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ADMIRALTY PATTERN SS. 81

Book of Instructions for

Admiralty Pattern W.587 Morse Transcribing Unit

Standard Telephones and Cables Limited

ADMIRALTY PATTERN SS.81

BOOK OF INSTRUCTIONS

FOR

ADMIRALTY PATTERN W.587

MORSE TRANSCRIBING UNIT.

ADMIRALTY PATTERN SS.81

BOOK OF INSTRUCTIONS FOR A.P.W587

MORSE TRANSCRIBING UNIT

C O N T E N T S

LIST OF FIGURES

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BOOK OF INSTRUCTIONS
FOR
ADMIRALTY PATTERN W.587
MORSE TRANSCRIBING UNIT

DATE OF DESIGN 1940

1. INTRODUCTION. PURPOSE OF THE MACHINE

This apparatus has been designed to enable high speed undulator tape signals to be aurally transcribed at suitable speeds.

The requirements for its operation are that a clearly audible contrast should be obtained between marking and spacing signals. This contrast has been specified as a minimum of 15 db. and, as will be seen later, depends to a great extent on the colour of the ink used. The contrast actually obtained is enhanced by the amplifier by means of a special negative feedback circuit.

In order to cater for individual requirements a variable speed control is fitted which provides for a variation of tape speed from 1 foot per minute to 5 feet per minute.

Since different samples of tape are recorded with the spacing and marking lines in different positions relative to the edges, means are provided to shift the tape relative to the light scanning system, so that variations in the settings of individual undulators can be compensated.

2. PRINCIPLE OF OPERATION.

For the conversion of the ink signals on paper tape into electric currents which can be made audible by means of telephones, use is made of a photo-electric cell. The cell consists of two electrodes, one a wire loop and the other a metal plate which is coated with a compound of caesium. This compound has the property (also exhibited by all metals but to a much smaller degree) of emitting electrons when light falls upon it. If the wire loop is made positive relative to the metal plate, the electrons will be attracted to the former and a current will flow. This current depends on the intensity of the light and on its colour, the caesium coating being particularly responsive to the red. This factor has some importance in the present application as will be explained later. The metal plate thus acts like the filament of a valve, only the current is very much smaller.

This photo-electric current as it is called, can be increased if the photo-electric cell is filled with a gas such as argon instead of being evacuated like a valve. The increase in current takes place because the electrons which leave the plate (called the cathode) immediately find themselves in a powerful electric field and start to move towards the anode (the wire loop) with increasing velocity. On the way molecules of argon are encountered, and when the electron has attained sufficient velocity it can ionize the gas molecule by knocking off one of its electrons which joins the general stream towards the anode, while the heavier gas molecule, now endowed with a positive charge, moves towards the cathode.

The cell used in this apparatus is a gas filled cell.

If now a spot of light falls on the paper tape and the reflected light is directed into a photocell, a current will flow through the latter.

As the tape moves an ink trace may cross the light spot and the amount of light reflected will vary and will cause a corresponding variation in the current in the photocell.

If the signals recorded on the tape were all perfectly formed, it would be possible to arrange for a stationary spot of light to be directed either on the "marking" signal or on the "spacing" signal. In the diagram fig.1, a spot image of a pinhole is shown scanning the marking line of an undulator tape passing over a roller. The resulting current due to the reflected light falling on a photocell would be the inverse of the signal shape on the tape, as shown on the graph below. That is, the current would be nearly zero for a mark and quite a large value for a space. The opposite would hold, of course, if the spot was directed along the spacing line.

However, noise and fading on the radio circuit often cause deformed signals, resulting in some uncertainty as to the exact position of the marking line, and even the spacing line is liable to shift very slightly in a slower manner.

In this apparatus the light is arranged to scan the signals over a comparatively wide band - somewhat smaller than the usual amplitude setting for the undulator.

There are other reasons, however, why this method of scanning has been adopted. So far, the photocell currents considered have been unidirectional pulses of current corresponding either to mark or space signals. Such currents are not so easy to amplify as an alternating current, the amplitude of which is controlled by the signals. Such an alternating or pulsating current could easily be obtained by chopping the light by means of a rotating disc having a number of evenly spaced holes around its periphery. If the spot of light followed the spacing line, there would be a small output of tone on a space, due to the poor reflection from an ink mark, and the frequency of the tone would be determined by the speed of the chopping disc and the number of holes in it. A much larger volume of tone would be obtained from a mark when the light would be reflected by clean paper.

There is, however a much more serious difficulty and that is that owing to the photocell being most sensitive to the red and invisible infra red rays, and owing to the large amount of light energy of red colour emitted by the lamp, it is not the relative reflecting powers of paper and ink in the visible range which must be considered but their reflecting power to deep red and infra red.

Here, unfortunately, the reflecting powers are very nearly equal and not more than 6 db. contrast can be obtained. The contrast depends on the type of ink used and is best for black ink, although the machine will work fairly well with blue.

A partial solution to the above difficulty is afforded by the special scanning disc which consists of two adjacent circles of square apertures, the area of the apertures being made as nearly as possible equal. This disc, in conjunction with a slit, ensures that the total area of light thrown on to the tape at any instant is a constant.

This will be better understood by reference to Fig 2 when it will be seen clearly that as the disc rotates the area A + B must always be the same, for as the disc moves downwards B increases as quickly as A diminishes until A disappears and B is the full width of the slit S-S'. Then B diminishes and A starts to increase again until B disappears and A fills the slit, and so on.

In the machine the division between the areas A and B is made by a wire across the centre of the slit, which masks the actual dividing line on the disc. This wire is fixed in position and if a new disc is assembled in the machine it must be lined up so that the wire masks the dividing line. Instructions for doing this are given under the maintenance part of this handbook.

It will now be appreciated that on the accuracy with which the total area A + B is made constant depends the silence of the background when the unmarked tape is passing through the scanning gate. The dimensions of the shorter sides of areas A and B are dependent upon the accuracy with which the original diagram was prepared and cannot be altered, but the lengths of the longer sides can be controlled. In addition to the jaws defining the slit, the slit is also provided with vertical jaws which can be moved by a fine thread screw relative to the fixed wire in the centre. This adjustment compensates for variations in reflecting power of the paper tape across its width and will be found quite sensitive, although once adjusted it does not generally need further attention.

When, therefore, the slit adjustment is correctly made so that areas A + B are constant, the variations in current in the photocell caused by variations of light intensity are due to:-

1. Errors in the scanning disc. If these are cyclic and recur once per revolution, a frequency equal to the speed of rotation $= \frac{1400}{60} = 23$ cycles

   These have been carefully reduced in manufacture.

2. Random errors in the scanning disc or random variations in transparency. These cause noise at indeterminate frequencies and may be due to a dirty disc. Hence the need for keeping the machine clean and free from oil etc.

3. Random variations in the reflecting power of the paper. This should not be serious but nothing can be done to improve it.

The above sources of noise are not great in practice and are largely eliminated by tuned circuits in the amplifier.

It will now be understood that if the light from either area A or B falls on an ink line a change in photocell current will result, which will be at the frequency of interruption of the light and can easily be distinguished from the random noise from clean paper by means of the tuned circuits provided in the amplifier.

Having now described the underlying principle of the method of scanning used, the optical system required to produce it will be dealt with.

The entire optical system is enclosed in a box casting on the front of the machine. At the extreme right (Fig.3) is an exciter lamp of a type used in motion picture projectors. This lamp is rated at 8v. 32 watts and under these conditions has a life of about 100 hours. This is materially increased by under-running the lamp at 6 volts, which gives all the light necessary for the proper operation of the machine. At 6 volts the actual dissipation is about 20 watts.

The lamp as constructed by the makers is held to a filament centre length (L.C.L.) of 50 mm ± 1.5 mm. This is not accurate enough for centring the filament in the machine, so a special socket with a screw (B) for raising and lowering the lamp is provided. The lamp is forced against the screw by a spring clamp and another screw (A) can be clamped against the side of the cap when the correct adjustment has been obtained.

The filament of the lamp is in the form of a coil and the lens system has been so designed that the image of the filament on the scanning disc and slit is a uniform band and the individual turns of filament do not cause irregularities in illumination along the length of the slit.

The light from the filament passes through a condenser lens L.1 and then through a field lens L.2. The former produces a parallel beam of light, while the latter throws an image of the condenser lens aperture on to the lens L.3.

Next to the field lens is the motor-driven scanning disc already described. The fixed slit is mounted on the other side of the scanning disc and as close to it as possible, since the objective lens L.3 must produce a sharp image of both on the paper tape. The scanning disc is enclosed in a protective guard.

The objective lens L.3 is a 2/3" microscope objective and is sunk into a brass block which also forms an ellipsoidal mirror. This lens forms an image of the slit on the tape.

Having formed an image on the tape, the reflected light must be collected and the maximum amount directed onto the cathode of the photocell. On the side of the brass block remote from the lamp an ellipsoidal mirror has been formed and the block is mounted in such a way that the light spot on the tape is at the focus.

The rays of light collected by the mirror will be concentrated at the other focus of the ellipse which is outside the mirror and at which the photocell is placed. The major axis of the ellipse has been made long enough so that the photocell is well clear of the tape and does not get in the way of threading the tape.

At the point where the light falls on the tape the latter passes over a steel roller. This is capable of adjustment in the direction of its axis by means of the screw F. This enables the tape to be moved so that the marking line is intersected by one of the light spots formed by the two rows of square apertures in the scanning disc.

3. MECHANICAL DRIVE

Behind the box casting housing the optical system is mounted an induction motor which drives the scanning disc at 1400 r.p.m. The scanning disc consists of a photographic reproduction of the scanning pattern clamped between two perspex discs, these in turn being clamped between brass plates on the motor shaft. The outer clamp plate has formed upon it a fan enclosed in a brass cover. This fan serves to keep a circulation of air in the compartment of the optical system and to prevent the accumulation of dust on the slit.

The scanning disc mounting provides a universal coupling to a longitudinal shaft ending in a worm. This engages with a worm wheel on a vertical shaft and provides a 50:1 gear reduction. The vertical shaft has a key way cut in it and a friction wheel is free to be moved up and down the shaft by means of striking forks. These forks are attached to a rack operated by a pinion mounted on the shaft of the variable speed control which is brought out to the front of the machine.

The friction wheel drives a spring-loaded friction disc which gives a 5:1 speed range. This disc is pinned to a transverse shaft on which is mounted the tape puller wheel. A spring-loaded jockey pulley holds the tape on to the puller wheel, the tape passing round the wheel about 270° so that a good pull is assured.

The tape, wound on an Admiralty pattern 5014 reel and pattern 5015 winder, enters the box at the right-hand end under a steel pulley, and passing under the guard round the scanning disc runs over a second pulley, over the scanning gate pulley and out of the box over a pulley at the left-hand end.

It then passes under the tape puller and so into the receiving trough.

The pulleys preceding and following the gate are arranged to slide on their shafts so as to take up a position depending on the adjustment of the scanning gate.

Directions as to threading the tape are given inside the lid of the optical compartment.

The longitudinal shaft from the motor to the reduction gear runs in a self-aligning ball bearing. A ball thrust bearing is fitted at the rear end of the motor to eliminate any end play in the shaft. This is most important, since the clearances between the scanning disc and the slit and field lens are too small to allow of any end play. The remainder of the bearings on the slow speed shafts are plain brass bearings. A ball thrust race is included behind the friction disc.

4. THE AMPLIFIER

The means whereby a variable current through the photocell is obtained has been described. It now remains to complete the description of the amplifier which renders the signals audible in the headphones.

Reference should be made to the schematic, Fig.4. On the right will be seen the power supply circuit which consists of a transformer T 1 operating from the 230 volt A.C. supply. This transformer has 3 secondary windings, an earthed shield being interposed between primary and secondary windings. One secondary supplies the exciter lamp at 6 volts, a second the valve heaters at 4 volts, and the third a selenium bridge-connected rectifier W2 which supplies the anodes of the valves and the polarising voltage for the photocell.

The output of rectifier W2 is smoothed by the choke L.3 and 24 mfd. condenser C8.

Resistances R1 and R2 provide a potential divider to supply the polarising voltage for the photocell. This voltage is approximately 70 volts. The condenser C.1 of 2 uF decouples the photocell supply from the valve anode circuits, forming a low impedence path to the 1000 cycle currents in the amplifier.

The cathode of the photocell is connected to earth through a parallel resonant circuit composed of choke L.1 and condenser C.2 shunted by a high resistance R 3. L.1 has an inductance of nearly 200 henries being wound on a Permalloy core. Condenser C.2 is of the order of 50 $\mu\mu$F The impedance of the tuned circuit at 1000 cycles is 3 megohms and in addition to providing frequency selectivity, also avoids the use of high resistances in positions in the circuit in which variations, due to humidity, would seriously affect the performance of the amplifier. Variations in the value of R3 are comparatively unimportant. The cathode of the photocell is connected to the grid of the valve V.1.

When the photocell receives impulses at 1000 cycles a large potential is built up across the tuned circuit, whereas currents due to noise develop much lower potentials due to the lower impedance of the tuned circuit at these frequencies.

V.1 is a variable μ pentode valve and is provided with automatic grid bias by means of the resistance R.4, which is fixed, and the resistance R.5, which is variable in ten steps. With R.5 at zero the gain is a maximum.

The screen grid of V.1 is maintained at about 80 volts by means of resistances R.8 and R.9, and is decoupled to the cathode for audio frequencies by the condenser C.3.

The outer or suppressor grid is strapped to the cathode on the valve socket.

The anode circuit is supplied through resistances R.6 and R.7. R.6 is a decoupling resistance and operates in conjunction with condenser C.4.

The valve V.1 is coupled to the valve V.2 by a resistance-capacity coupling, consisting of the resistance R.7 in the anode circuit of the valve V.1, the grid coupling condenser C.5 and the grid resistance R.10.

The valve V.2 is of the same type as V.1 (N.R.45). In this valve the screen grid is connected direct to the H.T. supply, while the anode circuit includes the output transformer T.2 tuned by the condenser C.7 and shunted by the resistance R.12. The low impedance winding of the transformer T.2 is connected to the two output jacks.

The transformer T.2 is wound on a toroidal core of high permeability dust and the primary inductance is adjusted within close limits to resonate at 1000 cycles with the condenser C.7. The impedance ratio of this transformer is 40,000:600 and the resistance R.12 shunted across the primary gives an output impedance at 1000 cycles, viewed from the output, of 600 ohms.

In the cathode circuit of V.2 is the contrast expander. This is the negative feedback device mentioned in the introduction to this handbook.

It will be remenbered that in describing the principle of operation, it was stated that the contrast between marking and spacing signals was governed by the relative reflecting powers of paper and ink for the deep red and infra red rays from the lamp. This was stated to be of the order of 6 db. or, expressed in other words, the amount of red light reflected from the paper is about double that reflected from the ink line. If now, a device can be obtained which will vary the gain of the valve V.2 according to the voltage impressed by the signal on its grid in such a way that the gain is turned up by 15 to 20 db. when a signal is received, a contrast ratio between mark and space of 20 - 25 db. will have been achieved.

Since the alternating currents due to signal and noise flowing in the anode circuit of valve V.2 also flow through the grid bias circuit of this valve, they can be made to control the gain of the valve V.2 by omitting a decoupling condenser across the bias circuit. A device is now needed which will reduce the impedance of this bias circuit to Alternating Current (without altering its resistance to direct current) when the applied alternating e.m.f. is large. With such an arrangement small noise e.m.f's will not be much amplified, since the impedance of the device will be large and will feed a large e.m.f. opposing the signal in the grid circuit of the valve, thus reducing its gain. The larger signal e.m.f's will reduce the impedance of the device and thus the feedback voltage. The gain will then increase and a larger output will be obtained.

The copper oxide rectifier is just such a device, and if two such rectifiers are connected in parallel, back to back, it will be found that a variation in impedance is obtained over a certain range of currents. The range can be extended by the use of further rectifiers connected back to back and in series with the first set.

The rectifier W.1 is assembled as one unit and consists of two single copper oxide discs connected back to back in series with four double disc units connected in pairs back to back. The first pair of single discs takes care of the lower range of signal powers and the second pair takes care of the higher signal powers. Thus the rectifier W.1 provides expansion due to variable feedback over a considerable range of output powers. actually from about 0.1 milliwatt to 10 milliwatts.

Provision must, of course, be made for the steady current resistance of the circuit (and hence the grid bias on the valve) to be kept constant. The rectifiers are therefore connected in series with a condenser C.6. In order that the bias circuit shall have a high impedance to signal currents, a choke coil L.2 is used and its resistance is built out to the required value for grid bias by means of resistance R.11.

In the same way provision must, of course, be made to prevent the steady anode current flowing through W.1 and thus shunting the grid biassing resistance. This is achieved by the blocking condenser C.6.

5. INSTALLATION AND OPERATION

The Morse Transcribing Unit is delivered packed in a wooden carrying case. After removal from the case, the front cover over the controls should be removed. It will be found that this cover may be screwed to the back of the chassis and should be replaced over the controls whenever the unit is dismantled for return to store.

Two NR.45 valves should be inserted in sockets V.1 and V.2. A Pattern 7508 Photocell should be inserted in the approp-riate socket above the ellipsoidal mirror.

A 230-volt A.C. supply and an earth connection should be connected to the unit where indicated.

It is now necessary to insert an exciter lamp (Ediswan 8v. 32 watts) and to focus the optical system. Instructions for this are included inside the door of the optical compartment but are repeated here for convenience.

The lamp socket will be found at the right-hand end of the optical compartment in front of the machine.

Slacken screws A and B and raise the clamp G. (See Fig.3). The lamp can now be fitted to the socket, the bayonet pins sliding down two grooves. Since the lamp is manufactured with the filament perpendicular to the line of the bayonet pins, the filament should be horizontal and approximately perpendicular to the axis of the optical system.

Allow the spring-loaded clamp G to rest on the top of the bulb. This forces the centre contact of the cap against screw B, which is provided with a spring plunger contact, and ensures a good contact during adjustment. There should be adequate contact with the cap itself for adjustment purposes, but if this is not the case, screw A may be slightly advanced until it is gently rubbing the cap, but it should not be so tightened as to prevent the lamp being raised or lowered by screw B.

The amplifier switch should now be turned on. The exciter lamp should then light and it will be found that a blurred image of the filament will be cast by the condenser lens L.1 upon the glass of lens L.2. If the lamp is at the correct height, this image will lie right in the centre of lens L.2. If it is too high the lamp must be raised and if too low the lamp must be lowered by means of screw B. When the adjustment is satisfactory screw A should be advanced to clamp the lamp cap and an extra turn should be given to screw B, after which B should be locked by means of its lock ring. If the photo electric cell is seen to emit a permanent blue glow, the H.T. voltage is too high and must be reduced by changing the tappings of the mains transformer, as described below under "Maintenance of Amplifier".

It is now important to check the adjustment of the motor and scanning disc. This will have been adjusted at the factory but it should be checked in case the motor fixing bolts have shifted during transit. THESE ADJUSTMENTS MUST NOT BE ALTERED UNLESS THE TESTS SHOW THAT THE MAKER'S SETTINGS HAVE SHIFTED.

Some clean paper tape should be threaded into the machine as shown in the instructions in the lid of the optical compartment. The scanning disc should be turned by hand (after removing the rear cover) until an image of the slit appears on the paper tape as it passes over the adjustable gate roller F. Further rotation of the scanning disc will cause this image to reduce in size and another will appear either to the left or right of it. If either of these images is intersected by a dark line, the wire in the middle of the fixed slit is not exactly over the boundary line between the two patterns on the scanning disc, and the motor must be loosened and moved either to the front or to the rear until the shadow of the wire can no longer be seen in either of the two slit images. The fixing bolts of the motor must then be carefully tightened and the scanning disc should be turned by hand to see that it is clear of all obstructions. During this test the intensity of the light should be reduced by placing one or two thicknesses of tracing paper in front of the lamp. It is important to rotate the disc through a complete revolution to observe any eccentricity.

The scanning disc should be wiped over with a clean cloth and care should be taken not to touch the parts near the scanning pattern.

The position of the condenser lens L.1 should be adjusted by slackening screws D and moving the lens mount until a uniform bright disc of light appears on the white disc. Screws D should then be clamped.

The adjustment of the focus on the tape should then be tested. During this adjustment it will be found desirable to reduce the brightness of the lamp filament, otherwise it is difficult to see the point of correct focus. A piece of thin paper should be held between the lamp and the condenser lens L.1. Screws E on the mounting of the lens L.3 and the mirror should be slackened and the mounting moved until a sharp image of the slit is obtained. Screws E should then be tightened up.

The socket of the photocell will be found to be adjustable by slackening two knurled screws H and moving the photocell until the image of the light on the tape is projected on to the centre of the cathode. The scanning disc should be turned by hand to ensure that both images fall on the cathode. The adjusting screws H should then be tightened.

The motor can now be started by operating the motor switch. A pair of telephones should be plugged into one of the two output jacks and the clean paper tape allowed to run through the machine.

In general, a sound will be heard in the telephones of about 1000 cycles. The adjusting screws C on the slit S should now be moved until this sound falls to a minimum. This adjustment moves the vertical jaws of the slit until the total light received from the tape is constant.

The machine is then ready for use.

6. OPERATING INSTRUCTIONS

When recording on the undulator, portions of tape which may be subsequently required for transcription should not be cut off short at the commencement and end of the required messages. Two feet of spare tape should be left at each end for threading into the transcribing unit.

The tape for transcription should be threaded through the machine in accordance with the diagram on the instruction plate. For this purpose the tape must be wound on the Pattern 5014 reel with the signals outwards. The gate adjusting screw F must be moved so that one of the two slit images intersects the marking signal but does not intersect the spacing line on the tape. This adjustment can either be performed aurally or visually. When the adjustment is complete, the door of the optical compartment should be closed.

The gain of the amplifier should be adjusted for a convenient output signal. The speed of the tape may be regulated by the speed control, but it is important that the regulation of the speed should only be made while the motor is running, otherwise a flat will be worn on the friction wheel which will ultimately give trouble due to an uneven drive.

7. MAINTENANCE INSTRUCTIONS

Lubrication:

The motor and the bearings of the friction wheel and disc should be lubricated once a week with a few drops of good light machine oil. The worm and worm wheel should be lubricated with vaseline.

The self-aligning ball race and the thrust races on the motor and friction disc should be smeared occasionally with vaseline.

Cleaning Optical System:

It is important to keep the scanning disc clean and to give the lenses an occasional cleaning with a soft cloth or lens tissue. The interior of the optical compartment should be kept clear of dust and may be brushed out as required by a fine paint brush.

Replacement of scanning disc or motor.

The scanning disc, being made of Perspex requires careful handling, since it scratches very readily, much more readily than plate glass. For cleaning, the makers recommend warm soapy water applied with cotton wool. This would not be a satisfactory method to apply when the disc is assembled in the unit, unless great care was exercised, but it would be used to clean throughly a spare disc assembly prior to mounting it. The disc should afterwards be rinsed with clear water and dried with a soft leather.

Should a disc become slightly scratched and a spare is not available, vigorous polishing with metal polish will clear it, followed by a finishing polish with the polish diluted with white spirit or kerosene. No hard leather or harsh fabric should ever be used for cleaning the disc.

Should the scanning disc be broken or damaged, it will be necessary to dismantle the motor.

The guard over the fan and that over the scanning disc should first be removed. Then the motor holding bolts should be slackened and withdrawn. This can be done by means of an O.BA spanner. Holes have been provided in the chassis to facilitate the entry of a box spanner. The nose of the motor can then be slipped out of the universal coupling and the motor and disc removed from the chassis.

The four screws securing the fan are next removed, when the clamp plates of the scanning disc will become free and the latter can be dismantled.

In re-assembling the scanning disc, it is most important to ensure that the photographic negative and the two plates are free from grease. They should be wiped with a clean rag dipped in carbon tetrachloride. Care should be taken in re-assembling not to allow fingerprints to be made either on the negative or on the plates of the scanning disc. After re-assembling the motor and scanning disc, the position of the motor must be adjusted so that the image of the wire in the fixed slit does not cut either image produced by the scanning pattern. This adjustment has been described under the instructions on installation.

It is most important to fit the end thrust bearing on a new motor before running, otherwise damage may result.

The bearing runs between the end plate of the motor and a collar secured by a grub screw. The position of the collar should be so adjusted that no end play exists in the armature shaft.

Replacement of exciter lamp

This is covered in the instructions inside the door of the optical compartment and the adjustment of the filament height and focus of lens L 1 are covered under the instructions on installation. When replacing a lamp it will not be necessary to re focus lens L 3 nor will it be necessary, in general, to readjust the slit screw C.

Maintenance of Amplifier

Apart from changing valves and possible replacement of the photocell, the amplifier will need no maintenance. To enable the performance to be checked, figures are given below for the currents and voltages which should be found in various parts of the circuit. Reference should be made to the schematic Fig.4 and the wiring diagram Fig 5.

Voltage across exciter lamp measured with an A.C. voltmeter 6 volts ± 0 25 volt.

Voltage across valve heaters measured with an A.C. voltmeter: 4 volts ± 0.25 volt.

The main H.T. voltage (measured across the terminals of condenser C.8) will be found to settle down from an initial value, which should not be greater than 190 volts under extreme conditions of mains variation, to a final value not exceeding 161 volts on full gain and 172 volts on minimum gain. If these voltages are not exceeded, the photocell should not show a blue glow.

Adjustment of the main H.T. can be effected by taps on the winding of the transformer T 1, which feeds the selenium rectifier W.2. This adjustment is provided to enable a higher voltage to be delivered to the rectifier if the latter increases in resistance after a long period of service.

When any adjustment of the input voltage to the rectifier is made, it is important that the input mains voltage is carefully regulated to the 230 volt. figure. Under these conditions the initial voltage should be 175 ± 5, and after the valves have warmed up this should fall to a value not exceeding 147 ± 5 on full gain and 157 ± 5 on minimum gain.

The transformer is arranged in the following way. The H.T. winding consists of terminals 3-4-5-6. The voltage between 3 and 4 is 15, between 4 and 5, 200, and 5 and 6, 30. Thus, using terminals 3 and 5, 215 volts is available, using 4 and 6, 230 volts and 3 and 5, 245 volts.

The anode currents of valves V.1 and V.2 may be measured between the plate connector and the plate cap. They should be as follows:-

	Min. gain	Maximum gain
V.1	0.65 mA ± .075 mA	4.5 mA ± .5 mA
V.2	7.3 mA ± .8 mA	7.0 mA ± .8 mA

Grid bias voltages (measured between the cathode pin and earth) :-

	Min. gain	Maximum gain
V.1	10V ± 2.0V	1.75V ± .5V
V.2	5V ± 0.75V	5.0V ± .75V

The arrangement of the valve pins is shown on Fig.6.

Owing to the high resistance of the potential dividing circuit, it is not practicable to measure the polarising voltage of the photocell unless an electrostatic voltmeter is used.

The choke L.2 is wound in two equal sections 1-2 and 3-4 which are connected in series. The transformer T.2 has both the primary and secondary windings formed of two equal halves which are connected in series. In every case the odd number terminals are the inner ends of the winding, so that when they are connected in series aiding the even number terminal of one winding is connected to the odd terminal of the other winding.

Replacing components.

Many components of the electrical circuit are Admiralty Pattern articles. However, the mains transformers and other transformers and chokes are covered by two sets of code numbers.

Apparatus bearing either code are suitable for use in the apparatus, the construction being identical.

				Maker.
Transformer	T.1	AS.4600-34	...	S.T.C., Ltd.,
"	T.2	DL.4324-4 or O.T.558		"
Choke	L.1	CF.4437-14 or R.T.3158	..	"
Choke	L.2	CG.4437-45 or R.T.3169	..	"
Condenser	C.7	4500-ACA condenser .02525 mfd ± 1%		"
Rectifier	W.1	MBH. 1-2-2 P/2-1-1/1-2-2N	...	Westinghouse
Rectifier	W.2	B-18-13-1 (consists of 2 - D-18-13-1 rectifiers)	..	S.T.C., Ltd.

HNE.

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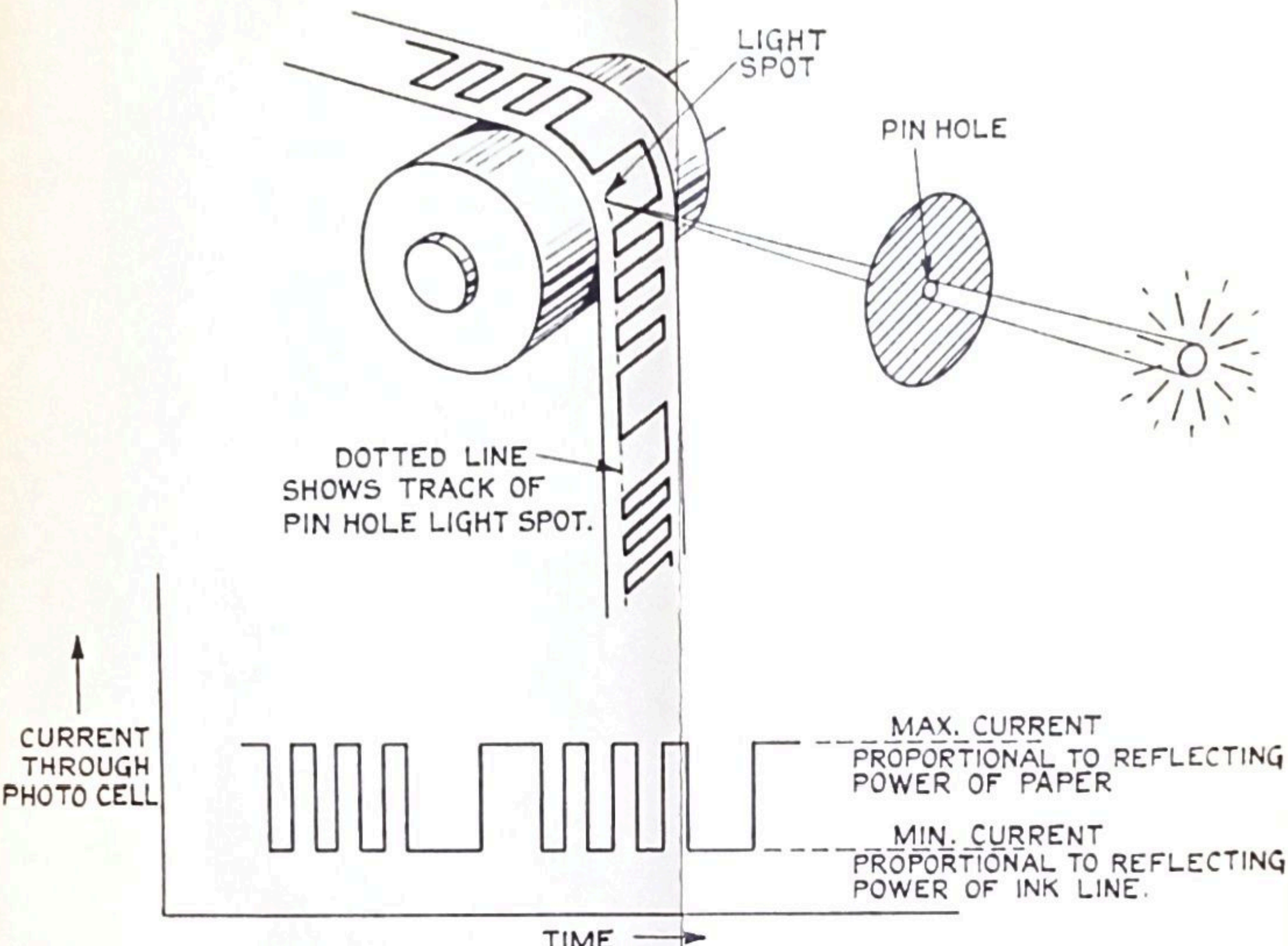


FIG. 1.
SCANNING TAPE BY A STATIONARY LIGHT SPOT.

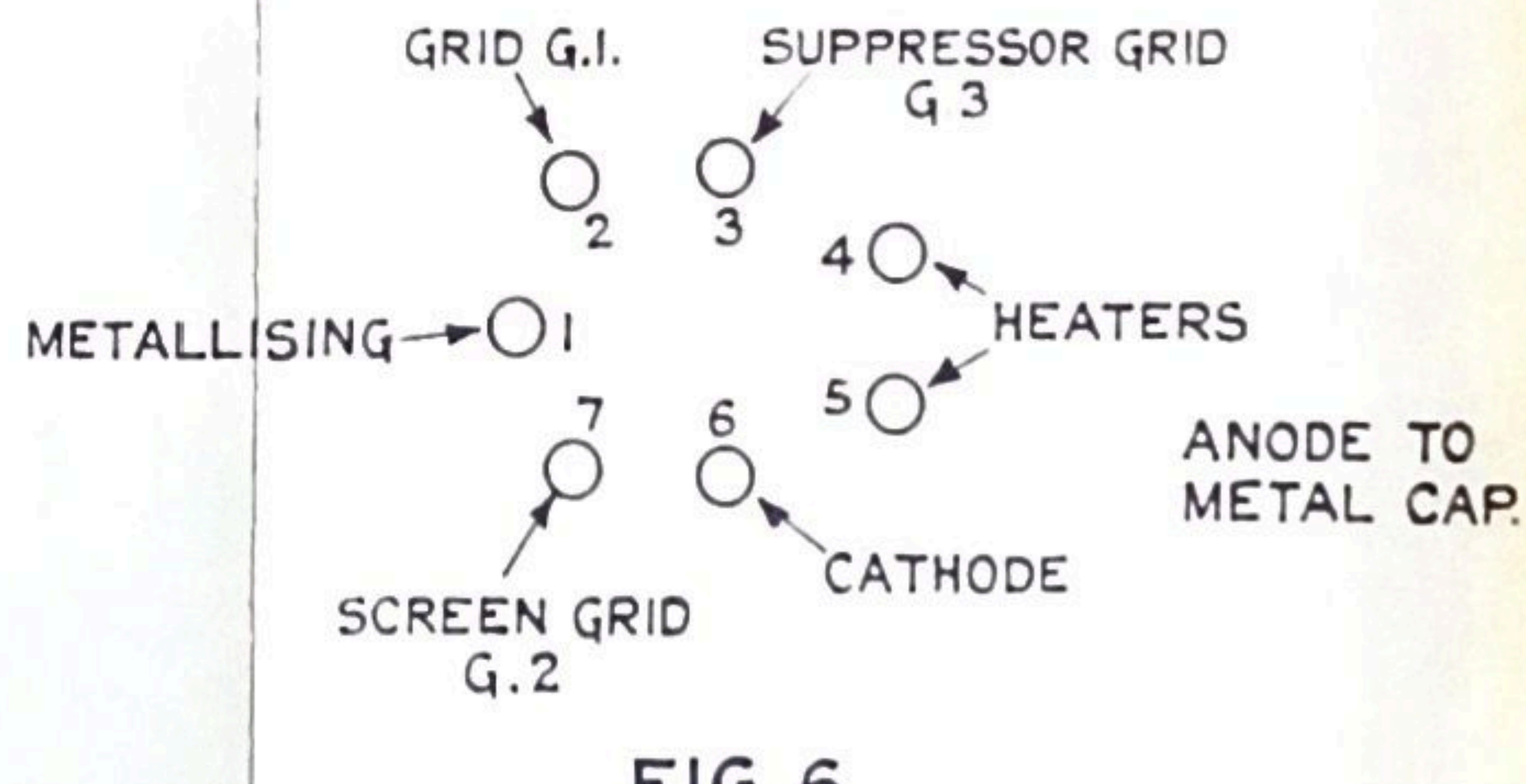


FIG. 6.
VALVE PIN CONNECTIONS VIEWED FROM UNDERSIDE.

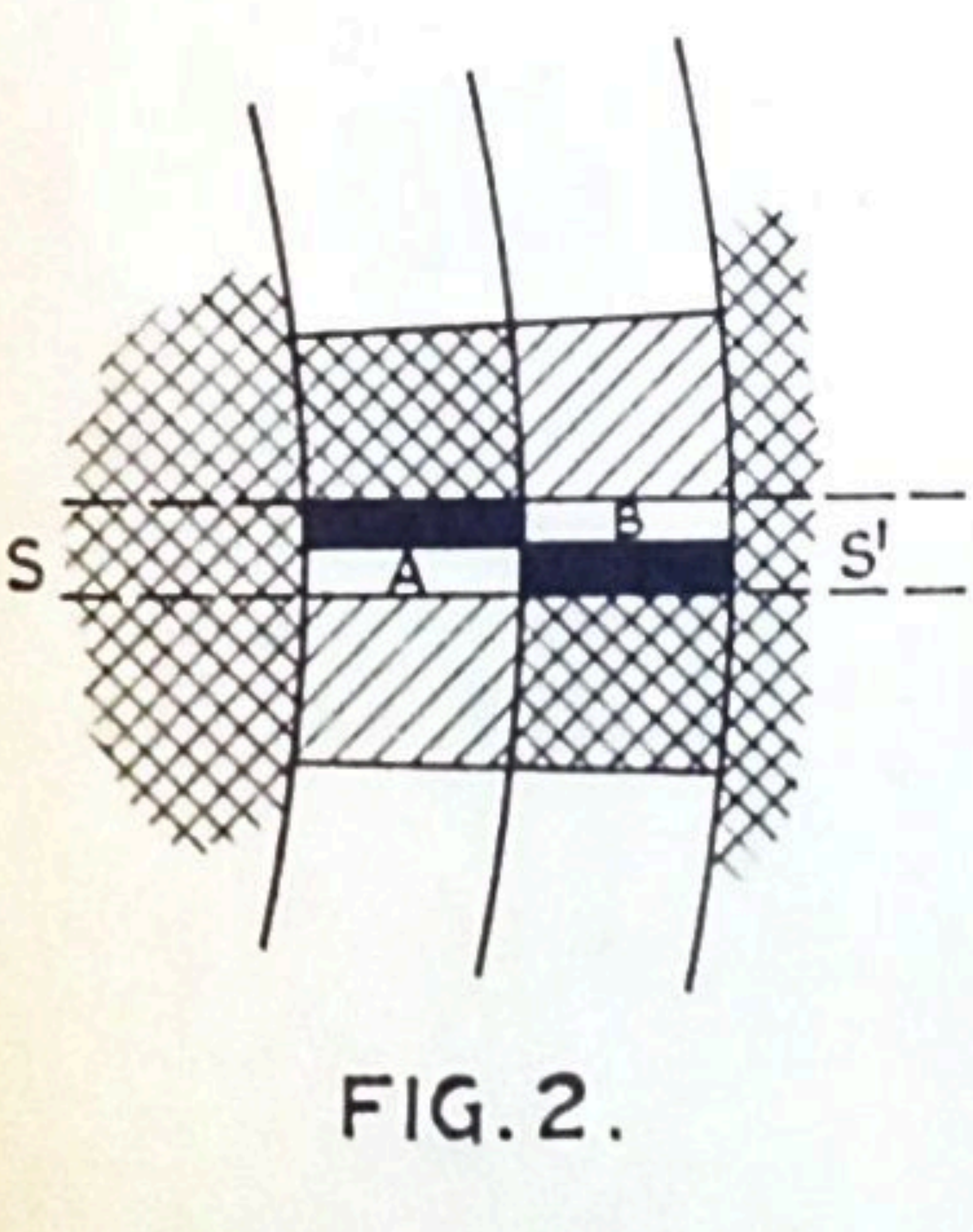
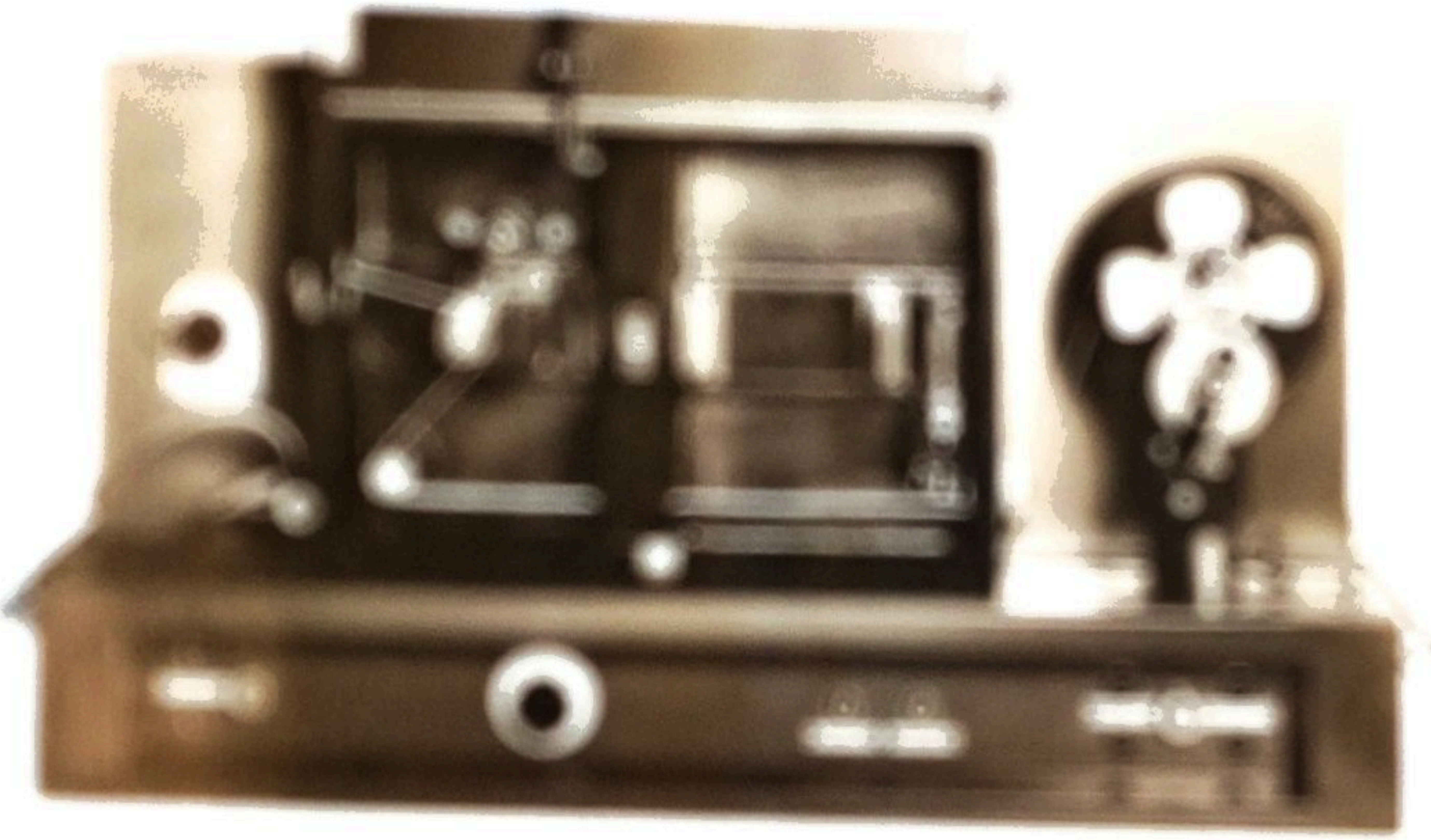


FIG. 2.

CLS. 1542
SHEET 23



ADMIRALTY PATTERN W 587

MORSE - TRANSCRIBING - UNIT.

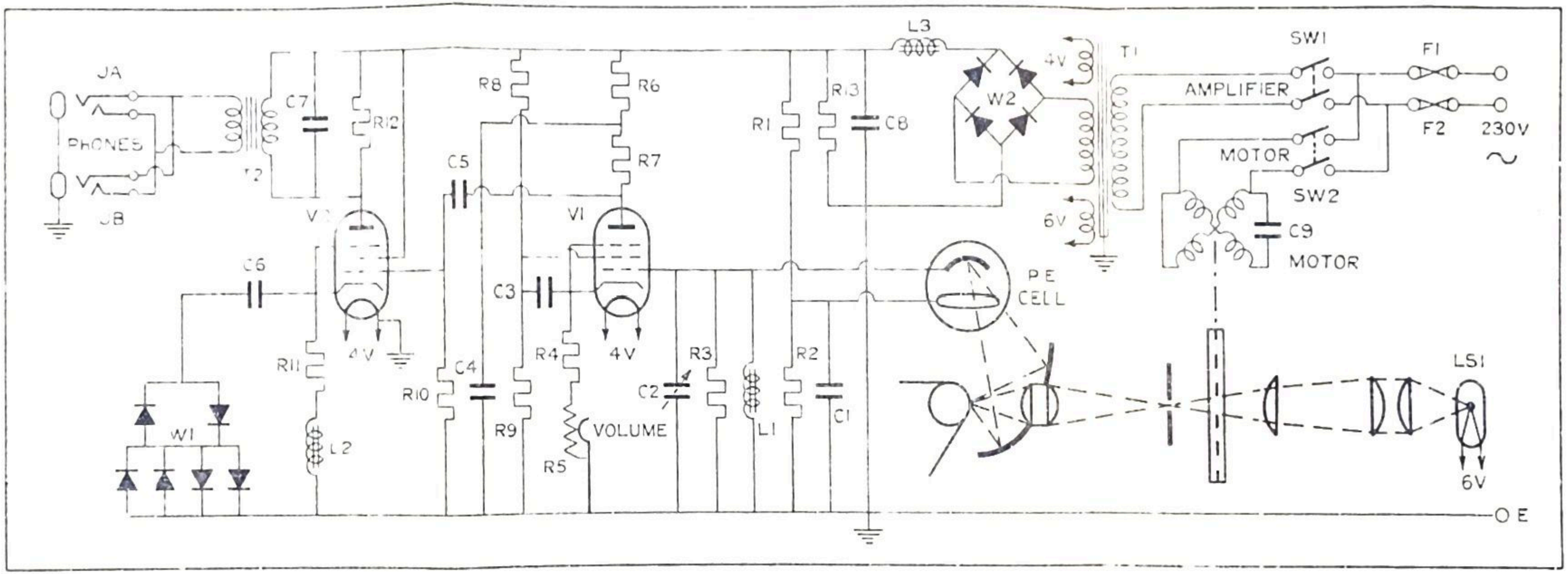
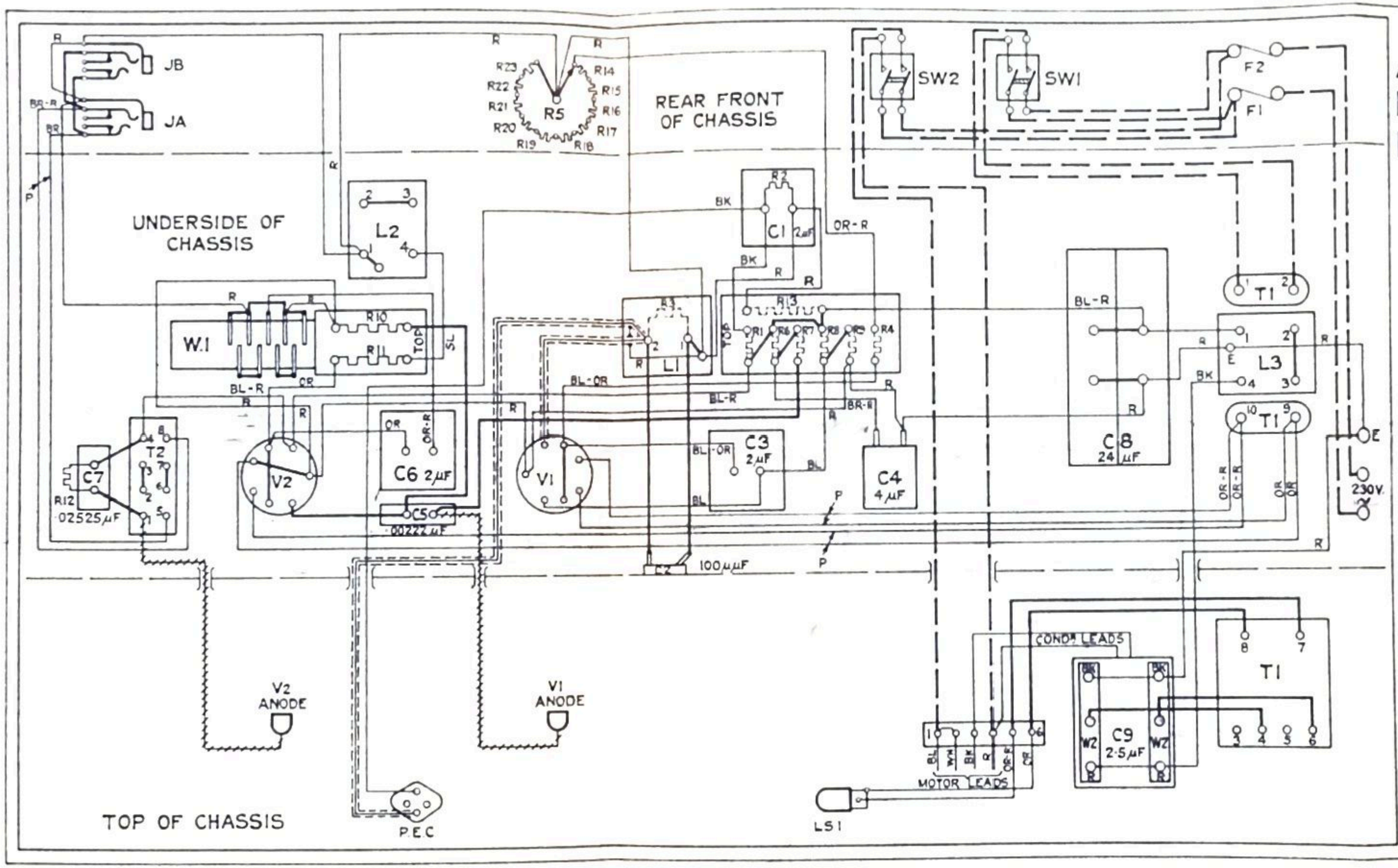


FIG. 4

CLS 1542
SHEET 30

ADMIRALTY PATTERN W587 MORSE TRANSCRIBING UNIT DIAGRAM OF CONNECTIONS.

TRIM TO THIS LINE FOR PASTER



RESISTANCE VALUES

R1	= 80,000 Ω	R13	= 15,000 Ω
R2	= 70,000 Ω	R14	= 200 Ω
R3	= 12 MΩ	R15	= 250 Ω
R4	= 200 Ω	R16	= 280 Ω
R5	= SEE R14 - R23	R17	= 320 Ω
R6	= 10,000 Ω	R18	= 450 Ω
R7	= 10,000 Ω	R19	= 600 Ω
R8	= 10,000 Ω	R20	= 900 Ω
R9	= 40,000 Ω	R21	= 1000 Ω
R10	= 100,000 Ω	R22	= 1500 Ω
R11	= 150 Ω	R23	= 1500 Ω
R12	= 30,000 Ω		

WIRING COLOURS

BK	= BLACK	BL	= BLUE
R	= RED	BL-R	= BLUE-RED
OR	= ORANGE	SL	= SLATE
OR-R	= ORANGE-RED	BL-OR	= BLUE-ORANGE
BR-R	= BROWN-RED	WH	= WHITE
BR	= BROWN		

◄◄ P = TWISTED PAIR

WIRING

— — SELF EXTINGUISHING CABLE IN CABLE FORM

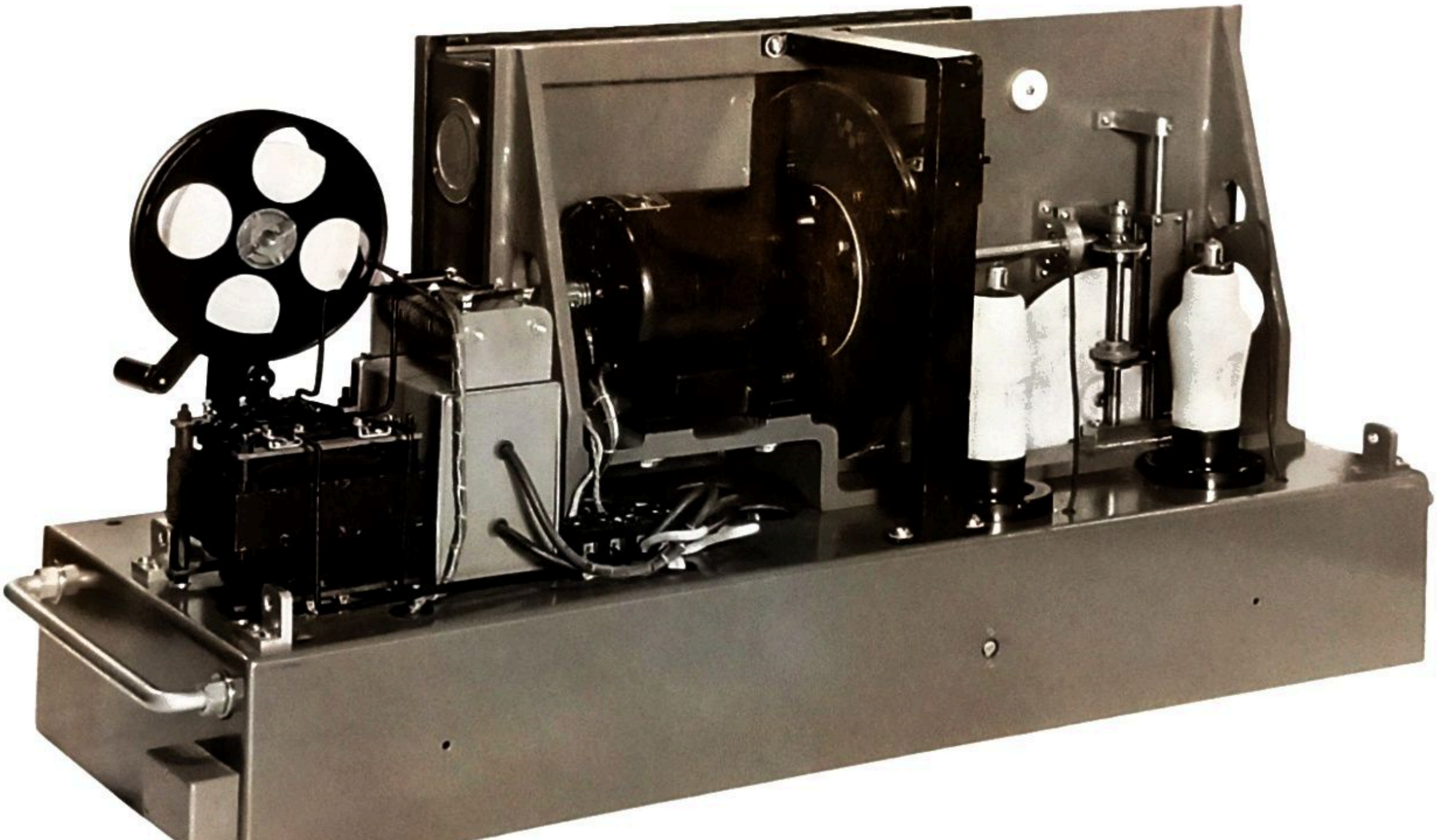
—— 8/·010" COTOPA INSULATED WIRE IN SEPARATE CABLE FORM

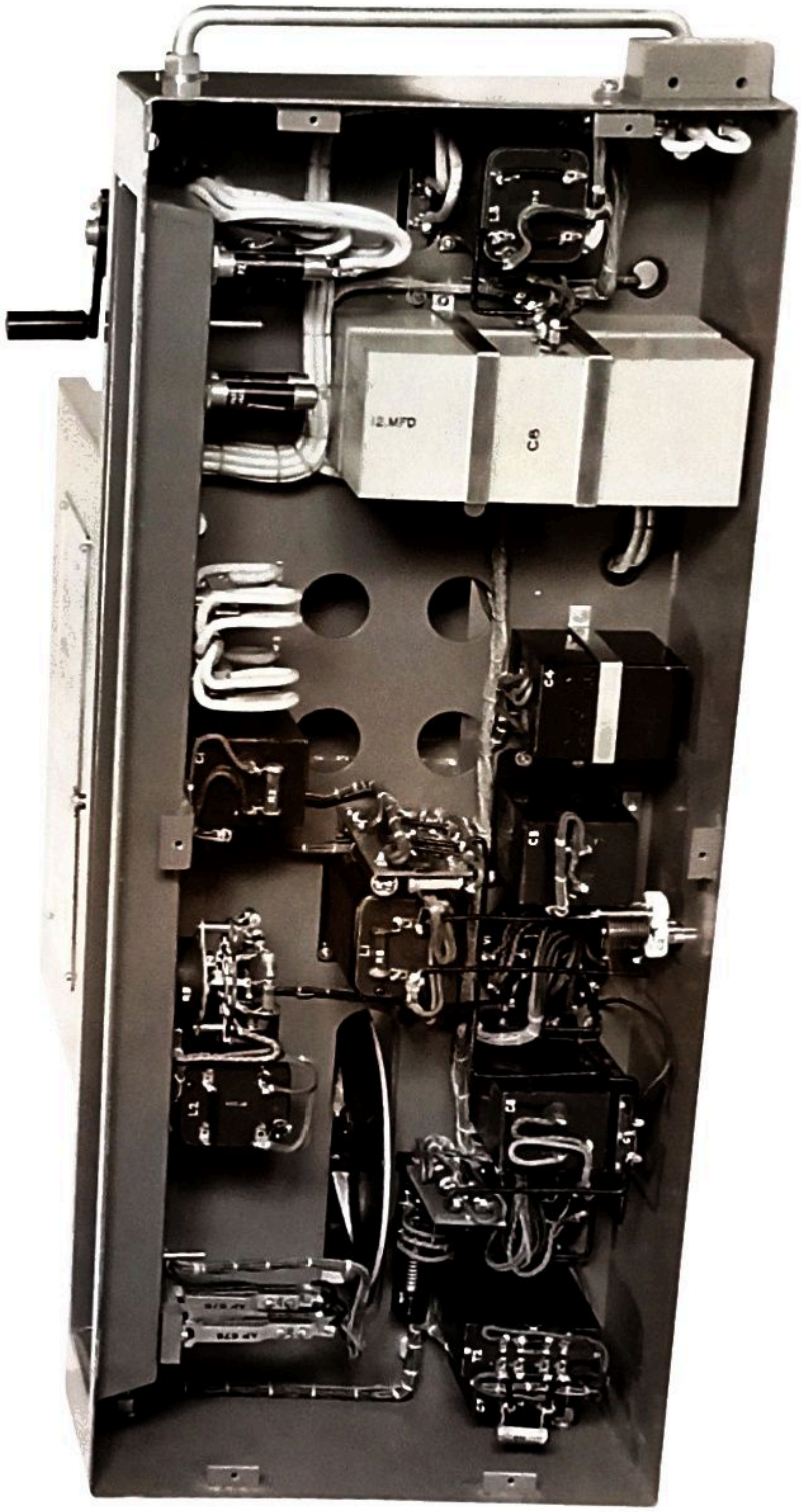
━━ 18 S.W.G. WITH BLACK SLEEVING

SINGLE SHIELDED WIRE, NOT IN CABLE FORM

17/·0076" COTOPA INSULATED WIRE

FIG. 5.




12.MFD
C5