THE
CHRONOS

WHEEL ENGINE

INSTRUCTIONS FOR USE

'ChronoS' DIVISION PLATES

Pattern DD 62

120 - 100 - 96 - 90 - 84 - 80 - 78 - 72 - 64 - 62.

Divisions available.	Row / Holes.	Divisions available.	Row / Holes.
2	120 / 60	30	120 / 4
3	120 / 40	31	62 / 2
4	120 / 30	32	64 / 2
5	120 / 24	36	72 / 2
6	120 / 20	39	78 / 2
7	84 / 12	40	120 / 3
8	120 / 15	42	84 / 2
9	90 / 10	45	90 / 2
10	120 / 12	48	96 / 2
12	120 / 10	50	100 / 2
13	78 / 6	60	120 / 2
14	84 / 6	62	62 / 1
15	120 / 8	64	64 / 1
16	96 / 6	72	72 / 1
18	90 / 5	78	78 / 1
20	120 / 6	80	80 / 1
21	84 / 4	84	84 / 1
24	96 / 4	90	90 / 1
25	100 / 4	96	96 / 1
26	78 / 3	100	100 / 1
28	84 / 3	120	120 / 1

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Motorised machines (Models WCE 2&4) are already mounted and provided with a suitable pulley, belt etc; for most normal requirements. The motors supplied with the machine may vary according to the availability and reference should be made to the notes supplied with the individual motor.

JOINING DRIVE BELTS

Measure the length of belt required and cut a piece of belting 10% shorter than the measured length to allow for stretch. Cut the ends square using a sharp knife or razor blade. Clamp an old knife or strip of thin spring steel on edge in the vice, and heat with a clean flame (a spirit lamp is ideal) until hot enough to melt the plastic. Hold the ends of the belt together with the blade in between them and gradually slide together until the two ends touch and weld together. Hold firmly until set. Any 'flash' may be trimmed with a razor blade.

CUTTING THE FIRST WHEEL

To become familiar with the operation of the machine it is suggested that the user experiments with a fly cutter filed from 0.25in diameter silver steel. The cutter should be about lin.,long with one end reduced to exactly half diameter, similar to the blank supplied with the machine. (Not WCE 3). File a suitable tooth form on the end of the cutter blank. For the first trial a square end about 0.062in wide is suggested and allow plenty of clearance both on the front and side of the cutting edge similar to a lathe parting tool. Harden the cutter in the usual manner and temper to a light straw colour. After tempering, the cutter should be brought to a high degree of finish with an oil stone slip. This is important if good results are to be obtained.

Mount the cutter in the cross hole of the cutter spindle taking care to allow the heel of the cutter to protrude through the spindle to provide a balancing effect at high speed. Lock the cutter with the grubscrew .

Remove the centre spindle from the machine and insert a pointed centering spindle (Provided with WCE 1,2 & 4 only). Check that the cutter frame is horizontal with respect to the main frame, and that the cutter is approximately in line with the point on the centering spindle. Coarse adjustments is provided by means of three alternative mounting holes on the cutter frame. To centre the cutter slacken the locking screw on the top of the cross slide, this will enable the vertical slide to be moved as required.

Check that the cutter edge is facing downwards when pointed towards the front of the machine, and is square with respect to the frame.

Remove the pointed centering spindle and replace the centre spindle so that approximately 0.25in.,of the full diameter protrudes above the top face of the machine centre arbor. (This height is adjustable by the positioning of the lower locknut). Place the thicker of the two 1.25in., wheel clamps on the centre spindle locating on the full diameter, which should not be allowed to protrude above the top face of the clamp.

Select a hard brass wheel blank about 2in dia x 0.062in thick and drill and ream a centre hole 0.25in diameter. Place the blank over the reduced diameter of the centre spindle followed by the thinner wheel clamp and upper locknut. Tighten down firmly making sure that the upper clamp is centred by the shoulder on the upper locknut.

With the clamp screw on the cross slide slack, adjust the position of the cross slide by means of the feed screw until the cutter does not quite touch the edge of the wheel blank when the operating handle is moved up and down.

Select a suitable size driving belt and fit to the motor and cutter pulleys, adjusting the motor position if necessary to bring the pulleys into line. Switch on the motor keeping fingers well clear of the rotating cutter, and gradually advance the feed screw until the cutter is just seen and heard to touch the edge of the wheel blank. Switch off, and with the operating handle raised advance the feed screw to a depth of cut required. Each division on the feed collar is 0.001ins., and one complete turn represents 0.050ins., Clamp the cross slide in the required position by means of the clampscrew.

Switch on and lower the operating handle slowly but firmly until the full cut has been taken, then raise the operating handle and switch off. Index the plate round by lifting the detent knob and rotating the required number of holes, and repeat until all the teeth have been cut.
Experiment will soon show that with a sharp cutter, very great depths can be cut in one pass, although for best finish it may be advisable to finish a wheel with a second cut all round of no more than 0.005in.

MULTI-TOOTH CUTTERS

Multi-tooth milling cutters are used in exactly the same way as the fly cutter described above. In some cases it may be found that a burr is thrown up, particularly if the cutter is not too sharp and it is often helpful in this case to clamp a scrap wheel blank on each side of the wheel being cut, so that the burr is produced on the scrap.

INDEXING

The division plate has ten rows of holes and the detent arm may be locked at the correct radius to select any desired row. To select another row slacken the dome nut at the end of the detent arm, and swing the arm to the correct radius. With the dome nut partially slackened an eccentric collar immediately below it may be rotated, which has the effect of moving the division plate a fraction of a division. This feature is particularly useful when it is required to line the cutter up with an existing wheel, or to widen a cut that has already been taken.

TO CHANGE THE DIVISION PLATE

Remove the centre spindle and locknuts, slacken the detent arm and swing it out of the way. Beneath the division plate will be found a collar containing a grubscrew. Slacken this grubscrew two full turns, this will

enable the centre arbor to be withdrawn upwards through the main frame and the division plate may then be removed sideways from between the frame members.

The plate may be detached from its mounting by removing the three retaining screws from the plate mounting arbor. Users who require to change plates frequently may prefer to keep all plates permanently mounted, and suitable spare mountings are available (part no.WCE 47A).

Replacement of the plate is carried out in reverse order making sure all mating surfaces are clean and lightly oiled and that the grubscrew locates on the machined flat on the centre arbor.

CUTTING RATCHET AND OFFSET WHEELS

It is often necessary to cut wheels with a known amount of undercut from a truly radial cut when required the procedure is as follows.

Firstly, set the cutter as previously described so that it is truly central. Then select a suitable row of holes on the division plate that will enable the undercut angle to be measured. For example on the 72 hole row, 1 hole represents 360 divided by 72 = 5 degrees.

Mount the wheel blank, and with centralized cutter make a fine mark on the edge of the wheel. Withdraw the cutter and rotate the division plate the required number of degrees. Then using the vertical slide adjust the cutter position until it again corresponds with the line previously marked on the wheel blank.

CUTTING LARGER WHEELS

The clamp plate which holds the vertical slide to the cross slide is reversible. If this clamp plate is removed the vertical slide can be moved to the rear of the cross slide by a distance of 1.5in., and the slide locked by fitting the clamp plate in front of the slide.

CUTTING HOUR SNAILS

Hour snails and other cams may be cut on the machine very simply with a minimum of marking out. For an hour snail select a row of holes on the division plate which is divisible by 12. Thus on the 96 hole row each hour step is represented by eight holes. Fix a suitably sized wheel blank in the machine making sure that the wheel clamps are smaller than the smallest (12 o'clock) step. Use a square ended fly cutter of width slightly greater than 1/96th of the largest circumference of the wheel. Mark the start of the snail with a pencil line, and make eight cuts at one hole intervals to give the first (1 o'clock)step. Then feed in the cutter by the depth of the step and make eight more cuts to give the second (2 o'clock) step. Feed the cutter in again and repeat the process until all twelve steps have been cut. Although this method produces a series of flats on the edge of the snail, they will be so small as to be almost imperceptible and very little work with a fine file will produce a smooth

finish.

CUTTING LOCKING WHEELS

Locking wheels are also cut using a square ended fly cutter, although here, of course, all cuts are made of the same depth. The division plate is set to the 78 hole row(1+2+3+4+5+6+7+8+9+10+11+12 = 78) and the notches are cut increasing the spacing by one hole each time.

SQUARE HOLED WHEELS

Centre spindles are available for the machine having accurately machined squares for winding ratchets etc. The best method of cutting these is as follows. Take an oversize wheel blank and file a square hole to fit the spindle roughly in the centre. Mount the blank on the spindle between two suitable wheel clamps, and using the turning adaptor (WCE 50) clamp the whole assembly together using the upper and lower locknuts. Mount the assembly in the lathe between centres and turn the blank to the correct overall diameter. The adaptor may then be removed and the blank on its centre spindle inserted in the wheel engine for the teeth to be cut, thus ensuring that the square will be centralized with respect to the wheel circumference.

MAINTENANCE AND LUBRICATION

As despatched, machine slides are correctly adjusted. If, after some use, further adjustment is required, care should be taken to see that no swarf or grit is present, as this can seriously upset the working of the slides. Both cross slide and vertical slide should be adjusted to be fairly stiff in operation, the vertical slide should not be able to fall under its own weight with the cutter frame mounted and the driving belt removed. Cutter spindle bearings should be free but without perceptible shake and should be well lubricated with '3-in-1' oil fairly frequently particularly when run at high speed. The remainder of the mechanism should be lubricated very sparingly more to prevent rust than anything else. Over oiling can cause swarf and dust to collect with detrimental effect. The division plate may be cleaned during use by brushing, after considerable use, the plate should be removed and tapped lightly on the bench. Any stubborn swarf remaining may be removed carefully with a fine needle followed by brushing with a stiff toothbrush. The main frame is carefully adjusted during assembly and should not be dismantled unless absolutely necessary.

SAFETY

We are required under the provisions of the 'Health and Safety at Work' Act to bring to the attention of users any hazards which may be encountered in the operation of the machine. Most of these are readily apparent, but we draw particular attention to the following.

1. Belt and Pulley Guards

With the lower power and elastic belts used, very little danger exists from accidental contact with the pulleys or driving belt, but care should be taken to keep ties and loose clothing from coming into contact with the moving parts. When used by relatively unskilled workers (e.g. in school workshops) it may be advisable to fit a simple belt guard and we shall be happy to advise in this respect. It is impracticable to fit a guard to the rotating cutter and care should be taken at all times to avoid contact with the cutter spindle when it is rotating.

2. Flying Swarf.

The design of the machine ensures that most swarf is thrown downwards during operation. Nevertheless, in some cases swarf may be projected from the cut with considerable velocity and in such instances the use of safety goggles or spectacles is recommended.

3. Electrical Safety.

The small motor employed with this machine does not warrant the fitting of a 'no volt' release relay . Should a power interruption occur ensure that the machine is switched off before power is reconnected to prevent inadvertent restarting. The motor should be efficiently earthed at all times.