24 t.p.i. x 1/2"
53-305	Socket Countersunk Head Screw	No. 10-24 t.p.i. x 3/4"
54-307	Socket Countersunk Head Screw	1/4" UNC x 3/8"
54-309	Socket Countersunk Head Screw	1/4" UNC x 5/8"
55-318	Socket Countersunk Head Screw	5/16" UNC x 3/4"
58-343	Socket Head Set Screw	No. 10-24 t.p.i. x 1/4"
58-344	Socket Head Set Screw	No. 10-24 t.p.i. x 5/16"
58-345	Socket Head Set Screw	No. 10-24 t.p.i. x 3/8"
59-350	Socket Head Set Screw	1/4" UNC x 1/4"
59-352	Socket Head Set Screw	1/4" UNC x 3/8"
59-356	Socket Head Set Screw	1/4" UNC x 3/4"
60-362	Socket Head Set Screw	5/16" UNC x 3/8"
61-371	Socket Head Set Screw	3/8" UNC x 1/2"
61-372	Socket Head Set Screw	3/8" UNC x 5/8"
67-418	Socket Head Set Screw	1/4" UNC x 5/16"
67-419	Socket Head Set Screw	1/4" UNC x 3/8"
68-433	Socket Head Set Screw	5/16" UNC x 3/4"
69-438	Socket Head Set Screw	3/8" UNC x 3/8"
73-470	Cheese Head Screw	6 B.A. x 3/8"
73-471	Cheese Head Screw	4 B.A. x 1"
73-474	Cheese Head Screw	4 B.A. x 3/4"
73-483	Cheese Head Screw	2 B.A. x 5/8"
73-485	Cheese Head Screw	2 B.A. x 3/8"
73-512	Countersunk Head Self Tapping Screw	7/64" Dia.
73-517	Socket Countersunk Head Screw	2 B.A. x 7/8"
73-518	Countersunk Head Screw	2 B.A. x 1/2"
73-519	Socket Cap Head Screw	2 B.A. x 3/4"

SPECIFICATIONS OF STANDARD PARTS (CONTINUED)

Item.			
11-749	External Circlip-Type 5101/66-Salter	7/8"	Dia.
11-756	External Circlip-Seager	1.1/4"	Dia.
11-757	External Circlip-Type 1400-Anderton	2"	Dia.
12-766	Internal Circlip-Type 1300-Anderton	28 mm	Dia.
12-767	Internal Circlip-Type 1300-Anderton	40 mm	Dia.
12-771	Internal Circlip-Seager	83 mm	Dia.
11-777	External Circlip-Type 1500-E.580-Anderton	3/4"	Dia.
13-785	Internal Circlip-Bevelled Type-5002-206-Salter	2.1/16"	Dia.
01-787	Steel Ball	3/16"	Dia.
01-788	Steel Ball	1/4"	Dia.
01-793	Pho. Bronze Ball	1/4"	Dia.
82-695	Compression Spring	1/4"	O/D x 1/2" F.L. x 22 SWG
82-802	Compression Spring - Flexo 93016	1/4"	O/D x 2" F.L.
82-807	Compression Spring - Flexo 223413	11/16"	O/D x 1.1/2" F.L. x 16 SWG
87-824	Heli-Coil Inserts	3/8"	UNC x 9/16"
87-825	Heli-Coil Inserts	1/2"	UNC
23-827	Garland Diaphragm Oiler	1/4"	Dia.
18-834	Plastic Knob - Red	1.1/4"	Dia.x 7/16" UNC
18-837	Plastic Knob - Cream	1.1/4"	Dia.x 3/8" UNC
18-839	Plastic Knob - Cream	1"	Dia.x 3/8" UNC
16-842	Plastic Handle	7/8"	Dia.x 3"
16-843	Plastic Handle	1.3/4"	Dia.x 1.11/16"
26-845	Oilring - Pioneer P.O. 05003707 -012	.364"	I/D x .070" Thick
27-846	Oilring - Pioneer P.O. 06204310	.424"	I/D x .103" Thick
26-849	Oilring - Pioneer P.O. 10008110	.799"	I/D x .103" Thick
27-850	Oilring - Pioneer P.O. 11208713 -212	.859"	I/D x .139" Thick
26-851	Oilring - Pioneer P.O. 12510013	.984"	I/D x .070" Thick
26-856	Oilring - Pioneer P.O. 22520013	1.984	I/D x .139" Thick
26-859	Oilring - Dowty No.2	1/2"	I/D x 5/8" O/D x 1/16"
26-870	oilring -223	1"	I/D x 1.3/4" O/D x 1/4"
79-864	Oilseal - Weston W.17510025 R4	1.3/8"	I/D x 1.7/8" O/D x 5/16"
79-867	Oilseal - Weston W.18713731 Timken/Natural 330663	1.5/8"	I/D x 2.3/16" O/D x 3/8"
79-868	Oilseal - Weston W.21916237	52 mm	O/D
79-869	Grease Ring - Nylos 6205 J.V.	1.1/4"	O/D
80-871	Oilsight - Tecalemit I.C. 4610	Hoffmann	A.10
02-872	Ball Journal	Hoffmann	A.15
02-874	Ball Journal	Hoffmann	S. 9
02-876	Ball Journal	Hoffmann	S.10
02-877	Ball Journal	Hoffmann	XLS.2
02-879	Ball Journal	3/4"	Bore x 9/16" O/D x 1/2"
03-890	Needle Roller INA Sc.68	9/16"	Bore x 3/4" O/D x 1/2"
03-891	Needle Roller INA Sc.98	17 mm	Bore x 40 mm O/D x 13 mm
03-892	Taper Roller K.G.S. KE 30203		
79-860	OILSEAL 7/8" x 1 3/8" x 1/4" USED ON HEADSTOCK PICK OFF SHAFT		

nominal dim OD / ID / W — actual dimensions

used 2 places 13/8 x 17/8 x 5/16 — OD / ID / WIDTH

SPECIFICATIONS OF STANDARD PARTS (CONTINUED)

Item.		
03-896	Taper Roller K.G.S. KE 30205	25 mm Bore x 52 mm O/D x 16 mm
03-897	Needle Roller INA Sc. 1612	1" Bore x 1.1/4"" O/D x 1"
03-898	Needle Roller INA Sc. 188	1.1/8" Bore x 1.3/8" O/D x 1/2"
10-926	Oilite Bush	3/4" Bore x 1" O/D x 1.1/8"
07-949	Vee Belt	A.53
06-960	Powergrip Belt	210 L 150
06-961	Powergrip Belt	345 L 050
06-962	Powergrip Belt	360 L 150 360 H 150
83-995	Isolating Switch - Santon	SR - 237
83-996	Start and Reverse Switch - Craig & Derricot	RT 3039 AS

MATRIX CLUTCH.

Standard Parts A - N listed on Page 3.

MK. 17 KOPP VARIATOR.

All Standard Parts listed on Page 33.