THE CHRONOS

PINION MILL

INSTRUCTIONS FOR USE

PINION MILL

ASSEMBLY INSTRUCTIONS

STEP 1:-Make up the following sub-assemblies

a)Feed Nut
Insert the feed nut (4) in the feed nut housing (3) and feed nut index collar (6) and lock in place with a 2BA x 3/16 grubscrew, locating on the flat of the feed nut. The nut and index collar should be able to rotate freely, with a minimum of end shake.Use a little thin oil prior to assembly.

b)Vertical Feed Screw
Insert the Vertcal Feed Screw (5) in the hole in the knee (7) and lock in place with a 4BA x 5/8ins grubscrew, tightened very firmly. Check that the Feedscrew ,is parallel to the rear face of the Knee by laying the whole assembly on flat surface a very slight degree of correction is permissible by bending the screw, using a suitable length of brass tube slipped over the screw,but caution must be observed.

c) Vertical Column:-
Fix the vertical slide (10a) to the vertical column(10) using 4 - 2 BA cap head screws and two 3/16 ins roll pins.

STEP 2:- Column Knee and Sub Base
Stand the Vertical Column Assembly in an upright position, with the large cross holes at the top,offer up the Knee Assembly to the front of the Column,with the Feedscrew pointing downwards,and pinch in place lightly using the Vertical Gib Strip(8a) and three 4BAxlins grubscrews.
The second hole down in the group of four grubscrew holes is left empty at this stage,in readiness for a slide locking screw.
Retain the Knee to the Column with the two Vertical Keep Plates(8) held in place with six 4BAx1/4in roundhead screws in the rear face of the Knee.
Screw the Feed Nut assembly on to the Feed Screw until the lower edge of the Feed Nut Housing is level with the lower edge of the Column.Fix the Sub Base (2) to the foot of the Column using two 1/4in BSFx3/4in caphead screws, finger tight only at this stage.Fasten the Feed Nut Housing to the Sub Base, using three 4BAx1/2in caphead screws from the above,again finger tight, making sure that the index line on the Feed Nut Housing is at the front.

NOTE:-
Two 3/16in roll pins are used to locate Vertical Column (10) on Sub Base (2) prior to fitting 1/4in BSFx3/4in caphead screws.

Carefully adjust the Vertical Gib Strip and Vertical Keep Plates until the Knee is able to move stiffly on the Column without shake,then lock the Gib strip screws with 4BA nuts and the Keep Plates with 4BAx1/8in grubscrews in the tapped holes provided in the Plates.Finally tighten the screws holding the Column and Feed Nut Housing to the Sub Base.Check the action of the Feed Nut by rotating the Index Collar. NOTE:- The above adjustment is one of the most important in the assembly of the machine if rigidity is to be acheived.The fit of the Knee to the Column should be finally rechecked when the machine has been fully assembled.
The Column and Knee assembly may now be fitted to the main machine Base(1) using three 1/4in BSFx1/2in caphead screws and 1/4in washers.

STEP 3:- Table

Rest the table (11) in the groove on the top face of the Knee, with the tapped holes for the Feed Screw Bracket at the right hand end and the dovetail section uppermost.Fit the Horizontal Gib Strip(9a) in front of the Table, and pinch lightly in place with four 4BAx7/16 grubscrews.Fit the Horizontal Keep Plates(9)using 6BA x 3/8 in roundhead screws.Adjust the Gib Strip and Keep Platesuntil the table can be moved by hand stiffly but without shake, then lock the adjustment as before, using 4BA x 1/8in grubscrews in the Keep Plates and 4BA on the Gib Strip screws.
Oil the horizontal Feed Screw (12) and insert it into the tapped holein the Knee from the right hand end. Wind the screw fully home as far as it will go, and slide the table fully to the left.Thread the Feed Screw Bracket (12a) over the exposed end of the Feed Screw, and fasten to the Table with two 4 BA x 3/8 in caphead screws.Check that the Feed Screw can rotate freely before finally tightening the screws holding the bracket...

Place a 1/4 in washer over the exposed end of the Feed Screw followed by the Handle Locknut (13a) and the Handle (13).Adjust the Handleto give about 1/8th turn of backlash before finally locking with the Locknut.Check that the Table may be moved fully from end to end of its travel by operating the Handle, adjusting the Gib Strip and Keep Plates if necessary.

STEP 4:-Prepare the Headstock Sub-Ass embly as follows:

Oil the Headstock Spindle (16) and insert in the Headstock (14) as shewn in the diagram.Lock in place using the two Lockrings (17), adjusting these so that the Spindle can rotate without any endshake. Place the Index Arm (23) loosely in the slot in the Headstock with a compression spring beneath the right hand end (There is a blind hole in the top of the Headstock to receive this Spring).Place the Pressure Pad (26) in the space behind the Index Arm, and complete the assembly by passing a 1/4 in dowel pin through the holes in the Headstock, the Index Arm and the Pressure Pad.Adjust the fit of the Index Arm in the slot by means of two 2BA x 3/8in grubscrews and locknuts, so that the Arm can move freely under spring pressure, but with no side shake whatsoever.Fit the Plastic Knob (24) to the Index Arm using a short M6 threaded stud.

Place an Index Plate (18) on the end of the Headstock Spindle, and fix in place with the Index Clamp Ring (19) finger tight only.Lock finally with three 4BA x 3/16in grubscrews in the tapped holes in the Clamp Ring.Screw the Collet Draw Tube (22) into the Collet (21) and pass through the Headstock Spindle.Lock in place with the Collet Lock Ring (20)

To fix the Headstock to the machine, place a Dovetail Clamp (25) in the cross hole in the Headstock,flat downwards, and slide the Headstock over the dovetail section of the Table.Lock in place with a 2BA nut and washer at the front of the Headstock.

Fix the Tailstock (15) to the other end of the Table in a similar fashion.Fix the Tailstock Runner (27) in the Tailstock and lock with a 2BA x 1/4in caphead screw.NOTE:The Headstock and Tailstock may be used at either end of the Table,as desired.

STEP 5:-Spindle Assembly pass the Cutter Spindle (30) through the lower large hole in the Column (shorter end to the rear) and fix lightly in place with a 2BA x 1/2 in caphead screw so that a cutter placed on the spindle will be in line with the point of the Tailstock Runner.

Place the Overarm (28) in the upper large hole in the Column, and lock in place with a 2BA x 1/2 in caphead screw.Fix the Steady (29) to the Overarm

so that the 'Oilite' bush will slide over the end of the Cutter Spindle, and clamp by means of a 4BA x 3/4in caphead screw bridging the split in the Steady.

Fasten the 60 tooth pulley (31) to the rear of the Cutter Spindle but do not lock finally at this stage.

STEP 6:-Drive Assembly Fix the Motor Unit (42) to the machine base, using two 2BA x 5/8in caphead screws and washers from underneath the Base, with the motor switch at the front of the machine.Again do not tighten finally at this stage.
Fix the Pulley Adaptor (37)to the Motor Spindle, using a 4BA x 3/16 in grubscrew, and fix the 16 tooth pulley (36) onto the spindle of the Adaptor.Place the Toothed Belt (38) over the two Pulleys and adjust the Pulleys laterally on their spindles to give belt alignment before finally tightening.Adjust the belt tension by sliding the Motor Unit on the Base bfore finally locking.Do not overtighten the belt as this will cause unnecessary strain on the bearings - a deflection of about 3/8in at the centre of the belt will give a suitable belt tension.A slack belt,on the other hand,will run noisily and jump under load giving premature belt and pulley wear.

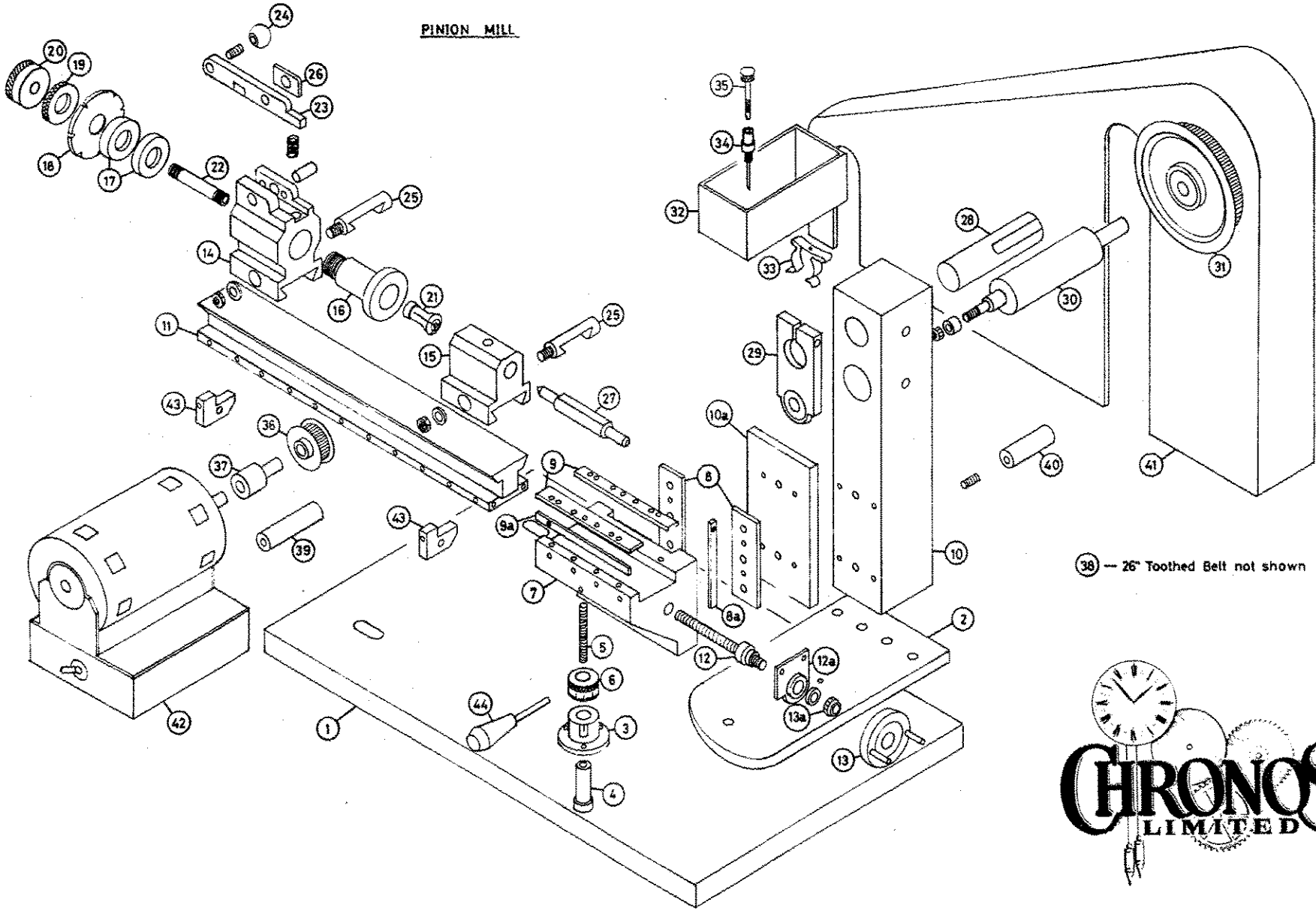
Fix the Long Belt Guard Spacer (39) to the rear of the Motor Unit and the Short Belt Guard (40) to the rear of the Column,using 2BAx3/4 in as threaded stud.Offer up the Belt Guard (41) and carefully mark up the position of the Spacers when the lower edge of the Guard is approximately 1/4 in above the lower edge of the machine base. Remove the Guard and drill two 3/16 in dia holes in the rear of the Guard where marked,to allow 2BA x 1/2in caphead screws and washers to fasten the Guard to the Spacers.

STEP 7:-Miscellaneous Details
a) Table Stops.Either or both of the Table Stops (43) may be fitted to the front of the Table,using 4BA x 1/2 in caphead screws in the tapped holes provided.Fine adjustment may be provided by inserting a 2BAxlin caphead screw and locknut in the tapped hole in the Table Stop.

b) Oil Feed Tank.The Oil Feed Tank may be assembled as follows:-
Fit the Needle Valve (35) into the Valve Body (34) and fit the Valve Body to the Oil Tank (32) from the inside.A 1/4 in washer should be fitted between the Valve Body and the inside of the Oil Tank and a 1/4 in BSF locknut outside the Tank.

Fit the Spring Clip (33) to the outside of the Tank using a 6BA x 1/4 in roundhead screw and locknut. The Tank Assembly clips to the Overarm and should rest snugly on top of the main machine Column; one or more 6BA washers may be fitted between the Spring Clip and the Tank to obtain the correct fit.
GENERAL All moving parts should be lightly oiled before assembly, using a'3-in-One' or similar thin oil.
Where caphead screws are used as lock screws (e.g. on tailstock runner and overarm) it will be found helpful to round off the end of the threaded portion with a fine file; this will prevent the end of the screw marking the locked component.
Before operating the machine, check the fit of both the vertical and horizontal slides, and adjust if necessary to give a fairly tight sliding fit. The vertical slide of the Knee would be locked before use with a 4BA x 7/8in caphead screw and steel pushrod in the remaining tapped hole in the side of the Knee.

PINION MILL



(38) — 26" Toothed Belt not shown

CHRONOS LIMITED

Pinion Mill Checklist

A. Pressed Steel Base
B. Belt Guard
C. Motor Assembly
D. Vertical Column
E. Pulleys
Feed Nut
Collet Lockring
Spring Clip
Oil Valve
Oil Tank
Drive Belt
F. Table
Horizontal Feed Screw
Handle Lock Nut
G. Knee
Keep Plates
Gib Strips
H. Sub Base
Vertical Slide
I. Headstock Spindle
Lockrings
Pulley Adaptor
Draw Tube & Collet
Feed Screw
Index Collar
J. Headstock
Tailstock
Dovetail Clamps
Tailstock Runner
K. Steady
Index Arm
Gaurd Spacers
Feed Screw Bracket
Table Stops
Feed Nut Housing
Pressure Pad
Index Clamp Ring
L. Cutter Spindle
Overarm
Handle
Tommy Bar
M. Division Plates
N. Sundry Screws ETC

THE CHRONOS PINION MILL PM1

OPERATING INSTRUCTIONS

The Chronos Pinion Mill is a self contained machine designed to cut pinions and small gear wheels up to a maximum diameter of 50 mm in most machineable materials, including silver steel. The following notes are intended for those unfamiliar with the machine, but as with all machines of this nature the capabilities are limited only by the ingenuity of the user.

MOTOR AND DRIVE UNIT

This version of the Pinion Mill is mounted on a sheet steel base, and is driven by a self contained induction motor unit of 1/20th H.P rating, 240 volts 50 Hz. The motor is provided with a three core flexible cable, and an earth (ground) connection must be provided. The supply outlet or plugtop should be protected by a 5 amp fuse.

Drive to the cutter spindle is by a toothed rubber belt and belt tension is adjusted at the works. Adjustment to this tension is unlikely to be necessary, but may be achieved if required, by slackening the two cap head screws which fix the motor assembly to the base. Care should be taken not to overtighten the belt, as this could lead to noisy running, as well as premature wear of both the belt and the bearings. When retightening the clamp screws, the motor shaft should be maintained parallel to the cutter spindle to provide accurate belt tracking. The motor is continuously rated, but nevertheless it may reach a fairly high temperature after long periods of operation, if a considerable amount of work is being undertaken, it is helpful if the machine is switched off between each pass of the cutter. The belt guard should always be in position when the machine is operated.

CUTTER SPINDLE

The cutter spindle is a self contained double ball race assembly, provided with an outrigger bearing to give additional rigidity. The whole spindle assembly may be moved within the machine column to adjust the cutter position. Cutter speed is fixed at approximately 380 r.p.m. and is suitable for High Speed Steel cutters working in free cutting silver steel.

To change the cutter, first remove the belt guard, and grip the large drive pulley in one hand while slackening the cutter locknut. The outrigger bearing should be in place during this operation to avoid bending the spindle. With the cutter slack, the outrigger may now be removed together with the locknut, outboard bearing collar and cutter. Replace the cutter following the above procedure in reverse, finally tightening the cutter locknut with the outrigger bearing locked in place.

This procedure ensures that the cutter bearing collar is accurately centered.

KNEE ASSEMBLY.

The work table is supported by a substantial steel 'knee' which can be adjusted vertically to alter the depth of cut. The vertical feed screw is of 1mm pitch and the calibrated feednut has 50 divisions,thereby providing calibrations of 0.020 mm. A detachable feed handle is provided to assist in fine control of the feed. All models of the machine have a lock screw provided at the right hand side of the knee slide, and this should be slackened before adjustment is attempted.

An adjustable gib strip is provided to take up any lateral wear in the knee slide and this should be adjusted to provide a stiff rigid feel to the slide (The works adjustment should hold for a considerable period) the 'fore and aft' movement of the same slide is controlled by much larger bearing surfaces, and these are accurately ground.

TABLE ASSEMBLY

The workpiece is mounted on centres held by a long steel table, controlled by a feedscrew and handle, providing a travel of well over 4 inches (100 mm). The table moves in a square slideway on top of the knee, and an adjustable gib strip and keep plates are provided to take up wear in all directions.

Table stops are provided to limit the table travel in each direction, and these should be set when cutting up to a shoulder or to prevent the cutter running into the head or tail stock.

HEAD AND TAILSTOCKS

The headstock and tailstock of the machine can both slide freely to any position on the table, and may be locked in place by the integral dovetail clamps, care being taken not to overtighten the nuts. If desired the positions of the headstock and tailstock may be interchanged.
The headstock contains a stout hollow spindle, holding a split collet (0.125., bore is supplied as standard) tightened by means of a drawtube and locknut. The arbor of the pinion to be cut should be turned to a close fit in this collet, preferably by no more than 0.002in undersize. If desired a male or female centre may be mounted in the collet, and work held between centres, driven by a suitable dog similar to a lathe carrier. A 4BA tapped hole is provided in the collet nose to accept a catch pin, and this should be fastened to the driving dog to ensure positive rotation of the work.

Indexing is achieved by a series of index plates mounted on the rear of the headstock spindle. To change the index plate, first remove the collet drawtube locknut. Slacken the three 4 BA grubscrews in the face of index plate knurled lockring by about 1/2 turn each, and remove lockring and index plate. The plate is replaced in reverse fashion,screwing the knurled lockring no more than finger tight before tightening the three grubscrews evenly.

The fit of the index detent arm in its hinge slot is important if shake is to be avoided. An adjustable pressure pad is provided to remove side shake and the fit of this joint should be checked frequently by attempting to rotate the index plate from side to side when locked.
End shake in the headstock spindle is adjusted by the two lockrings behind the index plate, and these should be adjusted when necessary to remove all play, this helps to avoid chatter on the finished work.

SETTING UP

Mount a suitable cutter on the main spindle as previously described, ensuring the teeth point in the correct direction. (The spindle rotates anti-clockwise when viewed from the front). To centre the cutter, slacken the screws holding both the cutter spindle and the overarm in the main column, and move the cutter spindle backwards or forwards until the cutter can be aligned with a male centre held in the tailstock. For pinion cutting, the cutter needs to be very accurately aligned with the axis of the pinion arbor, and it will be found helpful if the male centre used for alignment has a flat turned or filed on the end to match the width of the cutter tip, inspection through a strong glass will then enable the cutter tip to be brought accurately in line with this flat. If one particular cutter is to be used frequently, the following procedure is worth while. Align the cutter as accurately as possible by the above method, and cut one or more trial pinions to prove the setting. Insert a soft steel or brass runner in the tailstock and run the cutter into the end of this runner to the full depth of the tooth, cutting a groove in the runner. Remove the runner and mark it to match the cutter used. If this runner is now kept with the cutter the cutter can be replaced on any future occasion and aligned with its own runner very rapidly.

With the cutter mounted and centred a pinions is cut as follows:

Lock the cutter spindle and overarm. Lower the knee, and mount the workpiece between the head and tailstocks, making sure that the tailstock runner is firmly in contact with the work. With the machine switched on raise the knee slowly until the work just touches the rotating cutter. Switch off, and move the table lengthwise until the cutter is well clear of the work (see note on preparing workpiece below). Raise the knee a further amount, to the depth of the required cut. Switch on and take a cut by rotating the handle at a steady speed, until the cutter reaches the run out at the end of work. Switch off, restore the table to the starting point, index round one division and take the second cut at the same depth setting. Repeat this procedure until all the leaves have been cut.

PREPARING THE WORKPIECE

When preparing the workpiece remember to ensure that the arbor is reduced at each end to provide run out for the cutter, thus enabling the work to be indexed round for the next cut. If the work is particularly long or slender, it may be advisable to provide support under the work by means of one or two miniature 'bottle jacks' , these are easily made as required to suit each particular job, but in practice it has been found that work over

about 0.25in (6mm) seldom requires additional support of this nature.

CUTTER LUBRICATES

A drip tank is fitted to the overarm of the machine to enable cutting lubricants to be used when required, and a needle valve is provided to control the rate of flow to the cutter. The whole tank may be removed when not required by a steady pull in an upwards direction.
Brass and cast iron should invariably be cut dry. Aluminium and light alloys often benefit from the application of paraffin oil (kerosene). Steel varies in its requirements. Mild steel, silver steel and free cutting silver steel can benefit from the use of either straight or soluble cutting oil, but in many cases it will be found that the cutter will carry wet swarf around with it, tending to jam in the cut. In this case, it is better to cut the work dry, and periodically remove the swarf with a brush.

A suitable oil for use with the machine is Esso 'Kutwell'40 (soluble). If soluble oil is used, it should be diluted about 6 to 1 with water, and the machine should be carefully cleaned after use to prevent rust.

FINISHING THE WORK

Provided that reasonable care has been taken in setting the work and the cutter and the feed rate has not been too high, the pinion as cut will require very little finishing. The leaves may be polished if required using the traditional method of wooden slips and oilstone dust or other suitable abrasives.

Polishing can also be carried out on the machine itself, using boxwood laps. A suitable procedure is as follows.

Mount a piece of 0.375in., diameter free cutting silver steel in the tailstock, and raise the knee ofthe machine until the steel is about 0.125in above the centre of the cutter. Take a plunge cut with the cutter into the end of the steel to full depth. This provides a replica of the cutter form in the silver steel, which may then be removed from the machine, and filed to make a form tool, which in turn is used to turn a boxwood disc, of exactly the same shape as the original cutter. It is advisable to make a number of these wooden discs, and keep them and the form tool with the cutter. The wooden discs are then used in the machine in exactly the same manner as cutters, but with the application of suitable abrasives to polish the leaves of the pinion.

MOUNTING THE MACHINE

The machine is supplied with four resilient feet fitted to the underside of the base, and these enable the machine to be used on any suitable benchtop without further fixing.

MAINTENANCE

Very little maintenance is required on the machine, the main adjustment

points having already been described.

GENERAL OPERATING HINTS

1. Keep the work as rigid as possible. If a short pinion head is required in the middle of a long arbor, it is best to cut a long length of pinion and turn away the surplus afterwards.

2. For best finish it is advisable to take one cut all round the work to within 0.005in (0.1 mm) of finished size, and then to take a finishing cut to final depth using a slow feed. The slower the feed, the better the finish.

3. Keep the belt guard in position whenever the machine is running. Although the motor power is low, the toothed belt drive can inflict severe damage to clothing and fingers.

EXPORT MODELS

Models supplied for overseas markets are identical to those described above, with the exception of the motor unit. Where 110 or 115 volt motors are supplied, these will usually be for 50 Hz which will cause the cutter to run at slightly faster speed (450 r.p.m.). The standard 240 volt motor may also be run safely at 60 HZ if required with the same increase in cutter speed.

The machine may be supplied without a motor if requested. The user to obtain and fit a suitable motor locally. In this case the belt and motor pulley will be supplied the latter having a 10 mm bore. Suitable motors will have a power in the range 1/20 - 1/8 H.P and a speed of 1400 - 1800 r.p.m. Series wound motors are NOT recommended for this machine. It is permissible to drill the machine base at any point to fix the motor.

PINION MILL

MAJOR COMPONENTS LIST

(1) Pressed Steel Base
(2) Steel Sub Base
(3) Feed Nut Housing
(4) Feed Nut
(6) Feed Nut Index Collar
(5) Vertical Feed Screw
(7) Knee
(8) Vertical Keep Plates (2 off)
(8a) Vertical Gib Strip
(9) Horizontal Keep Plates (2 off)
(9a) Horizontal Gib Strip
(10) Vertical Column
(10a) Vertical Slide
(11) Table
(12) Horizontal Feed Screw
(12a) Feed Screw Bracket
(13) Handle
(13a) Handle Locknut
(14) Headstock
(15) Tailstock
(16) Headstock Spindle
(17) Lockring (2 off)
(18) Index Plate (Set of 3)
(19) Index Clamp Ring
(20) Collet Lock Ring
(21) Collet
(22) Collet Draw Tube
(23) Index Arm
(24) Plastic Knob
(25) Dovetail Clamp (2 off)
(26) Pressure Pad
(27) Tailstock Runner
(28) Overarm
(29) Steady
(30) Cutter Spindle
(31) 60 Tooth Pulley
(32) Oil Tank
(33) Spring Clip
(34) Oil Valve Body
(35) Oil Valve Needle
(36) 16 Tooth Pulley
(37) Pulley Adaptor
(38) 26" Toothed Belt
(39) Belt Guard Spacer - Long
(40) Belt Guard Spacer - Short
(41) Belt Guard
(42) Motor Assembly
(43) Table Stop (2 off)
(44) Feed Nut Adjustment Lever