



**UNDULATOR
MODEL 310**

INSTRUCTION BOOKLET

1.4855

F. T. Stewart
PCT 3 Section
A.S.W.E.
Pontsdown



UNDULATOR . MODEL 310

INSTRUCTION BOOKLET

SECOND EDITION

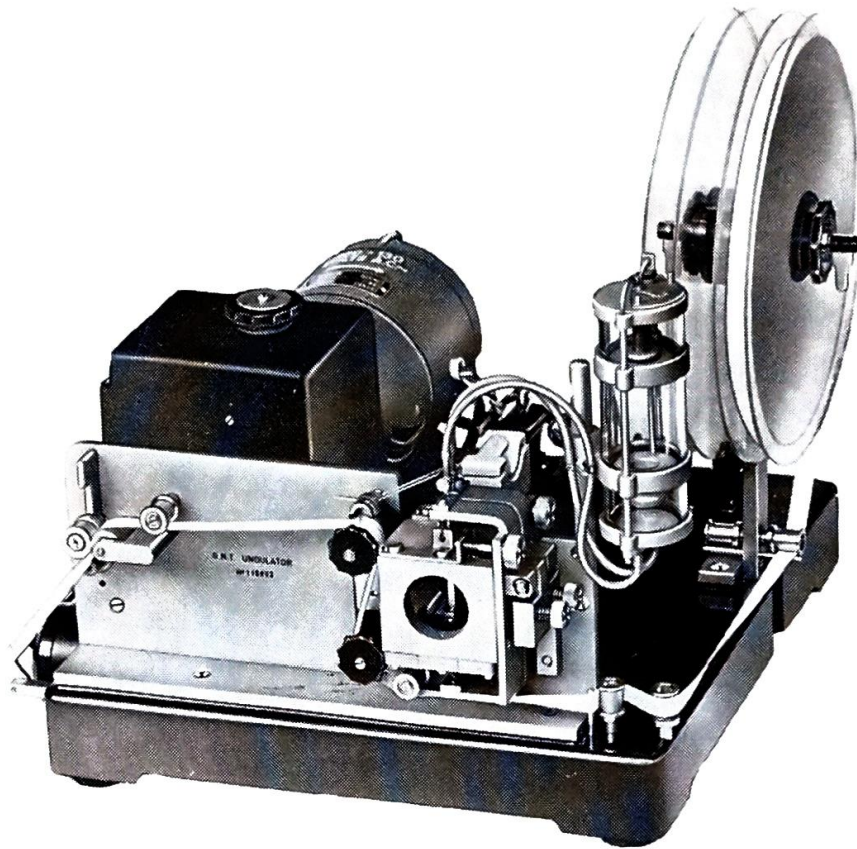
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G. N. T. Undulator Model 310

*When ordering please state voltage of supply
and whether alternating or direct current.*

THE G. N. T. UNDULATOR

MODEL 310

THE UNDULATOR, which is a robust form of syphon recorder, was originally designed in the 1870's by engineers of The Great Northern Telegraph Company who have since continually introduced improvements in the design.

The present instrument is specially designed with a view to recording wireless telegraph signals at speeds up to 300 words per minute and is fitted with two recording parts for the simultaneous recording on the same tape of signals from two different sources, for instance, wireless telegraph signals received on two different aerials (diversity reception), or received and retransmitted signals passing a repeater station.

The signals are applied to the undulator as ordinary direct current signals; wireless telegraph signals must, therefore, be rectified before being fed to the undulator.

The tape drive consists of a self-aligning pressure roller and a driving roller coupled to the speed regulator which is driven by the motor, and the speed regulator ensures that the speed is absolutely constant at any setting. The speed of the tape may be varied within the limits of 7 to 45 ft. (2.1 to 13.5 m) per minute, or, when a smaller driving roller is fitted, half these speeds.

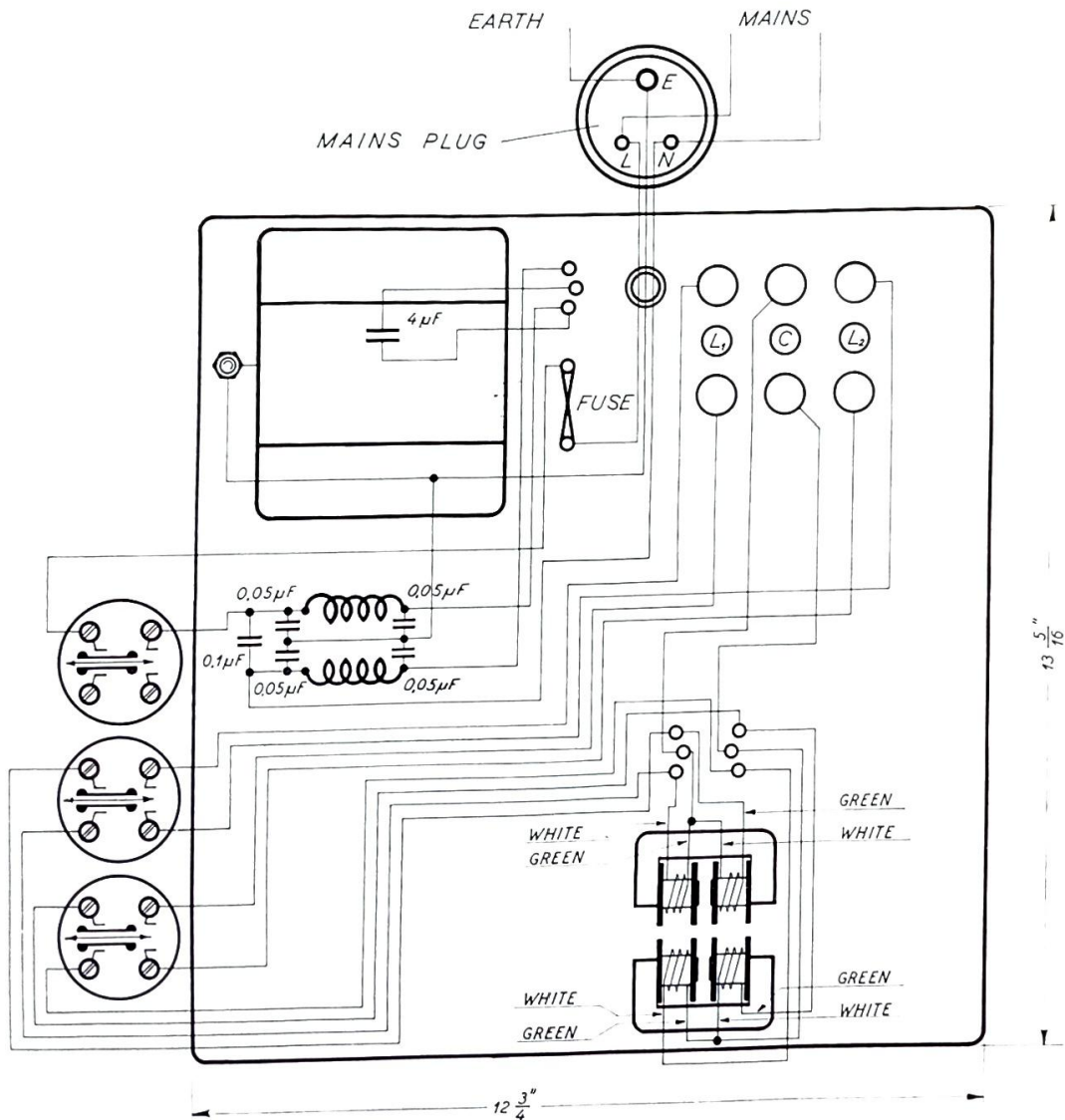
For D.C. operation a shunt motor is employed whereas for A. C. mains an induction motor is used. Both motors run at approximately 2,850 r. p. m., but in the case of two-voltage D. C. motors the motor speed at the higher voltage is somewhat above this figure.

An anti-interference device consisting of high frequency chokes and condensers is incorporated in the motor circuit to prevent interference on wireless receivers due to motor commutation.

On the left hand side of the base are three coupled switches, one for each recording part and one for the motor circuit.

External connections are made by plugs and sockets and by terminals. A 3-pin plug and socket is used for the mains, the third pin being available for earth connection of the motor body.

Each recording part has two coils in series with a centre tap. The three connections are brought out to three terminals, L_1 , C, and L_2 , for each recording part. The resistance of the two coils in series is approximately 300 ohms and the self-inductance approximately 3 henries. Other windings may be supplied if required.



Internal wiring diagram of G. N. T. Undulator Model 310.

The 4 μF condenser shown is avtice only when A.C. motors are employed, acting as a phase splitting condenser for this type of motor.

OPERATION

The armature of the recording part consists of two permanent magnets mounted on either side of a vertical spindle in order to obtain a small moment of inertia. The spindle which moves in sapphire bearings carries a reinforced stainless steel or nickel syphon, and the armature is mounted between two vertical electro-magnets with horizontal pole shoes.

Current flowing through the electro-magnets produces a field across the air gaps and through the extreme ends of the armature magnets. The armature will thus be deflected due to the interaction between the field and the poles of the armature magnets.

Spring control of each armature is afforded by means of a flat armature bias spring. By operating the bias adjusting screw, the syphon is deflected on the tape. For double current operation the syphon is adjusted to trail a line in the centre of its V-slot in the amplitude limiter when no current is received whereas for single current operation the syphon may, if desired, be biased towards the front edge of its V-slot under the same conditions.

The amplitude of the record may be adjusted to the size required by turning the amplitude limiter, which engages the syphons near their extreme ends. This amplitude limiting device may also be moved towards or away from the front plate and should be locked in its final position.

Two knobs on the tape platform assembly allow for vertical or lateral adjustment of the latter.

The ink container, which is of large capacity, is placed to the right on the front plate. The ink is fed to the syphon through a rubber tube.

The speed regulator consists of a centrifugal governor operating in conjunction with a slipping clutch.

When the motor is running, the friction disc will be driven at the speed at which the centrifugal force acting on the governor masses approximately balances the compression of the governor spring. The compression of the governor spring is determined by a cam operated by turning the knob on top of the speed regulator frame. By turning the knob clockwise, the compression is increased and this results in a higher speed. The governor spindle is driven by a key in the control collar and is geared to the output spindle through a pinion and gear wheel.

Paper tape.

The tape to be used is normally 12 mm wide but parts may be supplied for the conversion of the instrument for use with 9.5 mm ($\frac{3}{8}$ "") tape. The tape may be either plain or gummed.

To convert the instrument to use with 9.5 mm tape

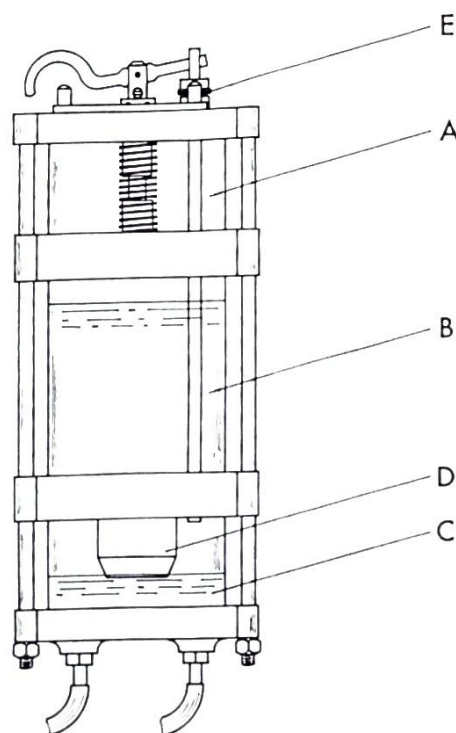
replace		by	
310/304	Pressure Roller (12 mm tape) c.p.	310/4	Pressure Roller c. p.
310/314	Guide Roller (on left of front plate)	310/13	Guide Roller
310/316	Tape Platform (12 mm tape)	310/16	Tape Platform
310/345	Amplitude Limiter, Double, c. p.	310/245	Amplitude Limiter, Double, c. p.

Filling of Ink Container.

Turn the cover clockwise, lift the lever at the top of the container, and pour ink into the upper compartment A. The ink will run down into the intermediate compartment B and on through tube D to the third compartment C. This will fill up until the ink level reaches the lower edge of the tube D, then it will stop rising owing to the increased air pressure in compartment C.

The ink will then fill the compartment B. When this is filled up, the lever should be lowered thus sealing the top of compartment B and making it air-tight. Finally, turn the dust cover anti-clockwise in order to close the filling aperture.

N.B. It is essential that the tube leading up through the container from compartment C is sealed by the pad E on the end of the lever when the lever is raised and that it is opened again when the lever is lowered.



DISMANTLING

Undulator front plate.

The recording parts may be removed as follows:

Remove the ink feed tubes from the syphons.

Remove the syphons.

Remove the two 3-pin plugs (one for each recording part) from their sockets in the main base.

Remove the spring clip at the end of the bracket spindle.

Push back the bracket spindle while supporting the two recording parts.

The two recording parts are now loose.

The armature of any recording part may be removed as follows:

Remove the armature top bearing.

Lift the armature so that the armature bottom bearing clears its pivot pin and remove the armature by lowering it free of the hole in the top of the bracket.

If desired, the armature magnets may be removed by first removing the armature bottom bearing. Next, remove the spring clip and the washer. The magnet holder can now slide off the spindle and the armature magnets may, likewise, slide off. On reassembling, it should be noted that (a) the armature nearest the front plate (armature unit, inner) should be assembled so that the magnet on the inner side of the spindle has its North-seeking pole on top while the reverse is the case for the magnet mounted in front of the spindle, (b) the armature unit, outer, should be assembled so that the magnet on the outer side of the spindle has its South-seeking pole pointing downwards while the reverse is the case for the magnet mounted at the back of the spindle. This is indicated on the drawings page 16.

In order to dismantle the driving roller, it is necessary to remove the front plate from the main base by unscrewing the two fixing screws; but before doing this it is advisable to lift the ink container off its support. Remove the pressure roller by freeing the pressure roller spring at the back and pushing the pressure roller lever forward. The driving roller spindle may now be removed by releasing the grub screw which secures the driving roller to the spindle.

Speed Regulator.

The speed regulator may be dismantled by first removing the motor. In order to do this, loosen the two grub screws which fix the driving disc to the motor spindle and slide the motor backwards. Next, the undulator front plate must be removed.

Remove the four fixing screws for the speed regulator frame.

Unscrew the three fixing screws for the ball bearing retaining plate on the front face of the speed regulator. Hold the centrifugal unit by one hand and retract the governor spindle with ball bearing and pinion.

The centrifugal unit is now entirely free, the collars being held only by the governor arm linkages.

The output spindle may be withdrawn after loosening the two set screws on the gear wheel boss.

The cam may be removed as follows: –

Turn the cam fully clockwise and remove the control arm spring.

Unscrew the control arm spindle; the control arm will now fall out.

Unscrew the knob locking disc screw and lift the knob and knob locking disc away.

The cam with spindle may now be pushed out.

Reassembly of the speed regulator is carried out in reverse order.

When fixing the driving disc to the motor spindle, see that it is pressed on to the spindle as far as it will go.

When reassembling the speed regulator and the motor, check that there is perfect alignment between the output spindle of the speed regulator and the driving spindle of the undulator front plate and that the motor spindle is truly in line with the governor spindle. This will be the case when the friction disc makes contact with the cork ring on the driving disc all round the periphery without play anywhere.

ADJUSTMENTS

In the course of time, the tape platform may be worn by the paper. A fresh wearing surface is obtained by dismantling the tape platform assembly, removing the platform, which is a press fit in its support, and reinserting it after having turned it so that a fresh wearing surface presents itself to the paper.

If, for instance, a burnt out coil on the electro-magnets should necessitate dismantling the latter, it should be noted on reassembling that the armature magnets should just touch the copper facing strips of the electro-magnets cores, when the deflection is maximum, as allowed by the amplitude limiter.

Ink Flow

Initial ink flow is obtained by lifting the ink container off its support and raising it as high as the connecting rubber tube will permit (it will be necessary to unclip the tube from the side of the container in order to do this). Switch on the paper flow and squeeze the rubber tube gently until the ink is flowing freely. Replace the ink container on its support and position it so that the ink level in compartment C is slightly above the tip of the pen. Although this difference can be varied slightly, it should not be more than $\frac{1}{4}$ " (7 mm) otherwise „blobbing“ may occur when the undulator is stopped (see page 6).

After the initial adjustment has been carried out, it should not be necessary to readjust at all providing that the container is always refilled before the ink in compartment B is exhausted.

Refilling can be carried out without taking the undulator out of service. Should the ink refuse to flow at any time, then it should only be necessary to squeeze the rubber tube gently in order to start the ink flow once more. This should only occur if the undulator has been out of use for some considerable time and the pen has become blocked. If, however, the syphon effect has been destroyed, it will be necessary to carry out the initial adjustment again.

MAINTENANCE

The armature sapphire bearings should be inspected occasionally and replacement effected if they are cracked.

The ink container should be rinsed in water occasionally to remove sediment.

If renewal of the ink feed tubes is required, it should be noted that this is ordinary bicycle valve tubing which should be easily obtainable anywhere.

The armature pivots must not be oiled.

Ink stains can be removed from the metal parts by rubbing with a cloth dipped in water or, if necessary, in methylated spirit.

Lubrication.

A good quality medium oil should occasionally be applied to the driving roller bearing, the guide rollers and the tape wheel spindle as well as to the output spindle bearing of the speed regulator, the pivots of the governor arm linkages, and the main spindle. The ball bearing for the governor spindle in the driving disc may be made accessible for oiling by turning the knob to the lowest speed position and pressing the friction disc forward.

The ball bearing of the pressure roller should be lubricated with grease and the same applies to the front ball bearing of the speed regulator, and the ball bearing on the control collar.

Motor.

Motors incorporating ball bearings should be lubricated with grease, while a good quality medium oil should be used for motors with plain bearings, in the latter case at frequent intervals.

In the case of D. C. motors, the commutator should occasionally be wiped clean with a rag moistened with paraffin.

Fuse.

Replacement of fuse wire should be effected by using copper wire 0.002 in. (0.05 mm) diameter.

INK

Ink can be prepared by dissolving aniline dye in water. In climates where the finished ink has a tendency to go mouldy, distilled water should be used. Of the usual kinds of dye not more than about 1 oz. should be used in 2 pints of water (equivalent to about 30 grammes to 1 litre). Various colours, such as red and green, are obtainable, but the almost universally used colour is a violet blue; the dye is known as Victoria Blue (or Brillant Blau F. F. R.), and of this dye is required only 15 grammes per litre ($\frac{1}{2}$ oz in 2 pints).

The solution should be brought to the boil and left to simmer for 10-15 minutes while being stirred. After cooling, it should be filtered at least once through filter paper or cloth.

850 cubic centimetres (abt. $1\frac{1}{2}$ pint) of the filtered solution is finally mixed with 50 cubic centimetres (2 ozs.) of glycerine and 100 cubic centimetres (4 ozs.) of methylated spirit. When using ink made to this recipe the ink will not dry up in the syphon but flow readily whenever the undulator is started, even if it has not been used for a considerable time.

An alternative method of preparing undulator ink consists in boiling old typewriter ribbons in water using 1-2 pints ($\frac{1}{2}$ -1 litre) for each ribbon. After cooling and filtering, glycerine and methylated spirit should be added as above.

OPERATING INSTRUCTIONS

The undulator should, as a rule, be operated with a variable resistance in series with each recording part, unless it is used in special valve circuits where this may be unnecessary. When using a series resistance corresponding to a line current of $\pm 16\text{mA}$, all speeds can be covered up to 150 words per minute. Above this speed it will be found convenient to shunt the series resistance with a condenser. Higher values of line current may be employed if desired.

The tape platform is first adjusted laterally until the tips of the syphons are exactly over, or slightly to the left of, the centre of the platform. In order to obtain a suitable friction between syphon and paper, the pressure on the paper of each syphon is adjusted by means of the vertical adjustment screws of which there are two, one for each recording part.

When inserting a new roll of tape, place it on the tape roll centre in such a way that the tape feeds from behind the tape wheel support. In the case of the first two guide rollers the tape should be passed between the roller and the guide pin.

If any difficulty is experienced in making the ink flow, detach the syphon from the armature spindle, retaining its connection to the ink feed tube. Hold the end of the rubber tube of the syringe supplied with each undulator tightly over the end of the syphon and suck the ink from the syphon by manipulating the syringe. If this is not effective, remove the syphon and clear it by pressing through it the fine metal wire, supplied for this purpose.

If the syphon is too badly clogged up, it should be left to soak in methylated spirit and then blown out by the syringe, or cleared by means of the fine metal wire as mentioned above.

A syphon which is not to be used for some time should be rinsed in water by means of the syringe before being put away.

SPARES AND ACCESSORIES

With each undulator the following spares and accessories are supplied:

- 1 310/10S Small driving roller c.p.
 - 1 310/86 Rubber syringe with tube
 - 1 310/92 Syphon clearing wire
 - 2 310/230 Syphon c.p.
 - 2 310/234 Syphon locking screw
 - 1 310/416 Ink sealing washer
 - 1 310/417 Air sealing washer
 - 4 310/423 Ink feed tube
 - 1 310/125 Instruction booklet
-

SPARE PARTS

FOR

G. N. T. UNDULATOR MODEL 310

On the following pages are shown drawings of a number of spare parts, and a parts list is also given. In some cases the letters c. p. are added to indicate a complete part, i. e., a part consisting of two or more separate parts assembled together.

When ordering spare parts, please give the number of each part and serial number of the instrument for which they are required.

Lists of recommended spare parts are given after the parts list. It is recommended that a set of Minor Spares or a set of Essential Spares be supplied with each undulator.

If the syphon is too badly clogged up, it should be left to soak in methylated spirit and then blown out by the syringe, or cleared by means of the fine metal wire as mentioned above.

A syphon which is not to be used for some time should be rinsed in water by means of the syringe before being put away.

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 - 1 310/125 Instruction booklet
-

SPARE PARTS

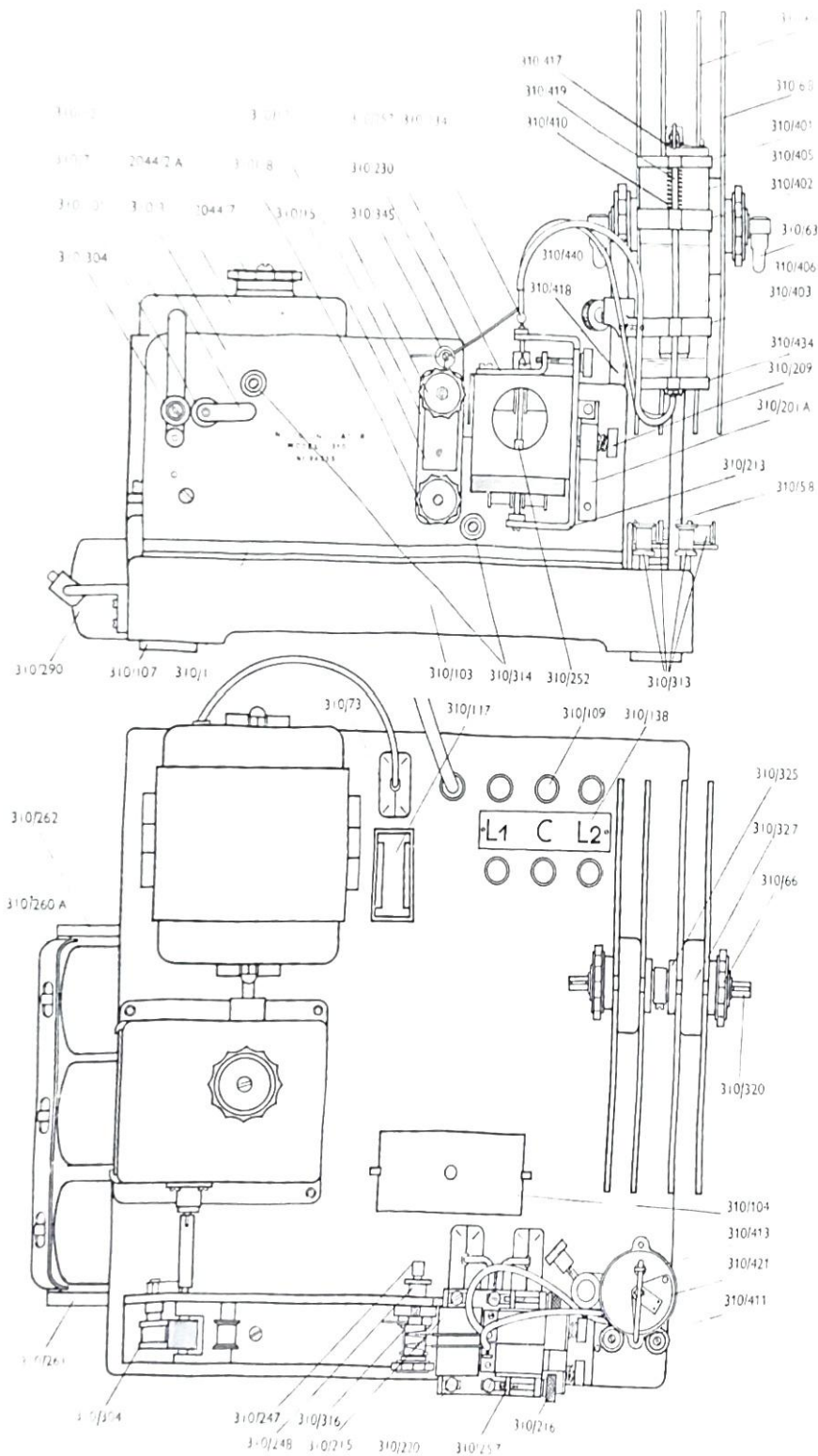
FOR


G. N. T. UNDULATOR MODEL 310

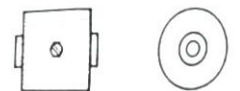
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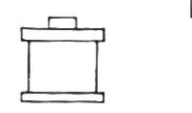
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310/4 PRESSURE ROLLER C P
- 

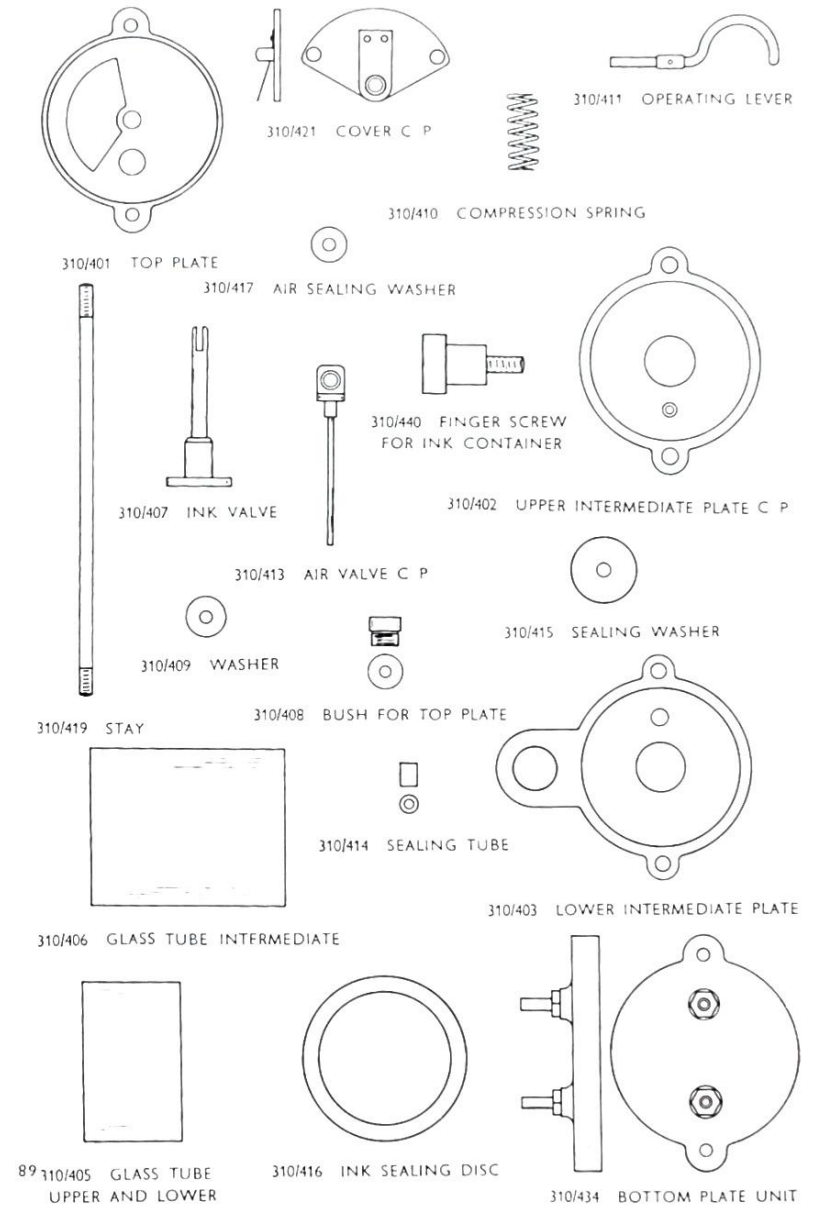
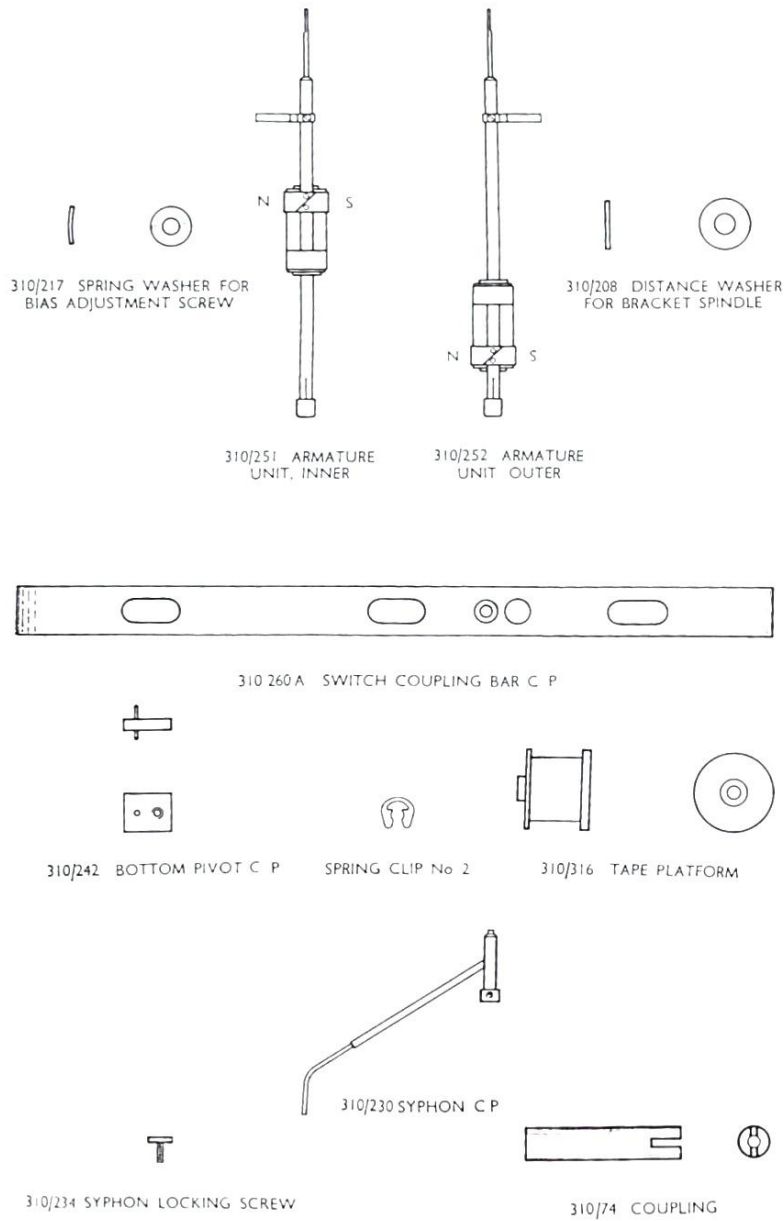
310/10 DRIVING ROLLER C P
- 

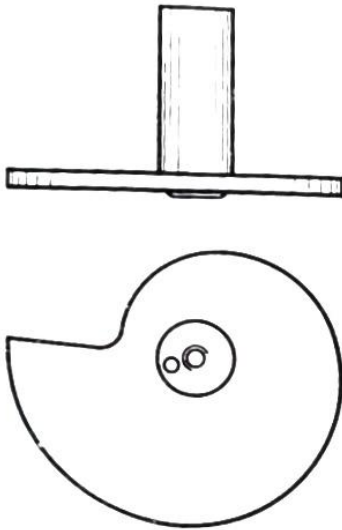
310/105 SMALL DRIVING ROLLER C P
- 

310/16 TAPE PLATFORM
- 

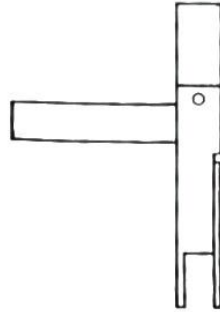
310/214 ARMATURE TOP BEARING C P
- 

310/13 GUIDE ROLLER





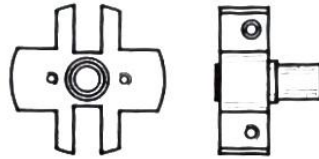
2044/6 CAM C P



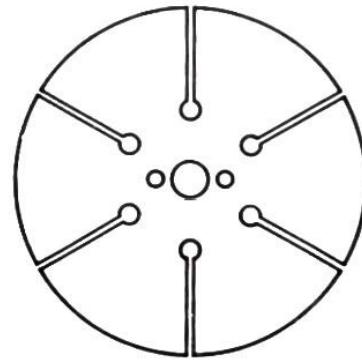
2044/11 CONTROL ARM C P



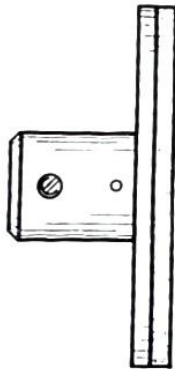
2044/7 KNOB



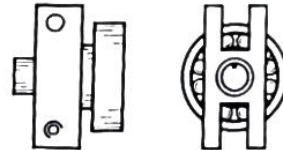
2044/66 FRICTION DISC



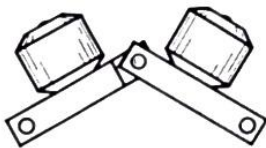
2044/65* FRICTION DISC



2044/21 DRIVING DISC C P



2044/35 CONTROL COLLAR C P



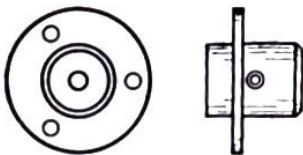
2044/37 GOVERNOR ARM LINKAGE C P



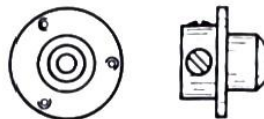
2044/38 GOVERNOR ARM LINKAGE END PIVOT



2044/33 MAIN SPINDLE C.P



2044/53 OUTPUT SPINDLE BEARING



2044/52 BOSS FOR GEAR WHEEL (120 TEETH)



2044/54 OUTPUT SPINDLE C.P

G. N. T. UNDULATOR MODEL 310

PARTS LIST

310/1	Base plate (same as 309/1)	310/19	Tape platform support screw (same as 309/19)
310/3	Front plate c. p.	310/20	Tape platform support screw spring washer (same as 309/20)
310/4	Pressure roller c. p. (9.5 mm tape, for 12 mm tape see 310/304)	310/21	Tape platform horizontal-adjustment eccentric c.p. (same as 309/21)
310/6	Pressure roller fixing nut (same as 309/6)	310/22	Tape platform horizontal-adjustment eccentric nut (same as 309/22)
310/7	Pressure roller lever c. p. (same as 309/7)	310/23	Tape platform spring washer (same as 309/23)
310/8	Pressure roller spring (same as 309/8)	310/58	Tape wheel support c. p. (same as 309/58)
310/9	Pressure roller spring support (same as 309/9 and as 112/15)	310/59	Guide roller distance boss (Tape wheels, same as 309/59)
310/10	Driving roller c. p. (same as 309/10)	—	Tape wheel spindle c. p. see 310/320
310/10S	Small driving roller c. p. (same as 309/10S)	310/61	Tape wheel spindle dolly (same as 309/61)
310/11	Driving roller spindle c. p. (same as 309/11)	310/62	Tape wheel spindle spring (same as 309/62)
310/12	Driving roller bearing piece (same as 309/12)	310/63	Tape wheel latch (same as 309/63)
310/13	Guide roller (Front plate, 9.5 mm tape, same as 309/13. For 12 mm tape see 310/314)	310/64	Tape wheel washer (same as 309/64)
310/14	Guide roller distance boss (Front plate, same as 309/14)	—	Inner tape wheel boss, see 310/325
310/15	Tape platform support (same as 309/15)	310/66	Outer tape wheel boss c. p. (same as 309/66)
310/16	Tape platform (9.5 mm tape, same as 309/16. For 12 mm tape see 310/316)	—	Tape roll centre, see 310/327
310/17	Tape platform guide plate (same as 309/316)	310/68	Outer tape wheel flange (same as 309/68)
310/18	Tape platform vertical-adjustment eccentric (same as 309/18)	310/69	Inner tape wheel flange (same as 309/69)

310/70	Tape wheel dowel screw (same as 309/70)	310/116	Condenser clamping strap (same as 309/116 and as 112/100)
310/73	Motor connecting plug c. p. (same as 309/73 and as 112/97)	310/117	Fuse c. p. (same as 309/117 and as 112/92)
310/74	Coupling (same as 309/74)	310/120	Packing case (same as 309/120)
310/80	Suppressor unit (same as 309/80 and as 451/40)	310/125	Instruction booklet
310/81	Motor connecting socket unit (same as 309/81)	310/138	Terminal plate (L ₁ , C, L ₂)
310/82	Suppressor coil (same as 309/82)	310/201	Recording part bearing piece
310/84	Suppressor condenser, .05 mcf. (same as 309/84)	310/207	Bracket spindle
310/85	Suppressor condenser, .1 mcf. (same as 309/85)	310/208	Distance washer for bracket spindle
310/86	Rubber syringe with tube (same as 309/86)	310/209	Vertical adjustment screw
310/90	Retaining screw (same as 309/90 and as 112/55)	310/211	Bracket, inner c. p.
310/92	Syphon clearing wire (same as 309/92)	310/213	Bracket, outer c. p.
319/94	Front plate fixing screw (same as 309/94)	310/214	Armature top bearing, c. p. (same as 309/35)
310/101	Mains plug, 3-pin c. p. (British standard, same as 309/101 and as 112/101)	310/215	Cover
310/102	Mains socket, 3-pin c. p. (British standard, same as 309/102 and as 112/102)	310/216	Bias adjustment screw
310/103	Main base c. p.	310/217	Spring washer for bias adj. screw
310/104	Tool well cover c. p. (same as 309/104)	310/220	Bias spring support screw
310/105	Tool well spring clip (same as 309/105)	310/223	Friction spring for verti- cal adjustment
310/107	Rubber foot (same as 309/107 and as 112/107)	310/225	Electro-magnet core c. p.
310/109	Terminal (Base) c. p. (same as 309/109)	310/226	Electro-magnet bobbin set (comprising 310/ 306 (2 off) and 310/ 307 (2 off))
310/111	D.C. motor c. p. (same as 309/111)	310/230	Syphon c. p. (same as 309/37, does not in- clude 310/234)
310/112	A.C. motor c. p. (same as 309/112)	310/234	Syphon locking screw (same as 309/38)
310/115	Condenser for A.C. mo- tor (same as 309/115 and as 112/99)	310/238	Spring washer
		310/239	Magnet holder
		310/240	Magnet
		310/241	Armature bottom bearing c. p. (same as 309/34)
		310/242	Bottom pivot c. p.
		310/245	Amplitude limiter, double c. p. (9.5 mm tape. For 12 mm tape see 310/345)

310/246	Amplitude limiter washer (same as 309/40)	310/327	Tape roll centre (same as 309/327)
310/247	Amplitude limiter spindle screw (same as 309/41)	310/345	Amplitude limiter, double c. p. (12 mm tape)
310/248	Amplitude limiter lock nut (same as 309/42)	310/400	Constant level ink container, unit (comprising 310/401 to 440 except 310/418)
310/251	Armature unit, inner (comprising 310/238-310/241, 310/253, and 310/255)	310/401	Top plate (same as 309/401)
310/252	Armature unit, outer (comprising 310/238-310/241, 310/254, and 310/255)	310/402	Upper intermediate plate c.p. (same as 309/402)
310/253	Armature spindle, inner c. p.	310/403	Lower intermediate plate (same as 309/403)
310/254	Armature spindle, outer c. p.	310/405	Glas tube, upper and lower (same as 309/405)
310/255	Armature bias spring c. p.	310/406	Glas tube, intermediate (same as 309/406)
310/256	Bias spring support, inner	310/407	Ink valve (same as 309/407)
310/257	Bias spring support, outer	310/408	Bush for top plate (same as 309/408)
310/260	Switch coupling bar c. p.	310/409	Washer (same as 309/409)
310/261	Switch coupling bar bearing (r.h.) c. p.	310/410	Compression spring (same as 309/410)
310/262	Switch coupling bar bearing (l.h.) c. p.	310/411	Operating lever (same as 309/411)
310/270	Cover for main base switch holes	310/413	Air valve c.p. (same as 309/413)
310/290	Switch, 2-poled	310/414	Sealing tube (same as 309/414)
310/304	Pressure roller c. p. (12 mm tape)	310/415	Sealing washer (same as 309/415)
310/306	Electro-magnet bobbin, r.h., c.p.	310/416	Ink sealing disc (same as 309/416)
310/307	Electro-magnet bobbin, l.h., c.p.	310/417	Air sealing washer (same as 309/417)
310/313	Guide roller (Main base & Tape wheel support, same as 309/313)	310/418	Ink container support (same as 309/418)
310/314	Guide roller (Front plate, 12 mm tape, same as 309/314)	310/419	Stay (same as 309/419)
310/316	Tape platform (12 mm tape, same as 309/316)	310/421	Cover c.p. (same as 309/421)
310/320	Tape wheel spindle c. p. (same as 309/320)	310/422	Ink tube clamp (same as 309/422)
310/325	Inner tape wheel boss (same as 309/325)	310/423	Ink feed tube (same as 309/423)

310/434	Bottom plate unit (comprising 310/435, and 436)	2044/11	Control arm c. p.
310/435	Bottom plate (same as 309/435)	2044/12	Control arm spring
310/436	Outlet tube (same as 309/436)	2044/21	Driving disc c. p.
310/440	Finger screw for ink container (same as 309/440, and as 112/ 19)	2044/24	Cork disc (included in 2044/21)
2044	Speed regulator assembly	2044/31	Retaining plate for driving pinion ball bearing
2044/2	Speed regulator frame c. p.	2044/33	Main spindle c. p.
2044/3	Side cover	2044/35	Control collar c. p.
2044/4	Control arm spring anchor c. p.	2044/37	Governor arm linkage c. p.
2044/5	Control arm spindle	2044/38	Governor arm linkage end pivot
2044/6	Cam c. p.	2044/43	Governor spring
2044/7	Knob	2044/51	Gear wheel (120 teeth)
2044/8	Knob locking disc c. p.	2044/52	Boss for gear wheel (120 teeth)
2044/9	Cam spindle spring washer	2044/53	Output spindle bearing
2044/10	Cam spindle washer	2044/54	Output spindle c. p.
		2044/61	Ball bearing $\frac{3}{16}$ " bore
		2044/62	Ball bearing $\frac{1}{4}$ " bore
		2044/65	Friction disc
		2044/66	Friction disc collar c. p.
		2044/70	Friction disc fixing ring

MINOR SPARES (310/369)

1	310/4	Pressure roller c. p. (9.5 mm) or	2	310/234	Syphon locking screw
1	310/304	Pressure roller c. p. (12 mm)	1	310/241	Armature bottom bearing c. p.
1	310/10	Driving roller c. p.	1	310/242	Bottom pivot c. p.
1	310/10S	Small driving roller c. p.	1	310/251	Armature unit, inner
4	310/11	Driving roller spindle c. p.	1	310/252	Armature unit, outer
1	310/20	Tape platform support screw spring washer	2	310/290	Switch, 2-pole
10	310/423	Ink feed tube	1	310/416	Ink sealing washer
2	310/90	Retaining screw	1	310/417	Air sealing washer
2	310/92	Syphon clearing wire	1	2044/61	Ball bearing, $\frac{3}{16}$ " bore
1	310/214	Armature top bearing c. p.	1	2044/62	Ball bearing, $\frac{1}{4}$ " bore
1	310/226	Electro-magnet bobbin set	1	2044/65	Friction disc

310/434	Bottom plate unit (comprising 310/435, and 436)	2044/11	Control arm c. p.
310/435	Bottom plate (same as 309/435)	2044/12	Control arm spring
310/436	Outlet tube (same as 309/436)	2044/21	Driving disc c. p.
310/440	Finger screw for ink container (same as 309/440, and as 112/ 19)	2044/24	Cork disc (included in 2044/21)
2044	Speed regulator assembly	2044/31	Retaining plate for driving pinion ball bearing
2044/2	Speed regulator frame c. p.	2044/33	Main spindle c. p.
2044/3	Side cover	2044/35	Control collar c. p.
2044/4	Control arm spring anchor c. p.	2044/37	Governor arm linkage c. p.
2044/5	Control arm spindle	2044/38	Governor arm linkage end pivot
2044/6	Cam c. p.	2044/43	Governor spring
2044/7	Knob	2044/51	Gear wheel (120 teeth)
2044/8	Knob locking disc c. p.	2044/52	Boss for gear wheel (120 teeth)
2044/9	Cam spindle spring washer	2044/53	Output spindle bearing
2044/10	Cam spindle washer	2044/54	Output spindle c. p.
		2044/61	Ball bearing $\frac{3}{16}$ " bore
		2044/62	Ball bearing $\frac{1}{4}$ " bore
		2044/65	Friction disc
		2044/66	Friction disc collar c. p.
		2044/70	Friction disc fixing ring

MINOR SPARES (310/369)

1	310/4	Pressure roller c. p. (9.5 mm) or	2	310/234	Syphon locking screw
1	310/304	Pressure roller c. p. (12 mm)	1	310/241	Armature bottom bearing c. p.
1	310/10	Driving roller c. p.	1	310/242	Bottom pivot c. p.
1	310/10S	Small driving roller c. p.	1	310/251	Armature unit, inner
4	310/11	Driving roller spindle c. p.	1	310/252	Armature unit, outer
1	310/20	Tape platform support screw spring washer	2	310/290	Switch, 2-pole
10	310/423	Ink feed tube	1	310/416	Ink sealing washer
2	310/90	Retaining screw	1	310/417	Air sealing washer
2	310/92	Syphon clearing wire	1	2044/61	Ball bearing, $\frac{3}{16}$ " bore
1	310/214	Armature top bearing c. p.	1	2044/62	Ball bearing, $\frac{1}{4}$ " bore
1	310/226	Electro-magnet bobbin set	1	2044/65	Friction disc

ESSENTIAL SPARES (310/370)

for undulators with A.C. motors.

1	310/4	Pressure roller c. p. (9.5 mm) or	1	310/252	Armature unit, outer
1	310/304	Pressure roller c. p. (12 mm)	2	310/214	Armature top bearing
1	310/226	Electro-magnet bobbin set	10	310/230	Syphon c. p.
1	310/251	Armature unit, inner	10	310/234	Syphon locking screw
1	310/112	A.C. motor c. p. (state voltage)	1	2044/35	Control collar c. p.
1	310/115	Condenser for A.C. motor	2	2044/61	Ball bearing $\frac{3}{16}$ " bore
10	310/423	Ink feed tube	2	2044/62	Ball bearing $\frac{1}{4}$ " bore
1	2044/24	Cork disc	1	310/101	Mains plug, 3-pin
			1	310/102	Mains socket, 3-pin

ESSENTIAL SPARES (310/371)

for undulators with D.C. motors.

1	310/4	Pressure roller c.p. (9.5 mm) or	2	310/214	Armature top bearing
1	310/304	Pressure roller c.p. (12 mm)	10	310/230	Syphon c. p.
1	310/101	Mains plug, 3-pin	10	310/234	Syphon locking screw
1	310/102	Mains socket, 3-pin	10	310/423	Ink feed tube
1	310/226	Electro-magnet bobbin set	1	310/111	D.C. motor c. p. (state voltage)
1	310/251	Armature unit, inner	1	2044/24	Cork disc
1	310/252	Armature unit, outer	1	2044/35	Control collar c. p.
			2	2044/61	Ball bearing $\frac{3}{16}$ " bore
			2	2044/62	Ball bearing $\frac{1}{4}$ " bore

MAJOR SPARES (310/372)

for undulators with A.C. motors.

1	310/226	Electro-magnet bobbin set	1	310/112	A.C. motor (state voltage)
1	310/251	Armature unit, inner	2	310/115	Condenser
1	310/252	Armature unit, outer	1	310/117	Fuse c. p.

MAJOR SPARES (310/373)

for undulators with D.C. motors.

1	310/226	Electro-magnet bobbin set	1	310/252	Armature unit, outer
1	310/251	Armature unit, inner	1	310/111	D.C. motor c. p. (state voltage)
			1	310/117	Fuse c. p.

Morse Code Instruments manufactured by G. N. T. Works:

- G. N. T. Keyboard Perforator Model 51**
 - G. N. T. Transmitter Model 112**
speed range 13-250 words per minute.
 - G. N. T. Transmitter Model 113**
speed range 5-35 words per minute, specially suitable for training purposes.
 - G. N. T. Transmitter Model 115**
speed range 5-35 words per minute, permits insertion of extended pauses between transmitted letters and words, ideal for training purposes.
 - G. N. T. Automatic Code Sender Model 125**
for periodic transmissions of Morse signals.
 - G. N. T. Undulator Model 309**
recording signals up to 300 words per minute.
 - G. N. T. Undulator Model 310**
similar to model 309, but with two recording parts.
 - G. N. T. Undulator Model 311**
similar to model 309 but having, in addition, a built-in amplifier.
 - G. N. T. Undulator Model 312**
similar to model 310 but having, in addition, built-in amplifiers, one for each recording part.
 - G. N. T. Reperforator Model 451**
speed range 40-200 words per minute.
 - G. N. T. Morse Key Model 605, or 606**
 - G. N. T. Line Commutator Model 758, or 759.**
 - G. N. T. Regenerator Model 1410**
for the regeneration of Morse signals,
speed range 40-200 words per minute.
 - G. N. T. Sounder Model 1518, 1521, 1522, or 1523.**
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 - G. N. T. Morseinker Model 1532, 1533, or 1536**
motor driven.
 - G. N. T. Tape Puller Model 2040, motor driven.**
 - G. N. T. Tape Winder Model 2081, motor driven.**
 - G. N. T. Converter Model 2201**
for conversion of perforated Morse code tape into teleprinter signals or teleprinter perforated tape.
 - G. N. T. Converter Model 2206**
for conversion of teleprinter perforated tape into Morse code perforated tape.
- and all auxiliary instruments for the telegraph stations.
Detailed information supplied on request.