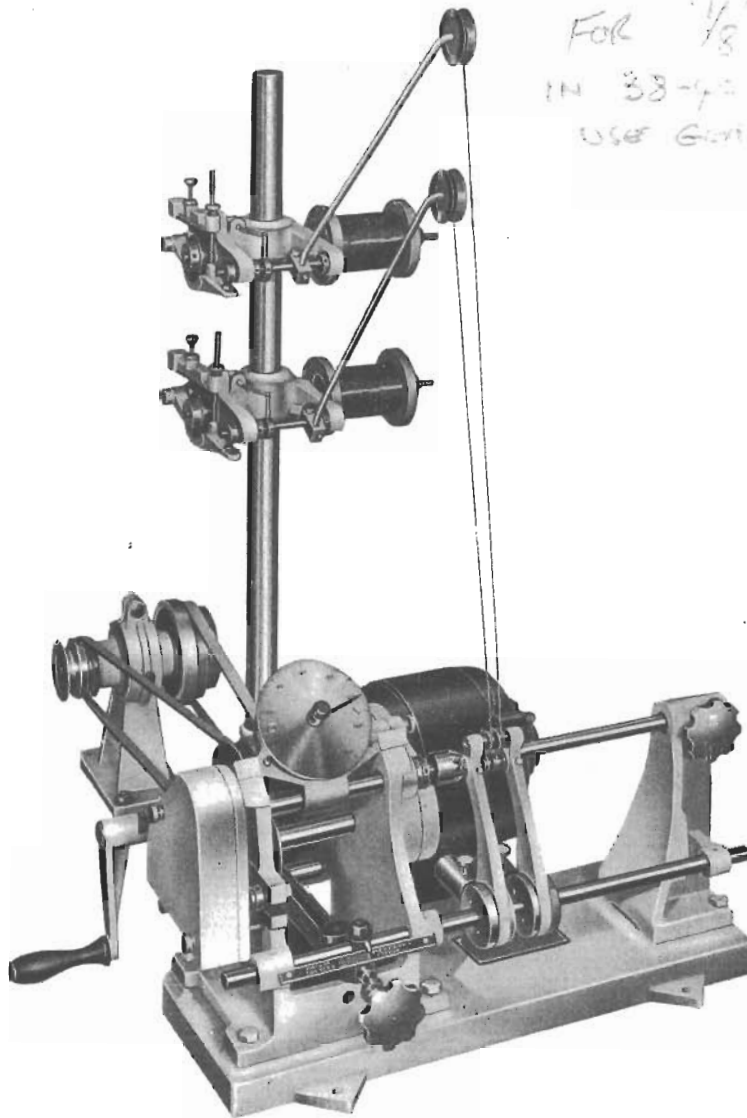




"DOUGLAS" WAVE WINDER AND PROGRESSIVE WAVE WINDING MACHINES



For $\frac{1}{8}$ " to $\frac{3}{16}$ "
IN 38-40 3-wire
USE GAMES 50/43/1-
& 60/10

INSTALLATION • OPERATION • MAINTENANCE

AND PARTS LIST

"DOUGLAS" WAVE



WINDING MACHINES

MANUAL OF INSTALLATION, OPERATION AND MAINTENANCE

THIS Instruction and spare parts manual is intended to cover all types of "DOUGLAS" Wave Winder and Progressive Wave Winding Machines.

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THE "DOUGLAS" WAVE WINDER

All types of wave wound coils, as used in the Radio and allied industries, may be wound on the "DOUGLAS" Wave Winder, within the limits specified under the heading "WINDING CAPACITY". This Machine is highly efficient and setting up can be accomplished by an operator with comparatively little experience of this type of work. Coils having fractional or multiple waves can be wound simply by changing gears, changing of the cam is not necessary. An important feature of the Machine is that it can be hand operated or power driven, making it ideally suitable for Laboratory use or Mass Production.

WINDING CAPACITY

Coils of various wave forms from $\frac{3}{32}$ " (2.4 mm.) to $1\frac{3}{4}$ " (45 mm.) wide and up to 4" (102 mm.) diameter can be wound on this Machine.

RANGE OF WIRE

The range of wire the Machine will handle varies from 46 s.w.g. (0.0024"—0.06 mm.) to 20 s.w.g. (0.036"—0.9 mm.) and, to ensure perfect winding it is recommended that the wire shall be either silk, rayon or cotton covered. Litz wire can also be wound if the overall diameter is within the above range.

INSTALLING THE "DOUGLAS" WAVE WINDER

EQUIPMENT

When a "DOUGLAS" Wave Winder leaves the factory it is complete with two wire guide arms, allowing for two coils or pies to be wound simultaneously. There is, however, sufficient space for up to four such windings to be made at once; the additional wire guide arms and reel carriers may be obtained at extra cost.

The equipment supplied with each Machine includes:—

1. Two "DOUGLAS" Standard Reel Carriers with Stand.
2. One set of change gears, comprising nineteen change gears and eight wave change gears.
3. One $\frac{1}{4}$ "— $\frac{5}{16}$ " spanner for adjusting the gear quadrant.
4. Two small hexagon wrenches for the 0 B.A. and 4 B.A. grub screws.
5. One length of round leather belt (sufficient to make two driving belts).

Should it be decided to have the Machine power driven, the manufacturers recommend a $\frac{1}{4}$ h.p. motor having a speed of 1,425 r.p.m. and a "DOUGLAS" Countershaft; both these items usually being purchased from the manufacturers along with the Machine. An endless canvas belt is also supplied when the last two items are ordered, for driving the countershaft from the motor.

For Overseas users, when the speed of the motor is slightly more or less than 1,425 r.p.m., a special pulley is fitted to the "DOUGLAS" countershaft.

BENCH LAYOUT

When choosing a site for the Machine sufficient space should be allowed for a Soldering Iron, material and finished work. A rack should also be provided for the change gears and wrenches.

The Machine should be set out as shown on the Bench Lay Out Plan, see Plate No. 3, as this arrangement occupies the most economical bench space, and, furthermore, allows for belt slackness to be taken up by the eccentric in the countershaft.

The Machine should first be secured to the front of the bench with four $\frac{1}{4}$ " (6 mm.) diameter bolts or stout wood screws. The "DOUGLAS" countershaft is then placed in position, as indicated on the Bench Lay Out Plan, and the leather belt passed around the pulleys on the Machine and countershaft, cut to the correct length, and fastened with a staple or similar fastener. The remaining length of belt will be found to be sufficient for making a drive from the countershaft to the cam on the Machine (see "DIRECTION OF ROTATION AND WINDING SPEEDS").

The position of the motor in relation to the countershaft is best determined by placing the canvas belt over the motor and countershaft pulleys. It is, of course, essential to see that all the pulleys are in perfect alignment before final fixings are made.

"DOUGLAS" WAVE WINDING MACHINES

To comply with the suggested method of starting the Machine a 5 amp. ON/OFF switch for starting and stopping the motor should be secured to the bench at the right hand end of the Machine (see Plate No. 3).

DIRECTION OF ROTATION AND WINDING SPEEDS

The Headstock Spindle must rotate in an anti-clockwise direction when viewed from the Tailstock end of the Machine.

The winding speed of the Headstock Spindle depends entirely upon the type of coils to be wound, and should not exceed a maximum of, say, 800/850 r.p.m.

Using a motor, as recommended by the manufacturers, three spindle speeds of approximately 350, 450 and 700 r.p.m. are obtainable by changing the position of the belt on the three stepped motor and countershaft pulleys.

NOTE: These speeds are slightly affected by the ratio of the four-gear train, but since this is so small it can be ignored.

The speed of the oscillation of the wire guide arms must also be taken into account, as this is affected by the changing of the wave gears.

Thus, when single or fractional wave gears are being used, the drive from the motor to the Machine must be on the machine pulley, whereas when multiple waves, i.e., 2, 3 or 4 crossings per turn, are being made, the drive must be on the cam, and in this case the belt must be crossed, or the direction of rotation of the motor reversed.

BEFORE STARTING

To facilitate packing the Machine for transit the Handle (Item No. 2, Plate No. 1) is reversed to its normal position and must be set correctly before the Machine is started.

All the protective Lanoline should be removed, and it is essential to see that all the oiling points are lubricated with a fine grade machine oil.

GUARDING MOVING PARTS

In accordance with Factory Regulations in force in the country where the Machines are being used, guards should be fitted over belts and other moving parts.

SETTING UP THE MACHINE

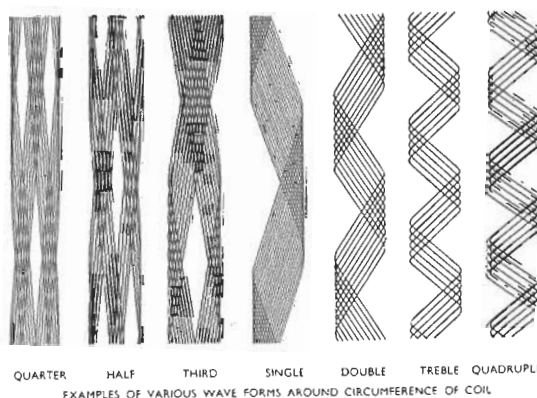
Whilst, of course, the design of wave wound coils is beyond the scope of this manual, it may be an advantage to mention one or two points before describing the set-up of the Machine.

- (a) Narrow coils usually have lower distributed capacity than wide coils of the same inductance, and, therefore, when low distributed capacity is required, a small cam throw should be used.
- (b) A maximum electrical efficiency (Q value) is generally obtained when the whole winding is about square in cross section. This is true whether the coil consists of one or more pie windings.
- (c) Multi-section coils are used when very low distributed capacity is desired.

The fundamentals of wave winding are the synchronism of a complete cam cycle with a revolution of the coil. If it is understood that a cam cycle is equivalent to the movement of the wire guide arm from a given point and back, it can be seen that to build up a pie winding the coil must rotate slightly more (progressive winding) or slightly less (retrogressive winding) than one revolution for a complete cam cycle. The wave form of a coil may be determined by the ratio of its mean diameter to its width. Where a coil is wide in comparison with its mean diameter a fractional wave should be used, whereas a multiple wave form should be used when the coil is narrow in relation to its mean diameter.

The term "wave" means the number of times the wire guide arm crosses the width of the coil in slightly more or less than one revolution. Thus, for single wave there are two crossings (one complete cam cycle), double wave four crossings (two complete cam cycles), and for fractional wave forms the coil rotates a multiple number of times for a complete cam cycle. For example: quarter wave, the coil makes slightly more or less than four revolutions in two crossings of the wire guide arm.

The wave change gears supplied with the "DOUGLAS" Wave Winder allow for quarter, third, half, single, double, treble and quadruple wave forms to be made; some examples are illustrated in the accompanying sketch.



"DOUGLAS" WAVE WINDING MACHINES

SETTING UP THE MACHINE

Having decided upon the wave form to be used, the necessary gears may be selected and placed in position as shown on the gear chart (see Page 9). **NOTE:** The Wave Change Gears are the eight thick ones and no others should be used.

To determine the gear combination for the compound gear train on the extreme left hand end of the Machine, the overall diameter of the wire being used is measured with a micrometer. This reading is then multiplied by 1.2 and the result is substituted in the formula shown on Page 8. All the A, B, C, D gear combinations shown in the table give retrogressive windings, and to obtain progressive winding the combination must be completely reversed.

When the two gears on the Gear Quadrant are meshed with the two fixed gears, slight play should be allowed between the teeth, otherwise excessive wear will take place and the gears will be noisy. **NOTE:** The formula mentioned above remains the same when the metric system is used (see typical examples on Page 8).

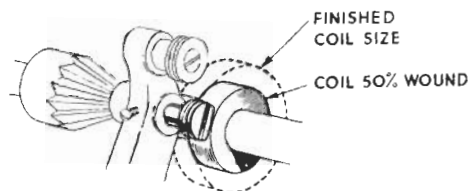
To set the winding width of the coil the Hand Wheel (Item 59, Plate No. 1) is turned in a clockwise or anti-clockwise direction. This alters the position of the Throw Adjusting Block (Item No. 51), for it will be seen that with this Block towards the front of the Throw Adjusting Screw (Item No. 57), the narrowest coil is wound, and at the back of the Throw Adjusting Screw the greatest width coil is produced. Having approximately positioned the Throw Adjusting Block, the Machine is operated by hand, and the number of divisions the Pointer (Item No. 65) crosses the Throw Indicator (Item No. 62) shows the width of winding, one division registering $\frac{1}{8}$ " (3.2 mm.). The Throw Indicator gives fairly accurate reading up to widths of $\frac{5}{8}$ " (15.9 mm.) (five divisions) but final checking may be made by measuring the two extremes of the throw of the Wire Guide Arm Spindle (Item No. 50). The only other settings to be made apply to Wire Guide Arms and Revolution Counter (see separate headings).

When all the settings have been made and the Machine is power driven, it is recommended that the Handle should be used to start the Machine revolving, and, having attained a good speed, the power is then switched on. The Handle is provided with a special slipping dog clutch and thus no harm can come to the operator when this is being carried out.

WIRE GUIDE ARMS

The Wire Guide Arms fitted to the "DOUGLAS" Wave Winder (one of which is illustrated on Plate No. 2) may be made right or left handed by changing the position of the Wire Guide Pulley and Guide Button (Items 15 and 13). The standard Guide Button allows for pie windings to be made at $\frac{7}{32}$ " (0.218"—5.5 mm.) spacings.

Special Guide Buttons, if required, may be obtained from the manufacturers. The position of the Guide Button plays an important part in the laying of the turns of wire, and when a new winding is set up it should be positioned as shown in the accompanying sketch. It will be seen that the centre of the flat is in contact with the coil at the 50% wound position.



Further adjustment, if necessary, may be carried out by loosening the Screw (Item No. 13) and slightly altering the angle of the Button. **NOTE:** If a good winding is not being produced, the left hand gear combination should not be changed until it has been ascertained that the trouble is not due to the Guide Button.

To change the position of the Wire Guide Arm, the Screw (Item No. 9) is loosened with the largest hexagon wrench provided and the Arm is moved along the Wire Guide Arm Spindle (Item No. 50, Plate No. 1) to the desired position. Care must be taken to tighten the Screw after adjustment of the Arm. If for any reason this Screw is removed, it is important to see that the special Grub Screw (Item No. 8) is not lost. This special screw does not need adjusting and should not be tampered with. It is fitted to avoid damage to the Wire Guide Arm Spindle (Item No. 50) that may be caused by Screw (Item No. 9).

The Weight (Item No. 5) may be removed from the Stud or pushed as near to the Arm as possible, when small coils up to, say, 1.5" (38 mm.) diameter are being wound. From experience it has been found that the Weight is only necessary when a coil has an initial or final diameter that would tend to make the Arm fall away from the coil.

REVOLUTION COUNTER

The Revolution Counter fitted to the "DOUGLAS" Wave Winder, shown on Plate No. 2, is driven by a Worm Thread cut in the Headstock Spindle, and will record up to 2,000 turns.

Before winding is commenced, and with the Pointer (Item No. 17) at about 150 on the Large Dial (Item No. 1), the Small Dial (Item No. 4) is turned until 1,800 can be seen in the aperture. The Pointer is then moved round to 200 on the Large Dial, and it will be observed that the moment the Machine is rotated the Small Dial returns to zero, hence an exact number of turns wound on to the coil can be recorded by the addition of the readings on both Dials.

"DOUGLAS" WAVE WINDING MACHINES

REEL CARRIERS

The "DOUGLAS" Standard Reel Carriers supplied for use with the "DOUGLAS" Wave Winder are fully described and illustrated in the Reel Carrier Manual. A copy should be kept

close at hand when the Machine is set up. A point that should be noted is that the tension of the wire must never be excessive for wave winding, as this will cause stripping of the covering.

MAINTENANCE

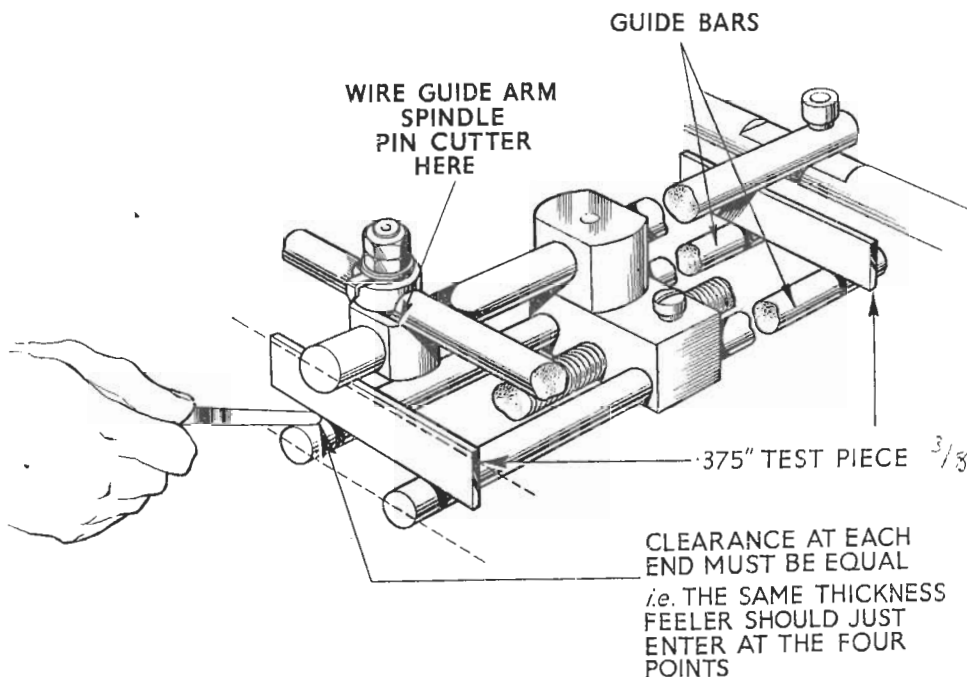
Periodical maintenance of the Machine has an important bearing on the production of good coils, as any appreciable "play" in the parts mentioned will cause undue trouble. Therefore, it is essential to ensure that:—

1. The Cam Roller and Pin (Items Nos. 37 and 38) are a good running fit in the cam path. If wear has taken place both parts should be renewed. When the Pin is fitted it is important to see that the Pin is a good push fit in the Actuating Spindle (Item No. 39) and a revolving fit in the Cam (Item No. 31).
2. The Front Eye Bolt (Item No. 61) should be renewed when end play is apparent in the Wire Guide Spindle. When fitting a new Eye Bolt, the Lock Nuts (Item No. 67) should be adjusted to ensure that it revolves freely in the Wire Guide Arm Spindle without any "play".
3. The Clamping Nuts (Item No. 33) should be adjusted to eliminate end play in the Cam Shaft (Item No. 40); also the Screws (Item No. 32) in the Cam should be checked and tightened if found loose.

4. Should there be any play in the Wire Guide Arms (Plate No. 2), the four screws (Item No. 11) should be evenly adjusted. A simple test for correct adjustment is made by ensuring that the Arms will fall away from the Machine under their own weight, without any shake being apparent.

5. From time to time it may be found necessary to replace the Wire Guide Arm Spindle (Item No. 50). This part is supplied drilled, but has to be fitted to the Machine by pin cutting. When performing this operation it is important to see that it lays parallel to the line AA (see accompanying sketch).

ALL THE OILING POINTS, INCLUDING THE CAM ROLLER, WORM DRIVE FOR REVOLUTION COUNTER, ETC., MUST BE FREQUENTLY LUBRICATED WITH A FINE GRADE MACHINE OIL. THIS PARTICULARLY APPLIES TO WIRE GUIDE ARM SPINDLE WHICH SHOULD BE OILED EVERY DAY.



"DOUGLAS" WAVE WINDING MACHINES

NOTES AND EXAMPLES FOR SELECTING WAVE CHANGE GEARS AND COMPOUND GEAR TRAIN

WAVE CHANGE GEARS

To obtain various wave forms the gears E, F shown in the diagram beneath the Gear Tables are interchanged. The combinations available with the gears provided are shown below.

When quadruple, treble and double wave forms

are being used, the drive must be on the Cam, and for half, third and quarter wave forms on the Pulley. If single wave forms are used the Cam or Pulley may be driven. It is most important that the "Direction of Rotation" of the Headstock Spindle is anti-clockwise (see Page 5).

GEAR COMBINATIONS FOR VARIOUS WAVE FORMS

| WAVE FORM | E GEAR | F GEAR |
|-----------------|--------|--------|
| QUARTER WAVE | 24 | 96 |
| THIRD WAVE ... | 30 | 90 |
| HALF WAVE ... | 40 | 80 |
| SINGLE WAVE ... | 60 | 60 |

| WAVE FORM | E GEAR | F GEAR |
|-----------------|--------|--------|
| DOUBLE WAVE ... | 80 | 40 |
| TREBLE WAVE ... | 90 | 30 |
| QUADRUPLE WAVE | 96 | 24 |
| | | |

COMPOUND GEAR TRAIN

To determine the combination for the compound gear train on the extreme left hand end of the Machine, the overall diameter of wire is measured with a micrometer, and this reading is multiplied by 1.2. The result is substituted in the formulæ below.

Formulae to be used for SINGLE, HALF, THIRD and QUARTER wave forms:—

$$= \frac{2 \times \text{WIDTH OF COIL}}{\text{OVERALL DIA. OF WIRE} \times 1.2} = X$$

Then

$$\frac{X}{X-1} = \frac{A \times C}{B \times D}$$

For example: Say a coil $\frac{1}{4}$ " wide has to be wound with wire whose overall diameter is 0.016", then

$$\frac{2 \times \frac{1}{4}}{0.016 \times 1.2} = \frac{2 \times .25}{0.016 \times 1.2} = \frac{0.50}{0.0192} = 192)5000(26$$

384

1160

1152

8 Ignore remainder.

Therefore, X = 26

Substituting this in formula $\frac{X}{X-1} = \frac{26}{26-1}$

$$\text{Therefore, } \frac{26}{25} = \frac{A \times C}{B \times D}$$

and from Gear Table:

$$A = 48 : B = 36 : C = 39 : D = 50.$$

The same formula as above can, of course, also be used for the metric system.

Taking the last example, and substituting millimetre for inches:

$$\frac{\frac{1}{4}}{0.016} = \frac{6.35}{0.406} \text{ mm.}$$

$$\text{Then } \frac{2 \times 6.35}{0.406 \times 1.2} = \frac{12.7}{0.4872} = 4872)127000(26$$

9744

29560

29232

328 Ignore remainder.

Therefore X = 26

Therefore, Gears A, B, C, D are the same as before.

When coils of DOUBLE, TREBLE and QUADRUPLE wave forms have to be wound, the width of the coil has to be multiplied by 4, 6 and 8 respectively.

For example: Treble wave form

$$\text{Formula} = \frac{6 \times \text{WIDTH OF COIL}}{\text{OVERALL DIA. OF WIRE} \times 1.2} = X$$

The gear combination shown in the Gear Table give retrogressive winding; that is to say, for each complete cam cycle the coil rotates slightly less than one complete revolution. For progressive winding, if the coil rotates slightly more than one complete revolution per cam cycle, the whole of the gear combination has to be reversed.

For example: Gear D is placed on Shaft A (see diagram beneath gear chart), and Gears B and C reversed.

Normally retrogressive windings give the best results, but there are some cases when the coil will not build up and progressive winding may be adopted.

COMPOUND GEAR TRAIN TABLE

| $\frac{x}{x-1}$ | A | B | C | D | $\frac{x}{x-1}$ | A | B | C | D | $\frac{x}{x-1}$ | A | B | C | D |
|-----------------|----|----|----|----|-----------------|----|----|----|----|-----------------|----|----|----|----|
| 400/399 | 50 | 42 | 32 | 38 | 144/143 | 48 | 39 | 36 | 44 | 50/49/020 | 50 | 35 | 30 | 42 |
| 391/390 | 46 | 40 | 34 | 39 | 133/132 | 42 | 36 | 38 | 44 | 49/48/020 | 42 | 36 | 35 | 40 |
| 385/384 | 44 | 32 | 35 | 48 | 126/125 | 48 | 40 | 42 | 50 | 46/45/022 | 46 | 30 | 32 | 48 |
| 375/374 | 50 | 34 | 30 | 44 | 125/124 | 50 | 31 | 30 | 48 | 45/44/022 | 48 | 32 | 30 | 44 |
| 370/369 | 40 | 36 | 37 | 41 | 124/123 | 48 | 36 | 31 | 41 | 42/41/024 | 50 | 41 | 42 | 50 |
| 352/351 | 44 | 36 | 32 | 39 | 120/119 | 48 | 34 | 30 | 42 | 41/40/025 | 50 | 40 | 41 | 50 |
| 342/341 | 38 | 31 | 36 | 44 | 117/116 | 36 | 29 | 39 | 48 | 40/39 | 50 | 39 | 40 | 50 |
| 323/322 | 38 | 28 | 34 | 46 | 116/115 | 48 | 30 | 29 | 46 | 39/38 | 50 | 38 | 39 | 50 |
| 321/320 | 40 | 29 | 32 | 44 | 115/114 | 40 | 38 | 46 | 48 | 38/37 | 50 | 37 | 38 | 50 |
| 300/299 | 50 | 39 | 36 | 46 | 112/111 | 48 | 36 | 28 | 37 | 37/36 | 50 | 36 | 37 | 50 |
| 288/287 | 48 | 41 | 36 | 42 | 111/110 | 48 | 40 | 37 | 44 | 36/35 | 50 | 35 | 36 | 50 |
| 276/275 | 48 | 44 | 46 | 50 | 105/104 | 30 | 39 | 42 | 32 | 35/34 | 50 | 34 | 35 | 50 |
| 273/272 | 42 | 34 | 39 | 48 | 100/99 | 48 | 40 | 32 | 38 | 34/33 | 48 | 36 | 34 | 44 |
| 260/259 | 39 | 42 | 40 | 37 | 96/95 | 40 | 38 | 48 | 50 | 33/32 | 44 | 32 | 36 | 48 |
| 253/252 | 44 | 48 | 46 | 42 | 93/92 | 48 | 32 | 31 | 46 | 32/31 | 50 | 31 | 32 | 50 |
| 248/247 | 40 | 39 | 31 | 38 | 92/91 | 46 | 39 | 36 | 42 | 31/30 | 50 | 30 | 31 | 50 |
| 246/245 | 36 | 42 | 41 | 35 | 88/87 | 44 | 29 | 32 | 48 | 30/29 | 50 | 29 | 30 | 50 |
| 231/230 | 42 | 40 | 44 | 46 | 85/84 | 50 | 40 | 34 | 42 | 29/28 | 50 | 28 | 29 | 50 |
| 222/221 | 36 | 39 | 37 | 34 | 78/77 | 48 | 42 | 39 | 44 | 26/25 | 48 | 36 | 39 | 50 |
| 221/220 | 39 | 30 | 34 | 44 | 77/76 | 42 | 48 | 44 | 38 | 25/24 | 50 | 40 | 35 | 42 |
| 210/209 | 40 | 44 | 42 | 38 | 76/75 | 48 | 36 | 38 | 50 | 24/23 | 50 | 46 | 48 | 50 |
| 205/204 | 40 | 34 | 41 | 48 | 75/74 | 50 | 37 | 36 | 48 | 23/22 | 50 | 44 | 46 | 50 |
| 204/203 | 36 | 29 | 34 | 42 | 70/69 | 42 | 36 | 40 | 46 | 22/21 | 50 | 42 | 44 | 50 |
| 196/195 | 28 | 39 | 42 | 30 | 69/68 | 46 | 34 | 36 | 48 | 21/20 | 50 | 40 | 42 | 50 |
| 190/189 | 40 | 36 | 38 | 42 | 66/65 | 44 | 39 | 36 | 40 | 20/19 | 50 | 38 | 40 | 50 |
| 187/186 | 44 | 31 | 34 | 48 | 65/64 | 50 | 40 | 39 | 48 | 19/18 | 50 | 36 | 38 | 50 |
| 185/184 | 50 | 40 | 37 | 46 | 64/63 | 48 | 36 | 32 | 42 | 18/17 | 50 | 34 | 36 | 50 |
| 176/175 | 40 | 35 | 44 | 50 | 63/62 | 42 | 31 | 36 | 48 | 17/16 | 50 | 32 | 34 | 50 |
| 171/170 | 38 | 34 | 36 | 40 | 58/57 | 48 | 36 | 29 | 38 | 16/15 | 50 | 30 | 32 | 50 |
| 165/164 | 44 | 32 | 30 | 41 | 57/56 | 36 | 28 | 38 | 48 | 15/14 | 50 | 28 | 30 | 50 |
| 161/160 | 42 | 48 | 46 | 40 | 56/55 | 42 | 30 | 32 | 44 | 14/13 | 50 | 39 | 42 | 50 |
| 156/155 | 40 | 31 | 39 | 50 | 55/54 | 40 | 36 | 44 | 48 | 13/12 | 50 | 36 | 39 | 50 |
| 154/153 | 44 | 34 | 28 | 36 | 52/51 | 39 | 34 | 32 | 36 | 12/11 | 50 | 44 | 48 | 50 |
| 148/147 | 40 | 35 | 37 | 42 | 51/50 | 48 | 32 | 34 | 50 | 11/10 | 50 | 40 | 44 | 50 |

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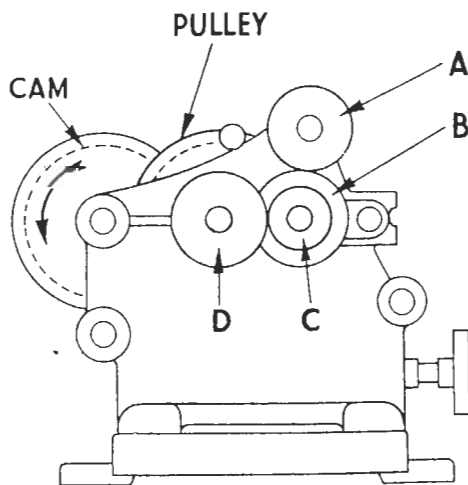


DIAGRAM OF GEARS A, B, C, D FOR COMPOUND TRAIN

Gears provided: 28, 29, 30, 31, 32, 34, 35, 36, 37, 38, 39, 40, 41, 42, 44, 46, 48 and two 50.

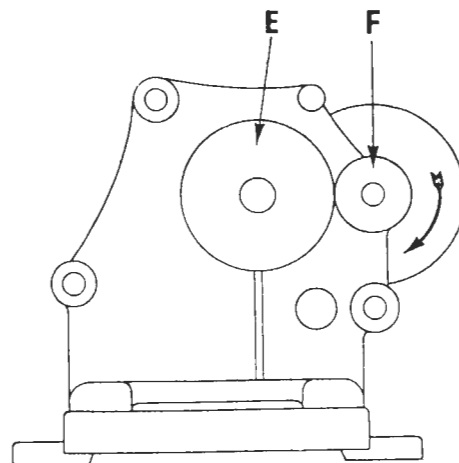


DIAGRAM FOR WAVE CHANGE GEARS E, F.

Gears provided: 24, 30, 40, two 60, 80, 90 and 96.

Plate 1—Parts List

| ITEM NO. | DESCRIPTION | PART NO. | NO. OFF | ITEM NO. | DESCRIPTION | PART NO. | NO. OFF |
|----------|---|----------|---------|----------|--|----------|---------|
| 1 | Complete Machine . . . | 50043/A | | 45 | Wave Change Gear, 80 teeth . . . | 30018/46 | 1 |
| 2 | Handle Complete . . . | 20382/A | 1 | 46 | Wave Change Gear, 90 teeth . . . | 30018/48 | 1 |
| 3 | Driving Pulley . . . | 20351/3 | 1 | 47 | Wave Change Gear, 96 teeth . . . | 30018/49 | 1 |
| 4 | Screw Securing Item 3 . | AS.41 | 1 | 48 | Special Washers for Change Gears . . . | 10586/1 | 5 |
| 5 | Driving Shaft complete with Gear Collar . . . | 20391/A | 1 | 49 | Screws Retaining Spindle Block . . . | S.224 | 5 |
| 6 | Revolution Counter Complete . . . | 20386/A | 1 | 50 | Wire Guide . . . | 11794/1 | 1 |
| 7 | Winding Shaft complete with Gear Collar . . . | 20384/A | 1 | 51 | Throw Adjusting Block . . . | 12189/2 | 1 |
| 8 | Clamping Nuts . . . | 12185/2 | 2 | 52 | Screw Locking Item 51 . . . | S.219 | 1 |
| 9 | Inner Guard . . . | 20227/3 | 1 | 53 | Eye Bolt for Adjusting Block . . . | 12180/1 | 1 |
| 10 | Outer Guard . . . | 20228/3 | 1 | 54 | Lock Nuts for Item 53 . . . | N.29 | 2 |
| 11 | Fluted Cone . . . | 10780/2 | 1 | 55 | Guide Bars . . . | 12191/1 | 2 |
| 12 | Screw Securing Item 11 | AS.23 | 1 | 56 | Screws Securing Item 55 . . . | AS.23 | 2 |
| 13 | Guard Support Pillars . | 12188/2 | 2 | 57 | Throw Adjusting Screw . . . | 11737/A | 1 |
| 14 | Terminal Nuts . . . | 10807/2 | 2 | 58 | Complete . . . | N.27 | 2 |
| 15 | Cone Centre . . . | 10595/A | 1 | 59 | Lock Nuts for Item 57 . . . | 20325/6 | 1 |
| 16 | Tailstock Spindle complete with Thrust Ball . | 12187/A | 1 | 60 | Hand Wheel . . . | S.456 | 1 |
| 17 | Tailstock Casting . . . | 40288/3 | 1 | 61 | Screw Securing Item 59 . . . | 12179/1 | 1 |
| 18 | Bolts Securing Item 17 | BSF.11 | 2 | 62 | Front Eye Bolt . . . | 20066/1 | 1 |
| 19 | Nuts for Item 18 . . . | N.29 | 2 | 63 | Throw Indicator . . . | S.463 | 2 |
| 20 | Dowel Pins locating Item 17 . . . | 20339/23 | 2 | 64 | Screws Securing Item 62 . . . | 12192/A | 1 |
| 21 | Hand Wheel . . . | 20325/4 | 1 | 65 | Clamping Piece . . . | 10331/2 | 1 |
| 22 | Eye Bolt . . . | 10597/1 | 1 | 66 | Pointer . . . | W.21 | 1 |
| 23 | End Bracket . . . | 11844/3 | 1 | 67 | Washer . . . | N.27 | 2 |
| 24 | Screws Securing Item 23 | AS.8 | 2 | 68 | Lock Nuts for Item 61 . . . | 40185/3 | 1 |
| 25 | Dowel Pins for Item 23 . | 20339/35 | 2 | 69 | Headstock Casting . . . | 12182/1 | 1 |
| 26 | Base . . . | 40173/3 | 1 | 70 | Quadrant Bolt . . . | W.23 | 1 |
| 27 | Left Hand Inner Guard | 20229/3 | 1 | 71 | Washer for Item 69 . . . | N.30 | 1 |
| 28 | Left Hand Outer Guard | 20230/3 | 1 | 72 | Nut Securing Item 69 . . . | 30018/4 | 1 |
| 29 | Guard Support Pillars . | 12188/1 | 2 | 73 | Change Gear, 28 teeth . . . | 30018/5 | 1 |
| 30 | Terminal Nuts . . . | 10807/2 | 2 | 74 | Change Gear, 29 teeth . . . | 30018/7 | 1 |
| 31 | Cam . . . | 20350/3 | 1 | 75 | Change Gear, 30 teeth . . . | 30018/8 | 1 |
| 32 | Screws Securing Item 31 | AS.41 | 2 | 76 | Change Gear, 31 teeth . . . | 30018/9 | 1 |
| 33 | Clamping Nuts . . . | 12185/2 | 2 | 77 | Change Gear, 32 teeth . . . | 30018/10 | 1 |
| 34 | Handle Driving Pin . . . | 20339/2 | 1 | 78 | Change Gear, 34 teeth . . . | 30018/11 | 1 |
| 35 | Cam Roller Shaft . . . | 11821/1 | 1 | 79 | Change Gear, 35 teeth . . . | 30018/13 | 1 |
| 36 | Screw Securing Item 38 | AS.29 | 1 | 80 | Change Gear, 36 teeth . . . | 30018/15 | 1 |
| 37 | Cam Roller . . . | 12194/1 | 1 | 81 | Change Gear, 37 teeth . . . | 30018/16 | 1 |
| 38 | Cam Roller Pin . . . | 12195/1 | 1 | 82 | Change Gear, 38 teeth . . . | 30018/18 | 1 |
| 39 | Actuating Spindle . . . | 12190/1 | 1 | 83 | Change Gear, 39 teeth . . . | 30018/19 | 1 |
| 40 | Cam Shaft Complete with Gear Collar . . . | 20390/A | 1 | 84 | Change Gear, 40 teeth . . . | 30018/21 | 1 |
| 41 | Wave Change Gear, 24 teeth . . . | 30018/2 | 1 | 85 | Change Gear, 41 teeth . . . | 30018/22 | 1 |
| 42 | Wave Change Gear, 30 teeth . . . | 30018/7 | 1 | 86 | Change Gear, 42 teeth . . . | 30018/24 | 1 |
| 43 | Wave Change Gear, 40 teeth . . . | 30018/20 | 1 | 87 | Change Gear, 44 teeth . . . | 30018/27 | 1 |
| 44 | Wave Change Gear, 60 teeth . . . | 30018/36 | 2 | 88 | Change Gear, 46 teeth . . . | 30018/29 | 1 |
| | | | | 89 | Change Gear, 48 teeth . . . | 30018/31 | 2 |

PLATE 1 "DOUGLAS" WAVE WINDER

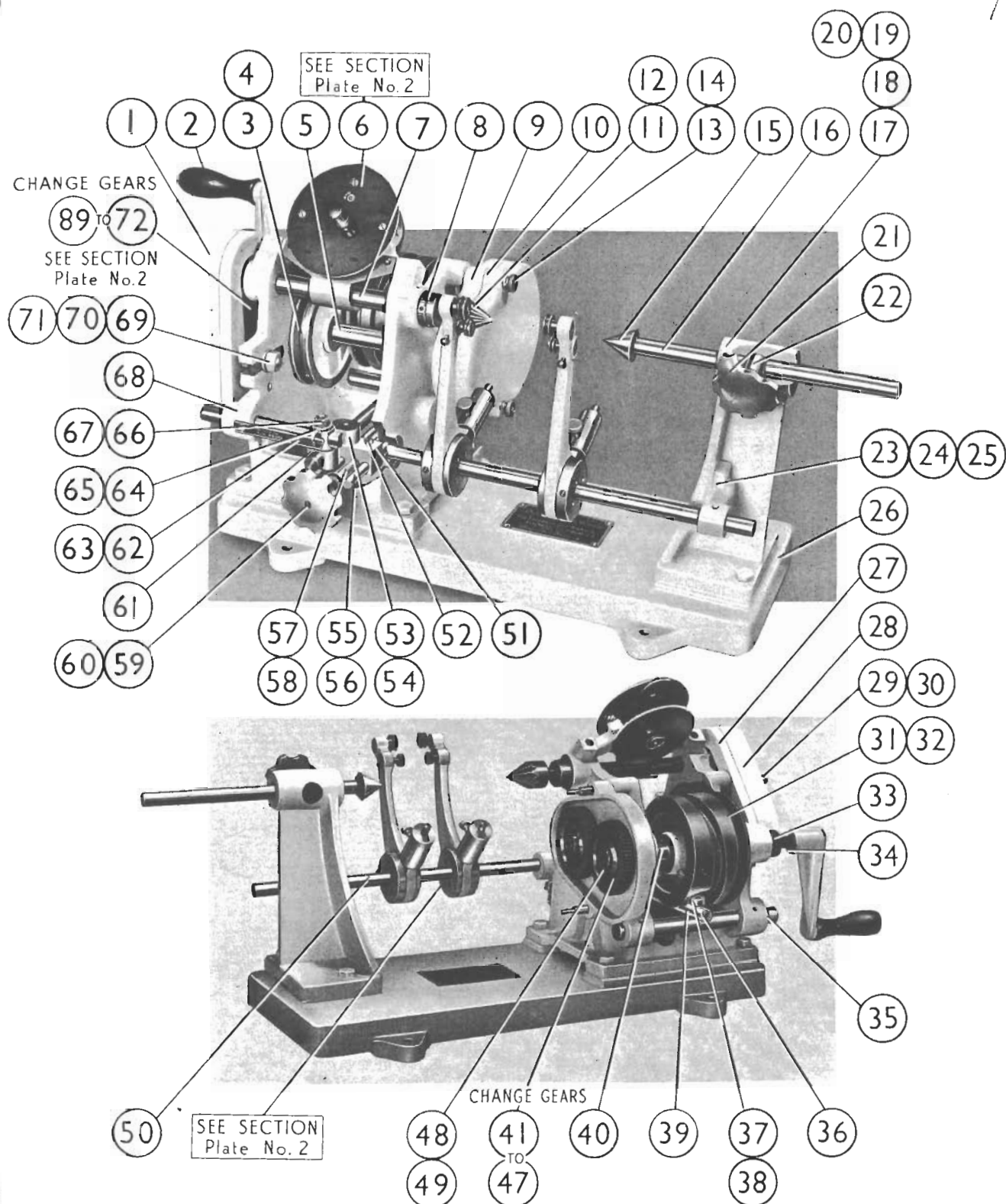


Plate 2—Parts List

GEAR DETAILS

| ITEM NO. | DESCRIPTION | PART NO. | NO. OFF | ITEM NO. | DESCRIPTION | PART NO. | NO. OFF |
|----------|------------------------|----------|---------|----------|----------------------|----------|---------|
| 1 | Gear Quadrant Complete | 12193/A | 1 | 3 | Gear Collet Assembly | 12196/A | 1 |
| 2 | Idler Assembly | 10831/A | 1 | 4 | Pin Securing Item 3 | 20339/22 | 1 |

WIRE GUIDE ARM ASSEMBLY

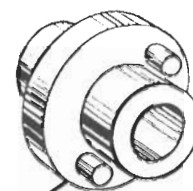
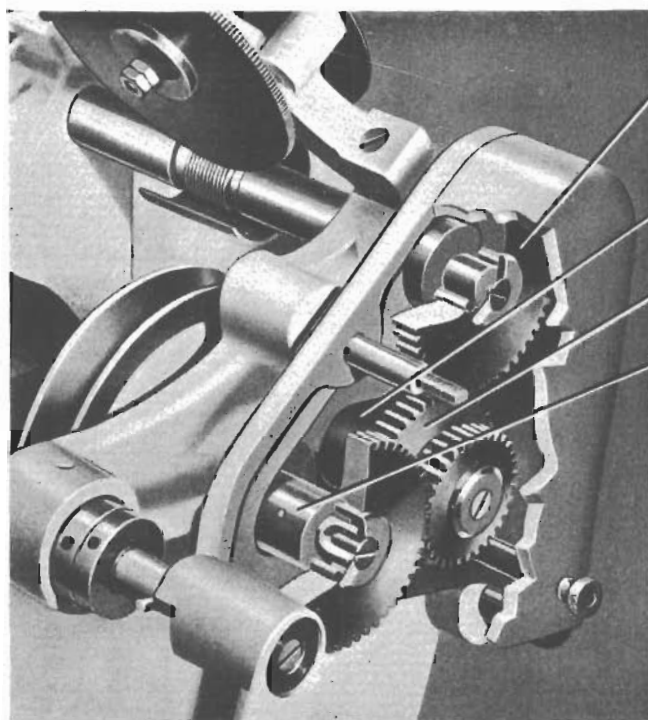
| ITEM NO. | DESCRIPTION | PART NO. | NO. OFF | ITEM NO. | DESCRIPTION | PART NO. | NO. OFF |
|----------|--------------------------------------|----------|---------|----------|----------------------------|----------|---------|
| 1 | Wire Guide Arm Assembly R.H. | 20387/A | 1 | 7 | Springs | 13160/1 | 4 |
| 2 | Wire Guide Arm Assembly L.H. (shown) | 20387/B | 1 | 8 | Special Grub Screw | 14208/1 | 1 |
| 3 | Wire Guide Arm with Weight Spindle | 14207/A | 1 | 9 | Clamping Screw | AS.32 | 1 |
| 4 | Special Screw Securing Item 5 | 12198/2 | 1 | 10 | Washer for Wire Guide Arm | 12805/1 | 1 |
| 5 | Weight for Wire Guide Arm | 12175/2 | 1 | 11 | Screws Securing Item 6 | S.454 | 4 |
| 6 | Wire Guide Bush | 12804/2 | 1 | 12 | Screw Securing Item 13 | S.412 | 1 |
| | | | | 13 | Wire Guide Stud | 12174/1 | 1 |
| | | | | 14 | Shoulder Screw for Item 15 | 12210/1 | 1 |
| | | | | 15 | Wire Guide Pulley | 12200/1 | 1 |

REVOLUTION COUNTER ASSEMBLY

| ITEM NO. | DESCRIPTION | PART NO. | NO. OFF | ITEM NO. | DESCRIPTION | PART NO. | NO. OFF |
|----------|-------------------------------|----------|---------|----------|---------------------------|----------|---------|
| 1 | Large Calibrated Dial | 11615/1 | 1 | 11 | Trip Arm | 12667/1 | 1 |
| 2 | Screws Securing Item 1 | S.457 | 2 | 12 | Bridge Casting | 10630/2 | 1 |
| 3 | Knob | 10223/1 | 1 | 13 | Screw Securing Item 12 | AS.8 | 1 |
| 4 | Small Dial Complete with Pins | 12673/A | 1 | 14 | Spindle | 12665/1 | 1 |
| 5 | Small Dial Screw | S.456 | 1 | 15 | I.O.M. Washer for Item 14 | 12668/1 | 1 |
| 6 | Nut for Item 5 | N.36 | 1 | 16 | Lock Nuts for Item 14 | N.22 | 2 |
| 7 | Small Dial Bush | 12669/1 | 1 | 17 | Pointer | 12664/1 | 1 |
| 8 | Leaf Spring | 12666/1 | 1 | 18 | Guard | 10328/2 | 1 |
| 9 | Screw Securing Item 8 | S.674 | 1 | 19 | Screws Securing Item 18 | S.462 | 2 |
| 10 | Worm Wheel | 12663/1 | 1 | | | | |

PLATE 2 "DOUGLAS" WAVE WINDER DETAILS

CHANGE GEARS
See Plate I.
for Parts



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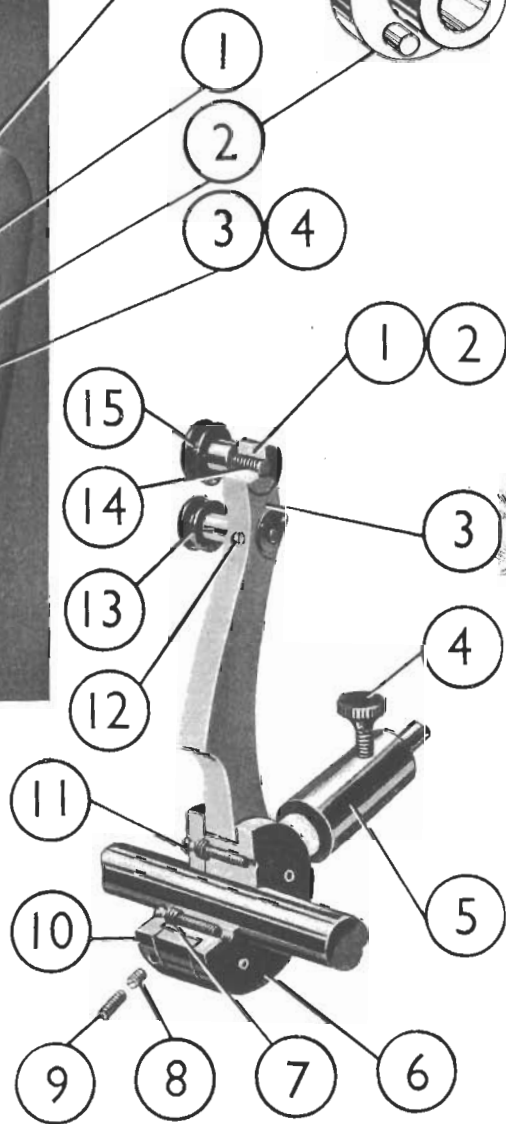
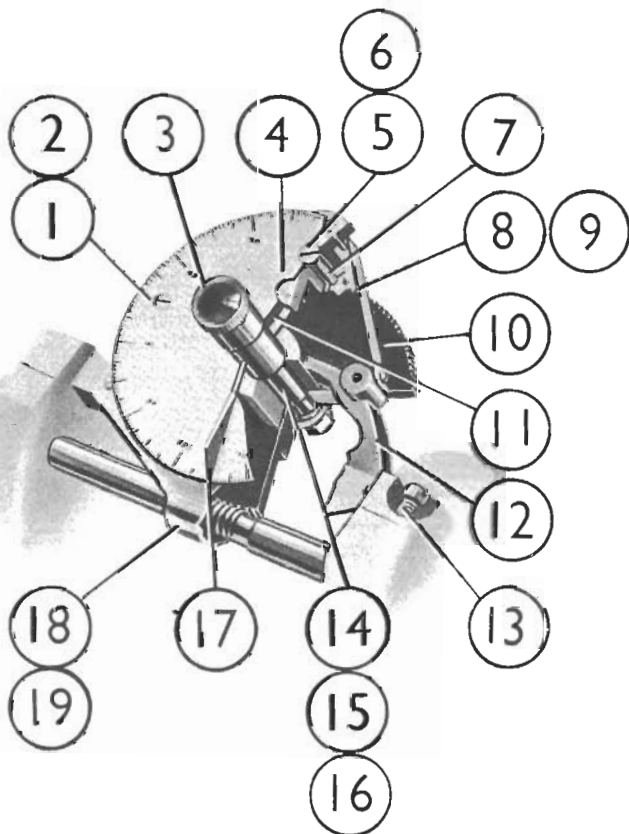
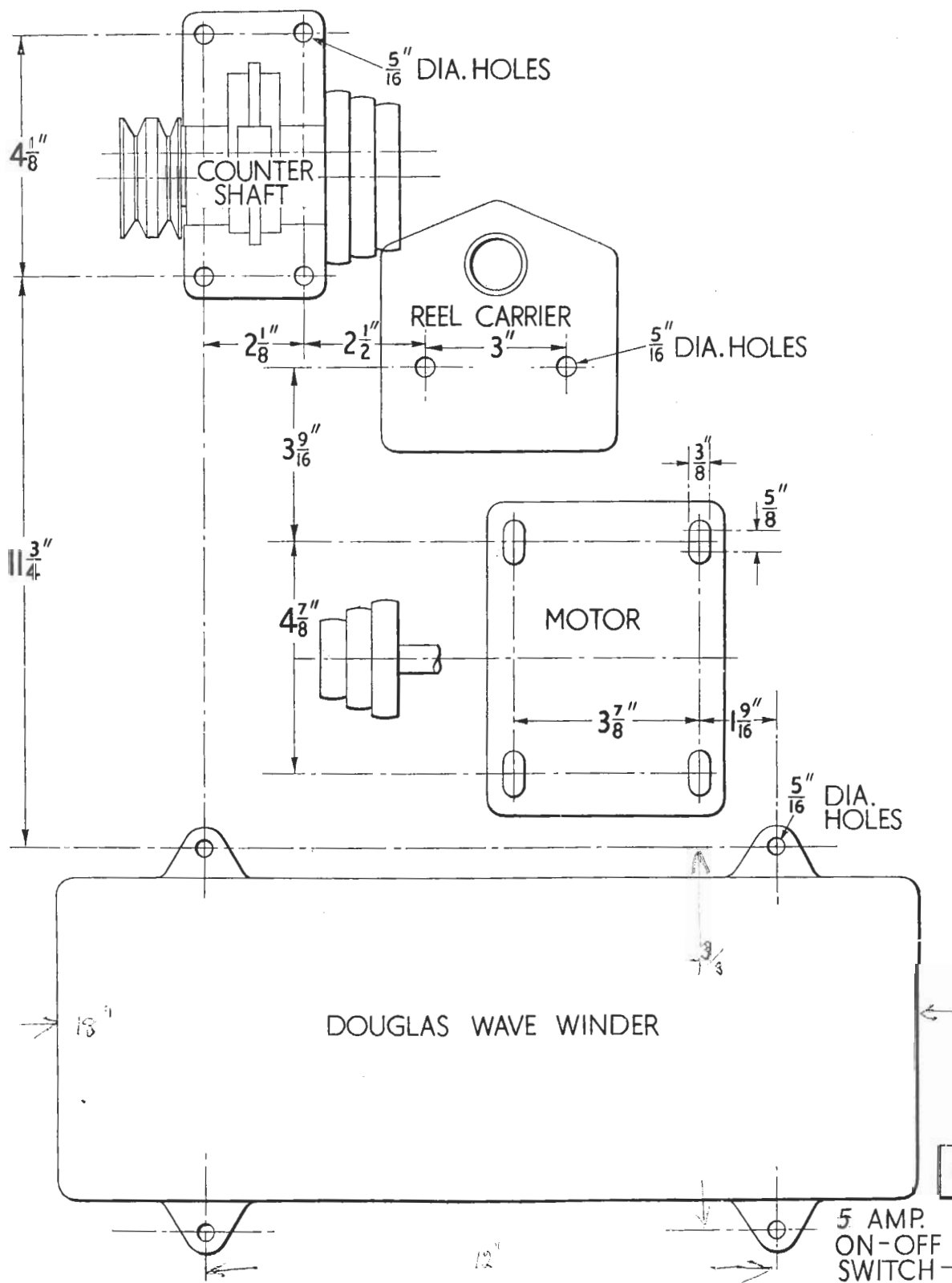


PLATE 3 BENCH LAYOUT (APPLICABLE FOR BOTH "DOUGLAS" WAVE WINDER AND PROGRESSIVE WAVE WINDER)





THE "DOUGLAS" WAVE WINDER WITH PRE-DETERMINED REVOLUTION COUNTER

The "DOUGLAS" Wave Winder may be supplied, or existing models modified, to incorporate a Pre-Determined Revolution Counter and a special "DOUGLAS" Countershaft fitted with an electro-magnetic trip to stop the Machine at a pre-determined number of turns.

With this device the Machine can be foot operated, the clutch in this special Countershaft allowing for a slow start to be made at the commencement of winding.

Since the Wave Winder is generally the same as that already described, only the special parts and fitments are described here.

The site for a "DOUGLAS" Wave Winder with a special Countershaft needs to be somewhat different from that already described, and a proposed scheme is shown on Plate No. 5. To fit the Foot Treadle it is necessary that a hole approximately 1" (25 mm.) diameter be cut in the bench to clear the Spring on the Treadle Rods, and the Treadle Bracket may then be secured to the floor in a convenient place for the operator to reach. This will mean that the Rods are at an angle sloping away from the operator and any adjustment required may be made by positioning the Clamping Blocks on the Rods.

"DOUGLAS" COUNTERSHAFT WITH ELECTRO-MAGNETIC TRIP

This special "DOUGLAS" Countershaft is illustrated on Plate No. 4, and comprises a clutch head, together with a Solenoid, etc., connected electrically to the Revolution Counter. With this device, the motor is constantly running, and in practice it is found that there is generally no over-run of turns. Referring to Plate No. 4, it will be noted that an adjusting screw is fitted to the armature of the Solenoid and operates in conjunction with the Micro Switch (Item No. 19).

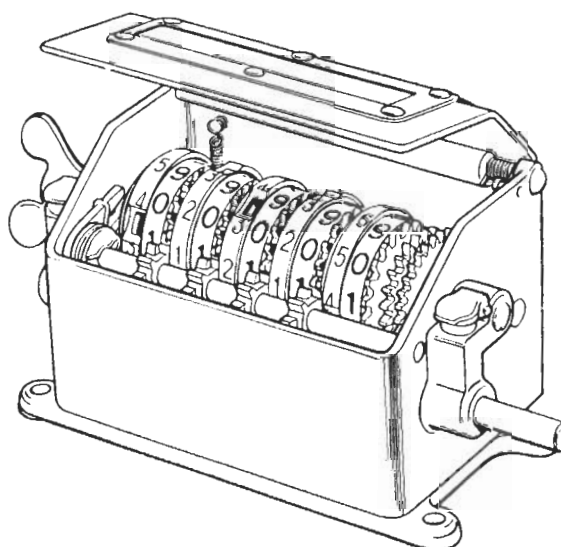
The purpose of the screw is to cut off the current to the Solenoid once it has operated. This is necessary, since the Solenoid operates on A.C. mains and is inclined to be noisy if the current is allowed to continually pass through the coil. The adjusting screw should be re-set if it is found that it does not come into contact with the Micro Switch when the armature is drawn towards the coil. When connecting this device to the mains it should be wired in series with the switch of the Revolution Counter.

REVOLUTION COUNTER

When the "DOUGLAS" Wave Winder is fitted with the pre-determined Revolution Counter a special coupling and bracket are necessary, and advice will be given by the manufacturers regarding this adaptation to existing Machines.

The Revolution Counter is a Veeder-Root pre-set type, and is set up by the following method. The key of the Counter should be rotated so that the figures shown on the white rollers are all noughts; the cover should then be raised and the aluminium rollers pushed to the right and then rotated until the appropriate figure is opposite the window. The cover is then allowed to return to its normal position (see accompanying sketch).

In operation, the aluminium rollers run back to zero, whilst the white rollers show the number of turns which have been wound on to the coil. When the aluminium rollers reach zero the switch at the back of the Counter is closed; this energises the Solenoid coil, which in turn releases the clutch lever on the Headstock.



VEEDER-ROOT PRE-SET ELECTRICAL TYPE
COUNTER AS FITTED TO SPECIAL DOUGLAS
WAVE WINDER

Plate 4—Parts List

| ITEM NO. | DESCRIPTION | PART NO. | NO. OFF | ITEM NO. | DESCRIPTION | PART NO. | NO. OFF |
|-------------|--|-------------|------------|-------------|---|-------------|------------|
| 1 | Flexible Coupling to Micro Switch . . . | 13814/1 | 1 | 13 | Screws for Item 12 . | AS.23 | 2 |
| 2 | Solenoid Assembly (in- cluding coil) . . . | 20484/A | 1 | 14 | Spindle Extension . . | 11772/1 | 1 |
| 3 | Solenoid Coil . . . | 13809/1 | 1 | 15 | Special Gear Guard . | 20924-Z | 1 |
| 4 | Double Vee Pulley . . | 10802/2 | 1 | 16 | Drive Pin | 11769/1 | 1 |
| 5 | Screw Securing Item 4 | AS.32 | 1 | 17 | Adapter | 11771/1 | 1 |
| 6 | Revolution Counter (pre- determined type) . . | 10217/1 | 1 | 18 | Special Drive Pin . . | 20339/1 | 2 |
| 7 | Screw Securing Item 6 | S.412 | 4 | 19 | Micro Switch | 11318/4 | 1 |
| 8 | Nuts for Item 7 . . . | N.36 | 4 | 20 | Housing for Micro Switch | 20410/A | 1 |
| 9 | Washers for Item 7 . . | W.16 | 4 | 21 | Spring for Release Arm | 11908/1 | 1 |
| 10 | Bracket for Revolution Counter | 40029/24 | 1 | 22 | Release Arm Assembly | 13813/A | 1 |
| 11 | Screws Securing Item 10 | S.449 | 2 | 23 | Bearing Bracket . . . | 12743/2 | 1 |
| 12 | Revolution Counter Coupling | 11770/1 | 1 | 24 | Foot Treadle Complete Assembly | 40207/A | 1 |
| | | | | 25 | Spring for Foot Treadle | 10880/1 | 1 |
| | | | | 26 | Complete Assembly . | 50092/A | |

PLATE 4 "DOUGLAS" COUNTERSHAFT WITH ELECTRO-MAGNETIC TRIP

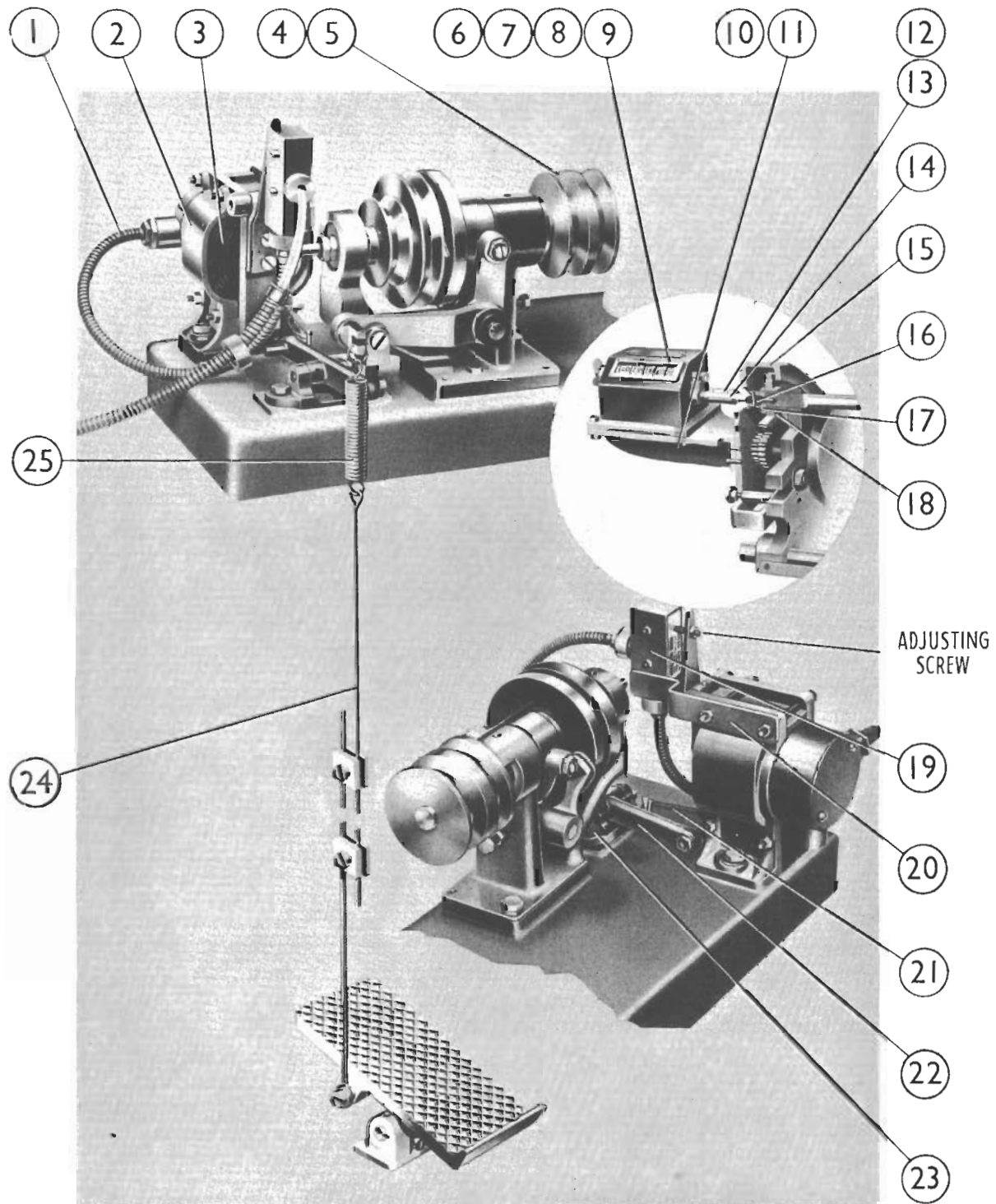
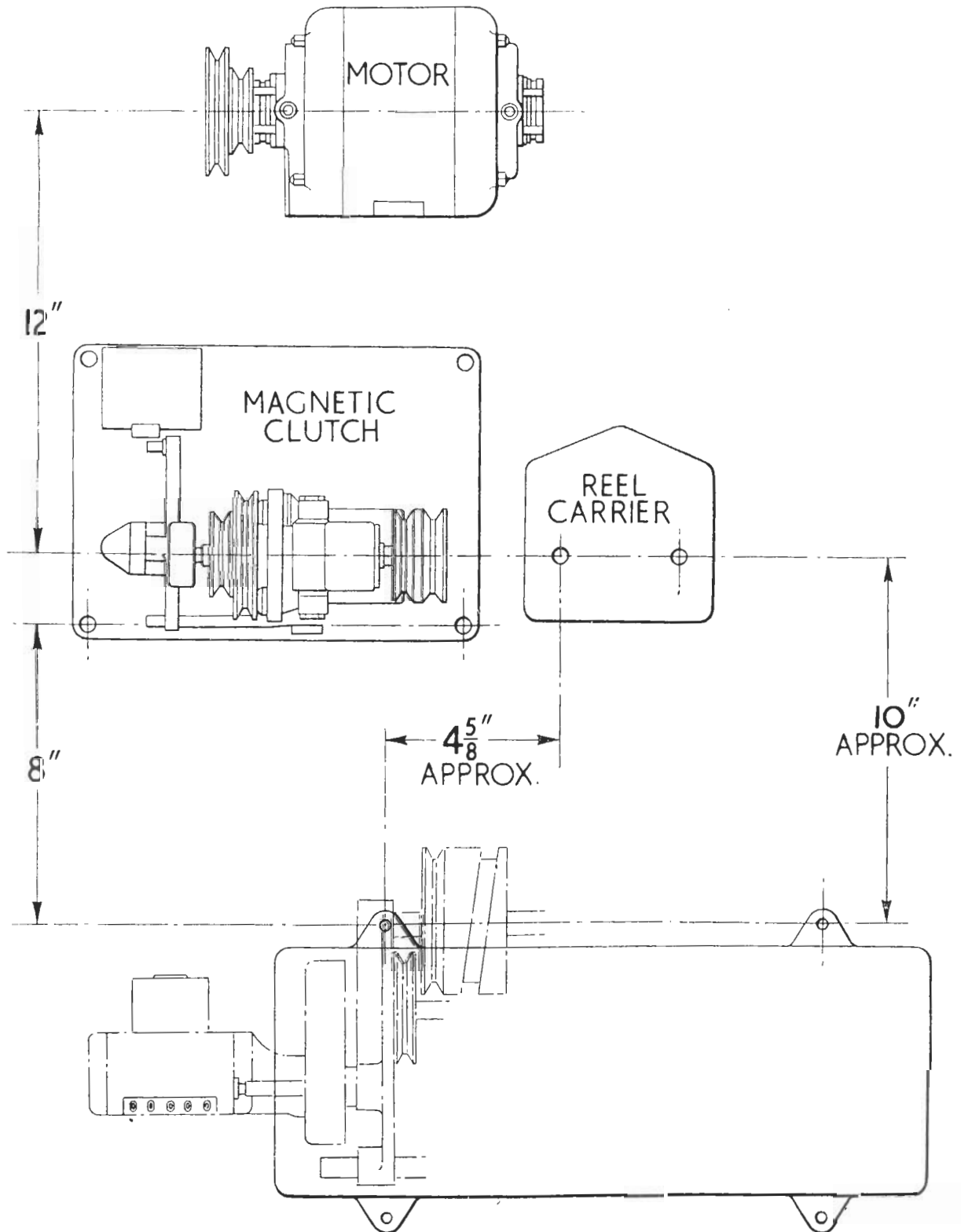


PLATE 5 BENCH LAYOUT





THE "DOUGLAS" PROGRESSIVE WAVE WINDER

The "DOUGLAS" Progressive Wave Winder is a Universal Machine for winding either wave wound or progressive wave wound coils. An illustration of this Machine is shown on Plate No. 6 and it will be noted that only one Wire Guide Arm is fitted. This means that with standard equipment only one wave wound coil can be wound at one setting. Should it be necessary to use the Machine for multiple pie winding a special Wire Guide Arm Spindle can be fitted by removing the Lead Screw and Carriage Assembly and fitting Wire Guide Arms, similar to those used with the "DOUGLAS" Wave Winder (see Plate No. 2). This additional equipment together with extra "DOUGLAS" Standard Reel Carriers, can be supplied by the manufacturers at extra cost.

EQUIPMENT

The equipment supplied with this Machine when it leaves the factory includes :

1. One "DOUGLAS" Standard Reel Carrier.
2. One set of Change Gears, comprising nineteen Wave Compound Gears and eight Wave Form Gears.
3. One set of Traverse Gears (eighteen).
4. One $\frac{1}{4}$ " - $\frac{5}{16}$ " Spanner for adjusting the Gear Quadrant.
5. Two small hexagon wrenches for the 0 B.A. and 4 B.A. grub screws.
6. One length of round leather belt (sufficient to make two driving belts.)

INSTALLING THE "DOUGLAS" PROGRESSIVE WAVE WINDER

The procedure for installing this Machine is the same as for the "DOUGLAS" Wave Winder and the instructions given on Page 4 and Plate 3 should be carefully followed.

SETTING UP THE MACHINE

PROGRESSIVE WAVE WINDING

The effective difference between a progressive wave wound coil and the conventional pie wound coil (wave winding) is the laying of the adjacent turns of wire. Since this is affected by the many adjustments that can be made to the "DOUGLAS" Progressive Wave Winder, a brief explanation of this will be helpful.

When a pie wound coil is being wound, the adjacent turns of wire are approximately the same distance apart for either direction of "throw" of the Wire Guide Button (see Plate No. 6, Item 60).

Whereas with progressive wave winding the "throw" of the Wire Guide Button is alternately in and out of phase according to the movement of the Wire Guide Button. In other words, the relative speed of the Button and the Coil are different for the two directions of the "throw" of the Button. Consequently, when the Wire Guide Button is throwing (cam action) in phase with the movement of the Wire Guide Arm

(traverse) the adjacent turns of wire are more widely spaced than when the Button is out of phase with this movement.

Many laboratory tests have been made with the "DOUGLAS" Progressive Wave Winder and it has been found that a considerable number of winding patterns can be wound. The accompanying illustration shows two typical examples.



"DOUGLAS" WAVE WINDING MACHINES

Due to this considerable scope of the Machine it is not practicable to lay down a formula for the various Machine settings, as individual coil design for a given inductance vary. To produce a coil similar to that illustrated on the small coil former, Page 9, the following materials and gears were used:—

| | |
|-----------------------|---------------------------------|
| Coil Former : | 0.25" (6.35 mm.) diam. |
| Double Silk Wire : | 0.006" (0.15 mm.) overall diam. |
| Traverse Gears : | 30 — 60 — 36 — 75 |
| Wave Compound Gears : | 50 — 35 — 48 — 50 |
| Wave Gears : | 60 — 60 |
| Throw : | 0.156" (3.97 mm.). |

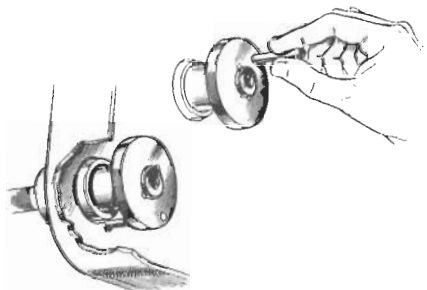
The completed winding using this setting will resemble a number of very narrow wave wound coils closely packed together along the coil former.

Although the Machine setting can only be made by trial and error to produce a coil of required inductance, following a little experience with the Machine the setting will be quickly achieved and for future reference the gear combination and Wire Guide Arm "throw" should be noted.

It is important that the Wire Guide Button with the radius face is used for progressive wave winding.

WAVE WINDING

To use the Machine for wave winding (pie coils) the traverse gear "D" on the Lead Screw should be removed and the Gear Blank and Pin Assembly placed in its position so that the pin enters the hole in the Gear Guard as shown in the accompanying sketch.



This is to prevent any movement of the Wire Guide Arm due to vibration during winding. The Wire Guide Button with the flat face should then be placed in the Wire Guide Arm, and with this done the instructions on Page 6 for the "DOUGLAS" Wave Winder, carefully followed.

The changing of position of the Wire Guide Arm between pies does, however, differ on this Machine. This may be carried out by either of the following two methods: Firstly, the Half Nut Arm, Item 43, may be lifted away from the Lead Screw, Item 72, by depressing the Release Stud, Item 42 Plate No. 6, the carriage may then be moved to the desired position and the Half Nut allowed to re-engage the Lead Screw. The second method, which gives a very accurate spacing of the pie windings, is to remove the Gear Blank and Pin Assembly having completed the first pie winding and use this assembly as a hand wheel (see sketch below), to rotate the Lead Screw. It is, of course, important to replace the Gear Blank and Pin Assembly to its former position in order to lock the Lead Screw.

When using the "DOUGLAS" Progressive Wave Winder for wave winding the tables and examples as shown on Pages 8 and 9 should be followed. The maintenance of the "DOUGLAS" Progressive Wave Winder is somewhat similar as for the "DOUGLAS" Wave Winder and the information given on Page 7 generally applies.

To fit the special Wire Guide Arm Spindle previously referred to, for multiple pie winding, the Taper Pins, Item 77, in the Collars, Item 76 Plate No. 6, should be driven out and the Lead Screw, Item 72, can then be withdrawn from the left hand end of the Machine. The grub screws securing the Top and Bottom Guide Rods, Items 69 and 71, should be loosened and the Guide Rods withdrawn from the left hand end of the Machine at the same time supporting the Carriage Assembly, Item 64, in the right hand.

IMPORTANT—Care must be taken to ensure that the Lead Screw and Guide Rods are not distorted as this will impair efficient working when replaced.

The special Wire Guide Arm Spindle may now be fitted to the Machine and to ensure that the Collars, Item 76, are pinned in the correct place, the Throw Adjusting Block, Item 51, Plate No. 1, should be set in a position which would allow the maximum throw of the Spindle at the right hand side. The special Spindle should then be pushed into the bearing Support Bracket, Item 36, so that there is a clearance of $\frac{1}{16}$ " between the end of the Spindle and the bottom of the Bush, Item 35. The holes in the Collars are then drilled through the special Spindle and reamed to suit the Taper Pins. It is important to ensure that the Collars fit tightly against the Clamping Piece, Item 80, to eliminate any "end play."

It is, of course, essential to place the required number of Wire Guide Arms, Item 1, Plate 2, on to the Spindle before pinning the Collars.

PROGRESSIVE TRAVERSE GEAR TABLE

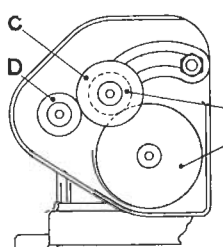
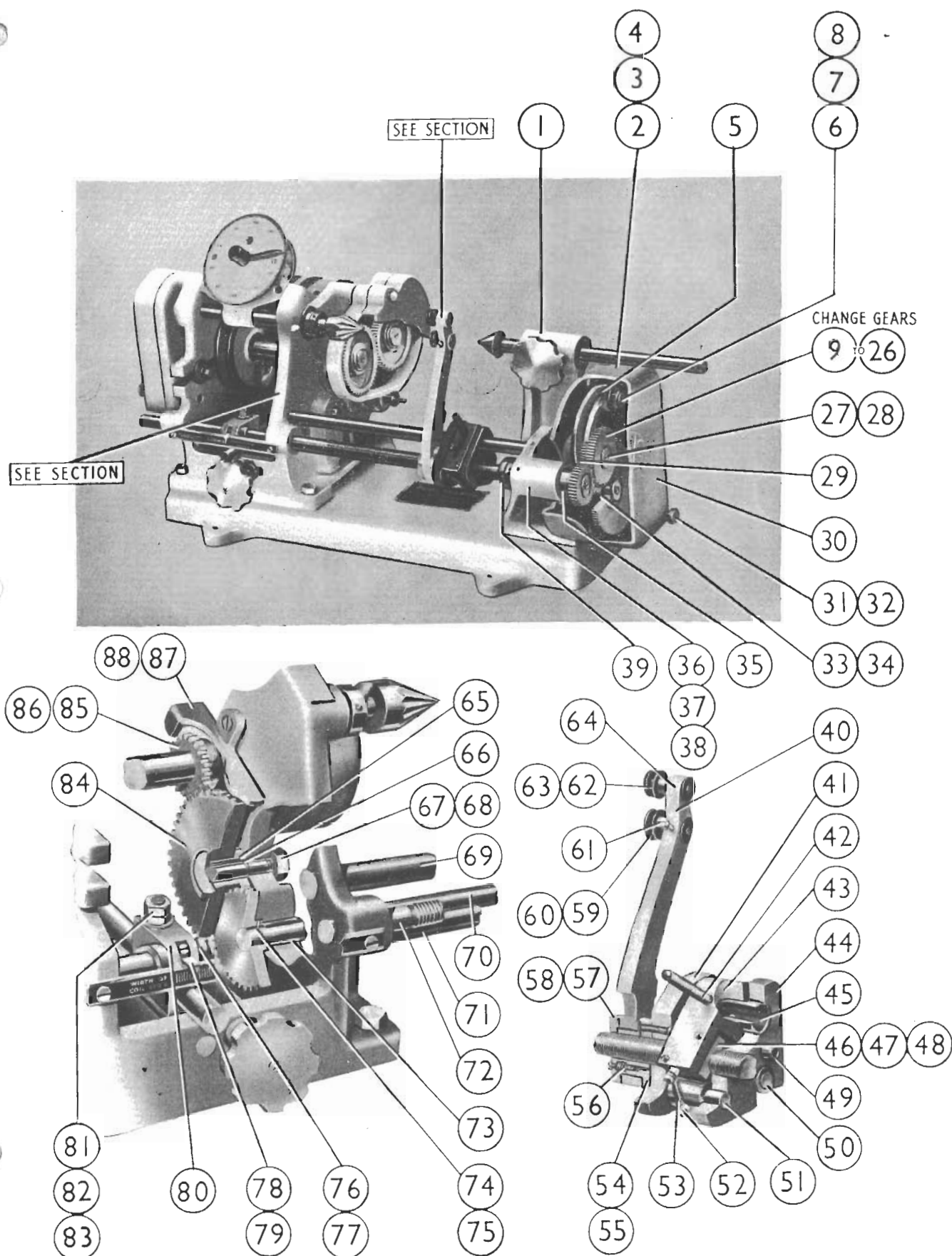
| TRAVERSE PER TURN IN INCHES | A | B | C | D | TRAVERSE PER TURN IN INCHES | A | B | C | D | TRAVERSE PER TURN IN INCHES | A | B | C | D |
|-----------------------------------|----|----|----|----|-----------------------------------|----|----|----|----|---|----|----|----|----|
| *0.0010" | 24 | 75 | 25 | 80 | 0.0100" | 30 | 40 | 48 | 36 | 0.0200" | 50 | 40 | 48 | 30 |
| *0.0011" | 24 | 72 | 25 | 75 | 0.0102" | 34 | 28 | 42 | 50 | 0.0202" | 40 | 44 | 80 | 36 |
| *0.0012" | 24 | 70 | 28 | 80 | 0.0104" | 65 | 30 | 36 | 75 | 0.0204" | 40 | 42 | 60 | 28 |
| *0.0013" | 24 | 65 | 25 | 70 | 0.0106" | 30 | 46 | 65 | 40 | 0.0206" | 34 | 44 | 80 | 30 |
| *0.0014" | 24 | 60 | 28 | 80 | 0.0108" | 36 | 28 | 42 | 50 | 0.0208" | 38 | 40 | 70 | 32 |
| *0.0015" | 24 | 70 | 35 | 80 | 0.0110" | 42 | 28 | 44 | 60 | 0.0210" | 42 | 50 | 70 | 28 |
| *0.0016" | 24 | 60 | 30 | 75 | 0.0112" | 42 | 30 | 48 | 60 | 0.0212" | 42 | 44 | 80 | 36 |
| *0.0017" | 25 | 65 | 32 | 72 | 0.0114" | 38 | 28 | 42 | 50 | 0.0214" | 44 | 48 | 70 | 30 |
| *0.0018" | 28 | 70 | 36 | 80 | 0.0116" | 30 | 60 | 65 | 28 | 0.0216" | 44 | 40 | 55 | 28 |
| *0.0019" | 24 | 70 | 40 | 72 | 0.0118" | 38 | 46 | 60 | 42 | 0.0218" | 48 | 44 | 60 | 30 |
| *0.0020" | 28 | 60 | 30 | 70 | 0.0120" | 40 | 28 | 42 | 50 | 0.0220" | 44 | 40 | 60 | 30 |
| 0.0022" | 30 | 80 | 44 | 75 | 0.0122" | 32 | 30 | 48 | 42 | 0.0222" | 46 | 38 | 55 | 30 |
| 0.0024" | 30 | 60 | 36 | 75 | 0.0124" | 36 | 42 | 55 | 38 | 0.0224" | 44 | 42 | 60 | 28 |
| 0.0026" | 38 | 55 | 30 | 80 | 0.0126" | 34 | 60 | 80 | 36 | 0.0226" | 46 | 40 | 55 | 28 |
| 0.0028" | 30 | 50 | 28 | 60 | 0.0128" | 32 | 30 | 48 | 40 | 0.0228" | 34 | 32 | 60 | 28 |
| 0.0030" | 30 | 50 | 30 | 60 | 0.0130" | 48 | 60 | 65 | 40 | 0.0230" | 46 | 40 | 60 | 30 |
| 0.0032" | 30 | 50 | 32 | 60 | 0.0132" | 42 | 28 | 44 | 50 | 0.0232" | 46 | 34 | 48 | 28 |
| 0.0034" | 30 | 50 | 34 | 60 | 0.0134" | 32 | 44 | 70 | 38 | 0.0234" | 36 | 44 | 80 | 28 |
| 0.0036" | 30 | 50 | 36 | 60 | 0.0136" | 34 | 30 | 48 | 40 | 0.0236" | 38 | 46 | 80 | 28 |
| 0.0038" | 30 | 50 | 38 | 60 | 0.0138" | 42 | 28 | 46 | 50 | 0.0238" | 40 | 36 | 60 | 28 |
| 0.0040" | 30 | 50 | 40 | 60 | 0.0140" | 28 | 30 | 60 | 40 | 0.0240" | 36 | 30 | 60 | 30 |
| 0.0042" | 30 | 50 | 42 | 60 | 0.0142" | 38 | 28 | 46 | 44 | 0.0242" | 50 | 55 | 80 | 30 |
| 0.0044" | 30 | 50 | 44 | 60 | 0.0144" | 36 | 30 | 48 | 40 | 0.0244" | 46 | 44 | 70 | 30 |
| 0.0046" | 30 | 50 | 46 | 60 | 0.0146" | 42 | 30 | 48 | 46 | 0.0246" | 46 | 44 | 80 | 34 |
| 0.0048" | 30 | 50 | 48 | 60 | 0.0148" | 44 | 65 | 70 | 32 | 0.0248" | 46 | 34 | 55 | 30 |
| 0.0050" | 30 | 30 | 40 | 80 | 0.0150" | 30 | 30 | 60 | 40 | 0.0250" | 30 | 30 | 70 | 28 |
| 0.0052" | 28 | 70 | 65 | 50 | 0.0152" | 38 | 30 | 48 | 40 | FORMULA TO FIND GEARS A.B.C. & D. $\frac{\text{DIA. OF WIRE}}{0.010} = \frac{A}{B} \times \frac{C}{D}$  | | | | |
| 0.0054" | 48 | 40 | 36 | 80 | 0.0154" | 42 | 30 | 44 | 40 | | | | | |
| 0.0056" | 42 | 30 | 30 | 75 | 0.0156" | 36 | 50 | 65 | 30 | | | | | |
| 0.0058" | 44 | 38 | 30 | 60 | 0.0158" | 30 | 38 | 60 | 30 | | | | | |
| 0.0060" | 30 | 30 | 36 | 60 | 0.0160" | 30 | 50 | 80 | 30 | | | | | |
| 0.0062" | 30 | 55 | 50 | 44 | 0.0162" | 34 | 42 | 60 | 30 | | | | | |
| 0.0064" | 36 | 30 | 32 | 60 | 0.0164" | 34 | 38 | 55 | 30 | | | | | |
| 0.0066" | 36 | 60 | 55 | 50 | 0.0166" | 80 | 46 | 42 | 44 | | | | | |
| 0.0068" | 36 | 30 | 34 | 60 | 0.0168" | 42 | 40 | 48 | 30 | | | | | |
| 0.0070" | 28 | 50 | 60 | 48 | 0.0170" | 34 | 40 | 60 | 30 | | | | | |
| 0.0072" | 36 | 60 | 48 | 40 | 0.0172" | 44 | 40 | 50 | 32 | POSITION OF GEARS A.B.C. & D. GEARS PROVIDED 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 55, 60, 65, 70, 75, 80 ADDITIONAL GEARS 24, 25 & 72, ARE REQUIRED FOR COMBINATIONS THUS* THESE MAY BE PURCHASED FROM THE COMPANY. | | | | |
| 0.0074" | 42 | 65 | 55 | 48 | 0.0174" | 40 | 46 | 60 | 30 | | | | | |
| 0.0076" | 30 | 30 | 38 | 50 | 0.0176" | 44 | 40 | 48 | 30 | | | | | |
| 0.0078" | 42 | 70 | 65 | 50 | 0.0178" | 46 | 42 | 65 | 40 | | | | | |
| 0.0080" | 30 | 30 | 40 | 50 | 0.0180" | 36 | 40 | 60 | 30 | | | | | |
| 0.0082" | 40 | 36 | 48 | 65 | 0.0182" | 60 | 36 | 46 | 42 | | | | | |
| 0.0084" | 30 | 30 | 42 | 50 | 0.0184" | 46 | 40 | 48 | 30 | | | | | |
| 0.0086" | 65 | 34 | 36 | 80 | 0.0186" | 34 | 40 | 70 | 32 | | | | | |
| 0.0088" | 30 | 30 | 44 | 50 | 0.0188" | 32 | 40 | 80 | 34 | | | | | |
| 0.0090" | 30 | 28 | 42 | 50 | 0.0190" | 38 | 40 | 60 | 30 | | | | | |
| 0.0092" | 30 | 30 | 46 | 50 | 0.0192" | 48 | 50 | 60 | 30 | | | | | |
| 0.0094" | 40 | 65 | 55 | 36 | 0.0194" | 32 | 44 | 80 | 30 | | | | | |
| 0.0096" | 30 | 30 | 48 | 50 | 0.0196" | 48 | 50 | 70 | 30 | | | | | |
| 0.0098" | 28 | 50 | 70 | 40 | 0.0198" | 38 | 48 | 80 | 32 | | | | | |

Plate 6—Parts List

| ITEM NO. | DESCRIPTION | PART NO. | NO. OFF | ITEM NO. | DESCRIPTION | PART NO. | NO. OFF |
|----------|--|----------|---------|--|---|----------|---------|
| 1 | Tailstock Casting | 40360/3 | 1 | 39 | Clamping Nuts | 13301/2 | 2 |
| 2 | Fixed Traverse Gear Guard | 40285/3 | 1 | 40 | Wire Guide Arm | 13326/2 | 1 |
| 3 | Screw Securing Item 2 | AS.21 | 1 | 41 | Arm Carrier Plate | 13307/2 | 1 |
| 4 | Screw Securing Item 2 | AS.18 | 1 | 42 | Release Stud | 13317/2 | 1 |
| 5 | Gear Quadrant Complete with Stud | 13577/A | 1 | 43 | Half Nut Arm complete with Spring Post and Stop Screw | 14159/A | 1 |
| 6 | Gear Quadrant Spindle | 13126/1 | 1 | 44 | Half Nut Arm Plate | 13309/2 | 1 |
| 7 | Washer for Item 6 | W.23 | 1 | 45 | Spacing Bush | 13306/1 | 1 |
| 8 | Nut for Item 6 | N.30 | 1 | 46 | Half Nut | 14276/1 | 1 |
| 9 | Traverse Change Gear, 28 teeth | 30018/4 | 1 | 47 | Screws Securing Item 46 | AS.5 | 2 |
| 10 | Traverse Change Gear, 30 teeth | 30018/6 | 2 | 48 | Dowels for Item 46 | 20339/14 | 2 |
| 11 | Traverse Change Gear, 32 teeth | 30018/9 | 1 | 49 | Clamping Screw | AS.40 | 1 |
| 12 | Traverse Change Gear, 34 teeth | 30018/10 | 1 | 50 | Bottom Spacing Bush | 13306/2 | 1 |
| 13 | Traverse Change Gear, 36 teeth | 30018/13 | 1 | 51 | Spacing Pillar | 13563/2 | 1 |
| 14 | Traverse Change Gear, 38 teeth | 30018/16 | 1 | 52 | Spring Anchor Post | 13314/2 | 1 |
| 15 | Traverse Change Gear, 40 teeth | 30018/19 | 1 | 53 | Half Nut Arm Spring | 11908/1 | 1 |
| 16 | Traverse Change Gear, 42 teeth | 30018/22 | 1 | 54 | Bush for Wire Guide Arm | 13303/1 | 1 |
| 17 | Traverse Change Gear, 44 teeth | 30018/24 | 1 | 55 | Screws Securing Item 54 | S.456 | 3 |
| 18 | Traverse Change Gear, 46 teeth | 30018/27 | 1 | 56 | Springs for Wire Guide Arm | 13549/1 | 3 |
| 19 | Traverse Change Gear, 48 teeth | 30018/29 | 1 | 57 | Wire Guide Arm Washer | 13550/1 | 1 |
| 20 | Traverse Change Gear, 50 teeth | 30018/31 | 1 | 58 | Screws Securing Item 57 | S.669 | 3 |
| 21 | Traverse Change Gear, 55 teeth | 30018/33 | 1 | 59 | Wire Guide Stud for Progressive Wave Winding | 13254/2 | 1 |
| 22 | Traverse Change Gear, 60 teeth | 30018/35 | 1 | 60 | Wire Guide Stud for Pie Type Winding | 12174/1 | 1 |
| 23 | Traverse Change Gear, 65 teeth | 30018/37 | 1 | 61 | Screw Securing Item 59 or 60 | S.449 | 1 |
| 24 | Traverse Change Gear, 70 teeth | 30018/39 | 1 | 62 | Wire Guide Pulley | 12200/1 | 1 |
| 25 | Traverse Change Gear, 75 teeth | 30018/43 | 1 | 63 | Shoulder Screw for Item 62 | 12210/1 | 1 |
| 26 | Traverse Change Gear, 80 teeth | 30018/45 | 1 | 64 | Complete Carriage Assembly including Wire Guide Arm | 20721/A | 1 |
| 27 | Special Washer for Change Gears | 10586/1 | 3 | 65 | 16 teeth Gear | 13120/1 | 1 |
| 28 | Screws Securing Change Gears | S.224 | 3 | 66 | Bush | 13304/1 | 1 |
| 29 | Idler Assembly | 10831/B | 1 | 67 | Gear Stud | 13294/2 | 1 |
| 30 | Traverse Gear Guard Cover | 40286/3 | 1 | 68 | Nut for Item 67 | N.28 | 1 |
| 31 | Studs for Gear Guard | 13295/2 | 2 | 69 | Top Guide Rod | 20660/1 | 1 |
| 32 | Terminal Nuts for Item 31 | 11473/2 | 2 | 70 | Traverse Gear Driving Shaft | 20625/1 | 1 |
| 33 | Gear Collet | 13125/2 | 1 | 71 | Bottom Guide Rod | 20666/2 | 1 |
| 34 | Pin Securing Item 33 | 20339/22 | 1 | 72 | Lead Screw | 20659/1 | 1 |
| 35 | Bush and Gear Collet Combined | 13578/A | 1 | 73 | Reservoir Bush | 11658/10 | 1 |
| 36 | Bearing Support Bracket | 13299/2 | 1 | 74 | 48 teeth Gear | 13118/1 | 1 |
| 37 | Screws Securing Item 36 | AS.46 | 2 | 75 | Pin Securing Item 74 | 20339/22 | 1 |
| 38 | Dowels Locating Item 36 | 20339/9 | 2 | 76 | Collars Retaining Item 80 | 13305/2 | 2 |
| | | | | 77 | Pins Securing Item 76 | R.27 | 2 |
| | | | | 78 | Pointer | 13325/2 | 1 |
| | | | | 79 | Screw Securing Item 78 | S.463 | 1 |
| | | | | 80 | Clamping Piece | 13269/2 | 1 |
| | | | | 81 | Eye Bolt | 13296/2 | 1 |
| | | | | 82 | Washer for Item 81 | W.21 | 1 |
| | | | | 83 | Lock Nuts for Item 81 | N.27 | 2 |
| | | | | 84 | 75 teeth Gear | 13119/2 | 1 |
| | | | | 85 | 27 teeth Gear | 13111/1 | 1 |
| | | | | 86 | Pin Securing Item 85 | 20339/22 | 1 |
| | | | | 87 | Internal Gear Guard | 13337/3 | 1 |
| | | | | 88 | Screws Securing Item 87 | S.230 | 2 |
| | | | | FOR ALL OTHER ITEMS NOT SHOWN, SEE PLATES 1 AND 2. | | | |

PLATE 6 "DOUGLAS" PROGRESSIVE WAVE WINDER





OTHER MACHINES IN THE "AVO" RANGE

"DOUGLAS" NO. 6
"DOUGLAS" NO. 1
"DOUGLAS" NO. 3
"MACADIE" S.C.
"MACADIE" T.D.S.M.
"DOUGLAS" NO. 15
"MACADIE" FULLY AUTOMATIC P.I
"DOUGLAS" NO. 3 EXTENDED BASE
"DOUGLAS" LARGE MULTI WINDER
"DOUGLAS" SMALL MULTI WINDER
"DOUGLAS" DUAL HEAD
"DOUGLAS" MAGNETO
"DOUGLAS" SPECIAL EXTENDED BASE NO. 6
"DOUGLAS" SPIRAL
"DOUGLAS" COTTON INSERTER
"DOUGLAS" NO. 7 TAPING MACHINE
"DOUGLAS" NO. 8 TAPING MACHINE
"DOUGLAS" NO. 9 TAPING MACHINE
"DOUGLAS" NO. 10 TAPING MACHINE
"DOUGLAS" NO. 11 TAPING MACHINE
"DOUGLAS" NO. 12 TAPING MACHINE
"DOUGLAS" HEAVY DUTY POWER DRIVEN
"DOUGLAS" HEAVY DUTY H.F.

THE AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO. LTD.

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