Preliminary Instructions

FOR

RADIO SET SCR-578-A

MANUFACTURED BY

BENDIX AVIATION, LTD.

NORTH HOLLYWOOD, CALIFORNIA

RESTRICTED

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PUBLISHED BY AUTHORITY

OF

THE CHIEF SIGNAL OFFICER

ORDER NO. 676 -WFSCPD-42
1152-WFSCPD-42

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WARNING NOTICE

Care should be exercised when the Hydrogen Generator is in use as hydrogen gas is explosive around flames, coals, or sparks. Also the operator should be careful not to touch the hydrogen generator when in use as it generates considerable heat. When the balloon is completely inflated the hydrogen generator can should be thrown away immediately as the residue is caustic and will cause burns if it comes in contact with the skin, eyes or clothing of the personnel. If this should occur, wash off immediately with water.

The power radiated from the antenna is not high enough to cause injury to the personnel.

Do not attempt to operate this equipment or have an antenna up if severe lightning is occurring. To do this may result in severe injury to using personnel.

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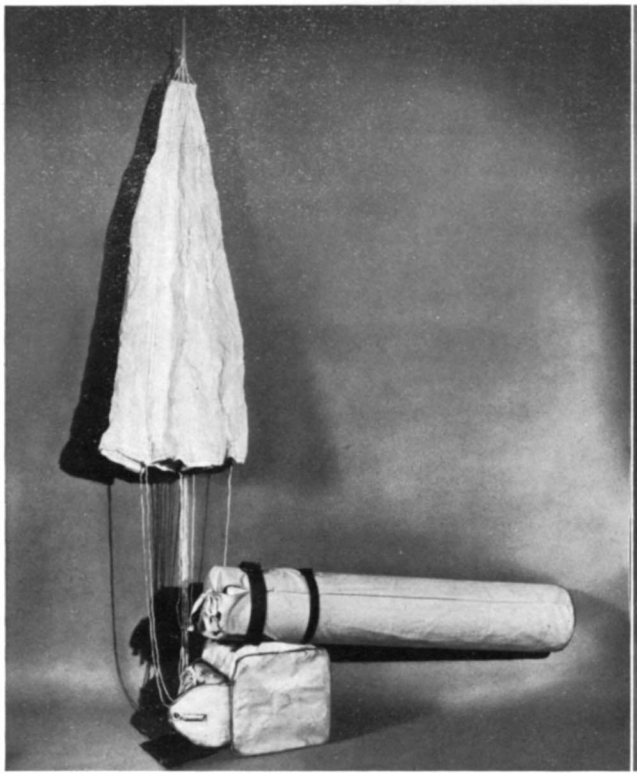

Fig. 1 — Bag BG-110-A, Packed and with Parachute M-276-A

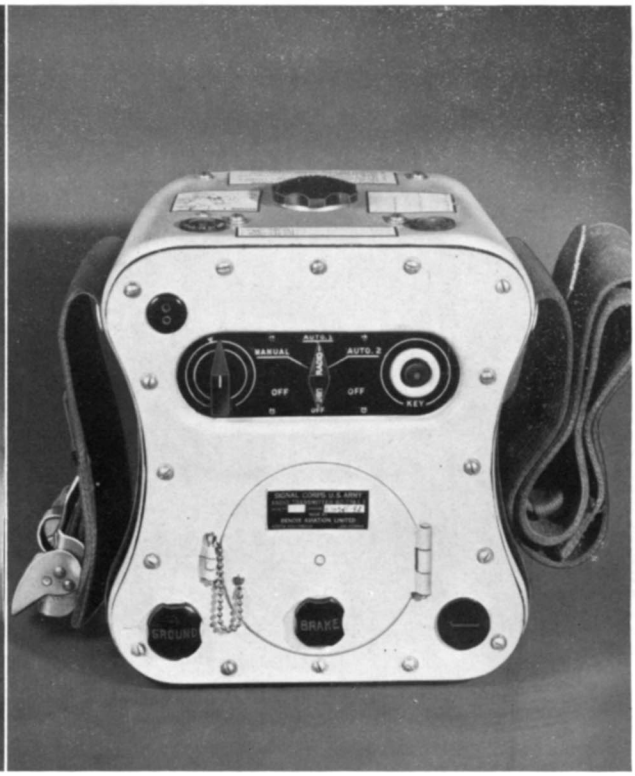

Fig. 2 — Radio Transmitter BC-778-A (front view)

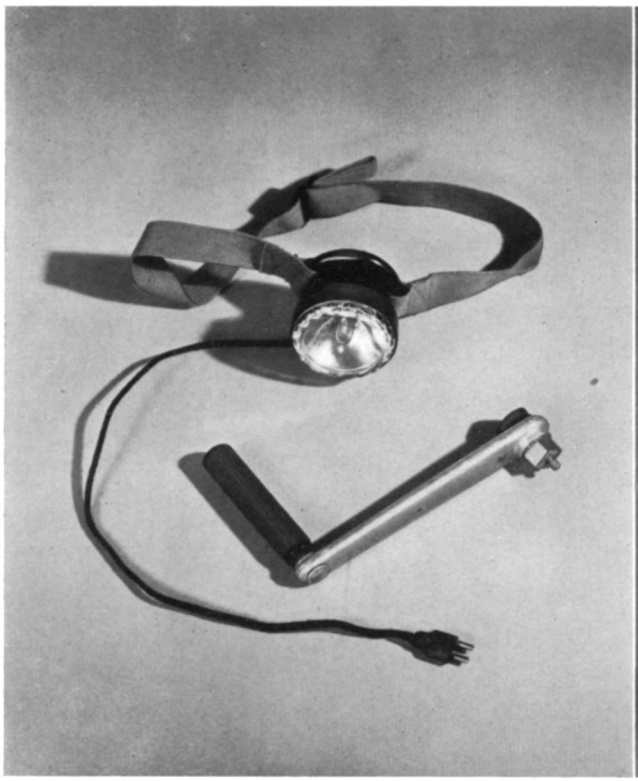

Fig. 3 — Crank GC-18-A and Signal Light M-308-A

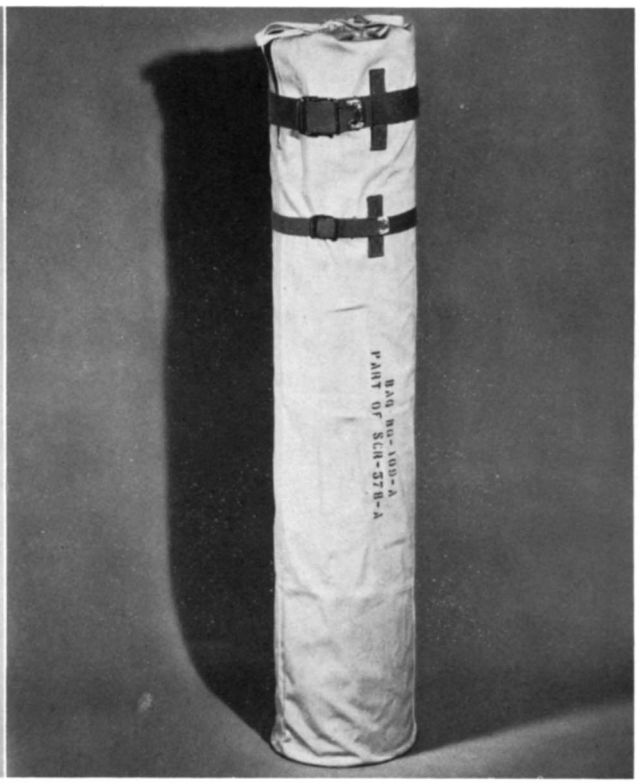

Fig. 4 — Accessory Bag BG-109-A Packed

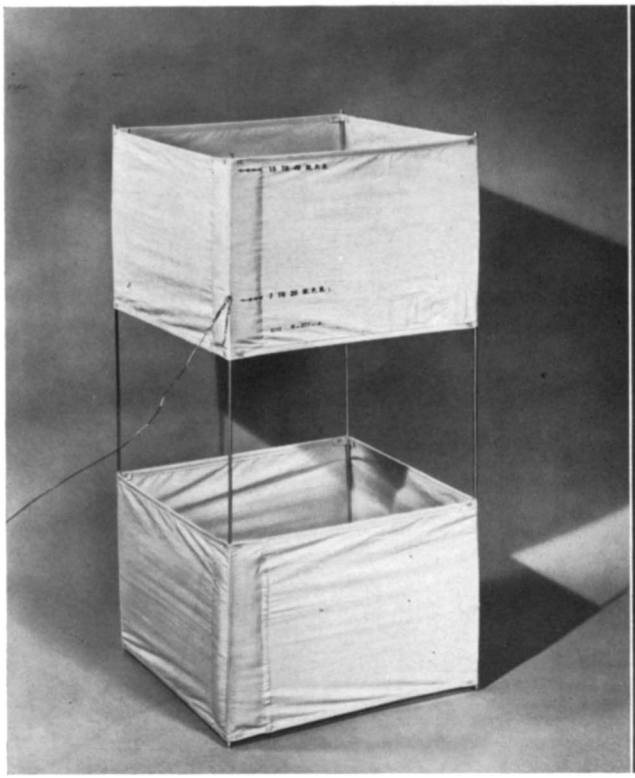

Fig. 5 — Kite M-277-A, Assembled and with Antenna attached

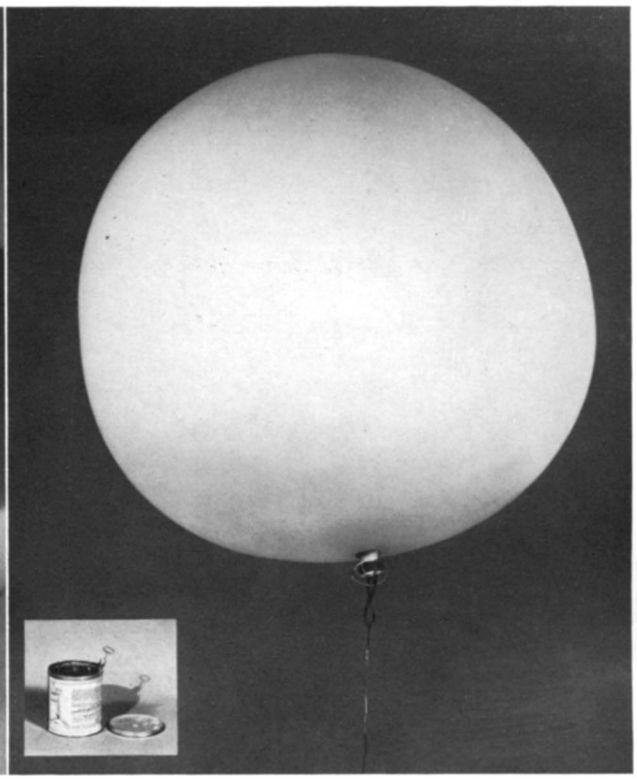

Fig. 6 — Balloon M-278-A, Inflated and with Antenna attached

Fig. 7 — Parachute M-276-A, Packed and with Static Line in place

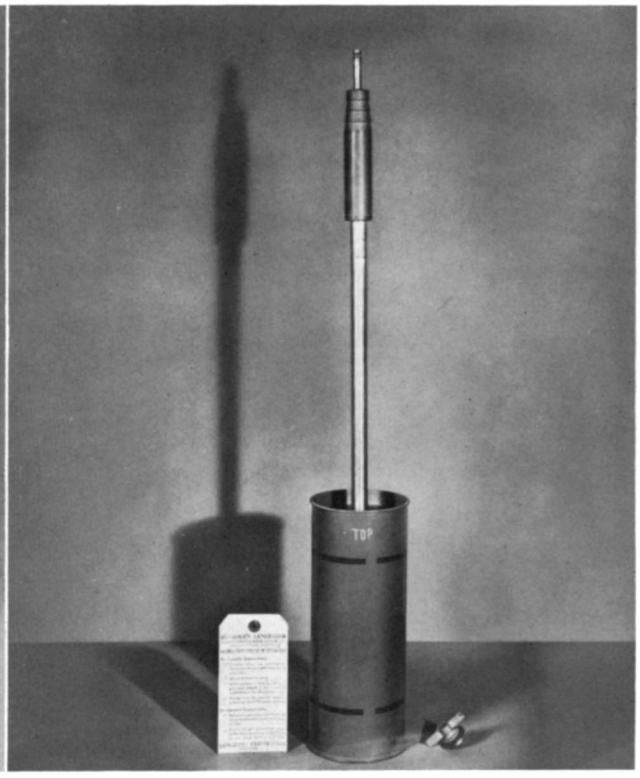

Fig. 8 — Generator M-315-A Hydrogen Assembled

Section 1 - Description

1. General: Radio Set SCR-578-A is a hand powered, emergency transmitter designed for operation in a small boat or life raft. It transmits a MCW signal on a frequency of 500 KC. This radio set is used by personnel in distress on water and provides for automatic transmission of a predetermined signal upon which the radio compass of searching parties can "home." This signal can also be keyed manually so as to communicate one's whereabouts to searching parties. No receiver is provided.

The above methods of manual and automatic keying are also used with a signal lamp which can be plugged into a socket on the transmitter case and used for visual signaling. When the signal lamp is used in this manner no radio transmission takes place.

Operational adjustments and tuning of Radio Set SCR-578-A have been kept to a minimum. Simplicity of operation thus permits inexperienced personnel having no knowledge of radio or radio transmission to operate this set by merely following the instructions printed on the equipment.

All parts of Radio Set SCR-578-A are of a rugged construction to withstand rough usage, such as dropping with a parachute. To permit dropping the radio set in this manner, a parachute is permanently attached to the bags containing Radio Set SCR-578-A.

2. Description of Components of Radio Set SCR-578-A.

a. Radio Transmitter BC-778-A is pre-tuned to the International Distress Frequency of 500 KC. See Figure 2. The emitted signal is MCW. The power to operate this transmitter is supplied by a hand-driven generator. This generator is operated by Hand Crank GC-18-A. The proper rotation speed at which the generator is to be operated is indicated by the lighting of the Speed Indicator lamp in the transmitter. A selector switch on the front panel of the transmitter permits the selection of either automatic or manual keying. Automatic keying is accomplished by a system of gears and discs which operate off the generator drive. The antenna is resonated by a tuning control mounted on the front panel. This resonance is indicated by maximum brilliancy of TUNE TO BRIGHTEST indicator lamp. Reel RL-48 is mounted on the front panel of the transmitter and it holds 300 ft. of Antenna Wire W-148. See Figure 13. A strap is provided for securing the transmitter between the legs of the operator, the transmitter case being designed for this. See Figure 9. The transmitter is used to provide the power for operating Signal Lamp M-308-A when it is plugged into the transmitter. For signal lamp operation the switch on the front panel must be rotated until the part marked LIGHT is either on manual or automatic keying position. The light can be keyed either manually or automatically. No radio transmission takes place when the signal lamp is in use. See Figures 3 and 13.

b. Kite M-277-A is a box kite used to carry aloft the antenna wire. It will fly in wind velocities of 7 to 50 m.p.h. If it should fall into the water, the kite will float for a limited time. The cloth on the kite has been treated to make it moisture repellent; however, continued soaking will eventually cause it to become saturated. See Figure 5.

c. Balloon M-278-A is used to hold up the antenna wire when it is not possible to fly the kite due to low wind velocity. It is inflated to a diameter of approximately four feet. See Figure 6.

d. Generator M-315-A Hydrogen is used to inflate the balloon. It uses Lithium Hydride which releases hydrogen upon coming into contact with water. It will supply enough hydrogen to inflate the balloon to a diameter of four feet. See Figure 8.

e. Bag BG-109-A is used to hold Kite M-277-A, two Balloons M-278-A, two Generators M-315-A Hydrogen, Signal Lamp M-308-A, and an extra roll of Antenna Wire W-148. See Figure 4.

f. Bag BG-110-A is used to hold Radio Transmitter BC-778-A and Crank GC-18-A. This bag has Parachute M-276-A permanently attached to it. This parachute is used to drop Radio Set SCR-578-A from the airplane.

Fig. 9 — Radio Transmitter BC-778-A in Operating Position

Both Bags BG-109-A and BG-110-A are strapped securely together. See Figures 1 and 7.

3. Table of Component Parts of Radio Set SCR-578-A.

Quantity	Article	Wt. in Lbs.
2 rolls (300 ft. each)	Antenna Wire W-148 (One roll on Reel RL-48) (One roll in accessory bag)	.55 ea.
1 each	Bag BG-109-A	2.95
1 each	Bag BG-110-A	1.5
2 each	Balloons M-278-A	1.2 ea.
1 each	Hand Crank GC-18-A	.45
2 each	Gen. M-315-A, Hydrogen	2.8 ea.
2 each	Inflating Tubes	.5 ea.
1 each	Kite M-277-A	1.45
1 each	Radio Trans. BC-778-A (With Reel RL-48 and wire)	15.8
1 each	Signal Lamp M-308-A	.2
1 each	Parachute M-276-A	1.0
	Total Weight	32.90

See Figure 20 for overall dimensions of Radio Set SCR-578-A when packed into Bags BG-109-A and BG-110-A.

SECTION II—INSTALLATION

4. Installation in an Airplane:

The two bags containing Radio Set SCR-578-A should be securely strapped together and stowed in an airplane in a location so that it is possible for the personnel of the airplane to readily remove this equipment in case of an emergency landing on water.

SECTION III—PREPARATION FOR USE

5. Removal from Airplane:

a. If the airplane has made an emergency landing on water, Radio Set SCR-578-A should be removed from the airplane at the same time the life raft is removed. The radio set is waterproof and will float, and therefore, it is not necessary to take any precautions in keeping the equipment out of the water.

b. The equipment may be dropped from the airplane by use of the parachute. The altitude of airplane when dropping the equipment should be between 300 and 500 ft. This will reduce the distance the equipment will drift before it strikes the water. To drop the equipment the following steps should be observed:

(1) Tie the loose end of the static line to the metal structure of the airplane.

(2) Be sure the static line is in the clear and will not foul.

(3) Throw out radio equipment through opening. Parachute will be opened by static line.

(4) **CAUTION: Do not attach static line to any part of one's body when throwing out radio equipment.**

6. Assembly of Equipment:

The following procedure shall be followed for preparing Radio Set SCR-578-A for use. **Warning: Do not leave the antenna up if severe lightning is occurring. To do this may result in severe injury to using personnel.**

a. **Radio Transmitter BC-778-A:**

(1) Remove Transmitter BC-778-A from Bag BG-110-A.

(2) Remove the cap located in top center of the transmitter by turning it counterclockwise. This makes the crank socket available.

(3) Remove Crank GC-18-A, found in the well in the back of the transmitter, by removing locking key. **Be careful not to drop the crank into the water as no spare crank is provided.**

(4) Insert the crank handle into the crank socket on transmitter. Secure in place by tightening the thumb nut in crank handle.

(5) Remove the cotter key from catch on the door located in lower center of the front panel. Open the door and release the end of antenna wire from the reel. Pull out enough wire to attach to kite or balloon.

(6) Set a slight amount of tension on the Brake. Tension is increased by turning Brake knob in a clockwise direction.

(7) Set transmitter in bottom of boat or life raft. (If possible secure transmitter to life raft by strap.)

b. **Assembly of Kite M-277-A and Raising of Antenna:**

(1) Remove kite from accessory bag. Kite is in long cylindrical package.

(2) Lay kite across lap with the ends extending to the sides.

(3) Hold the kite securely with one hand. Use the other hand to reach in through center of kite and push OUTWARD on the hinge spiders. Allow the four upright struts to spread as spiders move outward. Push each spider out slightly past "dead center" where they will lock in position. The entire process is similar to opening an umbrella. Care should be exercised in assembling kite as the spiders have a tendency to kick across "dead center" very violently and may result in damage to kite structure. See Figures 10 and 11.

(4) Attach antenna wire swivel clasp to one of the two eyelets on kite structure. Estimate the wind velocity and put antenna wire clasp into the eyelet that most nearly corresponds to that velocity. When in doubt as to wind velocity, select the eyelet indicated for the lower wind velocity. See Figure 12. If it is desired to dismantle kite, push in on spiders allowing the unit to collapse.

(5) (*a*) If possible stand up in boat or life raft and hold kite by a small length of the antenna wire. Permit kite to fly to leeward and slowly release antenna wire by using BRAKE. Keep steady tension on antenna wire to avoid kite dropping too low and possibly falling into water. The above procedure is used when moderate wind velocity is had.

(*b*) When wind velocity is low and with occasional gusts, wait for a gust of wind and then lightly toss kite into air. Have enough slack antenna wire to permit kite to gain altitude. After kite is launched keep steady tension on antenna wire. If the kite should fall into water, drag it back to raft, shake off water and allow to dry for a few minutes before trying to fly it again.

(6) Allow the kite to pull out ALL the wire on the antenna reel. Maximum efficiency of the transmitter is obtained when the antenna wire is all out, which is a length of 300 ft. Reduction in the length of the antenna will result in lower efficiency of the transmitter and the antenna must never be less than 175 ft. A short length of insulating cord is used to secure the end of antenna wire to the reel. A second length of cord is fastened to the antenna and is used to secure the antenna to the life raft in such a manner that it will take the pull of the kite and not interfere with the operator's activities. See Figure 9. Keep the antenna wire as near vertical as possible by keeping the kite directly overhead. **Never permit the antenna wire to drag in the water while transmitting.**

(7) Strap the transmitter between the legs. See Figure 9.

(8) Remove the antenna lead-in to transmitter from antenna reel cavity and attach the clip into the metal tab on antenna wire. If all the antenna wire is not used attach clip to bare wire. **Be sure a good contact is had at all times between clip and antenna wire.**

(9) Unscrew cap marked GROUND and pull out ground wire reel. Unreel wire and throw all of wire into water. Weighted end will hold wire in water.

(10) **Whenever possible use the kite to pull up the antenna wire. Never use balloon unless wind velocity is too low to fly kite.**

c. **Inflation of Balloon M-278-A and Raising of Antenna:**

Hydrogen is highly inflammable. Do not smoke or have lighted flame around when inflating balloon.

(1) Remove sealed balloon can from Bag BG-109-A. Open can and CAREFULLY remove balloon.

(2) Attach antenna wire to balloon. **Be careful not to lay the balloon on any object which may puncture balloon.**

(3) Remove hydrogen generator and inflation tube from Bag BG-109-A. Remove top and bottom plugs of generator. Screw inflation tube into TOP of generator.

(4) Wet and insert blunt needle on end of inflation tube into balloon valve hole. Be sure balloon is pushed down against the hilt or shoulder on inflation tube. Balloon must be kept against this shoulder while inflating if valve inside balloon is to be kept opened to permit hydrogen to enter.

Fig. 10 — Assembly of Kite M-277-A (first operation)

Fig. 11 — Assembly of Kite M-277-A (final operation)

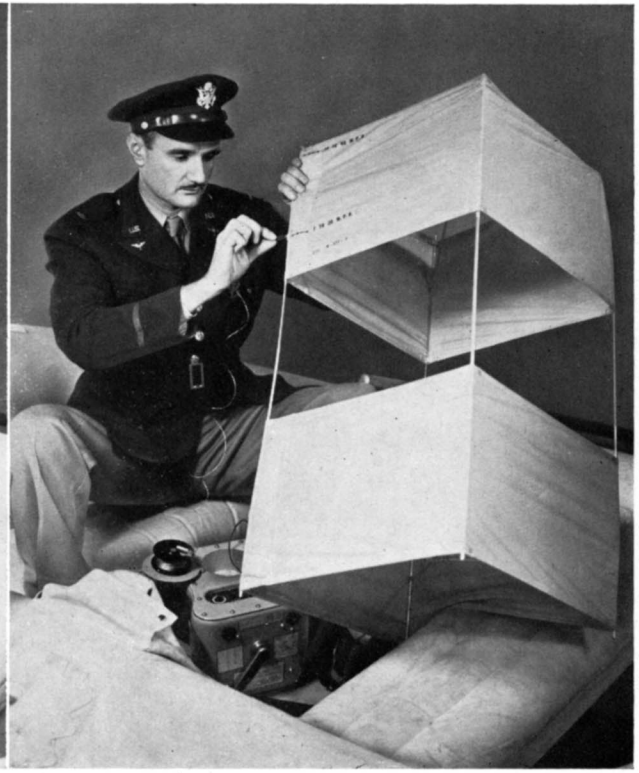

Fig. 12 — Attaching of Antenna to Kite M-277-A

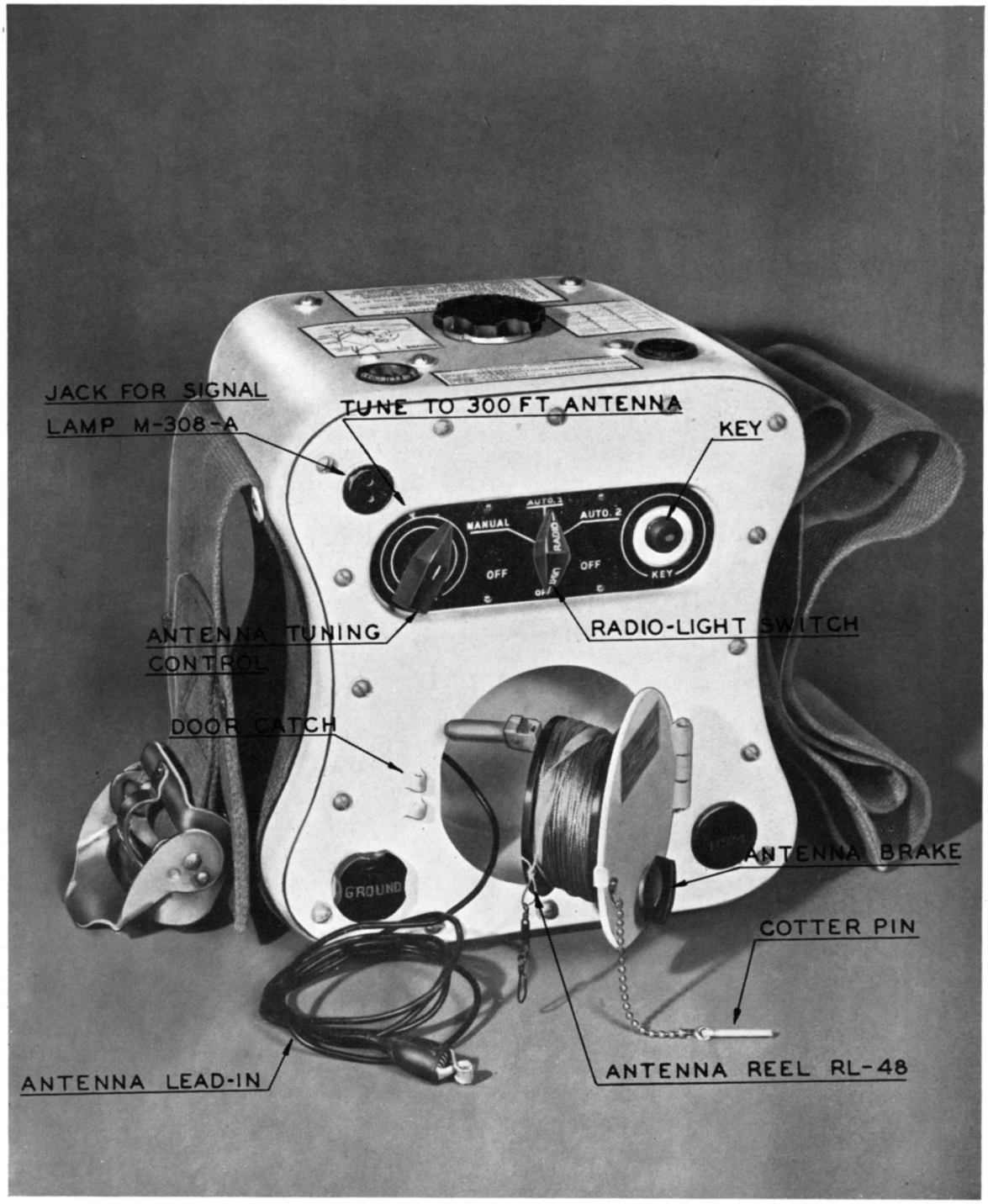

Fig. 13 — Radio Transmitter BC-778-A, Front Oblique View

Fig. 14 — Radio Transmitter BC-778-A, Rear Top Oblique View

(5) Slowly lower hydrogen generator into the water to first red line. Hold the balloon in such a position that its neck is not crimped and shutting off flow of hydrogen into balloon. Hold hydrogen generator at first red line for ten minutes. Grasp the insulated portion of inflation tube to hold generator in the water.

(6) Slowly lower hydrogen generator to second red line. Balloon is to be inflated until hydrogen generator is exhausted. It will then have a diameter of approximately four feet. This will take about one hour of time. When gas generation slows down, slowly raise and lower generator in water between red lines. **Do not immerse generator lower than the second red line.** If generator is generating hydrogen too fast a violent gurgling will be heard. This should be stopped by raising generator several inches, but do not raise it so far that bottom of generator is out of water.

(7) After inflating balloon, remove from inflation tube and put rubber stopper in balloon valve hole. Unscrew inflation tube from hydrogen generator can, and throw generator can away. CAUTION: If excessive liquid caustic has been deposited in balloon while inflating, insert inflation tube into balloon valve hole and allow liquid caustic to drain off through tube. **Do not permit an excessive amount of hydrogen to escape.** Drain caustic into water. This liquid caustic will burn the eyes or skin if it comes into contact with them. Immediately wash off with water any caustic that comes into contact with the eyes, skin or clothing.

(8) Slowly release antenna wire and allow the balloon to pull out ALL the wire on reel. Attach antenna to life raft and clip antenna lead-in from transmitter to antenna wire. See Figure 9.

(9) Strap the transmitter between the legs. See Figure 9.

(10) Unscrew cap marked GROUND and pull out ground wire reel. Unreel wire and throw all of wire into the water. Weighted end will hold wire in water.

(11) If a strong breeze comes up while balloon is up, the kite should be used. Make balloon captive to life raft by using part of the extra roll of antenna wire in Bag BG-109-A. When captive the balloon should be high enough that it will not strike any object that may make it burst nor should it interfere with the antenna.

SECTION IV—OPERATION

7. Operation as a Transmitter:

After the antenna has been raised by either the kite or balloon, the antenna lead-in clipped on, the ground wire thrown in the water and the transmitter strapped between the operator's legs, the following procedure is to be followed in operating Radio Transmitter BC-778-A.

a. Put the selector switch (marked RADIO-LIGHT) with RADIO in AUTO 1 or AUTO 2 position. See Figure 13.

b. Rotate the crank in a clockwise direction. Speed of rotation is approximately 72 revolutions per minute or slightly greater than one revolution per second. Correct rotation is indicated by the lighting of the Speed Indicator light. See Figure 14. Higher crank speed will be of no benefit as the transmitter contains a regulator that limits the amount of voltage produced. Lower crank speed will not give adequate power for efficient operation of the transmitter.

c. Continue cranking and allow 20 seconds for filaments of vacuum tubes to warm up. Then tune the transmitter to the antenna by adjusting the TUNING control to produce maximum brilliancy of the TUNE TO BRIGHTEST indicator. See Figure 14. If the entire antenna is used (300 ft.) the correct position of the TUNING knob will be approximately at the marked point on the panel. If shorter antenna is used the proper tuning is indicated at the point of maximum brilliancy of tuning indicator. It may be necessary to shade the tuning indicator in bright sunlight in order to see the point of maximum brilliance. The TUNE TO BRIGHTEST indicator will flash off and on with the keying of the transmitter. This can be used to indicate that the transmitter is operating and delivering radio frequency power to the antenna.

d. After the transmitter is tuned to the antenna the selector switch can be switched to any one of these three positions:

AUTO 1 position will automatically transmit SOS for 20 seconds and then a continuous dash for 20 seconds. It will then repeat this cycle of transmission (SOS for 20 seconds, and a 20 second dash) as long as the crank is rotated at the proper speed.

AUTO 2 position will automatically transmit AA for 20 seconds and then a continuous dash for 20 seconds. It will repeat this cycle of transmission (AA for 20 seconds, and a 20 second dash) as long as the crank is rotated at the proper speed.

MANUAL position the operator can manually key the transmitter with the push button marked KEY and which is located on the front panel of the transmitter. The push button KEY can be operated most conveniently with one of the first two fingers of the left hand, but with an arm motion rather than a finger action. If a second person is available, the keying should be done by him instead of the individual who is cranking.

Note: Radio Transmitter BC-778-A can be changed to transmit other characters on AUTO 1 and AUTO 2 positions. See Maintenance Section for necessary information to make this change. The transmitter is furnished by the manufacturer with AUTO 1 position to transmit SOS and a long dash, and AUTO 2 position to transmit AA and a long dash as marked on front panel.

c. KEEP CRANKING. It will be found that by changing from right to left hand every few minutes the cranking is not so tiring. If more than one operator is available, take turns in cranking. Do not have transmitter inoperative longer than one-half hour period at a time.

8. Operation of Signal Lamp M-308-A:

During darkness, Signal Light M-308-A can be used for visual signaling if needed. It is not necessary to raise any antenna to use the signal light. Remove Radio Transmitter BC-778-A from bag and insert the crank in socket. Secure signal light from accessory bag. Plug the cord attached to signal light into the socket in upper left hand corner of the control panel on transmitter. Strap the transmitter between the legs. The operator may strap the signal light to his head if he so desires. Position the knob marked RADIO-LIGHT so that the LIGHT end is pointing either to AUTO 1, or AUTO 2, or MANUAL. Crank the transmitter at a speed where maximum brilliancy of signal light is obtained. The signal light will be automatically keyed if in position AUTO 1 or AUTO 2. Manual keying may be had when switch is placed in MANUAL position. No radio transmission is had when signal light is being used.

SECTION V—MAINTENANCE

9. Monthly Inspection of Radio Set SCR-578-A:

Radio Set SCR-578-A should be subjected to a monthly operating check. This check should be made as follows:

a. Remove Radio Transmitter BC-778-A from bag and insert crank. Use a phantom antenna of a 31 ohm, 5 watt resistor and a 700 mmfd. condenser. Connect phantom antenna between antenna and ground connections on transmitter. Set selector knob on RADIO in either AUTO 1 or AUTO 2 position. Rotate crank at approximately 72 rpm. and adjust TUNING control to produce maximum glow in the TUNE TO BRIGHTEST indicator. Check AUTO 1, AUTO 2, and MANUAL position for correct keying. TUNE TO BRIGHTEST indicator will flash off and on with the keying and will indicate that the transmitter is generating and delivering radio frequency power to phantom antenna. The TUNE TO BRIGHTEST indicator will not glow unless transmitter is connected to phantom antenna. At 72 rpm. the Speed Indicator lamp should be lighted.

b. Plug in Signal Light M-308-A and rotate selector knob until it reads LIGHT at any of the three positions; AUTO 1, AUTO 2, and MANUAL. Check signal light on all three positions. Rotation of crank shall be approximately 72 rpm.

c. Make a visual check of all other units in accessory bag for possible mechanical damage. The balloons and hydrogen generator cans are sealed and should not be opened.

d. Parachute M-276-A should be unpacked and checked only by authorized personnel and should be done at least once every 60 days.

e. **Be sure transmitter hand cranked generator is rotated a few times once every month.** This must be done to keep grease from freezing or packing in generator bearings. This is accomplished if transmitter is tested into phantom antenna or if signal light is tested. SERVICE WARNING: Radio Transmitter BC-778-A should not be disassembled unless it fails to operate satisfactorily.

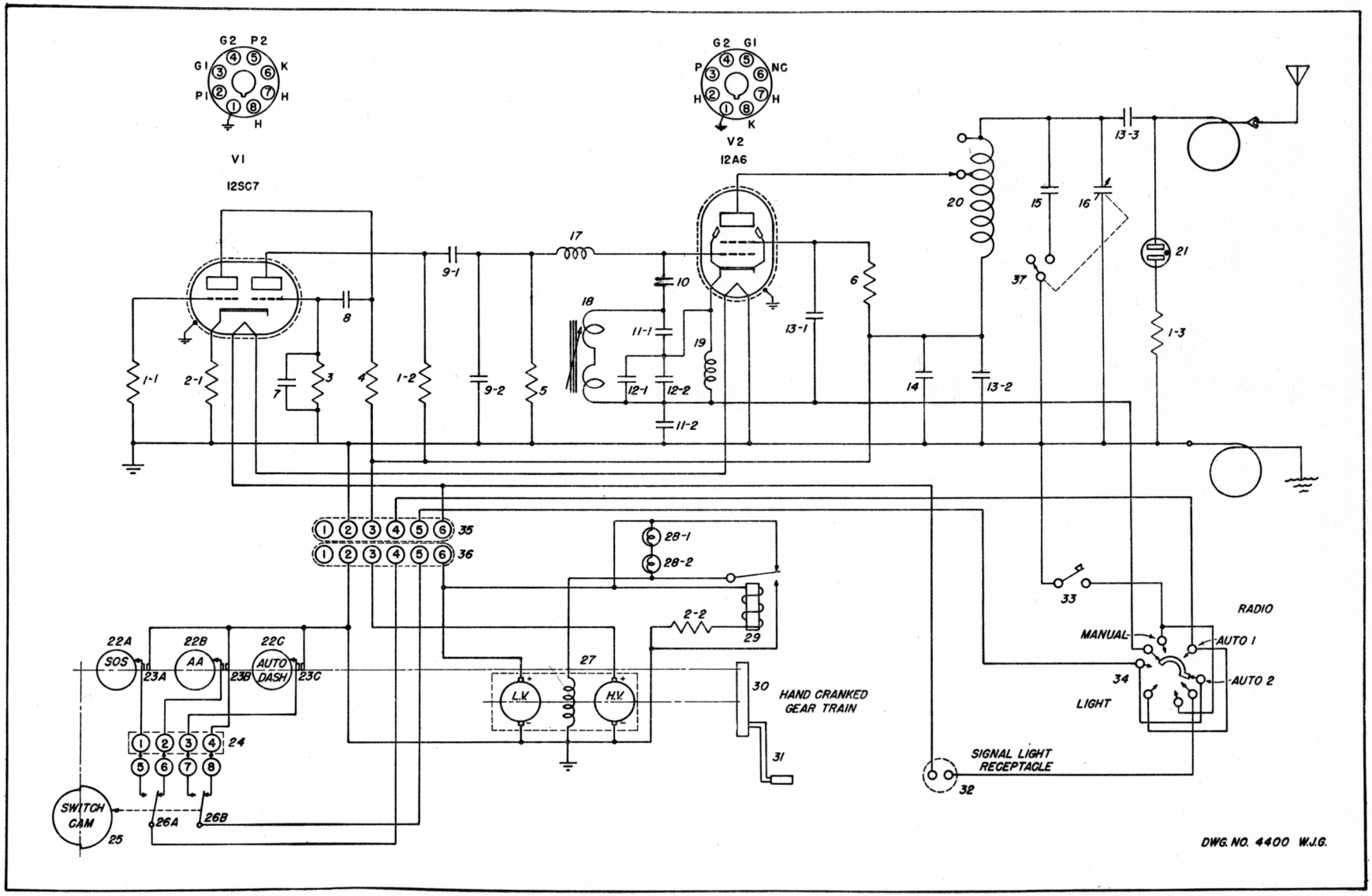

Fig. 15 — Radio Transmitter BC-778-A, Schematic Diagram

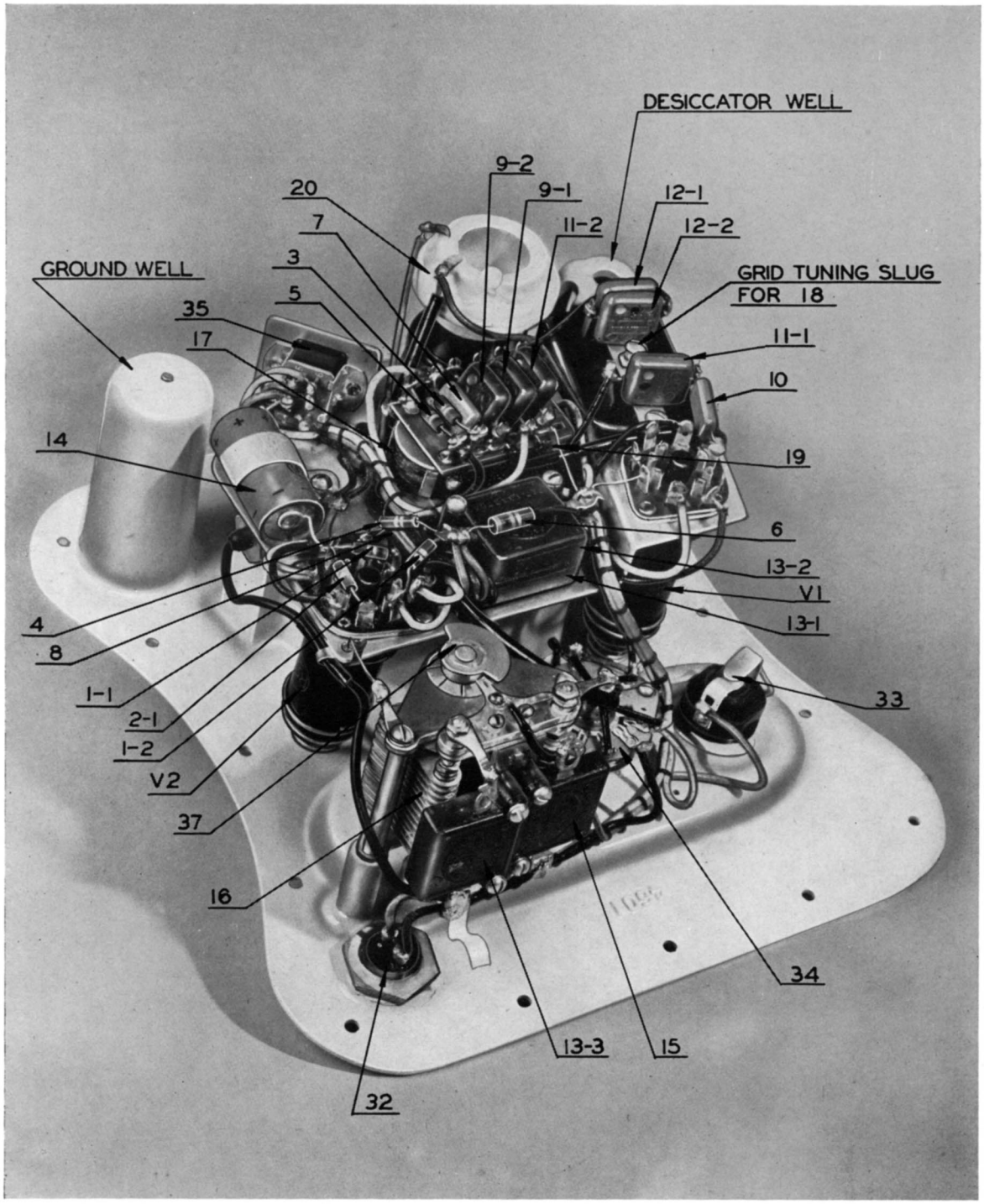

Fig. 16 — Radio Transmitter BC-778-A, Parts Layout, Panel

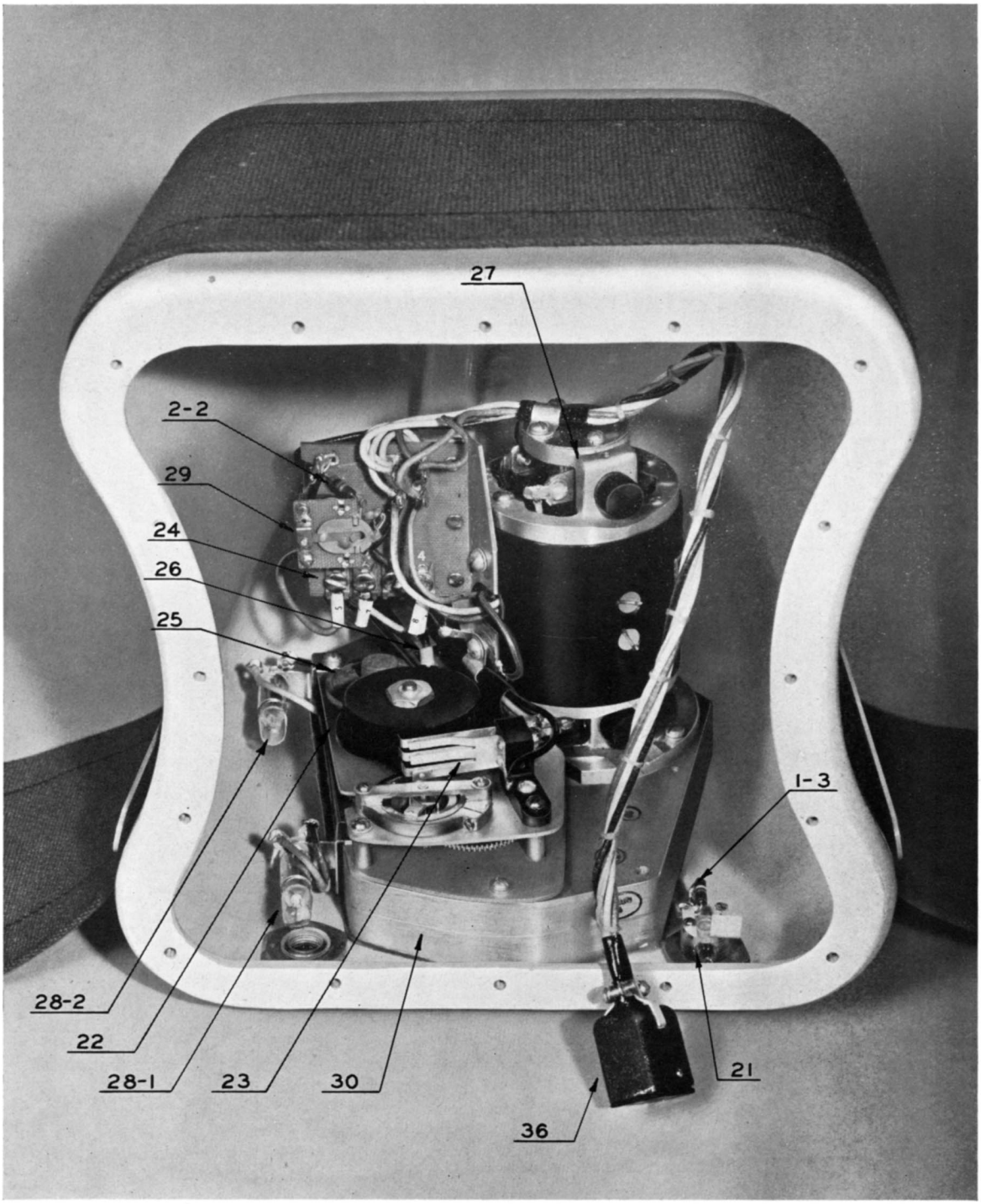

Fig. 16a — Radio Transmitter BC-778-A, Parts Layout, Power Supply

Adequate lubrication is provided for all parts for the life of the equipment under normal conditions. Additional lubrication may be detrimental to the operation of the equipment. The brushes of the generator should not require replacing during the life of the equipment. If the radio transmitter is subject to continuous humid conditions the desiccant should be replaced every month or when it becomes "pinkish white in color." This desiccant is "Telltale Silica Gel" and is normally blue in color. When it has absorbed all the moisture it can, it will turn "pinkish white in color." This silica gel may be obtained from authorized repair depots. Throw away old silica gel in sack and refill sack with new silica gel. Be sure screw-cap covering of silica gel chamber is securely replaced.

10. Field Repairs:

The following repairs can be made in the field if adequate facilities are had, but if possible these repairs should be made at authorized repair depots. Parts for these repairs can be obtained at these depots. It will be necessary to remove the screws around the edge of the front panel of the transmitter and to lift the front panel to make the following repairs. After repairs are made the front panel must be replaced and all screws put securely in place.

a. To test or replace tubes, loosen three screws holding chassis to front panel, lift up chassis and then remove tubes and holding springs at the same time and test in tube checker.

b. To test or replace Speed Indicator lamp 28-1 and series-load lamp 28-2, remove lamps from sockets and check continuity.

c. To replace or test TUNE TO BRIGHTEST neon lamp it will be necessary to unsolder leads connected to it and remove lamp. Leads are to be soldered to lamp after replacement.

***d.* If the front panel of transmitter is removed for any servicing, it will be necessary to replace the desiccant with new desiccant.**

11. Depot Repairs:

The following repairs can be done at authorized repair depots:

a. **Servicing of Generator:**

The hand powered generator is mounted in the lower half of the case for Radio Transmitter BC-778-A. It will be necessary to remove the screws around the outside edge of the front panel and to lift the front panel of transmitter to get at the generator. This generator has two windings, one low voltage winding and one high voltage winding. With the selector switch in RADIO-MANUAL position, key down, and approximate speed of rotation of crank of 72 rpm. the low voltage winding supplies 28 volts at 160 milliamperes and the high voltage winding 300 volts at 26 milliamperes. Voltage readings are to be taken with a high resistance voltmeter. The tube socket voltages between pin and ground, key down, MANUAL POSITION and at 72 rpm. are shown in the following table:

Tube No. . . V1		Mfgrs. Tube Type No. .						12SC7
Pin Number	1	2	3	4	5	6	7	8
Tube Element	GR	120	−5	−15	250	1.3	14	28
Volt Meter Scale	O	250	10	50	250	2.5	50	50

Tube No. . . V2		Mfgrs. Tube Type No. .						12A6
Pin Number	1	2	3	4	5	6	7	8
Tube Element	GR	GR	*300	200	*−85	NC	15	.75
Volt Meter Scale	O	O	1000	250	250	NC	50	2.5

FIGURE 17.—Table of Voltages for Tube Sockets

All readings were taken with a 20,000 ohm per volt meter and the transmitter was working into a phantom antenna consisting of a 31 ohm resistor in series with a 700 mmfd. condenser.

The brushes in the generator should never need replacement during the life of the equipment but if for some reason they are replaced they should be fully fitted to the commutator. The generator bearings should never be lubricated unless they have been replaced. Generator bearings should never need replacing but if it is necessary the generator will have to be removed from the case. To remove the generator, remove the four screws and spanner nut holding gear-train assembly and generator to the case. Remove three screws located at the base of generator, and then remove generator from gear train. Remove the gear on the armature shaft and the four brushes. Mark the brushes so they can be put back in the same brush holders and in the same position. Remove the two screw head bolts in the end of the generator and remove the end bracket. The armature is now

* It is necessary to take these readings through an RF choke connected directly to the tube pin or the transmitter will go out of oscillation, and a true reading will not be obtained.

accessible and may be withdrawn. The bearings must be removed by bearing pullers. Press on new bearings. Check lubrication of bearings before replacing armature. Use only Andok C, made by New Departure, lubricants on bearings.

b. **Governor and Code Wheel Adjustments:**

The governor and code wheel adjustments are locked at the factory and should not be disturbed unless definite proof is had that they are out of adjustment. It will be necessary to have equipment for adjusting speeds of rotation to a high degree of accuracy. The governor is designed to operate at 1320 rpm. This corresponds to a crank input speed of 48 rpm., a code wheel speed of 12 rpm., and a switch cam speed of 1½ rpm. When the crank is turned at a speed greater than 48 rpm., the clutch will slip and the governor will maintain the timing mechanism at constant normal speed. Coarse adjustment of the governor is made by loosening the CAM ARM LOCKING SCREW on the rotating assembly and moving the cam arm to right or left, thus changing the spring tension. Turn clockwise for lower speed and counterclockwise for higher speed. See Figure 18. **Make no adjustment of this spring unless it has definitely been determined necessary as this adjustment has been carefully made in the factory and should require no further adjustment.** Fine adjustment of the governor is made by loosening the COMPRESSION RING LOCKING SCREW and rotating the FRICTION CYLINDER. The conical inner surface causes the braking action to increase when the cylinder is rotated clockwise (lower speed) and causes the braking action to decrease when rotated counterclockwise (higher speed). The friction cylinder may be rotated by using a scribe or other sharp pointed object in the holes provided in the cylinder. See Figure 18.

The code wheel must be synchronized with the cam switch so that the cam switch completes its change-over during the one-second interval during which the code wheel contacts are traversing the 72 degree space on the code wheel. See Figure 18. This adjustment is made as follows:

(1) Loosen the code wheel lock nut so that code wheel turns free on shaft.

(2) Turn the crank until the cam switch contacts are exactly in the center of their vertical travel. Note: All cam switch contacts will be open circuit.

(3) Turn the code wheel until its contacts are exactly in the center of the 72 degree space.

(4) Lock the code wheel in this position by tightening the lock nut.

c. **Selection of Signal Sequences for Automatic Positions of Radio Transmitter BC-778-A:**

The signal sequences of AUTO 1 and AUTO 2 positions are set at the factory and are indicated on the transmitter. If it is desired to change the sequence it will be necessary to remove the front panel from the transmitter case. Figure 15, Schematic Diagram illustrates the mechanism and the terminal strip. Figure 19 shows the combinations of signals obtainable by interchanging the positions of the leads on the terminal strip.

d. **Circuit Analysis:**

The audio oscillator circuit is very stable but of rather unusual design. See Figure 15. The oscillator tube V1 (12SC7) is a dual triode which operates as a two stage amplifier in which regeneration is accomplished through a common, unbypassed cathode. The resistor 1-1 couples G1 of V1 to ground, hence the input grid operates essentially at ground potential. The input voltage and its polarity is determined by the phase of the current passing through resistor 2-1, the bias resistor for V1. The resistor 4 is the plate load resistor for P1 and 1-2 is the plate load resistor for P2. Resistor 4 is considerably higher resistance than resistor 1-2 so that normal current through P2 is greater than P1. Since P2 is 180 degrees out of phase with P1, the voltage developed across resistor 2-1, due to the current in P2, will be of opposite polarity to that developed from the current in P1. The coupling for the audio between P1 and G2 is provided by condenser 8. Condenser 8 also serves to block the DC component of P1 from G2. The resistor 3 provides a path for the grid charge of G2 to return to ground. Tuning of the audio frequency to approximately 1000 cycles is accomplished by condenser 7 in conjunction with other circuit constants. Condenser 9-1 serves to couple the signal generated in the audio signal generator to the grid of the RF oscillator as well as to keep the plate voltage of P2 from reaching the grid of V2 (12A6) tube. Condenser 9-2 is provided to bypass stray RF in connection with the inductor 17 which is used to block the RF generated in the grid of V2 from feeding back into P2 of V1.

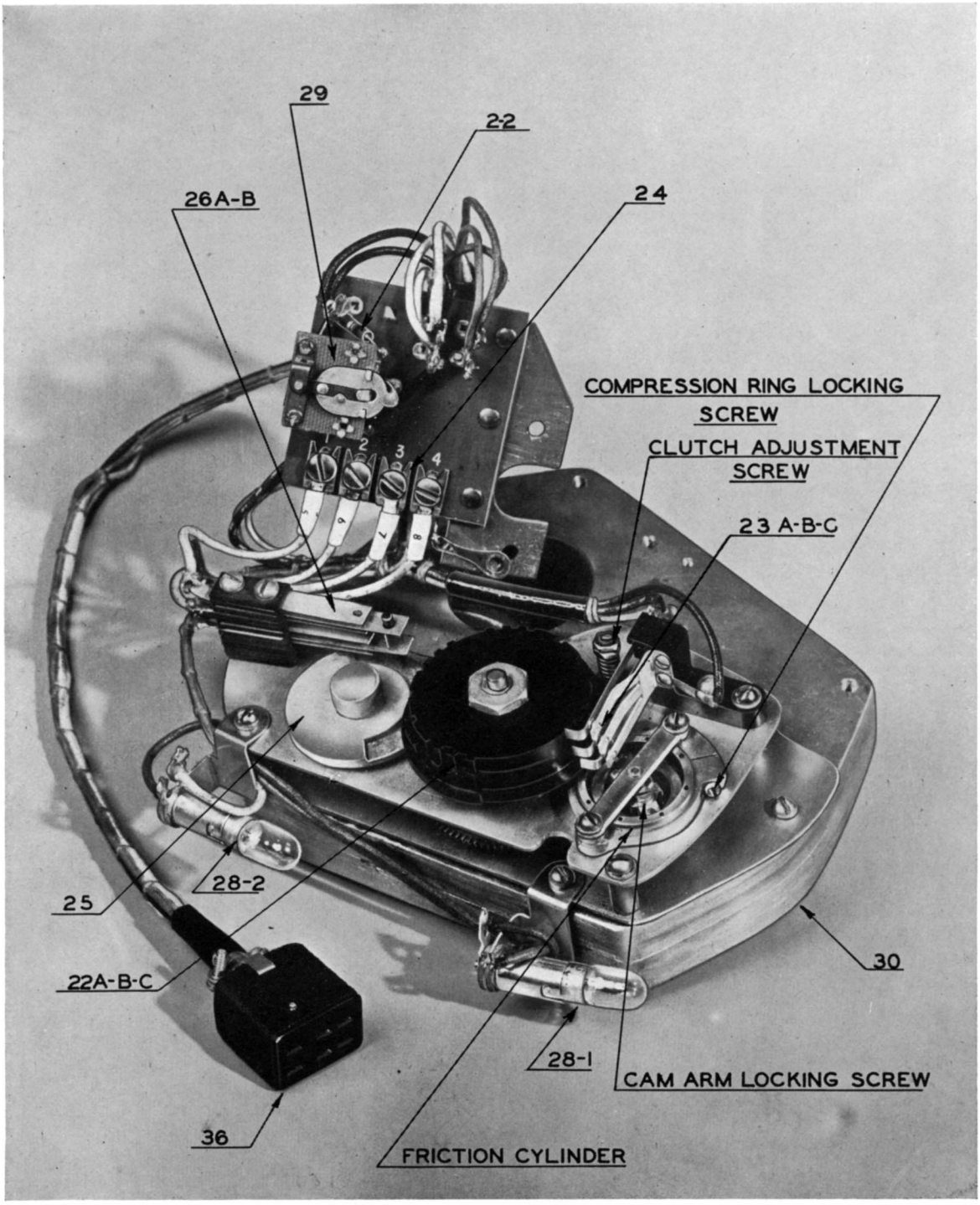

Fig. 18 — Gear Train and Keying Mechanism, Less Generator

AUTO 1 POSITION

LINK TOGETHER TERMINALS WHOSE NUMBERS ARE		SIGNAL TRANSMITTED A Repeating Cycle of	
		20 Seconds of	Followed by 20 Seconds of
1 and 5 . .	4 and 6	SOS	DASH (Solid)
2 and 5 . .	4 and 6	AA	DASH (Solid)
1 and 5 . .	2 and 6	SOS	AA
1 and 5 . .	1 and 6	SOS	SOS
2 and 5 . .	2 and 6	AA	AA
4 and 5 . .	4 and 6	DASH (Solid)	DASH (Solid)
1 and 5 . .	3 and 6	SOS	AUTOMATIC ALARM
2 and 5 . .	3 and 6	AA	AUTOMATIC ALARM
4 and 5 . .	3 and 6	DASH (Solid)	AUTOMATIC ALARM
3 and 5 . .	3 and 6	AUTOMATIC ALARM	AUTOMATIC ALARM

AUTO 2 POSITION

LINK TOGETHER TERMINALS WHOSE NUMBERS ARE		SIGNAL TRANSMITTED A Repeating Cycle of	
		20 Seconds of	Followed by 20 Seconds of
1 and 7 . .	4 and 8	SOS	DASH (Solid)
2 and 7 . .	4 and 8	AA	DASH (Solid)
1 and 7 . .	2 and 8	SOS	AA
1 and 7 . .	1 and 8	SOS	SOS
2 and 7 . .	2 and 8	AA	AA
4 and 7 . .	4 and 8	DASH (Solid)	DASH (Solid)
1 and 7 . .	3 and 8	SOS	AUTOMATIC ALARM
2 and 7 . .	3 and 8	AA	AUTOMATIC ALARM
4 and 7 . .	3 and 8	DASH (Solid)	AUTOMATIC ALARM
3 and 7 . .	3 and 8	AUTOMATIC ALARM	AUTOMATIC ALARM

FIGURE 19.—Table of Signal Sequences for Automatic Positions of Radio Transmitter BC-778-A

Resistor 5 provides a path for charges on the grid of V2 to return to ground. Condenser 10 is used to couple the oscillator circuit to the grid of V2 and to block the DC path from the cathode to the grid of V2. The RF oscillator is of the electron coupled type in which the tube is a tetrode consisting of the screen grid (which serves as an anode), the cathode, the control grid, and the plate. The plate is not a part of the oscillating circuit and serves only as an electron coupled load. Resonance of the RF oscillator is obtained with the inductor 18 and with the capacitors11-1, 12-1, and 12-2. Condenser 11-2 provides the return for the RF circuit to ground and parallels the keying device to prevent arcing of the contact points. The inductor 19 serves as an RF impedance to place the cathode above ground in respect to RF component. A portion of the RF voltage developed across the inductor 19 is fed back into the oscillator network. The condenser 13-1 serves to keep the screen of V2 at ground potential with respect to RF. The high voltage supply for the screen of V2 is reduced through the dropping resistor 6. The high voltage circuit is filtered by an electrolytic condenser 14 and a RF bypass condenser 13-2. The inductor 20 is the antenna loading coil which, in conjunction with condensers 15 and 16, serves to tune the transmitter to the antenna. The condenser 16 is a variable condenser of special design. It has a rotation of 360 degrees during 180 degree of which it closes the contact of switch 37 which parallels condenser 15 with the variable condenser 16. Condenser 13-3 is a blocking condenser to keep the DC component of the plate circuit of V2 from reaching the antenna. The current through the tuning indicator lamp 21 is limited by the resistor 1-3. The plug 35 and the jack 36 comprises the cable coupling between the transmitter and the generator power supply and keying device. The crank 31, when rotated, drives the gear train 30 which in turn drives the generator and the automatic keying mechanism. The generator contains two windings. One winding is used to supply the high voltage potential for the transmitter, and the second winding supplies the voltage for the filaments of the tubes and the power for the Signal Light M-308-A when used. This winding also supplies the power to the speed indicator lights 28-1 and 28-2 and energizes the voltage limiting relay 29. The resistor 2-2 in series with the coil of relay 29 is to limit the current in this circuit so that the relay will not be energized unless the voltage across the circuit exceeds the predetermined level. If excessive voltage is generated by rotating the crank at too high a speed the relay contact arm is energized and will ground the field coil. As soon as the field coil is grounded the flux in the generator armature windings are cutting fewer lines of force, hence lowering the output voltage. When the low voltage winding output drops sufficiently to release the relay contact arm the field coil is again energized. This will produce an oscillating effect in the relay. This oscillation of the relay contact arm will hold the voltage down until such time as the speed at which the crank is rotated is reduced . The gear train 30 also drives the automatic keying machanism 22-A, 22-B, and 22C. This mechanism consists of three discs which contain raised surfaces. As these discs are rotated they actuate a set of contacts which key the transmitter. The mechanism also contains a cam switch 25 which completes a cycle each forty seconds. The purpose of this cam is to change the characters of the transmitted signal every twenty seconds. The key 33 is a push button which is used to key the transmitter manually. The character of transmission is selected by the six position switch 34. Choice of AUTO 1, AUTO 2, and MANUAL keying of the transmitter or the signal light are available by placing the selector arm of the switch 34 to the desired function. The signal light jack 32, located on the front panel, is provided to plug in signal light.

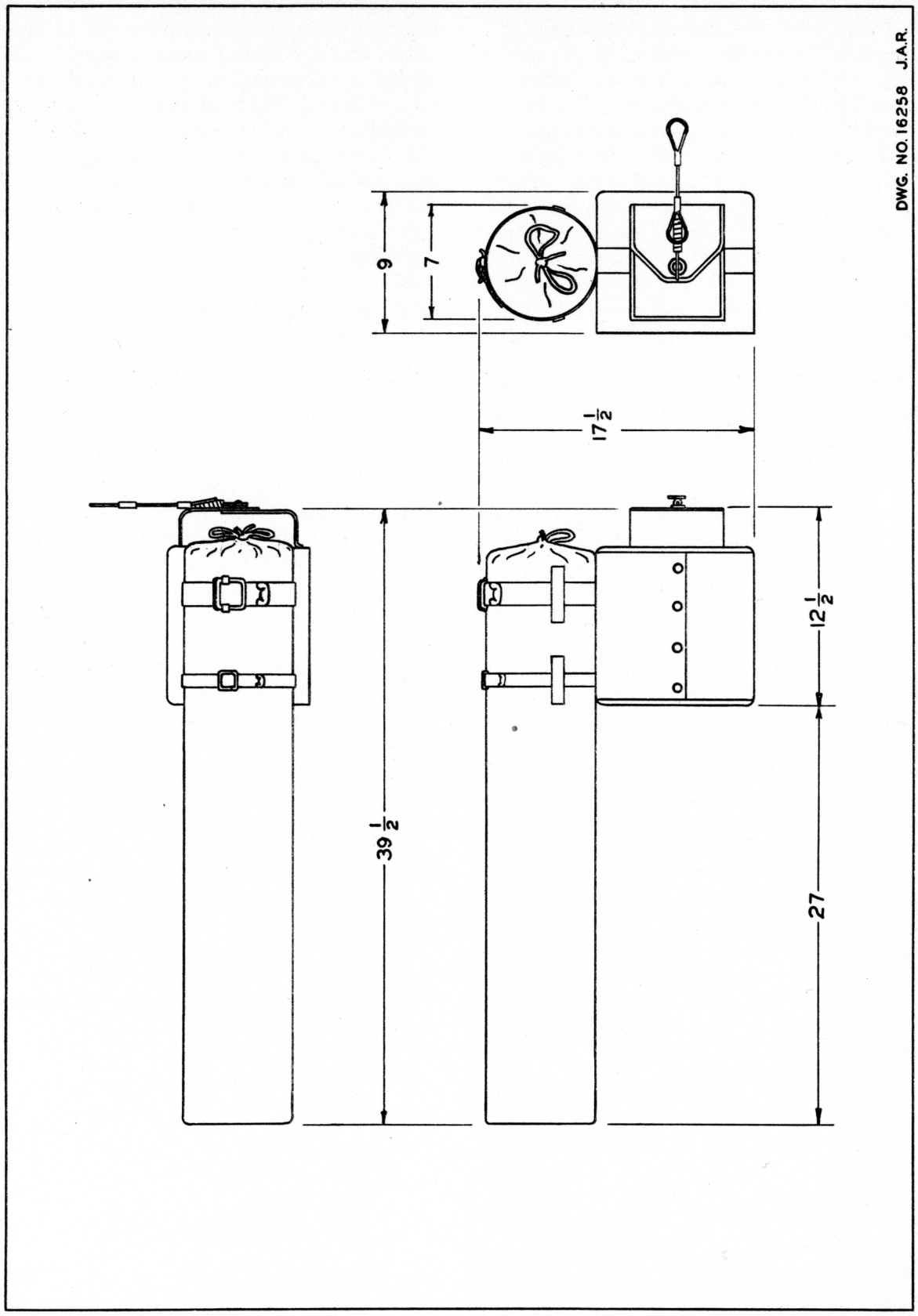

Fig. 20 — Radio Set SCR-578-A, Outline Dimensional Drawing

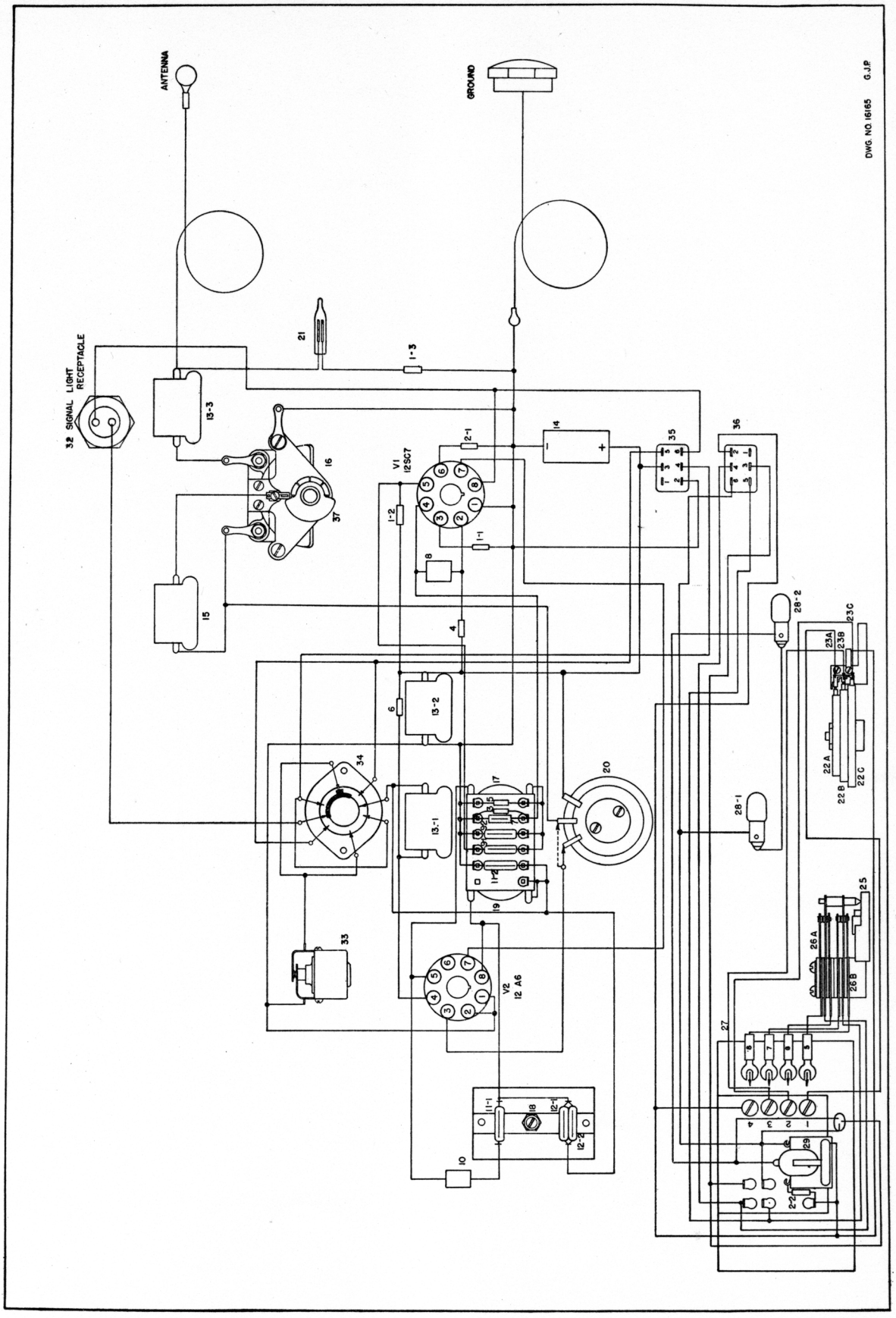

Fig. 21 — Radio Transmitter BC-778-A, Practical Wiring Diagram

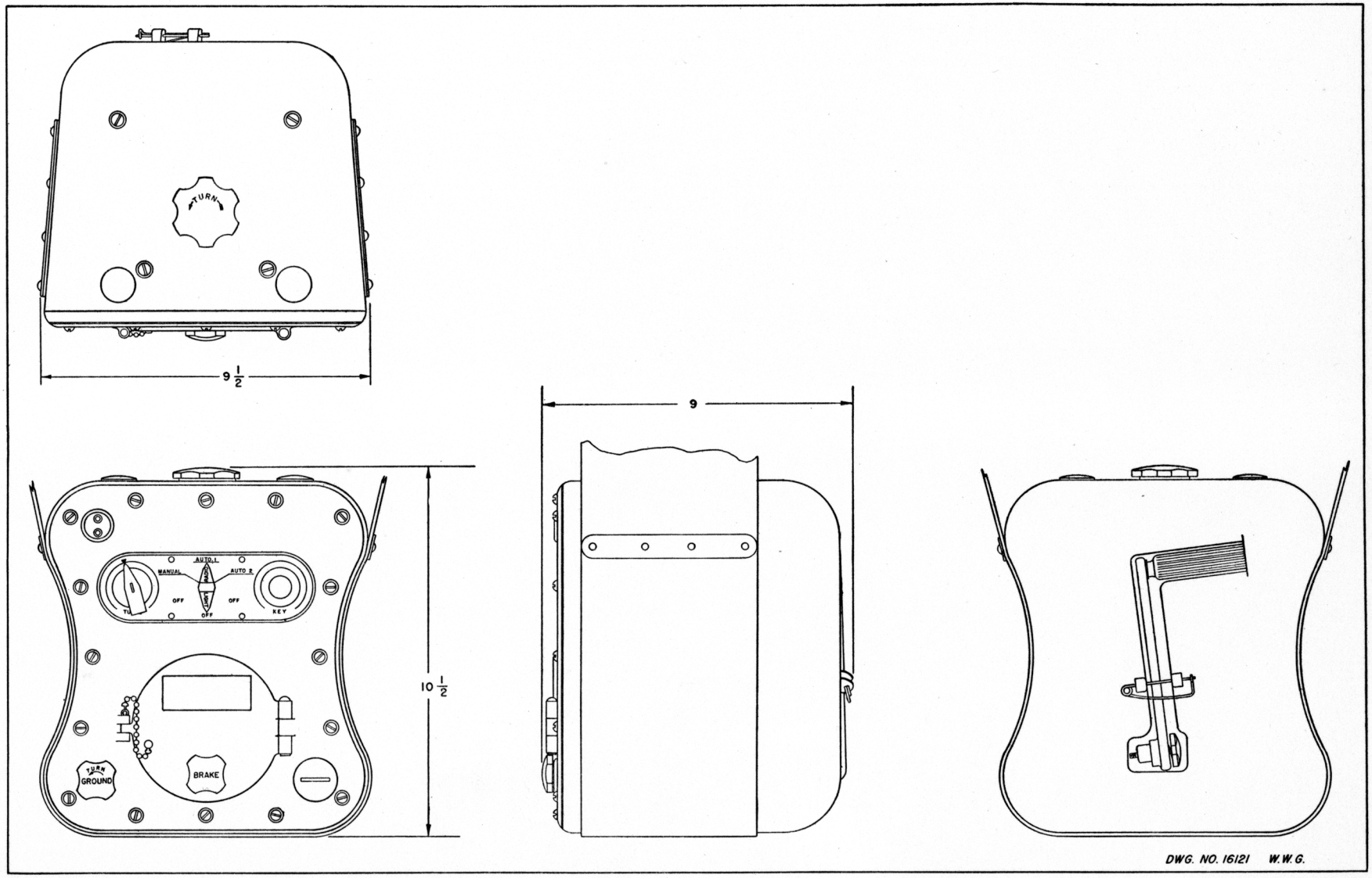

Fig. 22 — Radio Transmitter BC-778-A, Outline Dimensional Drawing

12. LIST OF REPLACEABLE PARTS

REF. No.	NAME OF PART	STOCK No.	DESCRIPTION	FUNCTION	DWG. No.
1.	Resistor		Allen Bradley type EB½W .1 megohm ±10%		
			Ref. No. 1-1	Grid 1 of V1	
			Ref. No. 1-2	Plate 2 load of V1	
			Ref. No. 1-3	Neon lamp current limiting	
2.	Resistor		Allen Bradley type EB ½W 1000 ohms ± 10%		
			Ref. No. 2-1	Cathode bias of V1	
			Ref. No. 2-2	Series with relay coil	
3.	Resistor		Allen Bradley type EB ½W .15 megohm ± 10%	Grid 2 of V1	
4.	Resistor		Allen Bradley type EB ½W .25 megohm ± 10%	Load resistor, P1 of V1	
5.	Resistor		Allen Bradley type EB ½W 50,000 ohm ± 10%	Grid leak of V2	
6.	Resistor		Allen Bradley type GB 1W 30,000 ohm ± 10%	Series with screen of V2	
7.	Condenser		Micamold type B .0001 mfd. 500 V. 20%	Tone compensation, G2 of V1	
8.	Condenser		Micamold type W .0015 mfd. 500 V. 20%	P1 coupling to G2, V1	
9.	Condenser		Micamold type W .001 mfd. 500 V. 20%		
			Ref. No. 9-1	Coupling AF osc. to RF. osc.	
			Ref. No. 9-2	RF bypass in G of V2	
10.	Condenser		Micamold type O .0005 mfd. 500 V. 20%	Blocking, G of V2	
11.	Condenser		Micamold type PW .003 mfd. 500 V. silvered mica 5%		
			Ref. No. 11-1	RF osc. tuning	
			Ref. No. 11-2	RF osc. return to ground	
12.	Condenser		Cornel Dubilier 1RS302 .004 mfd. 300 V. 5% silvered mica		
			Ref. No. 12-1	RF osc. tuning	
			Ref. No. 12-2	RF osc. tuning	
13.	Condenser		Cornel Dubilier 4S-11030 .03 mfd. 600 V. 20%		
			Ref. No. 13-1	Screen bypass	
			Ref. No. 13-2	High voltage RF bypass	
			Ref. No. 13-3	Series with antenna	
14.	Condenser		Solar M 408 electrolytic 8 mfd. 450 V.	High voltage filter	
15.	Condenser		Cornel Dubilier 4S-53020 .0002 mfd. 2500 V. 20%	Antenna tuning	
16.	Condenser		Bendix Aviation Ltd. 250 mmfd. tuning condenser	Antenna tuning	4670

12. LIST OF REPLACEABLE PARTS (Ctd.)

REF. No.	NAME OF PART	STOCK No.	DESCRIPTION	FUNCTION	DWG. No.
17.	RF Choke		Bendix Aviation Ltd. BX18-16 50 MH	Series with G of V2	
18.	Inductor		Bendix Aviation Ltd. Oscilator inductor	G of V2	4655
19.	RF Choke		Bendix Aviation Ltd. BX18-11 2.5 MH	Cathode of V2	
20.	Inductor		Bendix Aviation Ltd. Antenna inductor	Antenna tuning	4614
21.	Neon Lamp		General Electric NE-2 Neon Lamp	Antenna tuning indicator	G. E.
31.	Crank		Bendix Aviation Ltd.	To operate generator and keying mechanism	4506
32.	Socket		Bendix Aviation Ltd.	Socket for signal light	4632
33.	Key		Bendix Aviation Ltd.	Radio Transmission key	4604
34.	Switch		Bendix Aviation Ltd. BX16-54	Function selection sw.	
35.	Plug		Jones plug type P-306AB	Connect power to Transmitter	
37.	Switch		Part of Ref. No. 16	Parallels 15 and 16	
	Crankcase Cap		Bendix Aviation Ltd.	Seals crankcase	4547
	Ground Cap		Bendix Aviation Ltd.	Seals ground cable	4711
	Desiccator Cap		Bendix Aviation Ltd.	Seals desiccator compartment	4598
	Door Assembly		Bendix Aviation Ltd.	Reel for antenna wire	4685
	Sack		Bendix Aviation Ltd.	Sack to hold desiccant	4700
	Desiccant		Silica Gel 6-16TT	To remove moisture	
	Power Supply and Keying Mechanism, complete		Bendix Aviation Ltd.	Supply power and key transmission	4774
	The following are sub-assembly components of the Power Supply and Keying Mechanism				
22.	Code Wheel		Bendix Aviation Ltd. 22-A,B,C part of automatic keying mechanism	Automatic keying code	4775
23.	Keying Contacts		Bendix Aviation Ltd. 23-A,B,C, part of automatic keying mechanism	Automatic keying contacts	4767
24.	Terminal Strip		Bendix Aviation Ltd. 4 connection	Tie point	
25.	Cam		Bendix Aviation Ltd. part of automatic keying mechanism	Sequence changeover	4772
26.	Changeover contacts		Bendix Aviation Ltd. 26-A,B, contacts	Sequence changeover contact points	4770
27.	Dynamotor		Bendix Aviation Ltd. Model 3975-1	Lo, Hi, voltage generator	2873
28.	Pilot Lamp		Mazda type 1477 24-28 V pilot-lamp	Crank speed indicator	G. E.
29.	Relay		Leach relay type P3 1280 ohm winding	Voltage regulator	
36.	Jack		Jones plug type S-306cct	Connect power to Transmitter	
	Governor Gear Train Assem.		Bendix Aviation Ltd.	Regulate speed of automatic keying	15000
	The following is a sub-assembly of the Governor Gear Train Assembly				
30.	Gear Train		Bendix Aviation Ltd.	Generator Drive	4504

LIST OF MANUFACTURERS

Bendix Aviation, Limited	11600 Sherman Way, North Hollywood, California
Allen Bradley	1326 South 2nd Street, Milwaukee, Wisconsin
Micamold Radio Corporation	1085 Flushing Avenue, Brooklyn, New York
Cornell-Dubilier Electric Co.	1000 Hamilton Boulevard, South Plainfield, New Jersey
Solar Manufacturing Corporation	Bayonne, New York
G. E.	General Electric, Lamp Division, Schenectady, New York
Leach Relay Co.	5915 Avalon Boulevard, Los Angeles, California
Davison Chemical Corporation	Baltimore, Maryland
H. B. Jones Co.	2300 Wabansia Avenue, Chicago, Illinois