12" 6970

OPERATOR'S HANDBOOK

AND SPARE PARTS LIST

HARRISON

Model L6 MK.III

INSTRUCTIONS FOR ORDERING SPARES

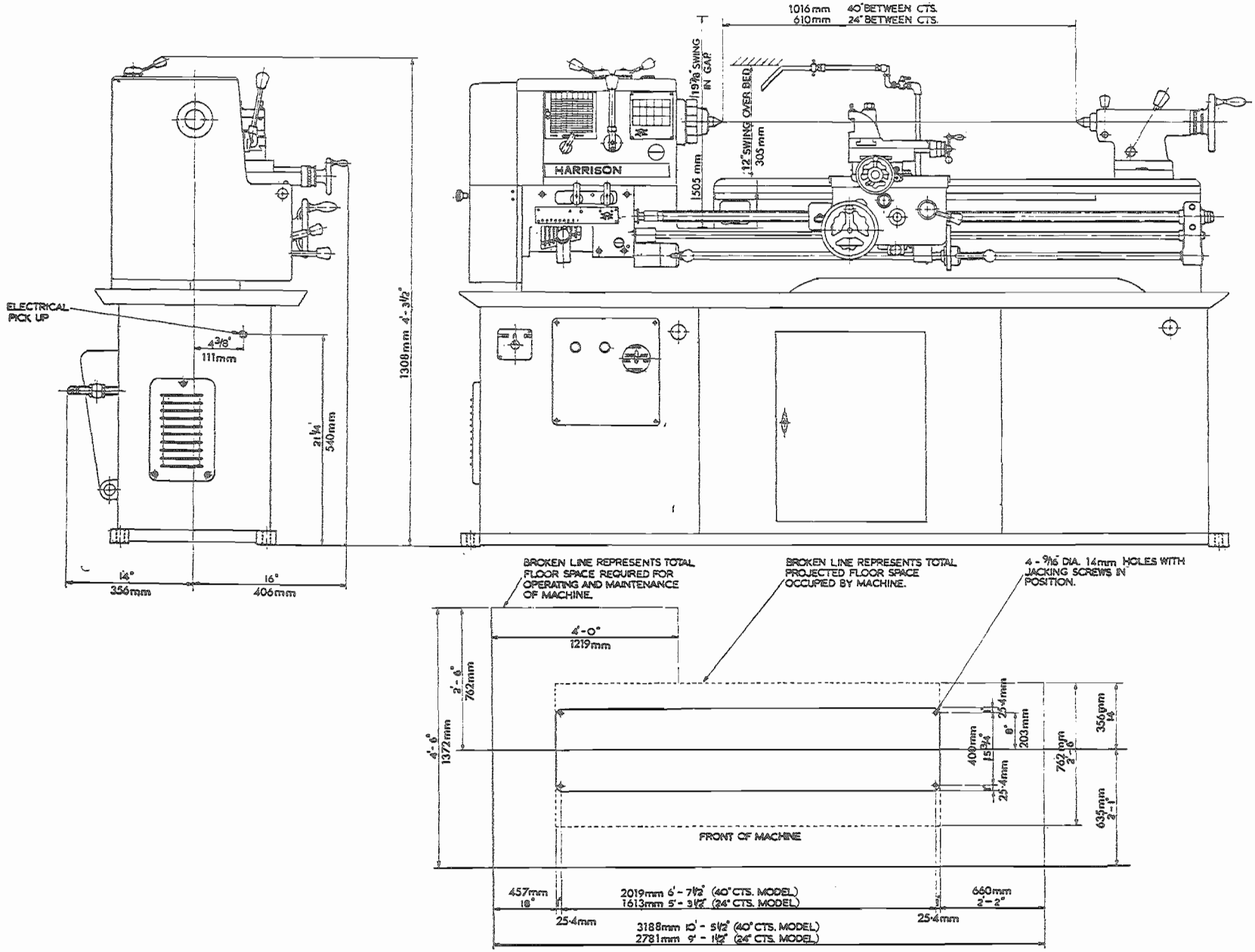
When ordering Spare parts always quote **Machine No.**
which is stamped on the bed at the tailstock end.
Spares can be obtained through your usual machinery dealer, or
direct from the manufacturers:—

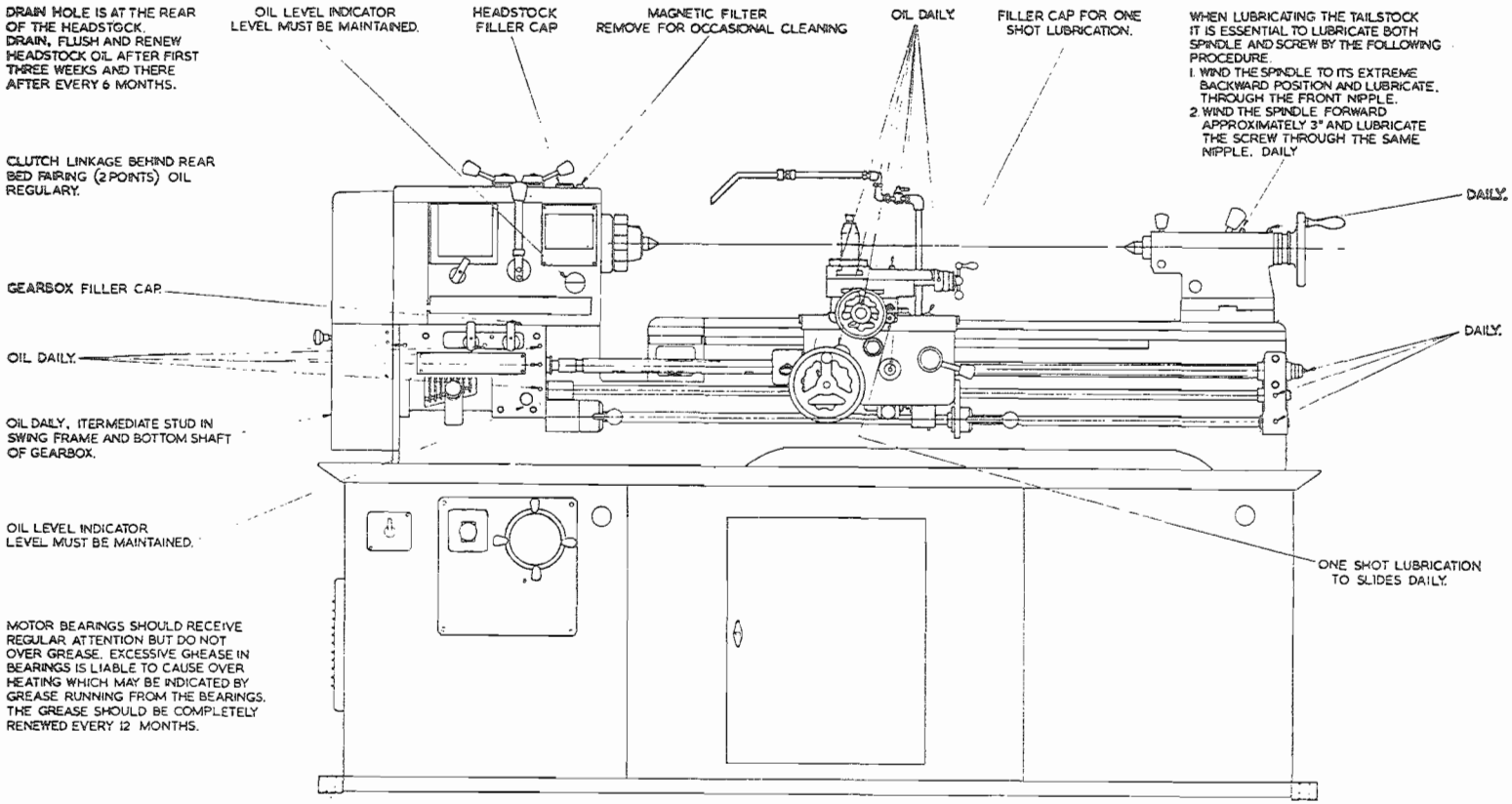
T. S. HARRISON & SONS LIMITED

P.O. BOX 20,
HECKMONDWIKE,
YORKSHIRE, ENGLAND
Telephone: Heckmondwike 3751 *Telegrams:* Harrison, Heckmondwike *Telex:* 55217

SPECIFICATION AND LEADING DIMENSIONS

13″ Model	STANDARD MODEL		WITH PROFILING EQUIPMENT	
Admits between centres	610 or 1016 mm.	24″ or 40″	610 or 1016 mm.	24″ or 40″
Bed length	1424 or 1830 mm.	56 1/16″ or 72 1/16″	1424 or 1830 mm.	56 1/16″ or 72 1/16″
Swing over carriage (with cover removed)	238 mm.	9 3/8″	—	—
Swing in gap—diameter	505 mm.	20 7/8″	—	—
Swing in gap—in front of faceplate	114 mm.	4 1/2″	—	—
Max. length of copy turning—between centres	—	—	464 or 870 mm.	18 1/4″ or 34 1/4″
Max. length of copy turning—with chuck	—	—	419 or 825 mm.	16 1/2″ or 32 1/2″
Max. cross slide feed	203 mm.	8″	203 mm.	8″
Max. compound slide feed	73 mm.	2 7/8″	73 mm.	2 7/8″
Swing over cross slide (normal turning)	—	—	159 mm.	6 1/4″
Swing over cross slide (copy turning)	—	—	140 mm.	5 1/2″
Max. depth of profiling	—	—	51 mm.	2″
Min. front angle	—	—	—	90°
Max. back angle	—	—	—	30°
Horsepower of hydraulic pump motor	—	—	—	1/2
Max. movement of Tailstock spindle	102 mm.	4″	102 mm.	4″
Set over of tailstock spindle	9·5 mm.	3/8″	9·5 mm.	3/8″
Centre to tool base (front)	27 mm.	1 1/16″	27 mm.	1 1/16″
Centre to tool base (rear)	—	—	22·2 mm.	7/8″
Max. tool section	28·6 × 16 mm.	1 1/8″ × 5/8″	28·6 × 16 mm.	1 1/8″ × 5/8″
Spindle speeds—number	—	8 or 16	—	16
Range with 3 h.p. motor	—	56–1,250 r.p.m.	—	—
Range with 2-speed 3/1 1/2 h.p. motor	—	34–1,500 or 45–2,000	—	45–2,000
Spindle bored to pass	38 mm.	1 1/2″ dia.	38 mm.	1 1/2″ dia.
Size of morse taper centres		No. 3		No. 3
Leadscrew	28·6 × 6 mm. P	1 1/8″ dia. × 4 TPI	28·6 × 6 mm. P	1 1/8″ dia. × 4 TPI
Range of threads (TPI) Norton Gearbox, 4 TPI Leadscrew	—	4 – 60 TPI	—	4 – 60 TPI
Range of feeds (longitudinal) Norton Gearbox, 4 TPI Leadscrew	—	·0020″ – ·033″	—	·0020″ – ·033″
Range of feeds (cross) Norton Gearbox, 4 TPI Leadscrew	—	·0012″ – ·019″	—	·0012″ – ·019″
Range of Metric Pitches, Metric Gearbox, 6 mm. P. Leadscrew	·2 – 7 mm. P	—	·2 – 7 mm. P	—
Range of feeds (longitudinal), Metric Gearbox, 6 mm. P. Leadscrew	·025 – 1·00 mm.	—	·025 – 1·00 mm.	—
Range of feeds (cross), Metric Gearbox, 6 mm. P. Leadscrew	·012 – ·47 mm.	—	·012 – ·47 mm.	—


1016mm 40" BETWEEN CTS.
610mm 24" BETWEEN CTS.
19 9/16" SWING IN GAP
12" SWING OVER BED
305mm
1505 mm
HARRISON
ELECTRICAL PICK UP
4 3/8"
111mm
1308mm 4'-3 1/2"
21 1/4"
540mm
14"
356mm
16"
406mm
BROKEN LINE REPRESENTS TOTAL FLOOR SPACE REQUIRED FOR OPERATING AND MAINTENANCE OF MACHINE.
BROKEN LINE REPRESENTS TOTAL PROJECTED FLOOR SPACE OCCUPIED BY MACHINE.
4 - 9/16 DIA. 14mm HOLES WITH JACKING SCREWS IN POSITION.
4'-0"
1219mm
2'-6"
762mm
4'-6"
1372mm
254mm
10"
254mm
203mm
409mm
15 3/4"
762mm
2'-6"
356mm
14"
254mm
635mm
2'-1"
FRONT OF MACHINE
457mm
18"
2019mm 6'-7 1/2" (40" CTS. MODEL)
1613mm 5'-3 1/2" (24" CTS. MODEL)
660mm
2'-2"
25·4mm
25·4mm
3188mm 10'-5 1/2" (40" CTS. MODEL)
2781mm 9'-1 1/2" (24" CTS. MODEL)



RECOMMENDED LUBRICANTS

	MOBIL	SHELL	ESSO	B.P. POWER	REGENT TEXACO	AMOCO	CASTROL	GULF	SUN OIL CO.
Headstock, Apron, Slide-ways and Nipples	D.T.E. HEAVY MEDIUM	TELLUS 33	NUTO H.44	ENERGOL H P 20	RANDO H D C	INDOIL 31	HYSPIN AWS 68	SERVICE 61	SUNVIS 831
Feed Gearbox	VACTRA OIL EXTRA HEAVY	VITREA OIL 72	ESSTIC 65	B.P. ENERGOL H P 60	REGAL OIL G R. & O.	INDUSTRIAL OIL 95	ALPHA 617	SECURITY 85	SUNVIS 851
Motor grease cups ...	MOBILPLEX 48	ALVANIA GREASE 3	BEACON GREASE 3	ENERGREASE LS 3	REGAL STARFAK PREMIUM 3	AMOLITH GREASE 3	SPHEEROL A P 3	GULFCROWN GREASE 3	SUN PRESTIGE 43

LUBRICATION

Complete lubrication is essential before running a new lathe and light running for a short period is recommended.
Daily lubrication will reduce wear and ensure trouble free running.
All nipples are easily visible and an oil gun is provided.
When lubricating the tailstock it is essential to lubricate both spindle and screw by the following procedure:—

1. Wind the spindle to its extreme backward position and lubricate through the front nipple on the top of the tailstock.
2. Wind the spindle forward approx. 3" and lubricate the screw through the same nipple.

The headstock oil level should be maintained at the height shown on the sight glass.

INTRODUCTION

The main purpose of this booklet is to provide users with a full list of parts, should replacements become necessary. When ordering spares please quote the part number, description and the LATHE NUMBER, which will be found stamped at the tailstock end of the bed.
Attention has been drawn to a few points which may be of use to the purchaser of a "HARRISON" lathe, the observance of which will ensure satisfactory service.
New developments and modifications resulting in improved performance may be incorporated from time to time on them and the right is reserved to modify the specification as may be required.

INSTALLATION

Slinging: Holes are provided in the base under the headstock and tailstock through which a bar may be passed for slinging purposes.

Care should be taken to avoid the lifting ropes bearing on the lead-screw or feed rod.

Cleaning: All bright surfaces are covered with an anti-corrosive compound before despatch from the works. This should be removed with petrol or paraffin before putting the machine into operation.

Levelling: Because of the rigid integrated construction of the bed and cabinet base the machine is inherently accurate and capable of performance within the specification, when it leaves the works.

The lathe should not be bolted down but should be lowered on to locating pins secured to a rigid floor and the jacking screws adjusted to eliminate rock. By bolting down, distortion could occur, introducing twist in the bed and the resultant damage may not be corrected by releasing the nuts on the bolts.

It is advisable to support the jacking screws on steel plates. The screws should be adjusted to enable the headstock end of the lathe being slightly higher than the tailstock end so that the front of the machine is raised relative to the rear. This facilitates return of the coolant to the sump.

Before despatch the machine has been carefully tested for smooth running and accuracy. (See test chart.) Any checks for accuracy MUST be made with the machine on a rigid floor. Ensure that the test mandrels are true, clean and free from burrs on the taper seating. Clean, and inspect the internal taper of the spindle before inserting the mandrel.

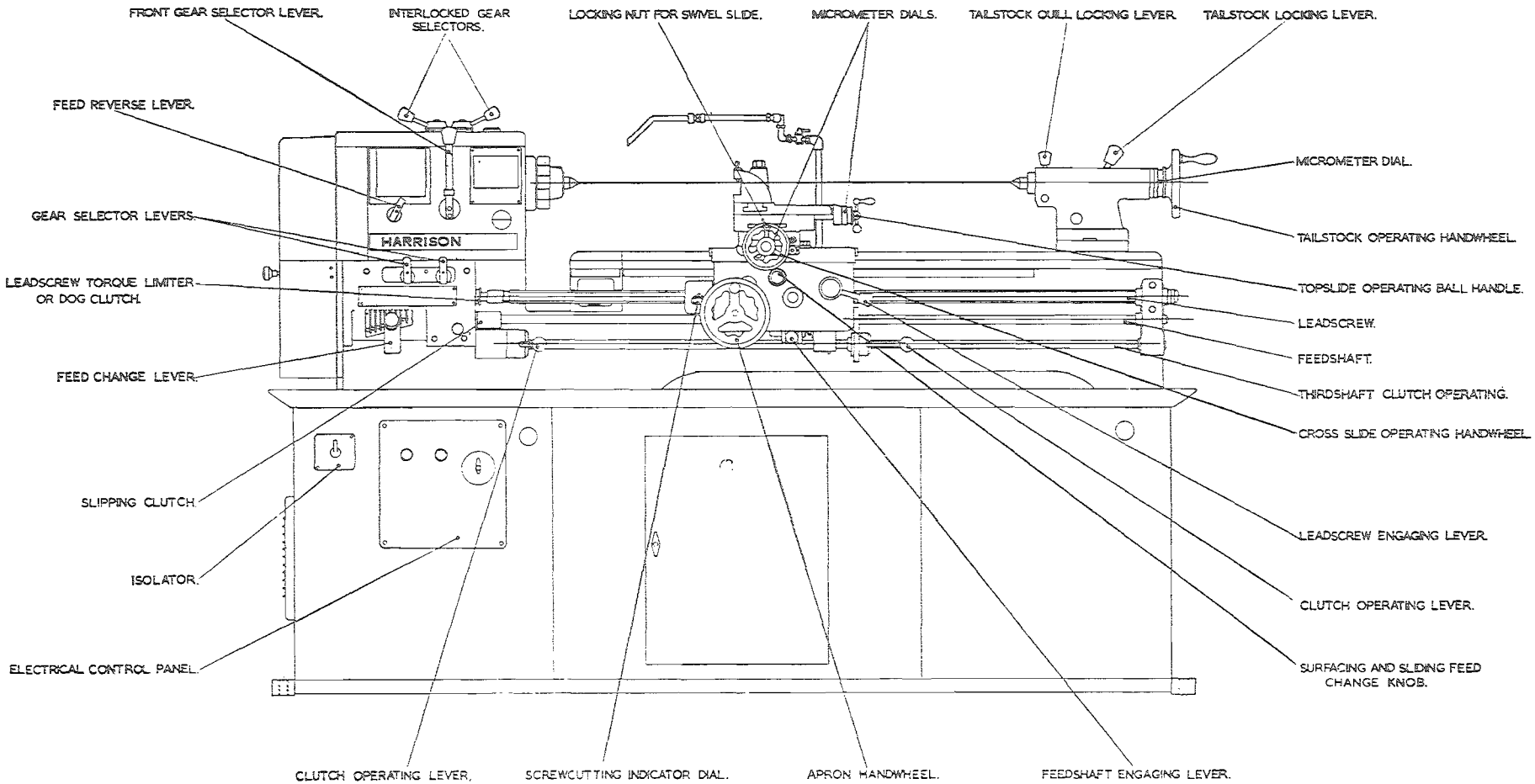
DETAILS OF ANY DISCREPANCY BETWEEN THE TEST CHART AND YOUR OWN TESTS SHOULD BE REPORTED TO THE MANUFACTURERS BEFORE ANY ADJUSTMENT IS MADE.

Electrical connection: The supply wires should be connected to the isolator switch at the end of the cabinet in the usual manner.

Initial operation: It is important to make sure that the feed or screwcutting levers are in the disengaged position before operating the Lathe otherwise damage can be caused by the saddle or tools running into the headstock or tailstock.

As the headstock is the most important unit of the Lathe only the best materials and workmanship are incorporated in this assembly. All the gear teeth are induction hardened to 450/500 Brinell and honed to a smooth and accurate form. The hardening may result in a sound of higher pitch than is evident on a Lathe which does not have hardened gears.

To ensure satisfactory operation of the bearings it is essential to run in the machine at lower speeds only during the first 40/50 hours of operation. After this initial run in period we also recommend that a further gradual build-up to the top speed operation is followed.



CONTROLS ON MODEL L.6 LATHE MK.III

CONTROLS

All control levers are shown on the illustration on the opposite page.

(*a*) **Electrical Controls.** A single panel, on the front of the lathe, contains all the electrical controls within easy reach of the operator. A push-button operated starter with overload and no-volt protection is standard equipment on all machines; other controls available being two speed, reversing and coolant pump rotary type switches.

(*b*) **Headstock.** Speed changes should only be made when the spindle is stopped. The standard machine incorporates a start/stop mechanical clutch and brake operated via a third shaft by control levers adjacent to gearbox and apron. An alternative electrical control by similar levers and third shaft provides direct reverse to the spindle in addition to forward and stop.

A two-position front gear lever selects the high speed range when in the right-hand position and the low speed range in the left-hand position and this, used in conjunction with the two position twin selectors at the top of the headstock, gives a total of eight spindle speeds. Freely sliding gears combined with a direct reading speed chart ensures effortless and instantaneous speed change.

Forward or reverse rotation of the feed gear train is obtained by a selector lever at the front of the headstock.

(*c*) **Norton Feed Gear box.** Thirty-six changes of threads and feeds are obtained by manipulation of the tumbler lever in conjunction with the two adjacent compound gear levers. The lever positions are determined by reference to the direct reading screwcutting and feed chart. For changewheel combinations see charts on page 12. An additional unit can be supplied giving lever operated selection of English or Metric threads. A range of 15 Metric thread pitches from 0·5 to 7 mm. together with the standard range of 4 to 60 TPI is directly available.

With the metric gearbox, 30 metric pitches are available having a range from 0·2 to 7 mm. pitch. Extra change wheels can be supplied for Metric/English conversion giving a thread range of 4 to 60 TPI. Change Wheel combinations are given on page 13.

(*d*) **Apron.** Instantaneous engagement and disengagement to both feeds is obtained by the trip lever of the drop out worm box situated at the base of the apron. The feed selector knob which is directly below the cross slide handwheel should be pushed in for sliding feeds and pulled out for surfacing feeds.

Engagement of the leadscrew for screwcutting is by means of the lever at the right of the apron which is pulled up for engagement and pushed down for disengagement. Simultaneous engagement of leadscrew and feed rod is prevented by interlocking control.

The carriage may be locked to the bed by means of the hexagon screw on the right-hand side of the carriage.

Exact repeat of leadscrew engagement is obtained with the screwcutting indicator.

On English models:
To cut even threads per inch, engage at any graduation.
To cut odd threads per inch, engage at any numbered graduation.
To cut half threads per inch, engage at graduations 1 or 3.
To cut quarter threads per inch, engage at graduation 1.
On Metric models:
To cut ·5, ·75, 1, 1·5, 2, 3 and 6 mm. P. engage at any graduation.
To cut 1·25, 2·5, 5 and 10 mm. P. engage at any numbered graduation.
To cut 4 mm. P. engage at graduations 60 or 120.

The indicator dial cannot be used for metric, B.A. and other special threads when a 4 TPI leadscrew is fitted.

It can be used for metric threads (divisible into 120) when a 6 mm. pitch leadscrew is fitted, but not for special threads, including English and American. For all special threads it is necessary to maintain engagement of leadscrew and an electrical reversing switch can be supplied for returning the carriage, enabling repeat cuts to be taken.

(*e*) **Slides.** Cross slide and compound slide are fitted with friction grip micrometer dials graduated to read ·001 in. The compound slide assembly is arranged to rotate through 360 degrees on the graduated cross slide and locking is by means of the two nuts on the swivel slide. Micrometer dials are also available to read 0·02 mm.

(*f*) **Tailstock.** Clamping to the bed is effected by the lever at the rear and spindle, quill locking is by means of the pad bolt on top of the tailstock.

FITTING AND USE OF ATTACHMENTS

Many operations other than turning are possible on a lathe fitted with a few attachments and these enable further operations to be carried out without recourse to special machines. The following attachments are available for "HARRISON" Lathes.

Collet Attachments. This type of chuck provides a most accurate means of gripping work, the accuracy being 0·0005 in. at the collet nose, and 0·003 in. at a distance 3 in. out.
Use of attachments is not restricted to cylindrical work and collets for square or hexagonal bar can be provided.

(i) **Draw Tube Type Collet Attachment** To fit the attachment, remove chuck or faceplate, centre and sleeve from spindle nose. Pass the draw tube through the spindle from nose, then assemble handwheel and clamping nut onto tube. Mount the spindle nose cover onto taper and secure with draw-nut which is integral with spindle. Assemble the closer bush into mouth of spindle, insert required size of collet and screw onto draw tube. The standard range of collets is from $\frac{1}{16}$" to 1" maximum in increments of $\frac{1}{16}$" but any size within this range (including metric) can be provided.

(ii) **Multisize Collet Attachment.** The complete assembly is mounted on the spindle nose. Collets are inserted after removing the closer bush with the wrench provided. The capacity of the attachment is $\frac{1}{8}$" to $1\frac{1}{2}$" and is covered by 11 collets.

Taper Turning Attachment. Whilst it is preferred that this attachment be fitted at the works, little difficulty should be experienced by the engineer wishing to make this addition to the lathe. Bolt holes are drilled in the rear of the carriage on all lathes to accept the support bracket of the attachment and an assembly instruction drawing is supplied with each unit. Taper Turning of lengths up to 11 in. (297 mm.) with included angles up to 20 degrees can be carried out, graduated scales being provided, reading degrees at the tailstock end and inches taper per foot at the headstock end.
Instructions for setting up prior to taper turning are as follows —

Release the two nuts clamping the swivel bar, set to the required angle by means of the adjusting screw at the rear and reclamp. Release the two socket head cap screws at the left-hand side of the attachment — these must remain released during taper turning. Taper turning at any point along the bed can be achieved by setting the support bracket at the rear end of the bed to the desired position.

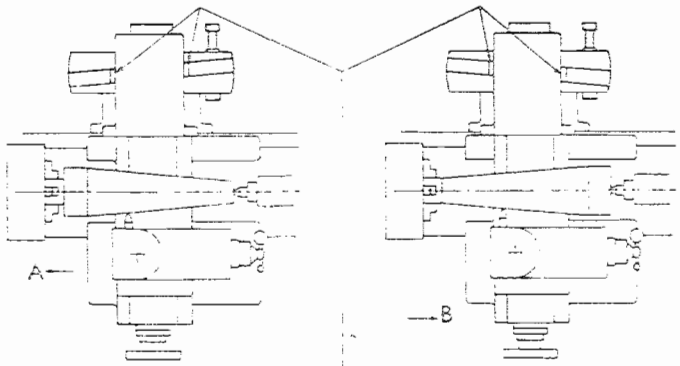


Fig. Y Fig. Z

For set up shown in Fig. Y with saddle traversing in direction 'A' and set up shown in Fig. Z with saddle traversing in direction 'B' it is advisable to eliminate backlash between cross slide screw and nut before engaging the tool with the work piece, this is achieved by advancing the tool beyond cutting depth when retracting the tool to the correct cutting position.
With saddle traversing in opposite directions to those shown in Figures Y & Z, backlash between cross slide screw and nut is removed by normal advancement of the tool.

Change over to normal turning as follows:—

Set swivel bar to zero graduation.
Withdraw support bracket to tailstock end of bed.
Lock the two socket head cap screws.

Milling Attachment. This attachment is mounted on to the compound slide, replacing the tool post. The tee slotted, vee grooved slide has vertical screw adjustment and is arranged to swivel against a scale

SCREWCUTTING (WITH ENGLISH GEARBOX & 4 T.P.I. LEADSCREW)

Metric Threads. For lathes not fitted with a lever operated English/Metric conversion unit extra change-wheels can be supplied covering a thread range of 0·5 – 7 m/m. Additional wheels required are 48T, 60T, 63T and 127T. Combinations are given on Chart 231.

Special Threads. Changewheels can be provided for comprehensive ranges of B.A., module, diametral, fractional and many other special thread pitches.

RANGE OF T.P.I.

RANGE	T.P.I.	TOP SHAFT	INTER-MEDIATE SHAFT	BOTTOM SHAFT	G.B. LEVER POSITION	
Standard	4 to 60	30	120	60	As G. Box Chart	
Fine	64 to 120	30	80	120	,,	*
Coarse	2 to $3\frac{3}{4}$	60	120	30	,,	†
Special Threads	$11\frac{1}{2}$	60	60	115	BD6	
	27	40	120	60	AD2	

* G. Box T.P.I. Position $= \frac{\text{T.P.I. Required}}{2}$

† G. Box T.P.I. Position = T.P.I. Required × 4

COMPLETE RANGE OF T.P.I.

Coarse (Additional)	2	$2\frac{1}{4}$	$2\frac{3}{8}$	$2\frac{1}{2}$	$2\frac{3}{4}$	3	$3\frac{1}{4}$	$3\frac{1}{2}$	$3\frac{3}{4}$
Standard	4	$4\frac{1}{2}$	$4\frac{3}{4}$	5	$5\frac{1}{2}$	6	$6\frac{1}{2}$	7	$7\frac{1}{2}$
	8	9	$9\frac{1}{2}$	10	11	12	13	14	15
	16	18	19	20	22	24	26	28	30
	32	36	38	40	44	48	52	56	60
Fine (Additional)	64	72	76	80	88	96	104	112	120
Special	$11\frac{1}{2}$	27							

American Pipe Threads. The complete range of pipe threads is directly available through the gearbox with the exception of $11\frac{1}{2}$ and 27 TPI: the additional changewheels required for these, together with their combinations, are shown on chart.

METRIC SCREWCUTTING CHART

METRIC PITCH MM.	TOP SHAFT	INTER-MEDIATE SHAFT	BOTTOM SHAFT	T.P.I. POSITION
·5	60	48–60	127	AD9
·75	60	48–60	127	AD4
1	60	48–60	127	AC9
1·25	60	48–60	127	AC6
1·5	60	48–60	127	AC4
1·75	63	48–60	127	AC2
2	60	48–60	127	BD9
2·5	60	48–60	127	BD6
3	60	48–60	127	BD4
3·5	63	48–60	127	BD2
4	60	48–60	127	BC9
4·5	63	48–60	127	BC8
5	60	48–60	127	BC6
6	60	48–60	127	BC4
7	63	48–60	127	BC2

No. 231

Warning: When cutting threads coarser than $\frac{1}{4}$" pitch it is advisable to engage the half nuts with the spindle stationary, then engage the clutch. The use of the lowest spindle speed is essential.
The maximum pitch that can be cut on a centre lathe is determined by the diameter and depth of cut required. The recommended maximum helix for roughing is 8° and a light cut up to 10° — 12°.
The cutting of a coarse thread should only be carried out by a skilled operator who will appreciate the limitations imposed by the conditions which will vary according to the type of material, thread and depth of cut, etc.

SCREWCUTTING (WITH LEVER OPERATED METRIC CONVERSION UNIT)

The machine can be fitted with a lever operated English/Metric conversion unit which makes available a metric range of 0·5 to 7 mm. pitches in addition to the standard English range of 4 to 60 TPI. The full range of metric pitches is listed below.

0·5	0·75	1	1·25	1·5	1·75	2
2·25	2·5	3	3·5	4	4·5	5
6	7					

If a customer requires to convert a machine with a standard English gearbox by fitting a conversion unit, he can fit the unit at a later date. This would enable him to obtain a range of metric threads from 0·5 to 6 mm. pitch. The full range is listed below.

0·5	0·75	1	1·25	1·5
2	2·5	3	4	5
6				

SCREWCUTTING (WITH METRIC GEARBOX & 6mm. PITCH LEADSCREW)

Metric Threads. (With metric gearbox and 6 mm. Leadscrew)
The range of metric threads is 0·5 to 7 mm. pitch (coarse) and 0·2 to 0·9 mm. pitch (fine). Change wheels required are 1–30T, 1–48T, 1–80T, and 1–120T. A range of 4 to 60 TPI can be cut with the addition of 1–60T and 1–127T change wheels.

RANGE	PITCH OR T.P.I.	TOP SHAFT	INTER-MEDIATE SHAFT	BOTTOM SHAFT	LEVER POSITION
Metric (Coarse)	0·5 to 7 mm.	30	120	48	As gearbox chart
Metric (Fine)	0·2 to 0·9 mm.	30	80	120	As gearbox chart
T.P.I.	4 to 60	30	120–127	60	As gearbox chart

FULL RANGE OF THREADS PER INCH

4	4½	4¾	5	5½	6	6½	7	7½
8	9	9½	10	11	12	13	14	15
16	18	19	20	22	24	26	28	30
32	36	38	40	44	48	52	56	60

FULL RANGE OF METRIC PITCHES

0·2	0·25	0·3	0·35	0·4	0·45	0·5	0·5625	0·6
0·625	0·7	0·75	0·8	0·875	0·9	1	1·125	1·25
1·5	1·75	2	2·25	2·5	3	3·5	4	4·5
5	6	7						

MAINTENANCE

Periodic inspection with adjustment where necessary, as given below, will ensure that this lathe retains its original high standard of accuracy and performance.

Drive Belts. The drive motor is mounted on a platform inside the cabinet base. Adjustment to the vee belt tension is by a screw at the rear of the machine.

Procedure for replacing vee belts is as follows:—

Remove the drive guard and inspection cover from end of cabinet base.

Release tension in belts by adjusting screw at rear.

Replace belts and carefully re-tension.

It is important to ensure that the belts do not slip as this would only increase both pulley and belt wear.

Clutch. If slip occurs then adjustment is as follows:—

Open the drive guard.

Increase the spring load by slightly rotating the nut (anti-clockwise, i.e. left-hand thread) on the end of the clutch shaft.

Constant operation of the clutch results eventually in wear on the driving faces (usually signified by the clutch refusing to drive) and the following adjustment will be necessary.

Stop the motor, leaving the clutch in the ON position.

Remove the fairing (at the rear of the bed, beneath the headstock).

Release the outer nut on the operating linkage one complete turn and re-clamp with inner nut.

The clutch should be dismantled at six-monthly intervals and any lubricant on the driving faces removed by washing in paraffin.

Headstock Spindle Bearings. Adjustment for wear on the Timken taper roller bearings on the main spindle is as follows:—

Remove headstock cover.

Release locknut (by turning anti-clockwise, i.e. R.H. thread) and rotate adjusting nut sufficiently to obviate play, then re-tighten locknut. It must be emphasized that this operation requires the utmost care as over-tightening can seriously impair the life of the bearings.

Sealing compound should be used when refitting the head-stock cover.

The magnetic plug (chromed head) which is fitted in the headstock cover must be occasionally removed and cleaned of any particles of steel which may have collected there. Always replace the magnetic plug after cleaning.

Saddle Adjustment. To adjust the rear strip release the four nuts on the underside of the strip, adjust the headless set screws by turning clockwise and re-lock the nuts. To adjust the front strip, release the caphead screw which secures the adjusting screw and rotate the latter anti-clockwise, re-clamp the caphead screw. Care should be taken to avoid over adjustment.

Cross Slide Adjustment. Take up of wear on the taper gib strip is by releasing the locknut, adjusting the screw and re-locking the nut.

The gib strip is of a length to allow adjustment over a range of wear but after a number of adjustments it may be necessary to shorten the screw.

Top Slide. Adjustment to the strip is by releasing the locknuts, tightening the screws and re-locking the nuts.

Electrical Controls. All electrical control equipment is mounted on the panel at the front of the cabinet and if removal is required it is IMPORTANT to ensure that the isolating switch (line switch) is in the OFF position. The isolating switch (line switch) MUST NOT be removed until the mains leads have been isolated.

RECOMMENDED LATHE PRACTICE

When a component is required to be machined on a lathe, the following principal points must be settled: (1) the manner in which the work should be mounted; (2) the tool set-up to be employed; and (3) the speeds and feeds to be employed.

Turning between Centres. This method of turning necessitates centre holes being drilled in both ends of the work. The operation should be performed by a special drill giving a countersink of 60 deg. angle to suit the lathe centres, the centre drill being held in a drill chuck mounted in the tailstock spindle with the work held in a chuck.

It is usual practice to carry out a facing operation on the end of the work piece before centre-drilling and it is essential that work overhang from chuck jaws, for both facing and drilling operations, should be a minimum, to ensure concentricity. Centre drills are delicate tools and easily broken, largely owing to lack of sensitivity in feeding the drill, and to work speed being too low. To prevent breakage use a high speed of work revolution and a very fine feed.

With the work mounted between centres, and fitted with a driving dog and with the tailstock centre well lubricated, it is important that the work should be free enough to turn by hand but without any end movement. Owing to heat generated by the cutting action, the work expands during machining, and if screwed up tightly before cutting commences, the result is that the centre end may become overheated causing damage to both centre and work.

When using carbide turning tools, the work speed may be so high that damage to a dead centre may take place however much care is used. It is better then, to use a revolving centre which rotates with the work, and is not therefore affected by high work speeds.

Tool Settings. Correct tool setting is important, for accurate grinding of tool angles is of no avail if the tool is improperly set in relation to the work. While normally the tool point should be on the centre line of the work, a setting slightly above centre is permissible, but a setting below centre may cause slender work to deflect and spring on the top of the tool and out of the centres. For all taper turning and screw cutting operations, it is essential that the cutting edge of the tool be mounted exactly on the centre line of the work, otherwise discrepancies in taper and thread form will result. A simple way to obtain correct tool height is by setting to one of the lathe centres.

For parting-off operations, use a tool with a rigid shank and with the overhang from the toolpost kept to a minimum. The cutting edge must be set on the work centre and square to the lathe axis. Do not attempt parting-off unless the work is well supported and ensure that overhang from the chuck is not excessive.

Chuck Work. When a chuck is not in use it should not be left so that cast iron dust or other cuttings may enter the bore or parts of the mechanism. The bore may be protected by plugging with a cloth, nevertheless before mounting the chuck on the lathe spindle, clean the bore of the chuck and the spindle nose and lubricate with Molybdenum Disulphide a tube of which, is supplied with the machine.

When mounting or removing a chuck, protect the slides of the bed with a piece of wood upon which to rest the chuck before lifting it onto the spindle nose. When tightening the chuck jaws, never try to obtain increased gripping power by lengthening the arm of the box key.

For second operation work, or for work which may be difficult to hold by standard jaws, the use of soft jaws shaped as required will often prove a time saving factor and ensure greater accuracy.

When setting work in an independent four-jaw chuck, make use

of the setting rings on the face of the chuck to obtain an approximate location. It is then a simple matter to make the final adjustment for greater accuracy.

Faceplate Work. The remarks in regard to the mounting of chucks apply equally to faceplates and catch plates. Some castings or forgings are so shaped as to be difficult to hold in a chuck, but can be clamped on a faceplate by straps and bolts utilising the holes and slots provided, but do not rely entirely upon these. Whenever possible use stops against the work to take the pressure of the cut.

An angle plate bolted on to the faceplate, on to which the work is mounted, is often useful for boring and facing operations. Always ensure that revolving work is securely fastened and that a balance weight is fitted to counteract the out-of-balance effect of the mounting units and work.

Use of Steadies. Long slender work, if unsupported between centres, will tend to whip or bend under pressure of the cutting action. To prevent this happening, a travelling steady should be employed. When machining black bar, first turn a short length of the bar at the tailstock end to the diameter required, and adjust the steady jaws to touch the work, then lock them in position. The jaws will then support the work at the point of the cut all along the length. Keep jaws well lubricated during the operation.

A stationary steady can be set up at any point along the bed to support a long shaft. If the shaft is of black bar, a ring somewhat wider than the jaws of the rest must be turned as a bearing for the jaws. If the shaft is slender, this can be a delicate operation, so that a sharp pointed tool with a very light cut should be employed.

Another use of a stationary steady is when an operation requires to be performed on the end of a bar. In such instances the distance from the chuck may be too great for machining to take place without additional support, and if drilling is required, the tailstock centre is not available. Thus to support the work by means of a steady, adjust the jaws to touch the work until it is running true, and then lock them. Again, use plenty of oil between the steady jaws and the revolving work.

Drilling and Reaming from the Tailstock. For these operations the work is gripped in a chuck or mounted on a faceplate. It is important that the drill be started true so that a hole concentric with the work diameter is produced, and a common method employed to attain this is by centre drilling before commencing normal drilling.

The limitation of a twist drill as a cutting tool is that it follows its own point which takes the line of least resistance. Incorrect grinding can cause additional inaccuracies by (1) cutting edges being ground to different angles, (2) cutting edges of equal angles but different lengths, (3) cutting edges of unequal angles and lengths causing the point to be off-centre. It is essential then to see that the radial components of the two cutting edges are equal so that they constrain the drill to follow a direct path, but if an accurate bore is required, a drilled hole should be enlarged by a single point tool and final size obtained by reaming.

Straight shank reamers are held in a chuck, while taper shanks may be inserted into the tailstock spindle. The reamer should be fed carefully through the hole by rotation of the tailstock handwheel, using an ample supply of lubricant when reaming steel.

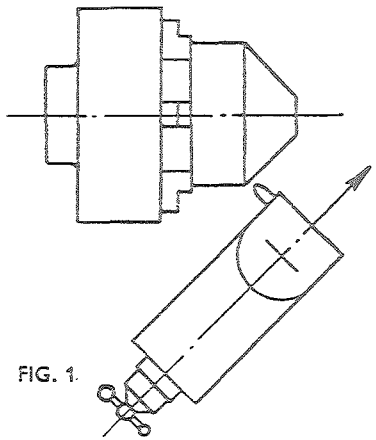


FIG. 1.

The recommended cutting speeds for reaming are:

Cast iron	20 ft. per min.	(6 m)
Mild steel	35 „ „	(10·6 m)
Medium carbon steel	30 „ „	(9 m)
Phosphor-bronze	35 „ „	(10·6 m)
Aluminium and duralumin	35 „ „	(10·6 m)

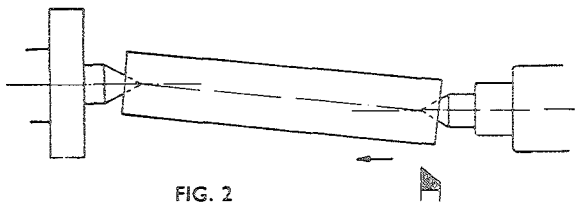


FIG. 2

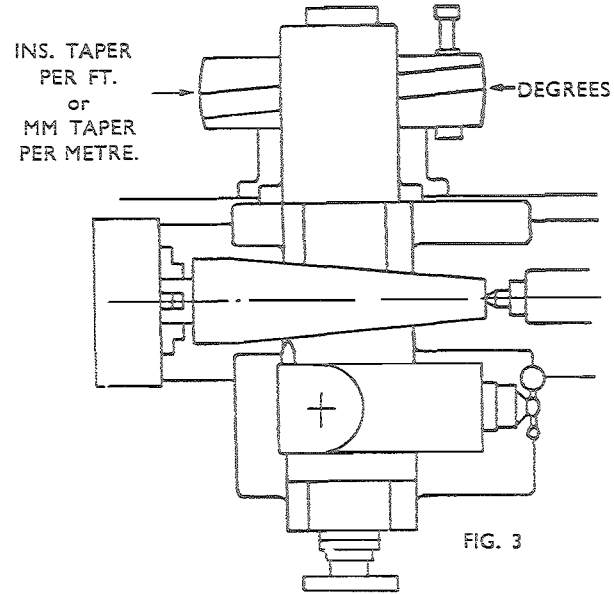


FIG. 3

Methods of Taper Turning and Boring. Three general methods are applicable. (1) As shown in fig. 1, by means of swivelling the compound rest to the angle required for either boring or turning. This method is by hand traverse of the tool, and is limited to the length of movement of the top slide, but it has the advantage that taper surfaces of any angle can be machined.

(2) The method shown in fig. 2 is by off-setting the tailstock centre. The drawback is that the centre points are not on the axis of the work, so that the centres are subjected to uneven wear and strain. Thus the method is limited to slow tapers on long work.
To find the amount of off-set X, if the taper is T inches per foot on

diameter and length of work is L inches, then $X = \frac{T \times L}{24}$ inches

or

To find the amount of off-set X, if the taper is T mm. per metre on diameter and length of work is L mm., then $X = \frac{T \times L}{2{,}000}$ mm.

If the included angle of taper is θ, $X = L \times \tan\frac{\theta}{2}$ inches (mm.).

(3) If the lathe is fitted with a taper turning attachment, fig. 3, then more accurate tapers, either external or internal, can be produced than by the two preceding methods. By the use of this attachment, the lathe centres are not of course taken out of alignment, so that the bearing surfaces are unaffected.

LATHE TOOLS

In mounting turning tools in the rest, the tool should only extend the minimum amount from the rest to obtain the maximum support against the downward pressure of the cut. For clamping the tool, ample pressure is provided with the spanner supplied, and on no

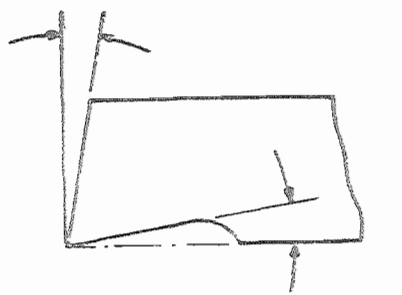


TABLE 1
Cutting Angles for H.S.S. and Cemented Carbide Tools

Materials	H.S.S.		Cemented Carbide	
	Top Rake	Clearance	Top Rake	Clearance
Mild steel	20°	6°	8°	4°–6°
High carbon steel ...	10°	4°	3°–4°	4°–6°
Soft cast iron ...	10°	8°	4°–8°	4°–6°
Chilled iron	0°	4°	0°	2°–4°
Copper	12°	10°	13°	4°–6°
Brass	0°–6°	10°	3°	4°–6°
Aluminium	30°	10°	16°	6°–8°

TABLE 2
Cutting Speeds in feet per minute (metres per min.)

Material	H.S.S. Tools				Cemented Carbide			
	Roughing		Finishing		Roughing		Finishing	
	ft.	m.	ft.	m.	ft.	m.	ft.	m.
Mild Steel	130	40	200	61	200	61	300	91
High carbon steel ...	45	14	60	18	200	61	400	122
Soft cast iron ...	60	18	75	23	200	61	350	107
Chilled iron	10	3	15	4·5	15	4·5	30	9
Copper	200	61	200	61	400	122	700	213
Brass	250	76	400	122	400	122	700	213
Aluminium	300	91	400	122	500	152	1,000	305

TABLE 3
Feeds in inches per revolution (mm. per revolution)

Material	H.S.S. and Cemented Carbide Tools			
	Roughing		Finishing	
	inches	mm.	inches	mm.
Mild steel	·010	·254	·007	·178
High carbon steel ...	010	·254	·007	·178
Soft cast iron ...	·013	·330	·008	·203
Chilled iron	·008	·203	·005	·127
Copper	·020	·508	·008	·203
Brass	·020	·508	·008	·203
Aluminium	·013	·330	·007	·178

account should extra pressure be applied by lengthening the leverage by dubious means such as a piece of piping. Such methods are unnecessary, and cause damage not only to the clamping screws, but the entire compound rest.

Boring tools may be of one piece solid forged, or may comprise cutter inserts fixed in a boring bar. A point of note in regard to the grinding of boring tools is that the conditions governing the top rake and clearance angles are different from those in turning, so that a secondary clearance is required for the front of the tool to clear the enveloping curve of the bore.

Speeds and Feeds. The cutting speed is expressed in surface feet per minute, and is the speed at which the surface of the work passes the tip of the tool. If D is the diameter of the work in inches, N the work speed in r.p.m., and S the cutting speed in feet per minute, then

$$N = \frac{3{\cdot}82 \times S}{D} \quad \text{or} \quad N = \frac{318 \times S \text{ (Metres/min.)}}{D\text{mm}}$$

The feed rate is expressed in inches per revolution of the headstock spindle.

The time to complete one cut, in minutes, can be calculated from

$$\frac{\text{Length of cut (in.) or (mm)}}{\text{Spindle speed (r.p.m.)} \times \text{feed (in. per rev.) or (mm per rev.)}}$$

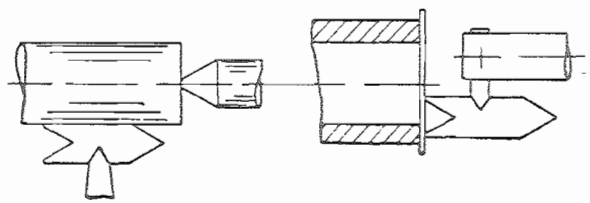


FIG. 4

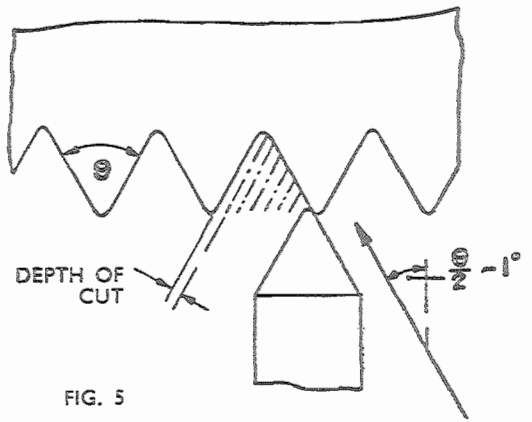


FIG. 5

Tables 1, 2 and 3 give suitable tool angles, cutting speeds, and feeds for a range of the common engineering materials.

Screwcutting.

For cutting vee threads the top of the tool is placed at centre height, having been previously ground to the required shape without any top rake. Note that if the tool is given top rake the plan angle of the tool is not the angle that will be reproduced in the work.

Fig. 4 shows the use of a setting gauge for both external and internal threading, but when cutting vee threads with the tool set in this manner, slow speeds and light feeds are necessary because the cuttings cannot be free flowing without top rake on the tool. Thus a better method for cutting external vee threads is shown in fig. 5 where the compound slide is swung around so that the tool is fed in at an angle of slightly less than half the included angle of the thread (i.e. approximately 26 deg. from normal, i.e. 64 deg. on cross slide graduations,

when cutting standard 55 deg. threads) so that metal is mostly removed by the left-hand side of the tool. Side rake can be provided so that heavier cuts can be taken and the chips flow easily away.

In commencing a screwcutting operation, take a light trial cut and check the number of threads per inch by measuring with a rule or screw pitch gauge. Then proceed by taking successive cuts until the full depth is reached. Check for depth and accuracy by means of the nut to fit the screw, or by a thread gauge of the ring type.

Tapered threads may be cut by means of a taper attachment or by off-setting the tailstock. In either case the tool must be set square to the work axis, and not to the tapered portion.

Square Threads. This section of thread is often used for multiple threaded screws, and the terms "pitch" and "lead" should be understood. Pitch is the distance from a point on one screw thread to a corresponding point on the next thread, measured parallel to the axis.

Lead is the distance that a screw thread advances axially in one turn. Thus on a single threaded screw the terms are identical, but a notation such as $\frac{1}{8}$ in. pitch, $\frac{1}{4}$ in. lead, would indicate a two start screw, and to produce this, the gearbox would require to give a saddle movement of $\frac{1}{4}$ in. for every revolution of the spindle, while the tool would be ground to produce $\frac{1}{8}$ in. pitch section of thread. The procedure when cutting a multiple start screw is to set the top slide parallel with lathe axis and cut the first thread in the usual manner at the correct LEAD. Cut subsequent threads by advancing the top slide each time a distance equal to the lead divided by the number of starts. This, of course, applies to all multiple threaded screws regardless of thread section.

Acme and Worm Threads. The procedure to be adopted for Acme and worm thread cutting is similar to that recommended for vee threads except for the setting angle of the compound slide. In this case the thread included angle is 29 deg. so that a slide setting of approx. 13 deg. from normal (i.e. 77 deg. on cross slide graduations) would be appropriate.

Full depth of an Acme thread is $0{\cdot}5\ P + 0{\cdot}01$ in. and width at bottom is $0{\cdot}3707\ P - 0{\cdot}0052$ in. where P is the thread pitch.

graduated 45 degrees each side of the vertical centre line. An arbor for mounting between centres and driven by the lathe driver plate is available to take 1 in. bore cutters. Machining by this means is, however, restricted to thin work and so, wherever possible, face or end milling is recommended. Face and end mills together with Woodruff key cutters can be provided having morse taper shanks for direct fitting to the spindle nose.

Milling and Gearcutting Attachment. As in the previous case, this attachment is mounted on the compound slide in place of the toolpost. On the vertical slide assembly, of similar construction to the milling attachment, is fitted a support for the work arbor together with indexing mechanism. Cutter arbor and cutter are mounted between the lathe centres, the drive being by driver plate and pin. It is important that, when setting up for gear cutting, the work arbor be exactly at right angles to the cutter arbor and the cutter directly under the centre line of the work arbor. Gears up to 7 in. diameter can be cut and cutters covering a wide range of gear pitches are available.

Dividing Attachment. Accurate indexing of the lathe spindle is achieved by use of this attachment. Work mounted in the chuck, on faceplate or between centres can be indexed for operation such as graduating, slotting, key seating, etc. The attachment fits on the top changewheel shaft after removal of the gear, the hinged guard remaining open whilst in use. A very wide range of divisions is possible with the standard index plate, but special plates can be provided when necessary.

Boring Table. This attachment fits directly on to the saddle. A boring bar with six cutters for use between centres can be supplied. To fit the table, remove the complete cross slide by turning the handwheel until the slide becomes free and can be taken from the rear of the carriage. Replace by the boring table, feeding on to the screw which is operated in the reverse direction. Place the boring bar between the lathe centres and drive by means of the driver plate.

Fourway Toolpost. It is self indexing and positively located. This unit replaces the standard type toolpost.

American Toolpost. Of the recognised American pattern with swivelling base plate and single clamp screw.

Coolant Pump. The electric pump unit is housed inside the cabinet base and access is through the louvre at the R.H. end of the cabinet.

Feed Stops.

(i) **Micrometer Carriage Stop.** Clamps to the front vee bed way and used for accurate machining of shouldered work. The screwed spindle is fitted with a micrometer dial having 0·001 in. or ·02 mm. graduations.

(ii) **Four Position Carriage Stop.** Similar to the above, this unit clamps to the front vee bed way and is used for multi-shouldered work. The indexing body contains four adjustable screws each of which can be used in turn to control various shoulder lengths.

(iii) **Cross Slide Stop.** Is located on the cross slide ways and is used on facing operations.

Bed Turret. This attachment is clamped to the bed ways replacing the tailstock. It comprises a lever operated slide of 4 in. stroke length with a six station automatically indexing turret, each station having an adjustable stop screw. Supplied with the lathe, the turret head is bored suitable for 1 in. diameter tool shanks but otherwise is left solid for boring in situ to ensure perfect alignment with the headstock centre. This attachment cannot be used with an extended cross slide or with hydraulic copying equipment.

Cut-off Slide. Used for parting off and facing operations. This quick acting lever operated slide, with front and rear toolposts, is clamped to the bed ways immediately in front of the chuck.

Additional Equipment. A wide selection of equipment available includes chucks of all sizes within the capacity of the lathe, tailstock drill chuck, rotating centre, half centre, pipe centre, turning tools and tool holders, etc.

Two Speed Equipment. Spindle speed ranges can be doubled by fitting a two speed motor and selector switch. The standard is 34 to 1500 r.p.m., but other ranges can be provided.

HYDRAULIC PROFILING EQUIPMENT

DESCRIPTION

The equipment comprises an independently operated rear tool slide fitted to a hydraulically operated angle slide, the whole being mounted on an extended cross slide. (A front compound slide is also fitted for normal turning.) Automatic copying control from the template to the hydraulic slide is by means of a stylus arm, mounted on taper roller bearings, actuating a spool type valve.

Template support heads and slide are mounted on the rear of the bed, one of the heads having a graduated eccentric sleeve to give 'set over' when required. Both heads can be locked in any position along the slide, the centres of each being adjustable by a handwheel.

Oil is supplied by the hydraulic pump unit usually placed on the floor at the tailstock end of the machine. The unit comprises an oil container, flange mounted motor and geared pump with pressure relief valve. Three flexible hoses connect the pump unit to the hydraulic slide, these being pressure, return and drain lines.

Copy turning is carried out with the tool in the normal upright position; an electrical reversing switch facilitating quick change-over from normal turning. The American type, key drive, long taper nose headstock spindle ensures complete protection and positive drive in both directions of rotation.

A micrometer saddle stop controls the movement of the carriage.

OPERATION

TEMPLATES AND COMPONENT BLANKS

The circular templates are usually produced exactly similar to the finished work, and often the first batch of components is used as the template. It is important that the template has a good surface finish, otherwise irregularities will be transmitted to the work piece and for more accurate reproduction best results are obtained with a hardened and ground template.

For work of large diameter, a smaller overall diameter template may be used providing the profile and lengths are the same.
It is important that the lengths of the component blanks be similar and the ends centre drilled to a constant depth to ensure uniformity of shoulder lengths throughout the batch.

PREPARATION AND SETTING UP (*Fig. 6*)

The oil container should be filled with the recommended grade of hydraulic oil and the level always maintained between the end and the maximum level shown on the dipstick.

The end fittings of the pressure, return and drain hoses are numbered 1, 2 and 3 respectively, and care must be taken to ensure that these are connected to the fittings on the attachment and oil container bearing corresponding numbers.

Connection of the electrical leads to the hydraulic pump motor should be such that the direction of rotation is anti-clockwise when viewed from above.

Before commencing copy turning, the hydraulic pump unit should be run for a few minutes and the hydraulic slide fed in and out a few times by means of the hand control lever to allow the oil to circulate quite freely through the system. This should apply whenever the machine has been idle for any length of time. The oil pressure reading on the gauge should be 150 lb. per sq. inch approximately.

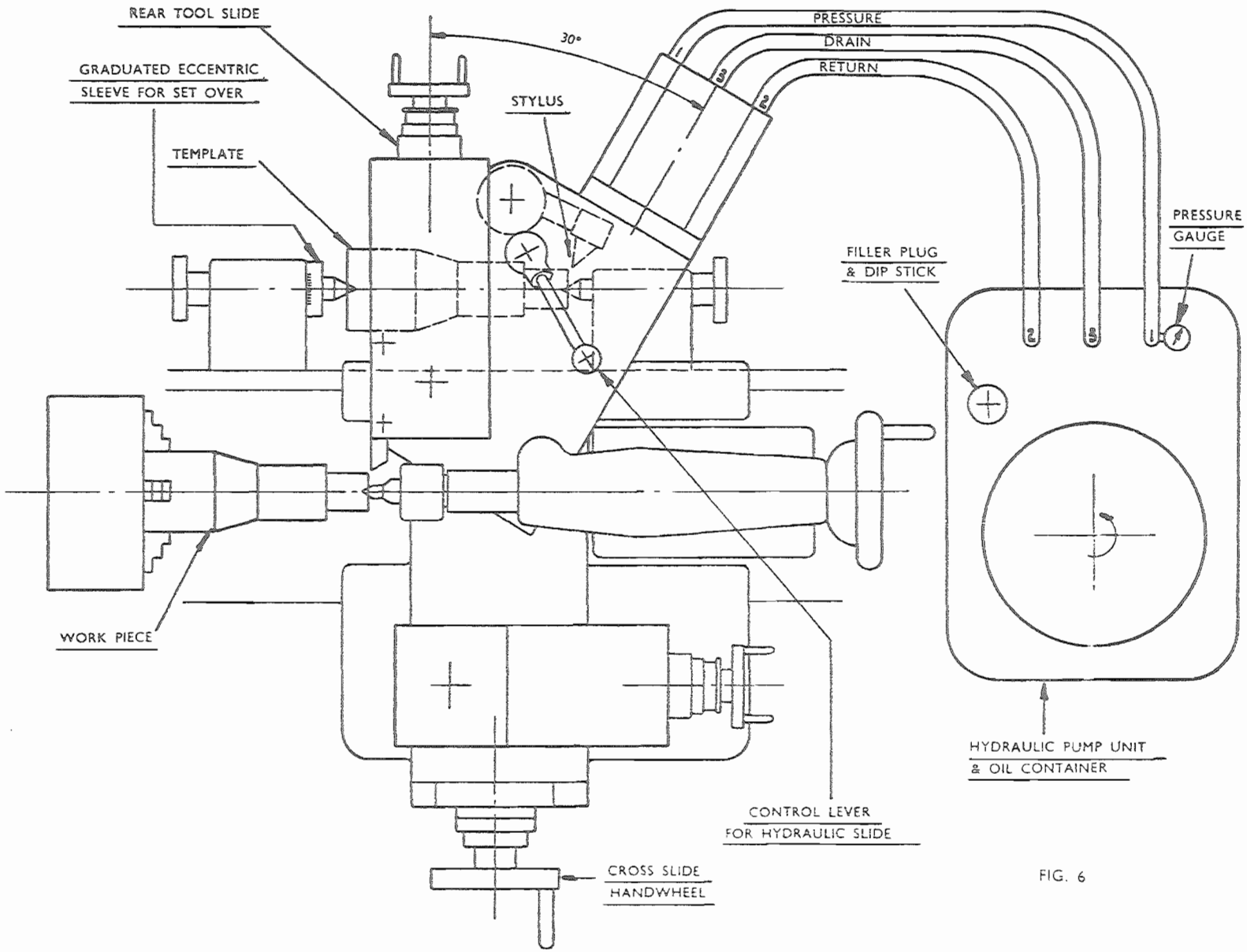

REAR TOOL SLIDE
GRADUATED ECCENTRIC SLEEVE FOR SET OVER
TEMPLATE
30°
STYLUS
PRESSURE
DRAIN
RETURN
PRESSURE GAUGE
FILLER PLUG & DIP STICK
WORK PIECE
HYDRAULIC PUMP UNIT & OIL CONTAINER
CONTROL LEVER FOR HYDRAULIC SLIDE
CROSS SLIDE HANDWHEEL

FIG. 6

As the tool lies approximately 6½ in. to the left of the stylus point, the template should be placed between the centres of the support heads a similar distance to the right of the intended position of the finished workpiece.

The hydraulic angle slide should be fed to its extreme inward position by means of the hand control lever.

Rotate the cross slide handwheel in an anti-clockwise direction until the stylus point contacts the smallest diameter of the template and commences actuating the valve controlling the hydraulic slide.

With a tool overhang of approximately 1 in. position the rear tool slide to ensure that the tool is clear of the largest diameter of the workpiece blank. Care should be taken to ensure that the tool is set exactly to centre height otherwise discrepancies will occur especially on small diameter work.

Copy turning can now commence, the depth of cuts for the 'first off' only being set by the rear tool slide handwheel.

On completion of the first workpiece, withdraw the hydraulic slide by means of the hand control lever and, only if more than one cut is necessary, traverse the whole slide assembly away from the work by means of the cross slide handwheel a distance equal to the depth of profile; on subsequent workpieces the cuts should be applied by this handwheel. The setting of the rear tool slide should not be altered after completion of the 'first off' unless a uniform fine finishing cut over the entire profile of the workpiece is required.

The micrometer saddle stop supplied with the lathe can be set towards the tailstock to position carriage after completion of each cut.

The cutting speed, depth of cut and feed rate are, as in normal turning, dependent upon the material, but accepted practice using carbide tipped tools is to combine high cutting speed with a fine feed to obtain the best surface finish.

E.g. material — mild steel, cutting speed 200 ft. (60 m.) per min. depth of cut $\frac{3}{16}$ in. (5 mm.), feed rate 0·002 in. (0·05 mm.) per rev.

A minimum number of cuts per component should be taken to minimise tool point wear, thereby maintaining repeat accuracy throughout the batch. Wherever possible, the more robust (a) of the two cutting tools should be used, the lighter tool (b) being reserved for work requiring steep back angles and grinding reliefs (*fig.* 9).

SCREWCUTTING (*Fig.* 7)

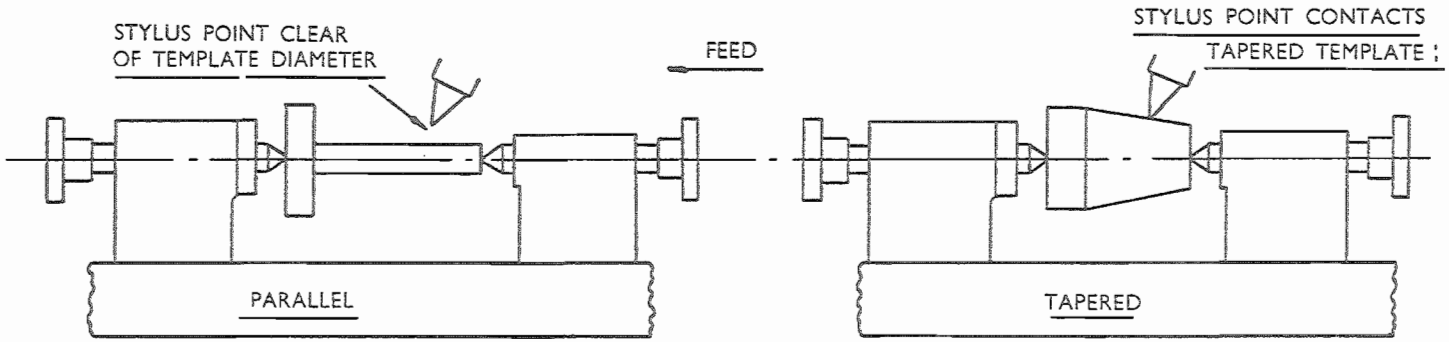
A higher cutting speed for screwcutting can be achieved by use of the Copying equipment. Whilst the only purpose of the equipment during screwcutting is the automatic withdrawal of the tool, the manual withdrawal speed is usually the factor limiting a threading operation, so the advantage to be gained from using the equipment will be readily appreciated. The most satisfactory results are obtained on fine threaded work and with the more free cutting materials, *e.g.* brass, cast iron, etc.

For cutting right-hand threads the tool should be in an inverted position, the direction of rotation of the headstock spindle therefore being in an anti-clockwise direction when viewed from the tailstock end of the lathe.

For cutting left-hand threads the tool should be in the normal upright position, the direction of rotation of the headstock spindle being in a clockwise direction.

The template required should have a single shoulder of sufficient depth to allow the tool to be automatically withdrawn from the work. The stylus point must always be clear of the template diameter contacting only the shoulder at point of withdrawal. If more than one cut is necessary, then these should be applied by the cross slide handwheel.

Taper screwcutting can be carried out to advantage (the above remarks regarding fine threads or free cutting materials again applicable), but the 'setting-up' differs slightly from that of parallel screwcutting. A template is required having a taper similar to that of the taper thread being produced, the stylus point contacting this



SCREWCUTTING

FIG. 7

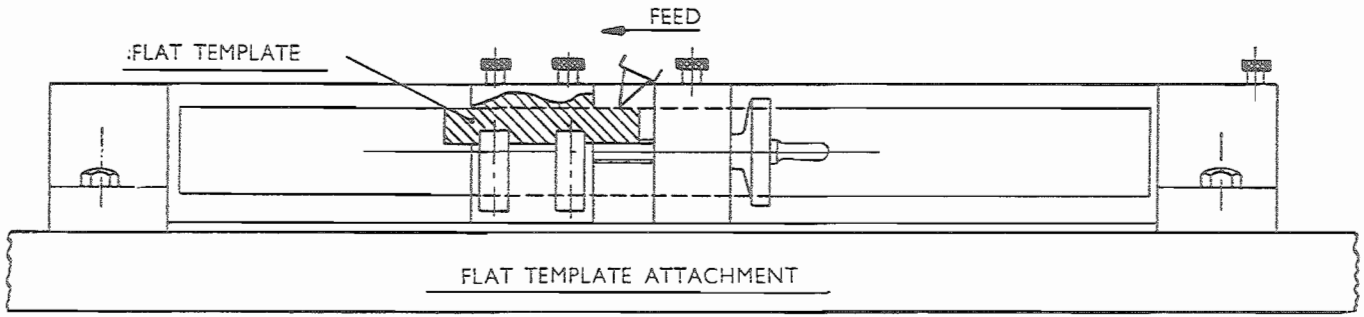


FIG. 8

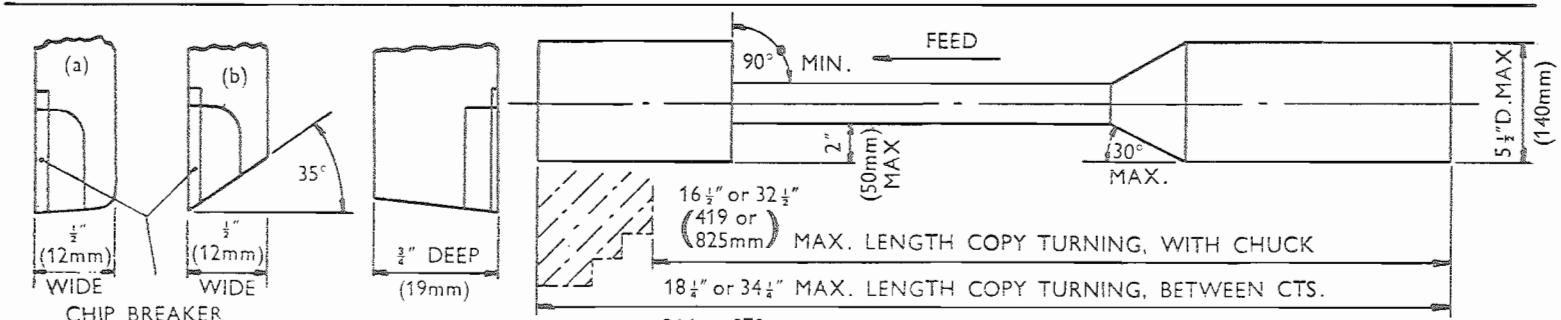


FIG. 9

during thread cutting. If more than one cut is necessary then this should be applied with the rear tool slide handwheel. Because of the angular action of the hydraulic slide a modified changewheel combination is required for each different taper.

FLAT TEMPLATE ATTACHMENT (*Fig. 8*)
(ADDITIONAL EQUIPMENT)

Whilst the major proportion of profile turned work is accomplished by the use of cylindrical templates an attachment is available specifically designed to accommodate flat templates.

The unit replaces the cylindrical template support heads and is clamped to the tenoned block attached to the rear of the lathe bed.

Provision is made for accurate alignment of the template to the lathe axis and a graduated dial provides micro longitudinal adjustment.

COPYING DISCREPANCIES

Discrepancies occurring between workpieces and template may be attributed to the following:—

(1) Tool requires regrinding.

(2) Tool is not on centre height — particularly important on small diameter work.

(3) Template and workpiece are not parallel — adjust by means of graduated eccentric sleeve in template support head.

(4) Gib strips on slides require adjusting.

MAINTENANCE

HYDRAULIC PUMP UNIT

Recommended grades of hydraulic oil:—

DTE Oil Heavy Medium	Supplied by Mobil Oil Co. Ltd.
or	
Tellus Oil 33	Supplied by Shell-Mex & B.P. Ltd.
or	
Nuto - H44	Supplied by Esso Petroleum Co. Ltd.
or	
Hy-Spin AWS68	Supplied by Castrol Ltd.
or	
Energol HL-100	Supplied by Shell-Mex & B.P. Ltd.
or	
Rando H.D.C.	Supplied by Regent Oil Co. Ltd.
or	
Indoil 31	Supplied by Amoco Ltd.
or	
Harmony 53	Supplied by Gulf Oil Ltd.
or	
Sunoco Sunvis 831	Supplied by Sun Oil Company.

or other equivalent grades.

The oil container should be drained, cleaned and renewed with oil at six-monthly intervals, whilst the filter fitted to the inlet port of the pump should be cleaned at three-monthly intervals. A drain plug is fitted at the base of the container and after draining, the cover and pump unit complete should be removed — by releasing the four screws at the corners of the cover. The container is then available for easy cleansing.

The working pressure registered on pressure gauge should read approximately 150 lb. per sq. inch, but if readings differ greatly from this figure then adjustment should be made to the relief valve which is inside the container.

Capacity of oil container approximately 3 gallons (13·6 litres).

MAINTENANCE (Continued)

LUBRICATION

Being a closed hydraulic system, the internal mechanism of the attachment requires no additional lubrication except for an oil nipple provided for lubrication of the stylus arm bearings and this together with periodic lubrication of the slides is all that is necessary.

(It is recommended that the slides be lubricated with molybdenum disulphide in petroleum jelly.)

PLAY IN SIDEWAYS

All the slides are provided with gibs. Adjustment should be effected as required and the set screws and locknuts carefully tightened.

REPLACEMENT OF HYDRAULIC RAM LEATHER *(Fig. 10)*

Instructions for replacing the hydraulic ram leather sealing the piston rod in the cylinder are as follows:—

Remove cap screws 'A' and withdraw hydraulic slide in direction of arrow.

Release set screw 'B' and raise item 'C' clear of the cross slide — cylinder and valve unit should now be clear.

Remove end cover 'D' and withdraw piston and rod from the cylinder.

Remove piston.

Replace ram leather 'E' — care being taken to ensure that the sealing lip is not damaged.

On assembling end cover 'D' use sealing compound on face.

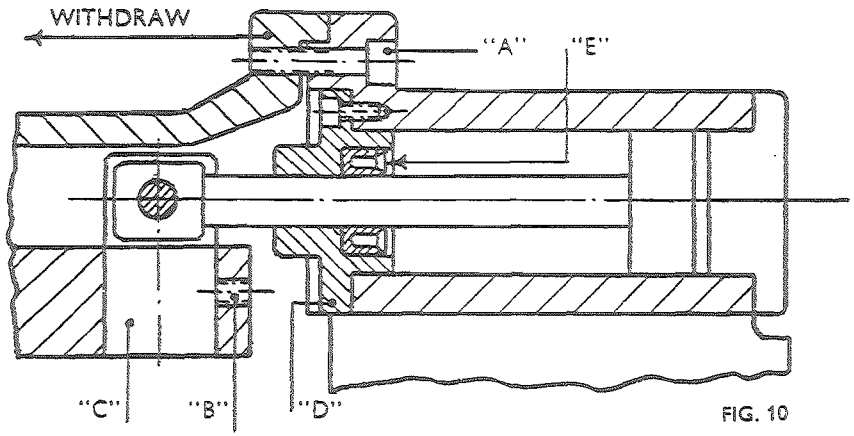


FIG. 10

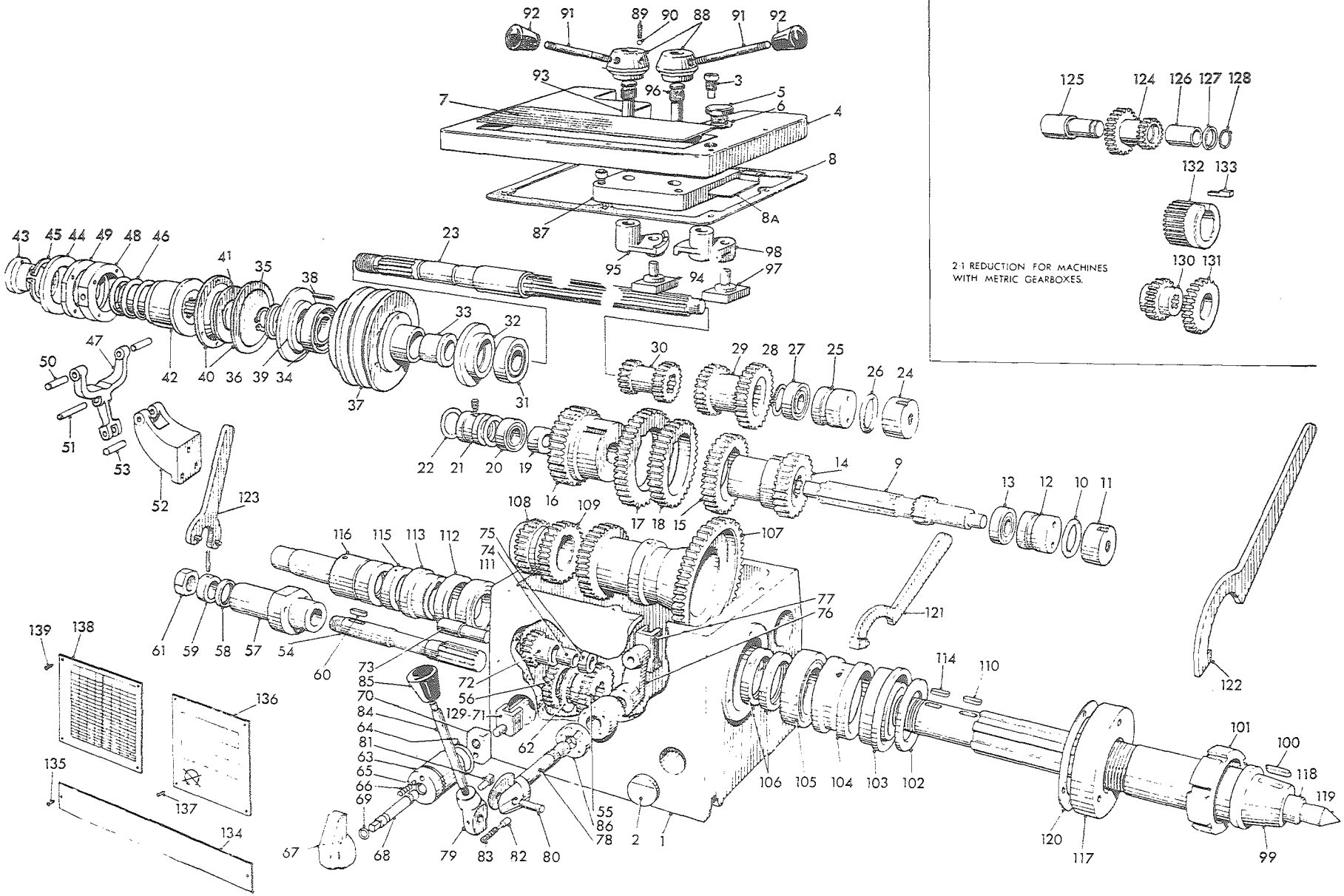
This hydraulic equipment has been made in the simplest and most foolproof form without unnecessary complications, and we believe that this is the most effective way of dealing with such apparatus. IT IS IMPORTANT TO SWITCH OFF THE HYDRAULIC UNIT WHEN NOT IN USE, so as to minimise temperature rise in the hydraulic tank. Heat is generated when the hydraulic fluid is by-passed through the relief valve to the tank and if the pump is left running unnecessarily without utilising the copying slides, viscosity of the oil can be reduced and can affect smooth operation.

ALL-GEARED HEAD

Item No.	Part No.	Description	No. Off
		ALL-GEARED HEAD	
1	L6-2-232	Headstock	1
2	1C4612	Oil Level Window	1
3	L6-2-104	Magnetic Plug	1
4	L6-2-258	Cover	1
5	L21-2-141A	Filler Cap	1
6	SP41	Fibre Washer	1
7	L6-2-267	Rubber Mat	1
8	L6-2-266	Gasket, Cover	1
8A	L6-2-270	Baffle Plate	1
9	L6-2-131G	Intermediate Shaft	1
10	131D1615M	"O" Ring	1
11	L16-2-177	Bearing Locating Bush, Outer ...	1
12	L16-2-176	Bearing Locating Bush, Inner ...	1
13	LJ $\frac{3}{4}$	Single Row Ball Bearing	1
14	L5-2-177G	46T Gear } Supplied Integral ...	1
15	L5-2-12G	56T Gear	
16	L5-2-176G	56T Gear } Supplied Integral ...	1
17	L5-2-9G	71T Gear	
18	L5-2-10G	65T Gear	
19	L6-2-10A	Spacing Collar	1
20	LJ $\frac{3}{4}$	Single Row Ball Bearing	1
21	MH1-2-15	Bearing Locating Bush	1
22	131D1615M	"O" Ring	1
23	L6-2-265	Driving Shaft	1
24	L16-2-177	Bearing Locating Bush, Outer ...	1
25	L16-2-176	Bearing Locating Bush, Inner ...	1
26	131D1615M	"O" Ring	1
27	LJ $\frac{3}{4}$	Single Row Ball Bearing	1
28	1500-E-743	Circlip...	1
29	L5-2-219/220	35 & 45T Double Gear	1
30	L5-2-173G	20 & 26T Double Gear	1
31	LJ $1\frac{1}{8}$ WSR	Ball Journal	1
32	L6-2-264	Bearing Locating Plate	1
33	L16-2-32	Bearing Spacer	1
34	MJ $1\frac{1}{8}$	Single Row Ball Journal	1

Item No.	Part No.	Description	No. Off
		All-Geared Head (contd.)	
35	L16-2-120	Retaining Ring	1
36	$1\frac{1}{16}$" Dia.	External Circlip	1
37	L16-2-16	Head Pulley	1
38	L16-2-182	Driving Pin	6
39	L16-2-18A	Bearing Locating Plate	1
40	DC8	Clutch Disc	2
41	L16-2-110	Clutch Plate	1
42	L16-2-21A/111	Clutch Operating Sleeve	1
43	L16-2-22	Adjusting Nut	1
44	L16-2-82	Braking Plate	1
45	5100/237	External Retainer	1
46	SG. 216	Spring	1
47	L16-2-40	Clutch Operating Lever	1
48	L16-2-43A	Shoe	1
49	L16-2-77A	Brake Disc	1
50	L16-2-76	Pin	2
51	L16-2-42	Swivel Pin	1
52	L16-2-39	Support Bracket	1
53	L16-2-41	Swivel Pin, Link Arm	1
54	L6-2-129	Reverse Shaft	1
55	L6-2-183G	44T Gear	1
56	L6-2-182G	41T Gear	1
57	L6-2-20	Reverse Shaft Bearing	1
58	W12508725	Oil Seal	1
59	L5-626	Collar	1
60	$\frac{1}{4}$" KS $\frac{5}{8}$"	Square Key	1
61	$\frac{7}{8}$" FB.	Hexagonal Nut. 12 TPI	1
62	L6-2-88	Washer	1
63	L6-2-256	Selector Shaft Bush	1
64	PC 1125, BS 216	"O" Ring	1
65	SB 2	Steel Ball $\frac{5}{16}$" Dia.	1
66	SG. 142	Spring	1
67	L6-3-103	Selector Handle	1
68	L6-2-262	Selector Shaft	1

ALL-GEARED HEAD



ALL-GEARED HEAD

Item No.	Part No.	Description	No. Off
		All-Geared Head (contd.)	
69	4-007	"Nu-Lip" Ring	1
70	L6-2-257	Selector Lever	1
71	L6-2-263	Mover Shoe	1
72	L6-2-14G	28T Idler Gear	1
73	L6-2-184	Stud, Idler Gear	1
74	L16-2-38	Bush	1
75	L16-2-37	Collar	1
76	L5-2-44A	Front Selector Lever	1
77	L5-2-43	Shoe	1
78	L6-2-260	Front Selector Lever Shaft	1
79	L5-2-114A	Front Selector Boss	1
80	L5-2-113	Swivel Pin	1
81	L5-2-111B	Plunger	1
82	L5-2-112	Return Pin	1
83	SG. 231	Spring	1
84	L5-2-109	Hand Lever	1
85	11007019	Hand Knob	1
86	L5-2-110A	Locating Plate	1
87	L6-2-235	Top Selector Lever Bracket	1
88	L6-2-259	Top Selector Lever Boss	2
89	SB 3	$\frac{1}{4}$" dia. Steel Ball	2
90	SG 5	Spring	2
91	L5-654	Top Selector Lever	2
92	11007012	Hand Knob	2
93	L6-2-5	Shaft, Top Selector, L.H.	1
94	L5-220A	Shoe	1
95	L5-206	L.H. Interlocking Lever	1
96	L6-2-4	Shaft, Top Selector, R.H.	1
97	L5-221	Shoe	1
98	L5-205	R.H. Interlocking Lever	1
99	L6-2-174	Main Spindle. LOO Taper Nose ...	1
100	L5-2-77	Key	1
101	L5-2-151	Draw Nut	1
102	L5-2-45	Washer	1
103	387/382B	Timken Taper Roller Bearing ...	1

Item No.	Part No.	Description	No. Off
		All-Geared Head (contd.)	
104	L5-2-42	Spacer	1
105	387/382A	Timken Taper Roller Bearing ...	1
106	L5-2-83	Adjusting Nut	2
107	L5-2-192G	Main Spindle Gear	1
108	L6-2-181GG	41T Spindle Gear	1
109	L6-2-181G	44T Spindle Gear	1
110	$\frac{1}{4}$" KR 1$\frac{1}{2}$"	Rectangular Key	1
111	XLJ 1$\frac{7}{8}$"	Ball Journal	1
112	L6-2-178	Sealing Ring	1
113	L6-2-180	Spacer	1
114	$\frac{1}{4}$" KR 1$\frac{1}{8}$"	Rectangular Key	1
115	L6-2-179	Locknut	1
116	L6-2-176	Tail End Sleeve	1
117	L5-2-41A	Front Bearing Cover	1
118	L5-2-101	Sleeve for Centre	1
119	L5-585A	Centre	1
120	L5-2-156	Gasket, Front Bearing Cover ...	1
121	WR. 20	Wrench, Adjusting Nuts	2
122	WR. 17	Hook Spanner	1
123	WR. 19	Wrench, Tail End Sleeve	1

ALL-GEARED HEAD

Item No.	Part No.	Description	No. Off
		All-Geared Head (contd.)	
		ALTERNATIVE COMPONENTS TO REVERSE SHAFT. 2:1 REDUCTION FITTED WHEN METRIC GEARBOX IS FITTED	
124	L6-2-157	35T & 23T Idler Gear	1
125	L6-2-185	Stud, Idler Gear	1
126	L6-2-145	Bush	1
127	L5-2-205	Spacing Ring	1
128	$\frac{3}{4}$" Dia.	External Circlip	1
129	L6-2-106A	Mover Shoe	1
130	L6-2-187G	35T Gear	1
131	L6-2-144G	46T Gear	1
132	L6-2-186	35T Spindle Gear	1
133	L6-2-189	Key	1
134	675	Nameplate 13" (676 165 mm.) ...	1
135	4 ANF × $\frac{1}{4}$"	Self Tapping Screws	3
136		Speed Plate. (Please state speed range when ordering)	1
137	4 ANF × $\frac{1}{4}$"	Self Tapping Screws	4
138	683	Screwcutting & Feed Plate (English)	1
	684	Screwcutting & Feed Plate (Metric) ...	1
	685	Scewcutting & Feed Plate (Lever operated conversion)	1
	686	Screwcutting & Feed Plate (for U.S.A)	1
139	4 ANF × $\frac{1}{4}$"	Self Tapping Screws	4

GEARBOX and TAILSTOCK

Item No.	Part No.	Description	No. Off
		NORTON 36 SPEED GEARBOX	
1	L6-3-98	Gearbox	1
2	L5-3-58	Sleeve	1
3	L5-3-59	Sleeve	1
4	L5-3-60	Sleeve	1
5	L5-3-61A	Sleeve	1
6	L16-3-12	Filler Plug	1
7	L16-3-11	Oil Feeder	1
8	L16-3-14	Gasket	1
9	L5-3-5	Top Shaft	1
10	L5-3-40	Bush, Top Shaft, L.H.	1
11	L5-3-7	Sleeve	1
12	L5-3-6	16T Gear	1
13	L5-3-8	32T Gear	1
14	L5-3-41	Bush, Top Shaft, Centre	1
15	L5-3-10	24T Sliding Gear	1
16	L5-3-9	16T Sliding Gear	1
17	SK8	Peg Feather Key	1
18	L5-3-42	Bush, Top Shaft, R.H.	1
19	L6-3-103	Selector Handle	2
20	SG 142	Spring	2
21	SB 2	Steel Ball, $\frac{3}{16}$" dia.	2
22	L5-3-56	Selector Shaft	2
23	L5-3-39A	Selector Lever, L.H.	1
24	L5-3-38	Selector Shoe	2
25	L5-3-39A	Selector Lever, R.H.	1
26	DW4064/A	Oil Level Window, $\frac{7}{8}$" o./dia. ...	1
27	L5-3-63	Middle Shaft	1
28	L5-3-43	Bush, Middle Shaft, L.H.	1
29	L5-3-64	Splined Gear, 16T	1
30	L5-3-65	Splined Gear, 18T	1
31	L5-3-66	Splined Gear, 19T.	1
32	L5-3-67	Splined Gear, 20T	1
33	L5-3-68	Splined Gear, 22T	1
34	L5-3-69	Splined Gear, 24T	1
35	L5-3-70	Splined Gear, 26T	1

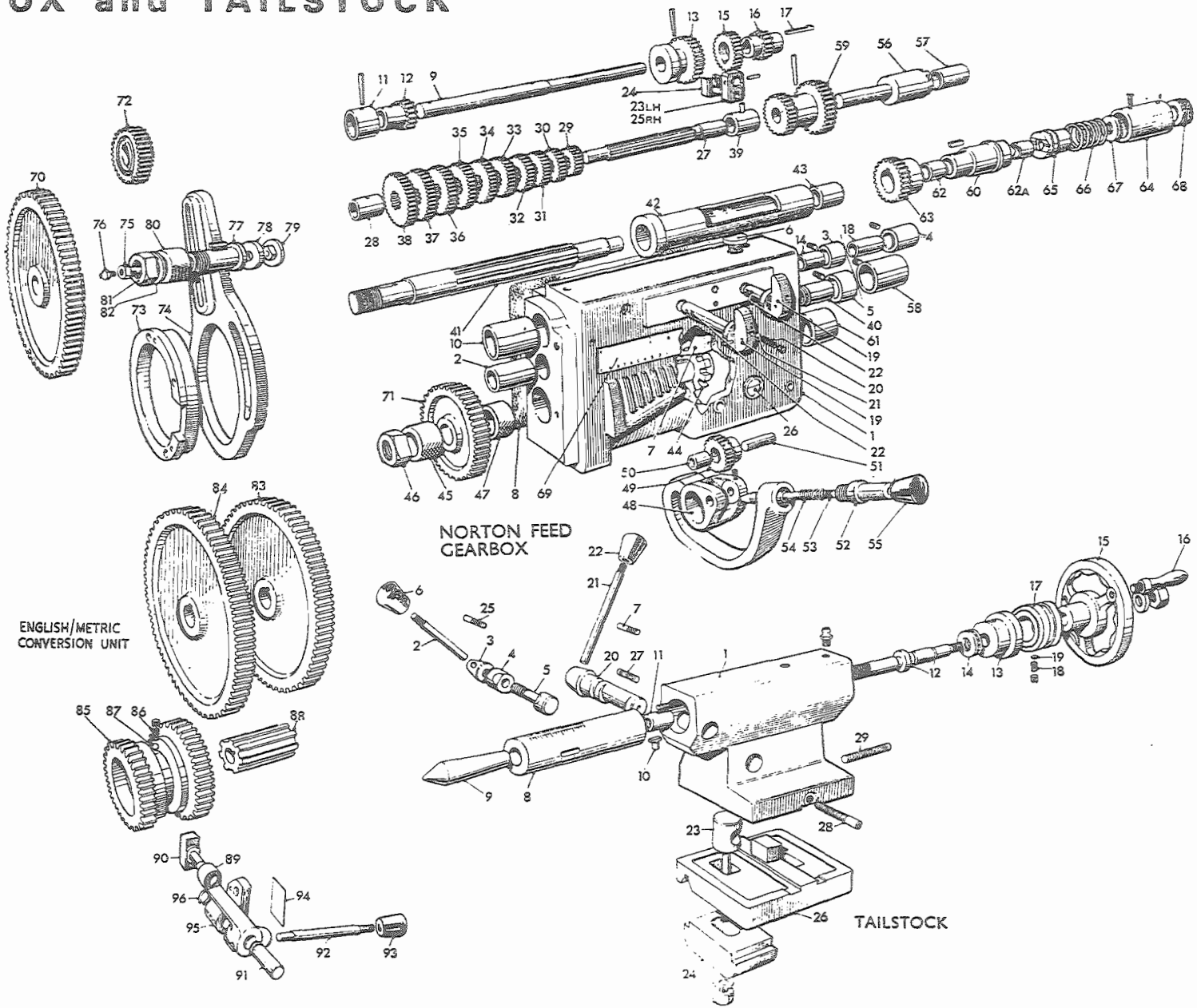
Item No.	Part No.	Description	No. Off
		Norton 36 Speed Gearbox (contd.)	
36	L5-3-71	Splined Gear, 28T	1
37	L5-3-72	Splined Gear, 30T	1
38	L5-3-73	Splined Gear, 32T	1
39	L5-3-76	Spacer	1
40	L5-3-75	Bush, Middle Shaft, R.H.	1
41	L6-3-101	Bottom Shaft	1
42	L5-3-78A	Sleeve	1
43	L16-3-10	Bush, Bottom Shaft, R.H.	1
44	L16-3-9	Oil Thrower	1
45	L5-502	Change Wheel Collar	1
46	$\frac{7}{8}$" FB	Hexagonal Nut, 12 TPI	1
47	L16-8-8	Spacing Collar	1
48	L16-3-2A	Swing Lever	1
49	L16-3-4	Gear	1
50	L5-3-55	Bush, Swing Lever	1
51	L5-3-28	Pin	1
52	L5-3-36	Plunger Sleeve	1
53	L5-3-37	Plunger	1
54	SG 141	Spring	1
55	11007012	Hand Knob	1
56	L5-3-74	Clutch Shaft, Lead Screw	1
57	L5-3-49	Bush, Lead Screw	1
58	L5-3-45	Bush, Clutch Shaft	1
59	L5-3-13	Gear	1
60	L5-3-31	Slipping Clutch Shaft	1
61	L5-3-48	Bush, Slipping Clutch Shaft... ...	1
62	L5-3-50	Bush, Feed Shaft	1
62A	L5-3-89	Bush	1
63	L5-3-30	Gear	1
64	L5-3-35	Sleeve	1
65	L5-3-32	Slipping Clutch	1
66	SG 266	Spring	1
67	L5-3-34	Washer	1
68	L5-3-33	Adjusting Nut	1
69	697A	Lever Position Plate (697 for USA)	1

GEARBOX and TAILSTOCK

Item No.	Part No.	Description	No. Off
		Norton 36 Speed Gearbox (contd.)	
70	L5-51B	Change Wheel, 120T	1
71	L5-51K	Change Wheel, 60T	1
72	L5-51DD	Change Wheel, 30T	1
73	L6-8-3	Mounting Ring, Banjo Plate ...	1
74	L16-8-2	Banjo Plate	1
75	L5-196	Change Wheel Stud	1
76	H4146	Hydraulic Nipple, Straight $\frac{1}{4}$" Whit.	1
77	L5-505	Socket	1
78	L6-8-8	Collar	1
79	L16-8-5	Socket Nut	1
80	L5-502	Change Wheel Collar	1
81	$\frac{7}{8}$" FB	Hexagonal Nut. 12 TPI	1
82	L5-13-25	Spacer	1
		Lever Operated Metric Conversion (Special Orders only)	
83	L5-51A	Change Wheel, 127T	1
84	L5-51NN	Change Wheel, 135T	1
85	L16-8-3A	Compound Change Gear	1
86	SG 5	Spring	1
87	SB 3	Steel Ball, $\frac{1}{2}$" dia.	1
88	L16-8-9	Sleeve	1
89	L6-8-59	Lever, Change Gear	1
90	L16-8-24	Shoe	1
91	L6-8-60	Pin, Lever	1
92	L6-8-62	Hand Lever	1
93	11007012	Hand Knob	1
94	688	Thread Selector Plate	1
95	L6-8-61	Boss	1
96	$\frac{3}{4}$" Dia.	External Circlip	1

Item No.	Part No.	Description	No. Off
		TAILSTOCK ASSEMBLY	
1	L6-7-27	Tailstock	1
2	11007011	Locking Handle for Quill	1
3	11007015	Nipping Nut	1
4	L6-7-40	Nipping Bush, Bottom	1
5	L6-7-39	Nipping Stud	1
6	11007012	Hand Knob	1
7	L6-7-41	Stop Pin	1
8	L6-7-31	Quill (L6-7-38, Metric)	1
9	L5-585A	Centre	1
10	L5-94	Key	1
11	L5-96	Nut (Please quote English or Metric)	1
12	L6-7-30	Screw (L6-7-37, Metric)	1
13	L6-7-29	Bush	1
14	51103	Thrust Race	1
15	11007006	Handwheel	1
16	15007018	Handle	1
17	11007008	Micrometer Dial (11007024, Metric)	1
18	SG 289	Spring	2
19	L5-5-15	Die	2
20	L6-7-33	Eccentric Lock Stud	1
21	L5-7-9	Locking Lever	1
22	11007019	Hand Knob	1
23	L6-7-21	Locking Eye Bolt	1
24	L6-7-3	Holding Down Plate...	1
25	L6-7-41	Stop Pin	1
26	L6-7-28	Base	1
27	$\frac{1}{2}$" FX 1$\frac{1}{4}$" BSF	Hollow Set Screw, Oval Point ...	1
28	$\frac{1}{2}$" FX 2$\frac{1}{2}$" BSF	Hollow Set Screw, Oval Point ...	1
29	$\frac{1}{2}$" FX 3" BSF	Hollow Set Screw, Oval Point ...	1

GEARBOX and TAILSTOCK

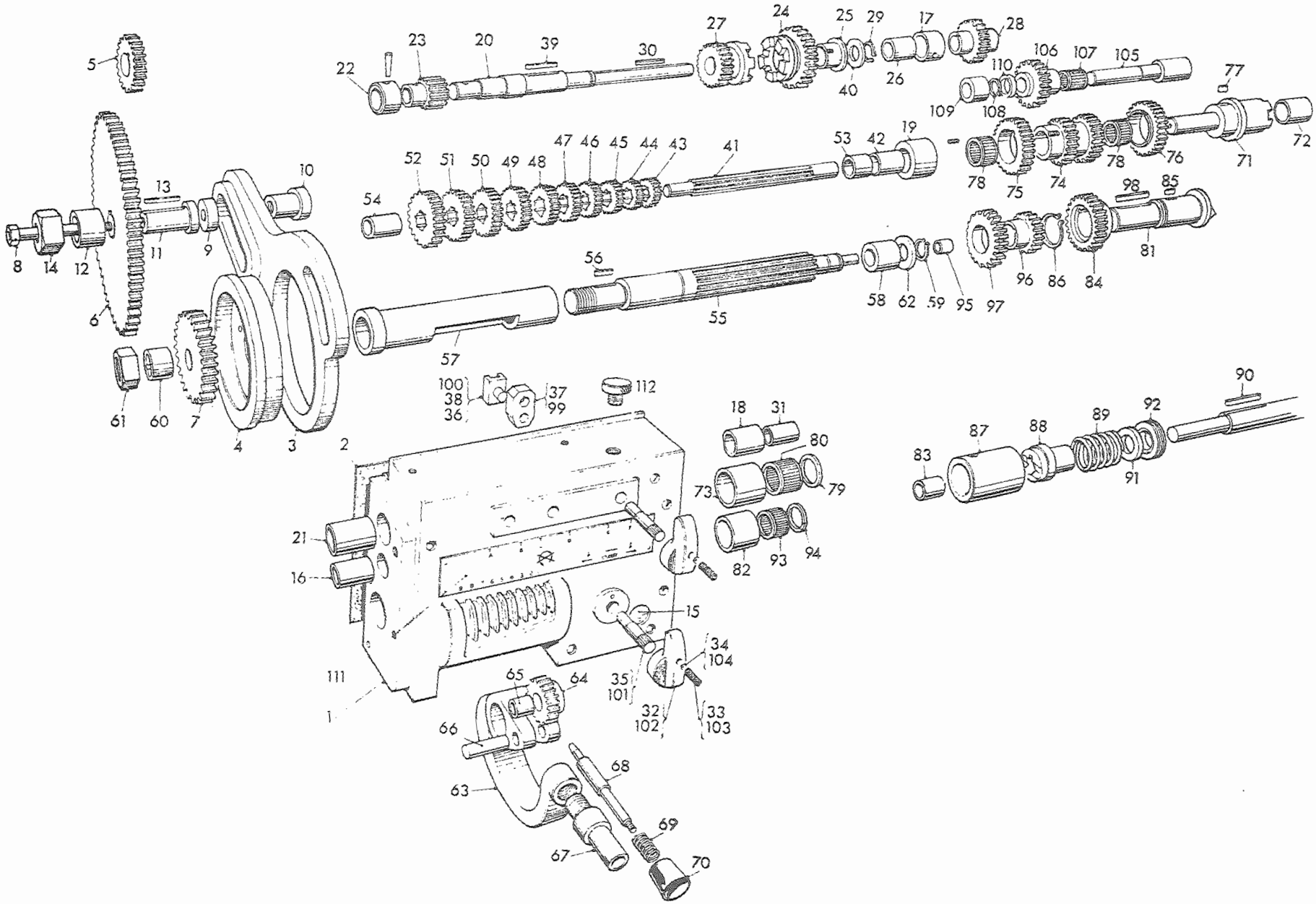


METRIC GEARBOX

Item No.	Part No.	Description	No. Off
1	L6-3-99	Gearbox	1
2	L16-3-14	Gasket	1
3	L16-8-2	Banjo Plate	1
4	L6-8-3	Mounting Ring	1
5	L5-51DD	Change Wheel, 30T	1
6	L5-51B	Change Wheel, 120T	1
7	L5-51KK	Change Wheel, 48T	1
*	L5-51E	Change Wheel, 80T	1
8	L5-196	Change Wheel Stud	1
9	L6-8-8	Collar	1
10	L16-8-5	Socket Nut	1
11	L5-505	Socket	1
12	L5-502	Change Wheel Collar	1
13	$\frac{1}{4}$" KS $1\frac{1}{8}$"	Square Key	1
14	$\frac{7}{8}$" FB	Hexagonal Nut, 12 TPI	1
15	DW4064/A	Oil Level Window, $\frac{7}{8}$" dia.	1
16	L5-3-58	Sleeve	1
17	L5-3-59	Sleeve	1
18	L5-3-60	Sleeve	1
19	L5-3-61A	Sleeve	1
20	L5-3-98	Top Shaft	1
21	L5-3-40	Bush, Left Hand	1
22	L5-3-7C	Sleeve	1
23	L5-3-6C	16T Gear	1
24	L5-3-102	32T Sliding Gear	1
25	L5-3-116	Flanged Bush	1
26	L5-3-41	Bush, Centre	1
27	L5-3-103	24T Sliding Gear	1
28	L5-3-104	21T Sliding Gear	1
29	$\frac{3}{8}$" Dia.	External Circlip	1
30	SK8	Key	1
31	L5-3-42	Bush, Right Hand	1
32	L6-3-103	Selector Handle	3
33	SG 142	Spring	3
34	SB 2	Steel Ball, $\frac{3}{16}$" dia.	3
35	L5-3-56	Selector Shaft	3
36	L5-3-38	Selector Shoe	2
37	L5-3-39A	Selector Lever	3
38	L5-3-93	Selector Shoe, Central	1
39	$\frac{3}{16}$" KS $1\frac{1}{2}$"	Square Key	1
40	L5-3-114D	Spacing Washer	1
41	L5-3-111	Mid-Shaft	1
42	L5-3-43C	Bush, Right Hand	1
43	L5-3-64	Splined Gear, 16T	1
44	L5-3-65	Splined Gear, 18T	1
45	L5-3-66	Splined Gear, 19T	1
46	L5-3-67	Splined Gear, 20T	1
47	L5-3-68C	Splined Gear, 22T	1
48	L5-3-69C	Splined Gear, 24T	1
49	L5-3-70	Splined Gear, 26T	1
50	L5-3-71	Splined Gear, 28T	1
51	L5-3-72	Splined Gear, 30T	1
52	L5-3-73	Splined Gear, 32T	1
53	L5-3-76C	Spacer	1
54	L5-3-75	Bush, Left Hand	1
55	L6-3-102	Bottom Shaft	1
56	$\frac{1}{4}$" KS $1\frac{1}{2}$"	Square Key	1
57	L5-3-78A	Sleeve	1
58	L5-3-47A	Bush, Right Hand	1
59	$\frac{3}{4}$" Dia.	External Circlip	1
60	L5-502	Change Wheel Collar	1
61	$\frac{7}{8}$" FB	Hexagonal Nut, 12 TPI	1
62	L5-3-114F	Spacing Washer	1
63	L16-3-2A	Swing Lever	1
64	L16-3-4	Gear 22T	1
65	L5-3-55	Bush	1
66	L5-3-28	Shaft	1
67	L5-3-36	Plunger Sleeve	1
68	L5-3-37	Plunger	1
69	SG 141	Spring	1
70	11007012	Hand Knob	1
71	L5-3-124	Clutch Shaft, Leadscrew	1
72	L5-3-49	Bush, Leadscrew	1
73	L5-3-126	Bush, Clutch Shaft	1

* Not illustrated.

...ORION, 36 SPEED GEARBOX (METRIC)



METRIC GEARBOX

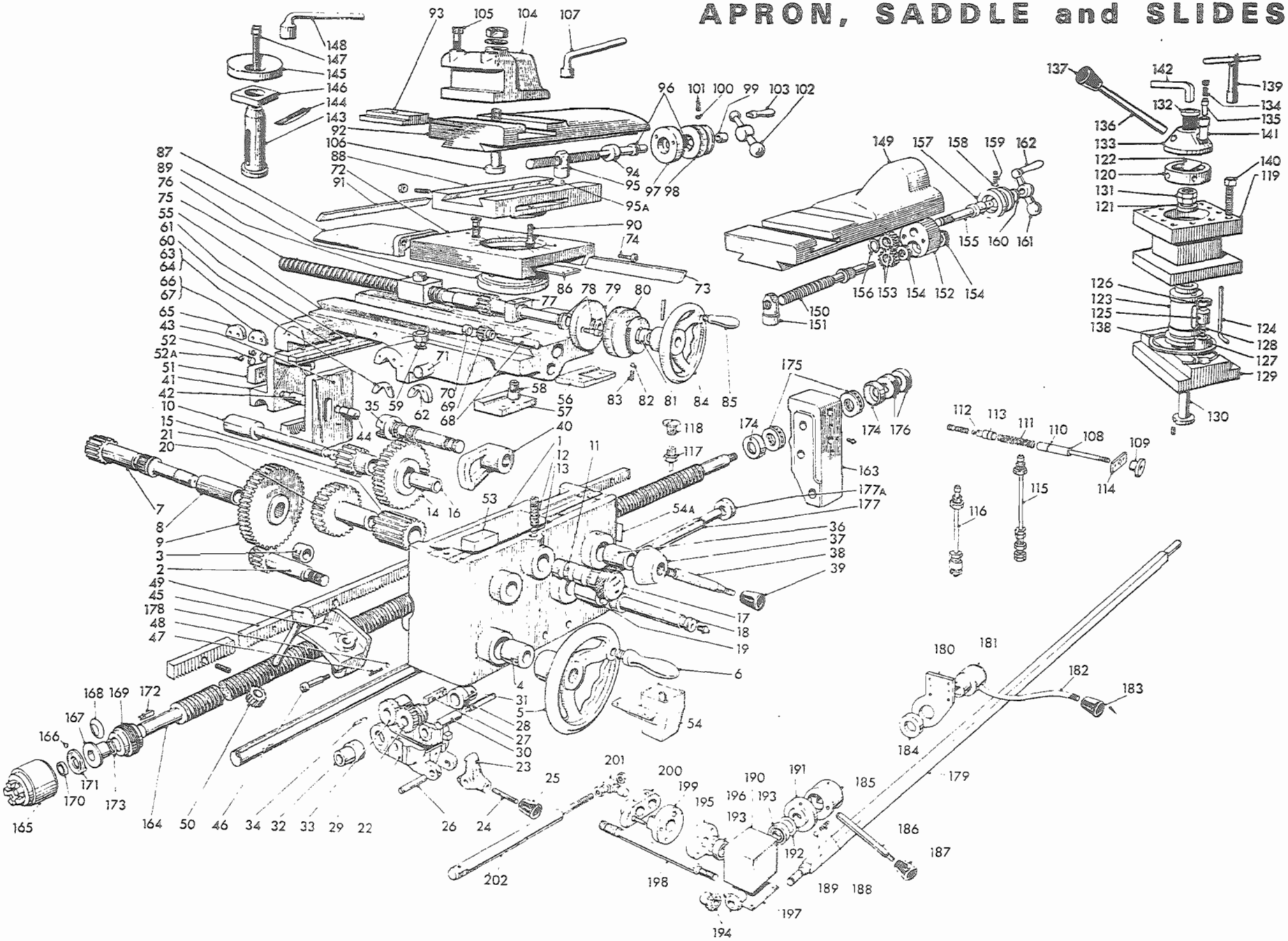
Item No.	Part No.	Description	No. Off
74	L5-3-105B	Gear 21T & 20T	1
75	L5-3-101	32T Gear	1
76	L5-3-112	32T Gear	1
77	$\frac{3}{16}$" KS $\frac{3}{8}$"	Square Key	1
78	SC 108	Needle Roller Bearing	2
79	GSC 18	Oil Seal	1
80	SC 1812	Needle Roller Bearing	1
81	L5-3-123	Slipping Clutch Shaft	1
82	L5-3-48C	Bush, Slipping Clutch Shaft... ...	1
83	L5-3-50	Bush, Feed Shaft	1
84	L5-3-96	Gear, 32T	1
85	$\frac{3}{16}$" KS $\frac{3}{8}$"	Square Key	1
86	$1\frac{1}{8}$" Dia.	External Circlip	1
87	L5-3-35	Sleeve	1
88	L5-3-32	Slipping Clutch	1
89	SG 266	Spring	1
90	$\frac{3}{16}$" KS $1\frac{1}{2}$"	Square Key	1
91	L5-3-34	Washer	1
92	L5-3-33	Adjusting Nut	1
93	SC 1812	Needle Roller Bearing	1
94	GSC 18	Oil Seal	1
95	L5-3-55	Bush	1
96	L5-3-100	Reverse Gear, 20T	1
97	L5-3-101A	Reverse Gear, 32T	1
98	$\frac{1}{4}$" KS $1\frac{1}{2}$"	Square Key	1
99	L5-3-39A	Reverse Selector Lever	1
100	L6-3-105	Selector Shoe	1
101	L5-3-56	Selector Shaft	1
102	L6-3-103	Reverse Lever	1
103	SG 142	Spring	1
104	SB 2	Steel Ball, $\frac{3}{16}$" dia.	1
105	L5-3-128	Idler Shaft	1
106	L5-3-127A	Idler Gear	1
107	SC 812	Needle Roller Bearing	1
108	$\frac{1}{2}$" Dia.	External Circlip	1
109	L5-3-108	Sleeve	1
110	L5-3-129	Thrust Washer	1
111	696A	Lever Position Plate (696 for USA) ...	1
112	L16-3-12	Filler Plug	1

APRON, CARRIAGE AND SLIDES

Item No.	Part No.	Description	No. Off
		APRON	
1	L5-4-1A	Apron	1
2	L5-4-43	Hand Motion Pinion	1
3	L5-4-42	Bearing	1
4	L5-4-45	Bearing	1
5	L5-4-39A	Handwheel } Supplied Integral	1
6	1507018	Handle }	1
7	L5-4-15B	Rack Pinion (For Standard Lathe)	1
	L5-4-15C	Rack Pinion (For Profiling Lathe)	1
8	L5-4-4	Bearing	1
9	L5-4-33	Rack Pinion Wheel	1
10	L5-4-37	Sliding Wheel Shaft	1
11	L5-4-35	Sliding Knob	1
12	SG 289	Spring	1
13	SB 3	$\frac{1}{4}$" dia. Steel Ball	1
14	L5-583A	Sliding Intermediate Gear	1
15	L5-576A	Sliding Intermediate Pinion	1
16	L5-4-41	Bush	1
17	25	Instruction Plate	1
18	L5-4-38	Worm Wheel Shaft	1
19	L5-4-7	Bearing	1
20	L5-88	Worm Wheel	1
21	L5-565	Broad Pinion	1
22	L5-4-9A	Worm Box	1
23	L5-4-10	Clip	1
24	L5-4-18	Lever	1
25	11007012	Hand Knob	1
26	L5-4-11	Pin	1
27	L5-564	Clip Bar	1
28	L5-4-40	Worm Stud	1
29	L5-567	Worm and Pinion	1
30	L5-87	Bush	1
31	L5-86A	Worm Box Bush Small	1
32	L5-86	Worm Box Bush Large	1
33	L5-566	28T Pinion	1
34	L5-699	Key	1

Item No.	Part No.	Description	No. Off
		Apron (contd.)	
35	L5-4-36	Shaft for Nut Box	1
36	L5-4-8	Bearing	1
37	L5-4-17A	Boss for Lever } Supplied Integral	1
38	L5-4-16	Lever }	1
39	11007012	Hand Knob	1
40	L5-4-34	Interlocking Quadrant	1
41	L5-4-19	Top Half Nut Slide (L5-4-19A Metric)	1
42	L5-538	Long Pin	1
43	L5-4-20	Bottom Half Nut Slide (L5-4-20A Met.)	1
44	L5-539	Short Pin	1
45	L5-4-21	Indicator Bracket (L5-4-21A Metric)	1
46	SS $\frac{1}{4}$" × 2"	Shoulder Screw	1
47	SG 5	Spring	1
48	SB 3	$\frac{1}{4}$" dia. Steel Ball	1
49	L5-4-13	Dial (L5-4-13A Metric)	1
50	L5-90	Indicator Pinion (L5-90A Metric)	1
51	L5-4-32	Nut Slide Plate	1
52	L5-4-31	Bearing Pad	2
52A	$\frac{5}{16}$" WS	Double Coil Spring Washer	2
53	L6-4-58	Tray	1
54	L6-4-60	Oil Reservoir	1
54A	378	Thread Indicator Chart (326 Metric)	1
		CARRIAGE AND SLIDES	
55	L6-5-1B	Carriage	1
56	L5-34B	R.H. Front Strip	1
57	L5-5-95	L.H. Front Strip	1
58	L6-5-73	Adjusting Screw	1
59	L5-5-94	Locking Piece	1
60	L5-5-91	Rear Saddle Support Strip	1
61	L5-5-92	Rear Saddle Strip	1
62	L16-5-9	Front Wiper Cover	2
63	L16-5-13	Front Wiper	2
64	L16-5-12	Felt Wiper	2
65	L5-5-17	Rear Wiper Cover	2

APRON, SADDLE and SLIDES



APRON, CARRIAGE AND SLIDES

Item No.	Part No.	Description	No. Off
		Carriage and Slides (contd.)	
66	L5-5-8	Rear Wiper	2
67	L5-5-10	Felt Wiper	2
68	L6-5-10	Stud	1
69	L5-696	Pinion	1
70	L5-698	Collar	1
71	L6-5-81	Stop Button	2
72	L5-25	Cross Slide	1
73	L5-33	Strip	1
74	L5-16-39	Adjusting Screw	1
75	L6-5-9	Screw (L6-5-12 Metric) (L6-5-79 Single Start) ...	1
76	L5-93	Nut (L5-808 Metric) (L5-5-100 Single Start) ...	1
77	L5-5-61	Swarf Shield	1
78	SKF 51102	Thrust Race	2
79	L6-5-8	Fixed Collar (L6-5-80 Single Start) ...	1
80	L5-5-42	Micrometer Collar (L5-5-45 Metric)	1
81	L5-5-43A	Bush	1
82	L5-5-15	Die	2
83	SG 5	Spring	2
84	L5-31B	Handwheel } Supplied Integral ...	1
85	L5-5-60	Handle }	1
86	L5-345	Front Cover Plate	1
87	L6-5-11	Cover, Cross Slide Ways	1
88	L6-5-84	Swivel Slide	1
89	L5-572B	Swivel Plate	1
90	L16-5-27A	Studs	2
91	L5-91	Strip	1
92	L5-5-22A/N	Compound Slide	1
93	L16-5-30	Tee Piece	1
94	L5-5-47B	Screw (L5-5-49B Metric)	1
95	L5-92	Nut (L5-811 Metric)...	1
95A	SB 3	Steel Ball ¼" dia.	1
96	SKF 51101	Thrust Race	2
97	L5-5-40C	Fixed Collar	1

Item No.	Part No.	Description	No. Off
		Carriage and Slides (cont.)	
98	L5-5-39	Graduated Collar (L5-5-44 Metric)	1
99	L5-5-55A	Bush	1
100	L5-5-15	Die	2
101	SG 290	Spring	2
102	L5-5-57A	Ball Handle } Supplied Integral ...	1
103	L5-570	Handle }	1
104	L16-5-28	Tool Post	1
105	⅜" FZ 1¾"	Square Head Set Screws, ½ Dog Point	2
106	L16-5-29	Stud	1
107	WR 7	Wrench	1
108	L6-5-89	Plunger	1
109	L6-5-90	Knob	1
110	PAO 250	"O" Ring	1
111	SG 327	Spring	1
112	L6-5-38A	Non Return Valve Complete ...	1
113	PAO 250	"O" Ring	1
114	L6-5-91	Cover	1
115	11005085	Non Return Valve Complete ...	1
116	7573/5	Meter Unit, Complete	1
117	L6-5-95	Straight Connector	1
118	11003132	Filler Plug	1
		FOUR-WAY TOOLPOST (Additional Equipment)	
119	L16-10-80	Square Turret	1
120	L16-10-90A	Pivot Ring	1
121	L16-10-156	Spacer	1
122	L16-10-93	Rocker Piece	4
123	L16-10-83	Sleeve	1
124	L16-10-94	Rod, Plunger	1
125	L16-10-85	Plunger	1
126	L16-10-84	Bush, Turret	4
127	L16-10-86	Bush, Tee Piece	1
128	SG 250	Spring	1

APRON, CARRIAGE AND SLIDES

Item No.	Part No.	Description	No. Off
		FOUR-WAY TOOLPOST (Additional Equipment) (contd.)	
129	L16-10-81	Tee Piece	1
130	L16-10-82	Stud, Centre	1
131	L16-10-143	Lock Nut	2
132	L16-10-91	Setting Bush	1
133	L16-10-128A	Tightening, Boss	1
134	SG 251	Spring	1
135	L16-10-130	Plunger, Boss	1
136	L16-10-95	Lever, Boss	1
137	BB 5	Bakelite Ball, 1¼" dia.	1
138	L16-10-98	Dust Ring	1
139	L16-10-138	Box Key	1
140	5/16" FZ 1½"	Square Head Set Screws, ½ Dog Point	12
141	L16-10-129	Bush	1
142	L16-10-135	Extractor Screw	1
		AMERICAN TOOLPOST (Additional Equipment)	
143	L5-5-25	American Toolpost	1
144	L5-5-24	Toolplate	1
145	L5-5-23	Ring	1
146	L5-5-26	Clamp Plate	1
147	½" FZ 2½"	Square Head Set Screw	1
148	WR 10	Wrench	1
		ALTERNATIVE COMPOUND SLIDE (Additional Equipment)	
149	L6-5-2/N	Compound Slide	1
150	L6-5-6A	Screw	1
151	L6-5-7	Nut	1
152	L6-5-3B	Bearing Housing	1
153	L6-5-5	16T Gear	2
154	SKF 51101	Thrust Race	2

Item No.	Part No.	Description	No. Off
155	L6-5-4B	Shaft, Top Slide Handle	1
156	½" Dia.	External Circlip	1
157	L5-5-39	Graduated Collar	1
158	L5-5-15	Die	2
159	SG 290	Spring	2
160	L5-5-55	Spacer	1
161	L5-5-57A	Ball Handle	1
162	L5-570	Handle	1
		EXTENDED CROSS SLIDE (Additional Equipment) *(Not Illustrated)*	
	L5-5-76	Extended Cross Slide	1
	L5-16-37	Cross Slide Strip	1
	L6-5-96	Rear Tool Post	1
	L5-5-69	Locking Nut	1
	L6-5-97	Stud, Rear Toolpost	1
		LEADSCREW, FEED SHAFT, THIRD SHAFT, RACK AND BRACKET ASSEMBLY	
163	L6-6-14	Screw and Shaft Bracket	1
164	L6-6-5	Leadscrew 24" Centres (L6-6-5A Metric)	1
	L16-6-1	Leadscrew 40" Centres (L16-6-1A Metric)	1
165	L5-10-259	Body, Torque Limiter	1
166	SB 3	Steel Ball ¼" dia.	2
167	L5-10-234B	Sleeve	1
168	39·6 × 25·5 × ·5 mm.	Disc Springs	15
169	L5-10-258B	Adjusting Nut	1
170	L5-10-242	Spacer	1
171	L5-10-281	Plate	1
172	SK 24	Key	1

APRON, CARRIAGE AND SLIDES

Item No.	Part No.	Description	No. Off
		LEADSCREW, FEED SHAFT, THIRD SHAFT, RACK AND BRACKET ASSEMBLY (contd.)	
173	SG 331	Spring Ring	1
174	L16-6-3	Cover, Thrust Bearing	2
175	SKF 51104	Thrust Bearing	2
176	L5-540	Nut	2
177	L6-6-2	Feed Shaft 24" Centres	1
	L16-6-2	Feed Shaft 40" Centres	1
177A	L5-645	Collar	1
178	L6-6-3 & 3A	Rack 24" Centres	1
	L6-6-4 & 4A	Rack 40" Centres	1
	L16-6-6	Rack 40" Centres	1
	L6-6-3B & 3C	Rack 24" Centres (Copying Lathes Only)	1
	L6-6-4B & 4C	Rack 40" Centres (Copying Lathes Only)	1
	L16-6-6A	Rack 40" Centres (Copying Lathes Only)	1
179	L6-6-31	Third Shaft 24" Centres	1
	L6-6-30	Third Shaft 40" Centres	1
180	L6-6-16	Support Plate	1
181	11006024	Boss Clutch Lever	1
182	1510027	Clutch Lever	1
183	11007019	Hand Knob	1
184	11006023	Collar	1
185	L6-6-34	Boss, Clutch Lever	1
186	11006021	Handle (11006021A with 2 speed reverse switch)	1
187	11007019	Hand Knob	1
188	SG 5	Spring	1
189	SB 3	Steel Ball ¼" dia.	1
190	L6-6-15	Bevel Housing	1
191	L6-6-29	Bearing Cover, Front	1
192	1⅝" O.D × 1⅛" ID × ·005"	Shim	2
193	XXLJ 20	Deep Groove Ball Journal	2
194	L6-6-27	Bevel Gears	2

Item No.	Part No.	Description	No. Off
195	L6-6-28	Bearing Cover, Rear	1
196	1⅝" OD × 1⅛" ID × ·010"	Shim	1
197	L6-6-32	Cover Plate	1
198	L6-6-26	Shaft	1
199	L6-6-17	Bearing Plate, Rear	1
200	L6-6-21	Link	1
201	L6-6-20	Stud	1
202	L6-6-22	Draw Bar	1

PROFILING EQUIPMENT *ILLUSTRATED ON PAGE 44*

Item No.	Part No.	Description	No. Off
		PROFILING EQUIPMENT	
1	L5-16-1	Cross Slide	1
2	L5-16-37	Strip	1
3	L5-16-39	Adjusting Screw	1
4	L16-13-4	Hydraulic Slide	1
5	L5-16-38	Strip	1
6	L5-16-39	Adjusting Screw	1
7	L16-13-5	Strip, Top Slide	1
8	H 4146	Hydraulic Nipple, $\frac{1}{4}$" Whit. ...	1
9	L6-13-1	Top Slide	1
10	L5-5-47B	Top Slide Screw (L5-5-49B Metric)	1
11	L5-92	Nut (L5-811 Metric)...	1
12	L5-5-40C	Fixed Collar	1
13	SKF 51101	Thrust Race	2
14	L5-5-39	Graduated Collar (L5-5-44 Metric)	1
15	L5-5-55A	Bush	1
16	SG 290	Spring...	2
17	L5-5-15	Die	2
18	L5-5-57A	Ball Handle	1
19	L5-570	Handle	1
20	L6-13-67	Tool Holder	1
21	$\frac{3}{8}$" FZ $1\frac{3}{4}$"	Square Head Set Screws	2
22	L6-13-68	Pivot Stud	1
23	L5-16-20	Connecting End, Piston Rod	1
24	L5-16-23	Pin	1
25	L5-16-3	Cylinder	1
26	L5-16-5	End Cover, R.H.	1
27	L5-16-6	End Cover, L.H.	1
28	SP 255	"U" Leather, $1\frac{3}{16}$" o./dia. × $\frac{5}{16}$" B.	1
29	L5-16-22	Piston Rod	1
30	L5-16-21	Piston	1
31	P-2667B	Piston Rings	2
32	L5-16-123	Gasket	1
33	L5-16/D	Valve Block (Complete)	1
34	1513004	Boss, Control Lever	1
35	1513005	Control Lever	1
36	11007019	Hand Knob	1

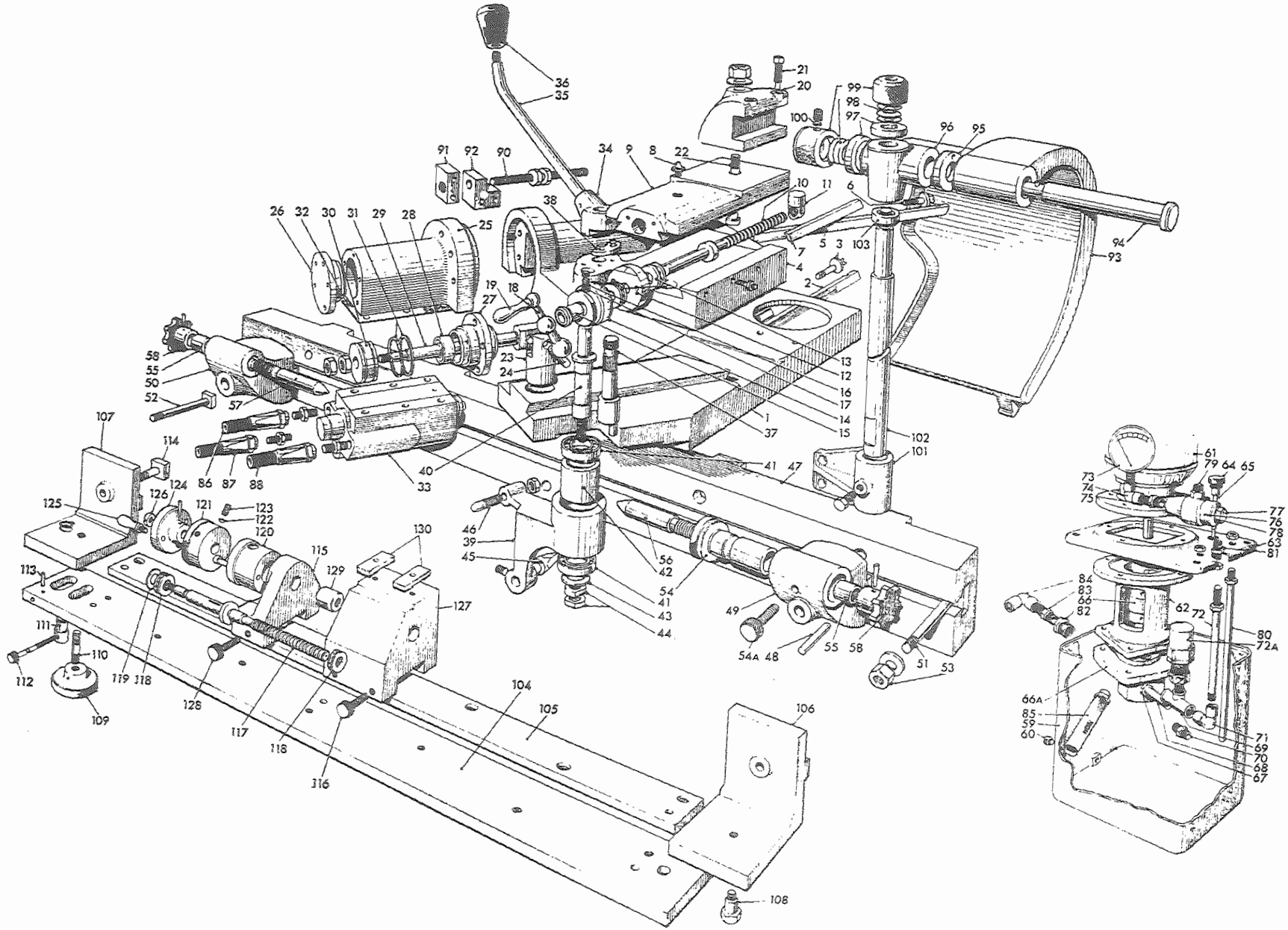
Item No.	Part No.	Description	No. Off
		Profiling Equipment (contd.)	
37	L5-16-9	Eccentric Stud	1
38	L5-16-24	Stop Piece	1
39	L5-16-51	Pivot Arm, Stylus	1
40	L5-16-54	Swivel Stud	1
41	A6075/A6157	Timken Taper Roller Bearings ...	2
42	L5-16-55	Spacer	1
43	L5-16-56	Washer	1
44	L5-16-57	Lock Nut	2
45	L5-16-12	Stylus	1
46	L5-16-11	Contact Pin	1
47	L5-16-91	Support Block (24" Centres)	1
	L5-16-92	Support Block (40" Centres)	1
48	L5-16-122	Dowels	2
49	L5-16-78	Head, R.H., Master Holder	1
50	L5-16-79	Head, L.H., Master Holder	1
51	L5-16-75	Locking Stud	1
52	L5-16-76	Locking Stud	1
53	L5-5-69	Locking Nut	2
54	L5-16-67	Eccentric Bush	1
54A	L5-16-148	Locking Screw	1
55	L5-16-70	Nut	2
56	L5-16-68	Centre, R.H.	1
57	L5-16-17	Centre, L.H.	1
58	SP 110	Handwheel	2
59	L5-16-40	Oil Container	1
60		Plug, $\frac{1}{4}$" B.S.P.	1
61	T10	"Brook" "Gryphon", Totally Enclosed Motor, Flange Fitting, $\frac{1}{2}$ H.P., 1,000 R.P.M.	1
62	L5-16-50A	Adaptor	1
63	L5-16-52	Cover, Oil Container	1
64	L5-16-65	Plug, Dipstick } Supplied Integral ...	1
65	L5-16-66	Dipstick }	1
66	70/CAX	Flexible Coupling, $\frac{5}{8}$" Bore	1
66A	L5-16/A	Hydraulic Pump Complete	1
67	L16-13-89	Reducing Bush, $\frac{1}{2}$" to $\frac{3}{8}$" B.S.P. ...	1

PROFILING EQUIPMENT *ILLUSTRATED ON PAGE 44*

Item No.	Part No.	Description	No. Off
		Profiling Equipment (contd.)	
68	L5-16-81	Oil Supply Pipe	1
69	L16-13-87	Tee Piece, ⅜" B.S.P.	1
70	L16-13-90	Hexagonal Nipple, ⅜" B.S.P. ...	1
71	L16-13-88	Elbow, ⅜" B.S.P.	1
72	L5-16-59	Oil Supply Pipe	1
72A	L5-16/B	Relief Valve Complete	1
73		3" Dia. Pressure Gauge	1
74	L16-13-88	Elbow, ⅜" B.S.P.	1
75	L16-13-90	Hexagonal Nipple, ⅜" B.S.P. ...	1
76	L5-16-140	Housing, Magnetic Plug	1
77	7734/05	Magnetic Filter Plug	1
78	SP 41	Fibre Washer	1
79	L16-13-90	Hexagonal Nipple, ⅜" B.S.P. ...	3
80	L5-16-58	Oil Return Pipe	1
81		⅜" B.S.P. Female Coupling	1
82	L16-13-89	Reducing Bush, ½" to ⅜" B.S.P. ...	1
83	L16-13-90	Hexagonal Nipple, ⅜" B.S.P. ...	1
84	L16-13-88	Elbow, ⅜" B.S.P.	1
85	SP 148	Gauze Filter	1
*86	SK106122 48"	⅜" bore, High Pressure Nylon Hose } For	1
‡87	SK106123 49"	" " " " " " } 24"	1
§88	SK106124 51"	" " " " " " } cts.	1
*86	SK106104 66"	" " " " " " } For	1
§87	SK106105 67"	" " " " " " } 40"	1
‡88	SK106106 68"	" " " " " " } cts.	1
		Retraction Stop (Extra Equipment)	
90	L5-16-110	Screw	1
91	L5-16-111	End Support	1
92	L5-16-112	Stop Piece	1
		Splash Guard (Extra Equipment)	
93	L16-13-77	Splash Guard	1
94	L16-13-79	Hinge Pin	1
95	L16-13-83	Washer	1

Item No.	Part No.	Description	No. Off
96	L16-13-78	Hinge Boss	1
97	L16-13-81	Washer	2
98	Z10	Disc Springs	6
99	L16-13-80	Clamp Nut	2
100	L5-5-15	Die Piece	2
101	L16-13-85	Support Bracket	1
102	L16-13-84	Support Pillar	1
103	L16-13-82	Swivel Washer	1
		Flat Template Holder (Extra Equipment)	
104	L5-16-164	Bottom Rail	1
105	L5-16-166	Top Rail	1
106	L5-16-168	Angle Bracket, Right Hand ...	1
107	L5-16-169	Angle Bracket, Left Hand	1
108	L5-16-187	Pivot Screw	1
109	L5-16-182	Locking Screw	1
110	L5-16-184	Stud	1
111	L5-16-181	Alignment Pivot	1
112	L17-10-72	Alignment Screw	1
113	L5-16-185	Pin	1
114	L17-10-75	Tee Bolt	2
115	L5-16-171	Adjustable Bracket	1
116	L17-10-64	Thumb Screw	1
117	L5-16-179	Leadscrew (L5-16-179A Metric) ...	1
118	E1306	Thrust Race	2
119	Z8	Disc Spring	1
120	L5-16-172	Fixed Collar	1
121	L5-16-173	Micrometer Dial (L5-16-173A Metric)	1
122	L5-16-190	Slug	2
123	SG 309	Spring	2
124	L5-16-174	Handwheel	1
125	L17-10-82	Handle	2
126	L5-16-175	Lock Nut	1
127	L5-16-170	Template Holder	1
128	L17-10-64	Thumb Screw	2
129	L5-16-178A	Leadscrew Nut (L5-16-178B Metric)	1
130	L17-10-65	Locking Plate	2

PROFILING EQUIPMENT



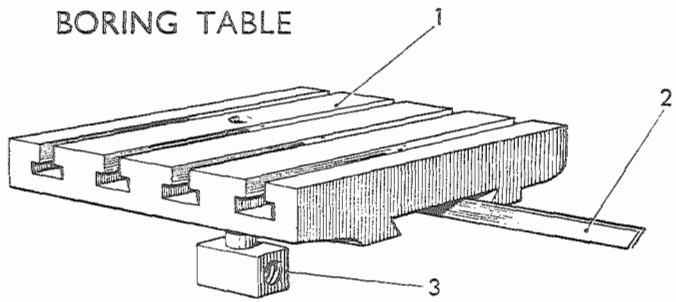
MISCELLANEOUS ACCESSORIES *ILLUSTRATED ON PAGE 46*

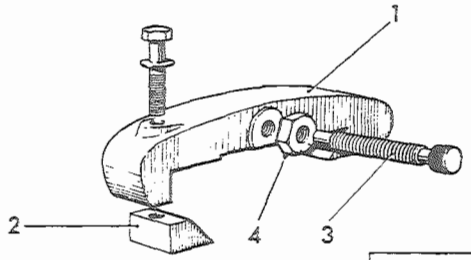
Item No.	Part No.	Description	No. Off
		STATIONARY STEADY	
1	L6-9-18	Base, Stationary Steady	1
2	L5-10-49	Top, Stationary Steady	1
3	L5-521	Swivel Stud	1
4	L5-95	Clip	1
5	L5-640	Swivel Pin	1
6	L5-10-50	Pin	3
7	L5-522	Nut	3
8	$\frac{5}{16}$" FY 2$\frac{1}{2}$"	Socket Head Cap Screws (screwed to head)	3
9	L6-9-2	Holding Down Plate	1
10	$\frac{1}{2}$" BC 3$\frac{1}{2}$"	Square, Square Head Bolt	1
		TRAVELLING STEADY	
1	L6-9-17	Travelling Steady	1
2	L5-522	Nut	2
3	L5-69	Pin	2
4	$\frac{5}{16}$" FY 1$\frac{3}{4}$"	Socket Head Cap Screws (screwed to head)	2
		DRIVER AND FACE PLATES (L.O.O. TAPER SPINDLE NOSE)	
1	L5-9-5	Driver Plate	1
2	L5-531	Pin	1
3	L5-9-8	Balance Peg	1
4	L5-9-7	9" dia. Face Plate	1
5	L6-10-37	18" dia. Face Plate	1

Item No.	Part No.	Description	No. Off
		MICROMETER CARRIAGE STOP	
1	L16-10-3B	Body (L16-10-3C Metric)	1
2	L5-10-33	Micrometer Screw (L5-10-59 Metric)	1
3	L5-10-32	Micrometer Collar (L5-10-60A Metric)	1
4	L5-10-35	Die Piece	1
5	L5-10-36	Knurled Screw	1
6	L5-10-34	Clamp Plate	1
		CROSS SLIDE STOP	
1	L5-10-37	Body	1
2	L5-10-38	Clamping Strip	1
3	L5-10-39	Stop Screw	1
4	L5-10-146	Lock Nut	1
		BORING TABLE	
1	L5-247	Boring Table	1
2	L5-260	Strip	1
3	L5-93	Nut (L5-808 Metric) (L5-5-100 Single Start)	1

MISCELLANEOUS ACCESSORIES

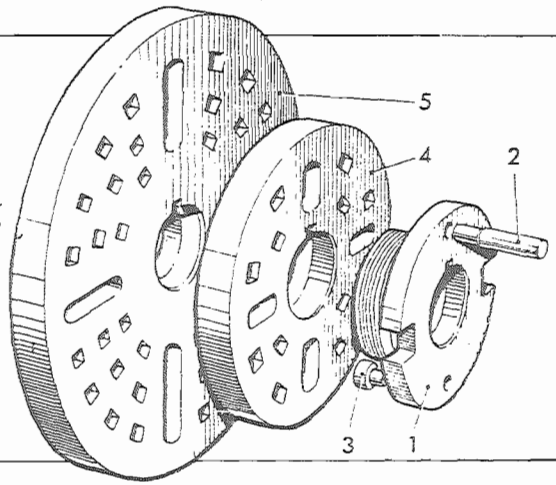
BORING TABLE

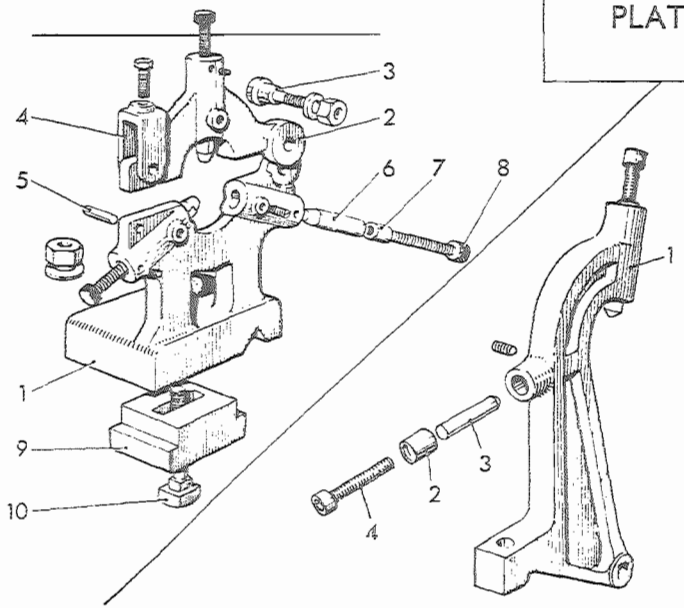




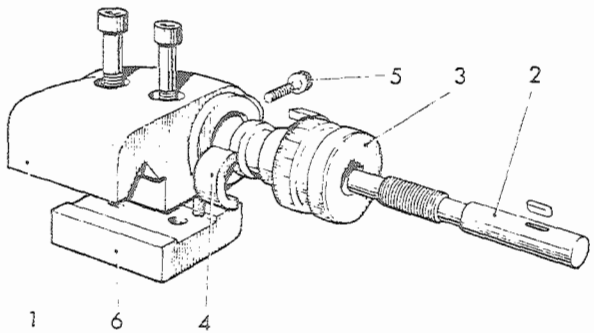
CROSS-SLIDE STOP

DRIVER, FACE AND CHUCK BACK PLATES





STEADIES



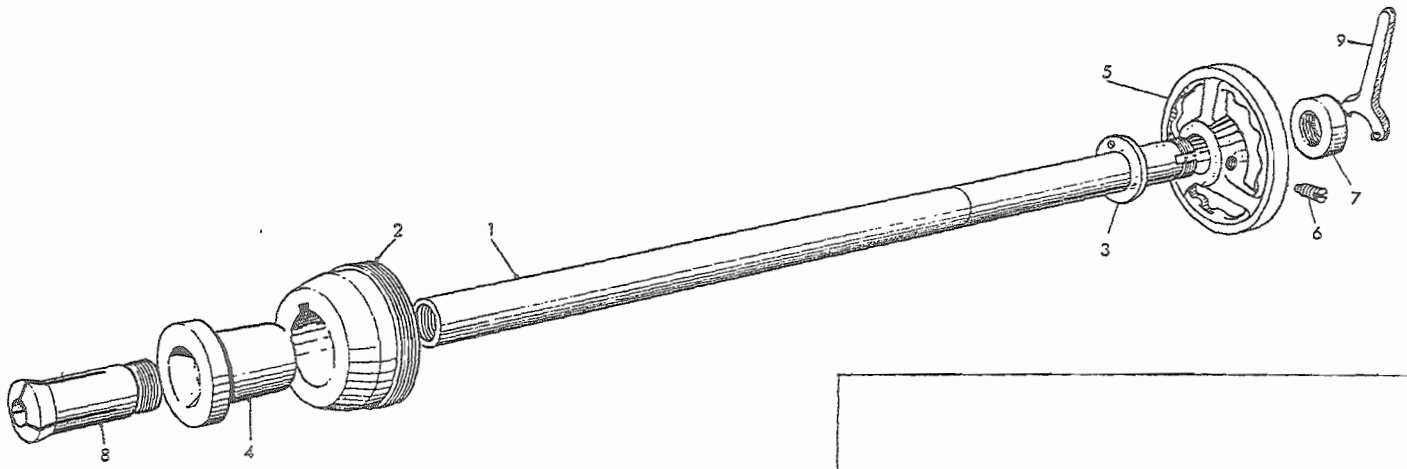
MICROMETER CARRIAGE STOP

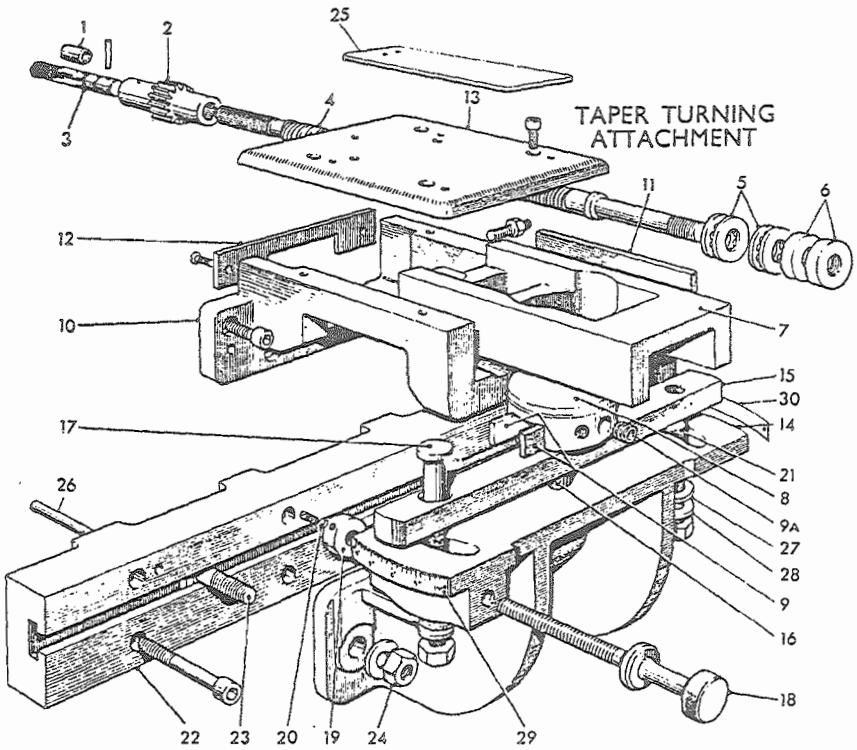
MISCELLANEOUS ACCESSORIES *ILLUSTRATED ON PAGE 48*

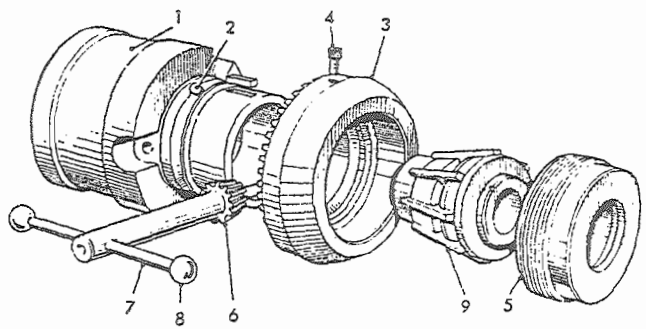
Item No.	Part No.	Description	No. Off
		COLLET ATTACHMENT (DRAW TUBE TYPE)	
1	L5-10-245	Draw Tube	1
2	L5-10-153	Spindle Nose Cover	
3	L5-10-248	Thrust Washer	1
4	L5-10-154	Closer Bush	1
5	L5-10-240A	Handwheel	1
6	L5-10-270	Key	2
7	L5-10-249	Nut	1
8	L5-10-172	Collets	As requ'd
9	WR 24	Wrench	1
		MULTISIZE COLLET ATTACHMENT	
1	L6-10-124	Body	1
2	SB-3	$\frac{1}{4}$" dia. Steel Balls	29
3	L6-10-125	Closer Sleeve...	1
4	L6-10-126	Stop Screw	1
5	L6-10-127	Cap	1
6	L6-10-128	Key	1
7	L6-10-129	Tommy Bar	1
8		Bakelite Ball	2
9	L6-10-130A	Multisize Collet (MC3) $\frac{1}{8}$" to $\frac{1}{4}$" (3·2 to 6·4 mm.) ...	1
	L6-10-130B	Multisize Collet (MC4) $\frac{1}{4}$" to $\frac{3}{8}$" (6·4 to 9·5 mm.) ...	1
	L6-10-130C	Multisize Collet (MC5) $\frac{3}{8}$" to $\frac{1}{2}$" (9·5 to 12·7 mm.) ...	1
	L6-10-130D	Multisize Collet (MC6) $\frac{1}{2}$" to $\frac{5}{8}$" (12·7 to 15·9 mm.) ...	1
	L6-10-130E	Multisize Collet (MC7) $\frac{5}{8}$" to $\frac{3}{4}$" (15·9 to 19·0 mm.) ...	1

Item No.	Part No.	Description	No. Off
		Multisize Collet Attachment (contd.)	
9	L6-10-130F	Multisize Collet (MC8) $\frac{3}{4}$" to $\frac{7}{8}$" (19·0 to 22·2 mm.) ...	1
	L6-10-130G	Multisize Collet (MC9) $\frac{7}{8}$" to 1" (22·2 to 25·4 mm.) ...	1
	L6-10-130H	Multisize Collet (MC10) 1" to $1\frac{1}{8}$" (25·4 to 28·6 mm.) ..	1
	L6-10-130J	Multisize Collet (MC11) $1\frac{1}{8}$" to $1\frac{1}{4}$" (28·6 to 31·8 mm.) ...	1
	L6-10-130K	Multisize Collet (MC12) $1\frac{1}{4}$" to $1\frac{3}{8}$" (31·8 to 35·0 mm.) ...	1
	L6-10-130L	Multisize Collet (MC13) $1\frac{3}{8}$" to $1\frac{1}{2}$" (35·0 to 38·1 mm.) ..	1

MISCELLANEOUS ACCESSORIES







FOR LOO & DI-5" SPINDLES

MISCELLANEOUS ACCESSORIES

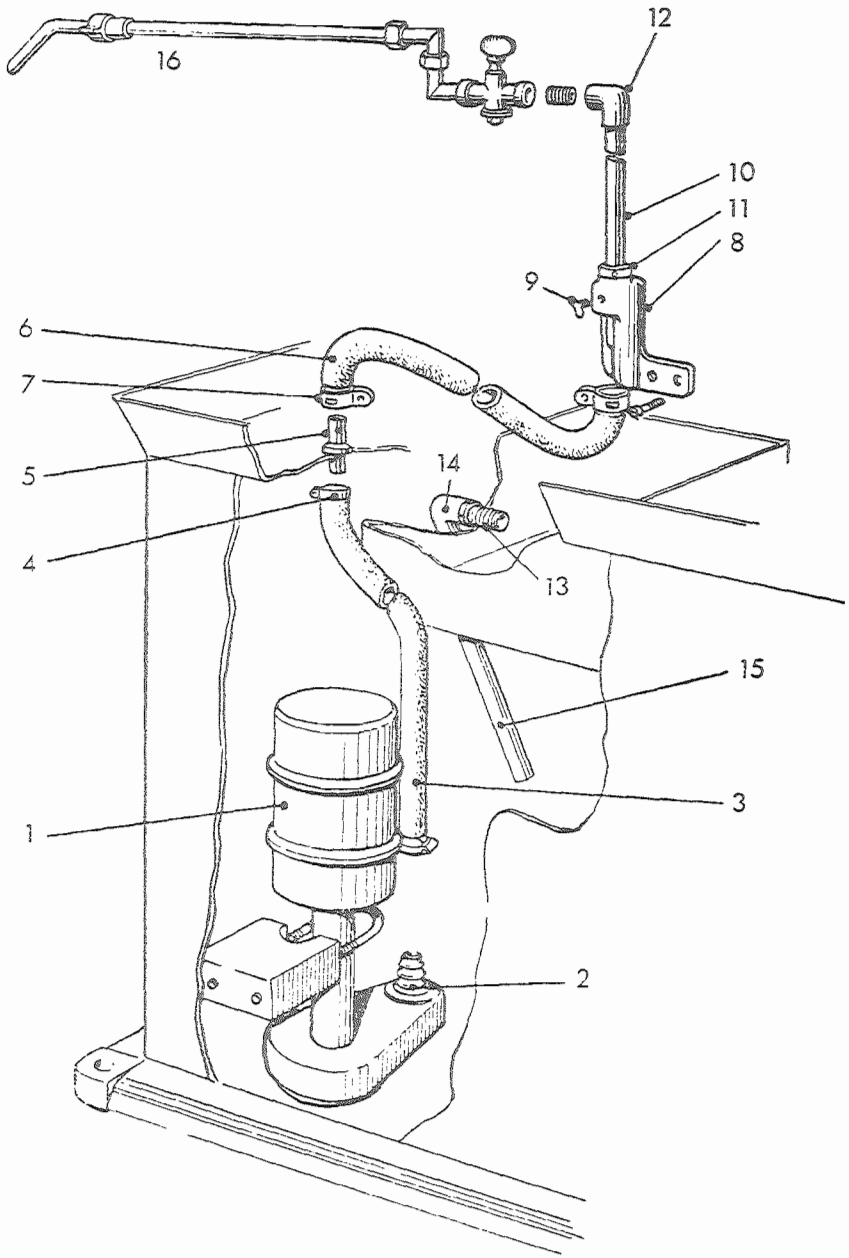
Item No.	Part No.	Description	No. Off
		TAPER TURNING ATTACHMENT	
1	L16-12-4	Bush	1
2	L6-12-3	Pinion } Supplied Integral	1
3	L6-12-4	Shaft }	
4	L6-12-1	Cross Slide Screw (L6-12-2 Metric) (L6-12-37 Single Start)	1
5	SKF 51101	Thrust Bearing	2
6	PT/F146/11/201	Locknut $\frac{7}{16}$" BSF	1
7	L5-14-10B	Slide Block	1
8	L5-14-40A	Top Slide	1
9	L5-14-20	Strip	2
9A	SG 119	Spring	2
10	L5-14-12B	Support Bracket, Slide Block	1
11	L5-14-21	Strip	1
12	L5-14-18B	Cover, Strip	1
13	L16-12-12A	Cover Plate	1
14	L5-14-14	Support Bracket, Swivel Slide ...	1
	L5-14-14A	Support Bracket, Swivel Slide (Metric)	1
15	L5-14-41A	Swivel Slide	1
16	L5-14-36A	Swivel Pin	1
17	L5-14-25	Stud, Taper Setting	1
18	L5-14-24	Screw	1
19	L5-14-26	Collar	1
20	L5-14-32	Die Piece	1
21	L5-14-37	Locking Stud	1
22	L5-16-84	Block (24" Centres)	1
	L5-16-85	Block (40" Centres)	1
23	L5-822	Bolt	2
24	L5-5-69	Locking Nuts	2
25	L6-12-5A	Rear Cover Plate (Cross Slide Screw)	1
26	L5-16-122	Dowels	2
27	L5-14-38	Spherical Washer, Male	1

Item No.	Part No.	Description	No. Off
28	L5-14-39	Spherical Washer, Female	1
29	460	Index Plate (Degrees)	1
30	461	Index Plate (Inches per foot)	1
	462	Index Plate (mm. per m.)	1
	L6-12-29	Saddle Cover } Not illus. Special ...	1
	L5-14-35	Stud }	

MISCELLANEOUS ACCESSORIES

SUDS PUMP

Item No.	Part No.	Description	No. Off
		ELECTRIC PUMP and FITTINGS	
1	AQ3/2	Electric Suds Pump with Clamp Fixing (with thermal overload for U.S.A.)	1
2	⅜" BSP	Nozzle	1
3		Plastic Hose ⅝" bore × 18" long ...	1
4	OX	Pipe Clip	2
5	L16-11-1	Connecting Pipe	1
6		Plastic Hose ½" bore × 4' 6" long (24" Centres)	1
		Plastic Hose ½" bore × 5' 6" long (40" Centres)	1
7	G14-95	Pipe Clip	2
8	L5-12-13	Bracket for stand pipe	1
9	L5-12-8A	Thumb Screw	1
10	L5-12-6	Stand Pipe	1
11	L5-12-7	Collar	1
12	G14-98	¼" Gas Elbow	1
13		⅜" Gas Hexagonal Nipple	1
14		⅜" Gas Elbow	1
15	L5-16-58	Return Pipe	1
16	LP 198	Coolant Fitting, complete with Universal Swivel and Tap	1
	L5-12-37	Bracket	1
	L5-16-82	Support Arm } Supplied } For Profile	1
	L5-16-108	Boss } Integral } Lathes only	
	L5-12-17	Connecting Pipe (For Taper Turning and Profile Lathes only)	1



MISCELLANEOUS ACCESSORIES *NOT ILLUSTRATED*

Part No.	Description	No. Off
	CHANGE WHEELS	
	With Standard Gearbox and 4 T.P.I. Leadscrew	
	Additional Wheels for Cutting Metric Threads	
L5-51KK	Change Wheel, 48T	1
L5-51K	Change Wheel, 60T	1
L5-51V	Change Wheel, 63T	1
L5-51A	Change Wheel, 127T	1
	Additional Wheels for Cutting 11½ T.P.I. and 27 T.P.I.	
L5-51Q	Change Wheel, 40T (27 T.P.I.)...	1
L5-51U	Change Wheel, 115T (11·5 T.P.I.)	1
L5-51K	Change Wheel, 60T (11·5 T.P.I.)	1
	Additional Wheels for Cutting Module	
L5-51Q	Change Wheel, 40T	1
L5-51CCC	Change Wheel, 42T	1
L5-51H	Change Wheel, 66T	1
L5-51AAA	Change Wheel, 75T	1
L5-51A	Change Wheel, 127T	1
	Additional Wheels for Cutting D.P.	
L5-51M	Change Wheel, 55T	1
L5-51G	Change Wheel, 70T	1
	CHANGE WHEELS	
	Metric Gearbox with 6 mm. Leadscrew	
	Additional Wheels for Cutting English	
L5-51K	Change Wheel, 60T	1
L5-51A	Change Wheel, 127T	1
	Additional Wheels for Cutting Module	
L5-51M	Change Wheel, 55T	1
L5-51NNN	Change Wheel, 56T	1

Part No.	Description	No. Off
	Additional Wheels for Cutting D.P.	
L5-51M	Change Wheel, 51T	1
L5-51G	Change Wheel, 70T	1
L5-51A	Change Wheel, 127T	1
	MILLING AND GEARCUTTING ATTACHMENT (Common Parts)	
L5-140	Angle Bracket	1
L5-165	Nipping Stud	1
L5-141	Swivel Slide	1
L5-155	Nut (L5-892 Metric)	1
L5-143	Vertical Slide	1
L5-150	Strip	1
L5-162A	Screw (L5-893A Metric)	1
L5-144	End Plate	1
L5-5-39	Micrometer Collar (L5-5-44 Metric) ...	1
L5-351A	Locking Bush	1
L5-14-32	Die	1
SG 290	Spring	2
L5-5-15	Die	2
L5-5-57A	Ball Handle	1
L5-570	Handle	1
L5-5-30	Tee Piece	1
L5-10-266	Stud	1
	GEAR CUTTING ATTACHMENT ONLY	
L5-146	Bracket for Arm	1
L5-164	Nipping Stud	3
L5-167	Support Bar	1
L5-147	Supporting Arm	1
L5-156	Bush	1
L5-159	Centre	1
L5-145	Spindle Bracket	1
L5-160	Spindle	1
L5-142	Worm Bracket	1
L5-151	Worm Wheel	1
L5-161	Nut	1
L5-10-220	Worm	1
L5-662A	Lock Nuts	2
L5-148A & B	Index Plate	1 off each
L5-10-221	Index Arm	1
L5-10-222	Plunger	1
L5-10-215	Plunger Knob	1

MISCELLANEOUS ACCESSORIES *NOT ILLUSTRATED*

Part No.	Description	No. Off
	Gear Cutting Attachment (contd.)	
SG 119	Spring	1
L5-10-214A	Index Finger	1
L5-10-214B	Index Finger	1
L5-229	Clamp Plate	1
SG 252	Retaining Clip	1
L5-10-211	Bush	1
L5-10-213	Locknut	1
L5-170	Cutter Arbor	1
L5-173	Short Spacer	2
L5-172	Long Spacer	1
L5-174	Driver Pin	1
L5-179	Nut	1
L5-169	Work Arbor	1
L5-175	Washer	1
L5-171	Draw Screw	1
	4 POSITION CARRIAGE STOP	
L16-10-124A	Body	1
L5-10-120	Bush	1
L5-10-121	End Plate	1
L5-10-122	Stop Screw	4
L5-10-143	Die Piece	4
SG 5	Spring	1
SB 3	Steel Ball, $\frac{1}{4}$" dia.	1
L16-10-125	Clamp	1
	HIGH SPEED STEEL TURNING TOOLS	
L6-10-45	R.H. Knife Tool, No. 7	1
L6-10-46	L.H. Knife Tool, No. 8	1
L6-10-47	Square Nose Tool, No. 11	1
L6-10-48	External Screwcutting Tool, No. 13	1
L6-10-49	Cut Off Tool, No. 16	1
L6-10-50	Straight Round Nose Tool, No. 17	2
L6-10-51	R.H. Round Nose Tool, No. 19	1
L6-10-52	L.H. Round Nose Tool, No. 20	1
L6-10-53	Internal Screwcutting Tool, No. 50	1
L6-10-54	Internal Round Nose Tool, No. 50	1
L6-10-55	Internal Square Nose Tool, No. 50	1
	CENTRES, ETC.	
L5-10-185	Half Centre	1
L5-10-186	Square Centre	1
L5-10-193	2 Prong Centre	1
L5-10-192	3 Prong Centre	1

Part No.	Description	No. Off
	High Speed Steel Turning Tools (contd.)	
L5-10-191	4 Prong Centre	1
L5-10-170	Light Centre	1
L5-10-194	Screwed Centre	1
L5-10-190	Cup Centre	1
L5-10-189	Hollow Centre	1
L5-10-187	Flange Chuck	1
L5-10-188	Drill Pad	1
	DIVIDING ATTACHMENT	
L6-10-67	Bracket	1
L5-657	Worm	1
L6-10-79	Worm Shaft	1
L5-662A	Lock Nuts	2
L5-10-83	Index Plate	1
L5-10-221	Index Arm	1
SG 119	Spring	1
L5-10-211	Bush for Index Finger	1
L5-10-213	Lock Nut	1
L5-10-224A	Index Finger	1
L5-10-224B	Index Finger	1
L5-10-222	Plunger	1
L5-10-215	Plunger Knob	1
L5-138	Worm Wheel	1
L5-10-229	Clamp Plate	1
SG 252	Retaining Clip	1
	BORING BARS	
L5-646	$1\frac{3}{4}$" dia. Boring Bar	1
L5-647 A, B, C, D, E, F	$\frac{3}{8}$" Dia. Bits	6

BED and DRIVE *NOT ILLUSTRATED*

Part No.	Description	No. Off
	BED AND DRIVE	
L6-1-1A	Bed (40″ Centres)	1
L6-1-15A	Bed (24″ Centres)	1
L6-1-2	Gap Piece	1
L6-1-38	Gap Cover (not required for Gapless Bed)	1
L6-1-36A	Bed without Gap (40″ Centres)	1
L6-1-37A	Bed without Gap (24″ Centres)	1
L5-1-198	Cup Washer	6
L5-1-199	Sealing Washer	6
L5-1-200	Support Washer	6
L6-1-78	Cabinet Base (40″ Centres)	1
L6-1-77	Cabinet Base (24″ Centres)	1
L5-1-138	Door (L5-1-138B for USA)	1
L5-1-181	Boss for Hinge Pin	4
L5-1-183	Hinge Pins	2
ZA	L & F Lock (T44/RE Lock for U.S.A.) ...	1
L16-1-31	Inspection Cover	1
L16-1-32	Louvre	1
L5-1-100	Motor Platform	1
L16-1-12	Hinge Pin	2
L16-1-10	Swivel Stud, Base	1
L16-1-9	Adjusting Screw	1
L16-1-11	Swivel Stud, Platform	1
L5-1-101	Slide Rails	2
L6-1-45	Washer Support	4
L6-1-50	Pad, Support	2
L6-1-47	Pad	2
L6-1-42	Washer (Rubber) Motor Mounting.. ...	4
L6-1-43	Pad (Rubber), Motor Mounting	4
L6-1-44	Pad (Rubber), Motor Mounting	4
1501016	Bracket, Motor Platform	1
L6-1-83	Drive Guard, Inner	1
L6-1-83A	Drive Guard Inner (Fitted with English-Metric Conversion Unit	1
L6-1-53	Jacking Screw	3
1501023	Stud	1
1501013	Angle	2
L6-1-84	Change Wheel Guard	1
1501008	Hinge	1
1501012	Knob	1
1501032	Catch Plate	1
L17-8-92	Spring Clip	1
L6-1-85	Rear Fairing	1
L16-3-12	Filler Plug...	1
	Hex. Nipple $\frac{3}{8}$″ B.S.P. .. .	1
	Elbow, $\frac{3}{8}$″ B.S.P.	1
	Plug, 1″ B.S.P.	1
	Control Panel	1
	Hinge	2
L5-1-42	Jacking Screw for Cabinet Base ..	4

ELECTRICAL EQUIPMENT

Part No.	Description	No. Off
	ALTERNATIVE DRIVE ASSEMBLIES 3 PHASE 50 CYCLES SUPPLY	
	For 56 — 1,250 r.p.m. Spindle Speeds	
C.184	Motor 3 h.p. 1,500 r.p.m. Drip Proof Continuous Rated	1
L6-1-12H	Motor Pulley	1
A.77	Vee Belts	2
D.100La	Motor 3 h.p. 1,500 r.p.m. T.E.F.C. Continuous Rated	1
L6-1-90	Motor Pulley	1
A.77	Vee Belts	2
	For 34 — 1,500 r.p.m. Spindle Speeds	
C.184	Motor 3/1½ h.p. 3,000/1,500 r.p.m. Drip Proof Continuous Rated	1
L6-1-12C	Motor Pulley	1
A.77	Vee Belts	2
	For 45 — 2,000 r.p.m. Spindle Speeds	
C.184	Motor 3/1½ h.p. 3,000/1,500 r.p.m. Drip Proof Continuous Rated	1
L6-1-11C	Motor Pulley	1
A.77	Vee Belts	2
	ALTERNATIVE DRIVE ASSEMBLIES 3 PHASE 60 CYCLES SUPPLY	
	For 56 — 1,250 r.p.m. Spindle Speeds	
K.182T	Motor 3 h.p. 1,800 r.p.m. Drip Proof ... Continuous Rated	1
L6-1-13D	Motor Pulley	1
A.77	Vee Belts	2

Part No.	Description	No. Off
	For 34 — 1,500 r.p.m. Spindle Speeds	
K.182T	Motor 3/1½ h.p. 3,600/1,800 r.p.m. Drip Proof Continuous Rated	1
L6-1-14C	Motor Pulley	1
A.77	Vee Belts	2
	For 45 — 2,000 r.p.m. Spindle Speeds	
K.182T	Motor 3/1½ h.p. 3,600/1,800 r.p.m. Drip Proof Continuous Rated	1
L6-1-13C	Motor Pulley	1
A.77	Vee Belts	2

ELECTRICAL EQUIPMENT

Part No.	Description	No. Off
	HYDRAULIC PUMP MOTORS	
T.8	½ h.p. 1,000 r.p.m. 3 phase 50 cycles, Totally Enclosed Fan Cooled, Continuous Rated, Flange Mounted	1
	American and Canadian Markets	
T.8	½ h.p. 1,200 r.p.m. 3 phase 60 cycles, Totally Enclosed Fan Cooled, Continuous Rated, Flange Mounted	1
	SUDS PUMP	
AQ3/2	Electro Suds Pump 3 phase 50 cycles	1
	American Market	
AQ3/2	Electro Suds Pump 3 phase 60 cycles with Thermal Overload	1
	Canadian Market	
AQ3 2 CSA	Electro Suds Pump, 3 phase 60 cycles ...	1
	CONTROL PANELS	
L5-1-115	Control Panel, Blank	1
L5-1-212	Control Panel, with Start, Stop Push Buttons	1
L5-1-212A	Control Panel, with Start, Stop Push Buttons and 1 Rotary Switch	1
L5-1-212B	Control Panel, with Start, Stop Push Buttons and 2 Rotary Switches	1
L5-1-212C	Control Panel, with Start, Stop Push Buttons and Lever Operated Reverse Switch ...	1
L5-1-212D	Control Panel, with Start, Stop Push Buttons, Lever Operated Reverse Switch and 1 Rotary Switch	1
L5-1-211	Contractor Mounting Plate	1
L5-1-210	Support Pillar	2
	Canadian Market	
MH1-1-8J	Control Panel with B.15 Starter	1
MH1-1-8K	Control Panel with B.15 Starter and 1 Rotary Switch	1
MH1-1-8L	Control Panel with B.15 Starter, 1 Rotary Switch and 1 Mini Start	1
MH1-1-8M	Control Panel with B.15 Starter and 1 Mini-Start	1
MH1-1-8N	Control Panel with B.15 Starter and 2 Mini-Starts	1
MH1-1-8P	Control Panel with B.15 Starter, 1 Rotary Switch and 2 Mini-Starts	1
MH1-1-8R	Control Panel with B.15 Starter and Lever Operated Reverse	1

Part No.	Description	No. Off
MH1-1-8S	Control Panel with B.15 Starter, Lever Operated Reverse and 1 Mini-Start ...	1
MH1-1-8T	Control Panel with B.15 Starter, Lever Operated Reverse and 2 Mini-Starts ...	1
	American Market	
L5-1-180B	Control Panel for Dial Type Switching Unit ...	1
L5-1-180C	Control Panel for Dial Type Switching Unit and Coolant	1
L5-1-180D	Control Panel for Dial Type Switching Unit and Coolant /Hydraulic	1
L5-1-88	Hanger for Control Panel (All Machines) ...	2
	MAIN MOTOR CONTROLS ALL MARKETS EXCEPT U.S.A. AND CANADA	
CT 10	"Danfoss" Starter Unit up to 10 amps. Full Load Current	1
Type DT	Push Button Operator Block, Black	1
Type PT	Push Button Operator Block, Red	1
CHT 10	"Danfoss" Starter Unit over 10 amps up to 16 amps. Full Load Current	1
Type DT, AK	Push Button Contactor, Black	1
Type PT-r/AK	Push Button Contactor, Red	1
	Canadian Market	
B.15	Crabtree Starter	1
	U.S.A. Market	
361103U/100	Arrow Starter and AT.1204 Arrotrip Overload 440v.	1
362203U/100	Arrow Starter and AT.1203 Arrotrip Overload 220v.	1
	TWO SPEED REVERSING SWITCHES	
IPA413/349P	Rotary Switch 220/440v. 3 phase 50 cycles ...	1
SR3314AX92	Rotary Switch (used with Lever Operated Unit and for Continental Market)	1
P5AP1/0396B	Rotary Switch (Canadian Market)	1
P3P1 1674	Rotary Switch (American Market)	1
128	Two Speed Forward and Reverse Instruction Plate	1
228	Two Speed Forward and Reverse Instruction Plate, used when Switch is Lever Operated	1
L5-1-53	Spacer for Rotary Switch (not required when Lever Operated)	2

ELECTRICAL EQUIPMENT

Part No.	Description	No. Off
	REVERSING SWITCH	
1PA46/312P	Rotary Switch 400/440v. 3 phase 50 cycles ...	1
ESR337K/MTH	Rotary Switch 220/240v. used for Lever Operated Unit and Continental Market ...	1
P5AP1/0026B	Rotary Switch used for Canadian Market ...	1
130	Forward and Reverse Instruction Plate ...	1
252	Forward and Reverse Instruction Plate, used when Switch is Lever Operated	1
L5-1-53	Spacer for Rotary Switch (not required when Lever Operated)	2
	SUDS CONTROL	
1PA44/31P	Rotary Switch	1
361103U/100	Arrow Starter without Overload 440v. (American Market)	1
362203U/100	Arrow Starter without Overload 220v. (American Market)	1
80461H	"Mini-Start" Starter (for Canadian Market) ...	1
385	Instruction Plate	1
206	Instruction Plate (for American and Canadian Markets	1
L5-1-53	Spacer for Rotary Switch	2
	COOLANT/HYDRAULIC CONTROL	
1PA47/319P	Rotary Switch	1
361103U/100	Arrow Starter with Overhead AT.1224, 440v. (For Hydraulic Control, American Market)	1
362203U/100	Arrow Starter with Overload AT.1223, 220v. (For Hydraulic Control, American Market)	1
80461H	Mini-Start Starter (For Canadian Market) ...	2
730	Instruction Plate	1
205	Instruction Plate (Coolant) (For American and Canadian Markets)	1
206	Instruction Plate (Copying) (For American and Canadian Markets)	1
2194	Plug and Socket (Canadian Market)	1
L5-1-53	Spacer for Rotary Switch	2
	ISOLATING SWITCH	
RP.1242	Isolating Switch	1
725	Instruction Plate	1
726	Instruction Plate (American Market) ...	1
229	Instruction Plate	1
246	Instruction Plate (American Market) ...	1
SP.683	Connection Box (Canadian Market) ...	1

Part No.	Description	No. Off
	LEVER OPERATED REVERSE SWITCH UNIT	
L16-14-1	Front Plate	1
L16-14-3	Driving Shaft	1
L-16-14-5	48T. Gear	1
L16-14-8A	Boss	1
L16-14-9	Operating Lever	1
L16-14-6	12T. Gear	1
L16-14-10	Spacer	3
L16-14-2	Backplate	1
L16-14-11	Driven Shaft	1
L16-14-12	Spacer	2
L16-1-46	Bracket for Instruction Plate	1
	DIAL OPERATED SWITCHING UNIT	
L16-14-47	Gasket	1
11014002	Guard Ring	1
11014003	Bearing Block	1
11014004	Adaptor Plate	1
BZ-2RW 82255-A2	Micro Switch	1
11014005A	Change Speed Dial	1
11014009	Spindle	1
11014006	Push Rod Sleeve	4
11014008	Operating Rod	4
SG 251	Spring	4
11014007	Change Speed Knob	4
11014011	Switch Sealing Ring	1
11014010	Collar	1
SB 2	Steel Ball $\frac{3}{16}$" dia.	1
SG 142	Spring	1
11014012	Disc	1
L16-14-41	Two Speed Switching Adaptor	1
0B2AK	Stop Button	1
LP4	Legend Plate Stop	1
L16-14-44	Push Button Enclosure	1
L16-14-50	Lid for Push Button Enclosure	1
	FITTED WITH A COOLANT PUMP	
27900U	Coolant Push Button	1
L16-14-45	Gasket	1
	FITTED WITH COOLANT /HYDRAULIC	
27900U	Coolant Push Button	1
27903U	Hydraulic Push Button	1
L16-14-45	Gasket	1
L16-44-46	Adaptor Plate	1