TM 11-2258

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

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FACSIMILE SETS AN/TXC-1 -1A, AND -1B

DEPARTMENT OF THE ARMY • DECEMBER 1947

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TM 11-2258

This manual supersedes so much of TM 11-375 B, 5 April 1944, including C 1, 4 August 1945, and C 2, 17 May 1946, and TM 11-4038, 6 December 1945, as pertains to Facsimile Sets AN/TXC-1 and -1A.

FACSIMILE SETS AN/TXC-1 -1A, AND -1B



DEPARTMENT OF THE ARMY • DECEMBER 1947

For sale by the Superintendent of Documents, U.S. Government Printing Office

Washington 25, D. C.

DEPARTMENT OF THE ARMY
Washington 25, D.C., 15 December 1947

TM 11–2258, Facsimile Sets AN/TXC–1, –1A, and –1B, is published for the information and guidance of all concerned.

[AG 300.7 (28 Oct 47)]

BY ORDER OF THE SECRETARY OF THE ARMY:

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For explanation of distribution formula, see TM 38–405.

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WARNING

HIGH VOLTAGE

is used in the operation
of this equipment.

DEATH ON CONTACT

may result if personnel
fail to observe safety precautions.

DESTRUCTION NOTICE

WHY — To prevent the enemy from using or salvaging this equipment.

WHEN — When ordered by your commander.

HOW —

1. Smash—Use sledges, axes, handaxes, pickaxes, hammers, crowbars, heavy tools.
2. Cut—Use axes, handaxes, machetes.
3. Burn—Use gasoline, kerosene, oil, flame throwers, incendiary grenades.
4. Explosives—Use firearms, grenades, TNT.
5. Disposal—Bury in slit trenches, fox holes, other holes. Throw in streams. Scatter.

USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT

WHAT —

1. Smash—Chassis, panel, drum, lead screw, clutch, motor, tubes, transformers, fork oscillator, terminal strips, meters, controls, coupling units.
2. Cut—Cords, cables, wiring.
3. Burn—Covers, terminal boards, wiring, technical manuals, photographic equipment.
4. Bend—Chassis, panels, drum, lead screw, table.
5. Bury or scatter—All of the above materials after destroying.

DESTROY EVERYTHING

SAFETY NOTICE

Facsimile Set AN/TXC–1(*) uses high voltages which may be dangerous to life.

Voltages as high as 1,000 volts, 1,800 cycles alternating current, may be developed in the motor amplifier circuit of Facsimile Transceiver TT–1(*)/TXC–1.

Voltages as high as 1,250 volts, 60 cycles alternating current, and 450 volts direct current are developed in Rectifier Power Unit PP–86(*)/TXC–1.

High voltage in the motor circuit of Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1 is exposed when the cover is removed from the motor and clutch assembly.

Keep one hand in your pocket while making high-voltage measurements. This precaution will prevent touching the electrical circuit with more than one part of the body at one time.



First Aid for Electric Shock

RESCUE.

In case of electric shock, shut off the high voltage at once and ground the circuits. If the high voltage cannot be turned off without delay, free the victim from contact with the live conductor as promptly as possible. Avoid direct contact with either the live conductor or the victim's body. Use a dry board, dry clothing, or other nonconductor to free the victim. An ax may be used to cut the high-voltage wire. Use extreme caution to avoid the resulting electric flash.

SYMPTOMS.

a. Breathing stops abruptly in electric shock if the current passes through the breathing center at the base of the brain. If the shock has not been too severe, the breath center recovers after a while and normal breathing is resumed, provided that a sufficient supply of air has been furnished meanwhile by artificial respiration.

b. The victim is usually very white or blue. The pulse is very weak or entirely absent and unconsciousness is complete. Burns are usually present. The victim's body may become rigid or stiff in a very few minutes. This condition is due to the action of electricity and is not to be considered rigor mortis. Artificial respiration must still be given, as several such cases are reported to have recovered. The ordinary and general tests for death should never be accepted.

TREATMENT.

a. Start artificial respiration immediately. At the same time send for a medical officer, if assistance is available. Do not leave the victim unattended. Perform artificial respiration at the scene of the accident, unless the victim's or operator's life is endangered from such action. *In this case only*, remove the victim to another location, but no farther than is necessary for safety. If the new location is more than a few feet away, artificial respiration should be given while the victim is being moved. If the method of transportation prohibits the use of the Shaeffer prone pressure method, other methods of resuscitation may be used. Pressure may be exerted on the front of the victim's diaphragm, or the direct mouth-to-mouth method may be used. Artificial respiration, once started, must be continued, without loss of rhythm.

b. Lay the victim in a prone position, one arm extended directly overhead, and the other arm bent at the elbow so that the back of the hand supports the head. The face should be turned away from the bent elbow so that the nose and mouth are free for breathing.

c. Open the victim's mouth and remove any foreign bodies, such as false teeth, chewing gum, or tobacco. The mouth should remain open, with the tongue extended. Do not permit the victim to draw his tongue back into his mouth or throat.

d. If an assistant is available during resuscitation, he should loosen any tight clothing to permit free circulation of blood and to prevent restriction of breathing. He should see that the victim is kept warm, by applying blankets or other covering, or by applying hot rocks or bricks wrapped in cloth or paper to prevent injury to the victim. The assistant should also be ever watchful to see that the victim does not swallow his tongue. He should continually wipe from the victim's mouth any frothy mucus or saliva that may collect and interfere with respiration.

e. The resuscitating operator should straddle the victim's thighs, or one leg, in such manner that:

(*1*) the operator's arms and thighs will be vertical while applying pressure on the small of the victim's back;

(*2*) the operator's fingers are in a natural position on the victim's back with the little finger lying on the last rib;

(*3*) the heels of the hands rest on either side of the spine as far apart as convenient without allowing the hands to slip off the victim;

(*4*) the operator's elbows are straight and locked.

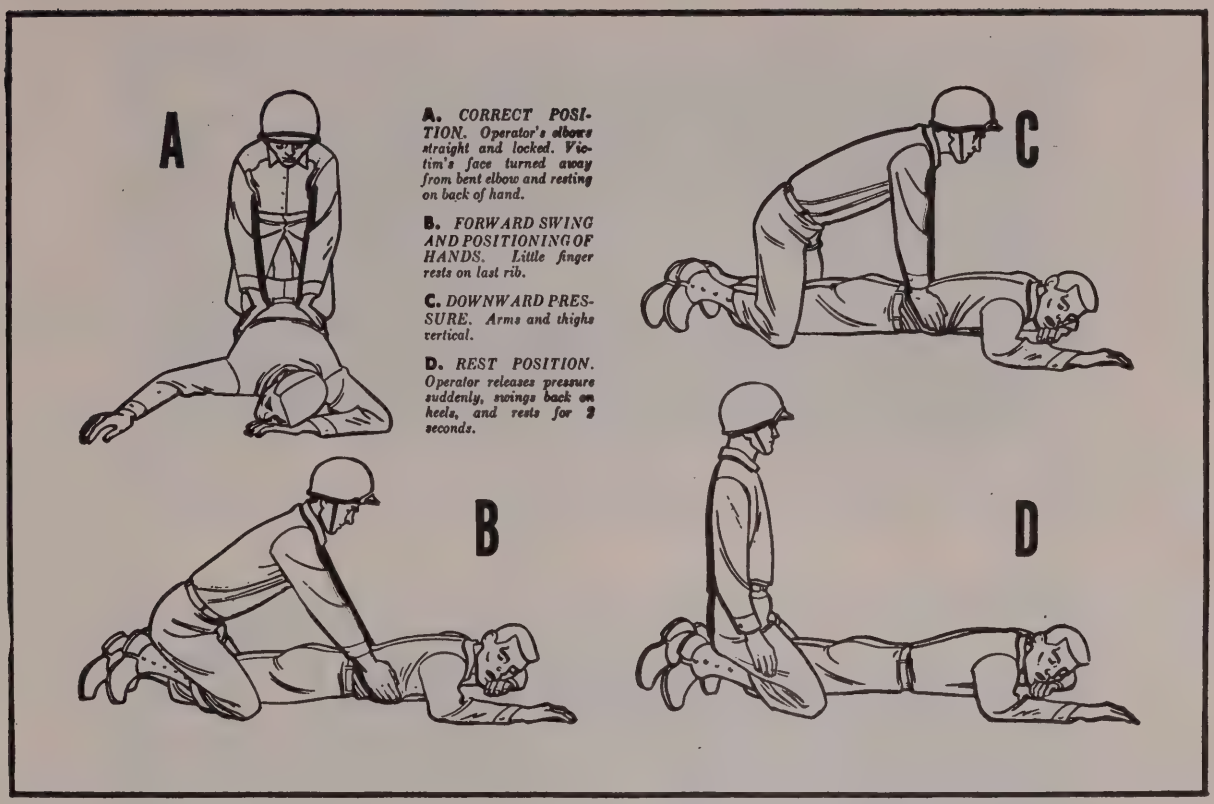
f. The resuscitation procedure is as follows:

(*1*) Exert downward pressure, not exceeding 60 pounds, for 1 second.

(*2*) Swing back, suddenly releasing pressure, and sit on the heels.

(*3*) After 2 seconds rest, swing forward again, positioning the hands exactly as before, and apply pressure for another second.

g. The forward swing, positioning of the hands, and the downward pressure should be accomplished in one continuous motion, which requires 1 second. The release and backward swing require 1 second. The addition of the 2-second rest makes a total of 4



seconds for a complete cycle. Until the operator is thoroughly familiar with the correct cadence of the cycle, he should count the seconds aloud, speaking distinctly and counting evenly in thousands. Example: one thousand and one, one thousand and two, etc.

h. Artificial respiration should be continued until the victim regains normal breathing or is pronounced dead by a medical officer. Since it may be necessary to continue resuscitation for several hours, relief operators should be used if available.

RELIEVING OPERATOR.

The relief operator kneels beside the operator and follows him through several complete cycles. When the relief operator is sure he has the correct rhythm, he places his hands on the operator's hands without applying pressure. This indicates that he is ready to take over. On the backward swing, the operator moves and the relief operator takes his position. The relieved operator follows through several complete cycles to be sure that the new operator has the correct rhythm. He remains alert to take over instantly if the new operator falters or hesitates on the cycle.

STIMULANTS.

a. If an inhalant stimulant is used, such as aromatic spirits of ammonia, the individual administering the stimulant should first test it himself to see how close he can hold the inhalant to his own nostril for comfortable breathing. Be sure that the inhalant is not held any closer to the victim's nostrils, and then for only 1 or 2 seconds every minute.

b. After the victim has regained consciousness, he may be given hot coffee, hot tea, or a glass of water containing ½ teaspoon of aromatic spirits of ammonia. *Do not give any liquids to an unconscious victim.*

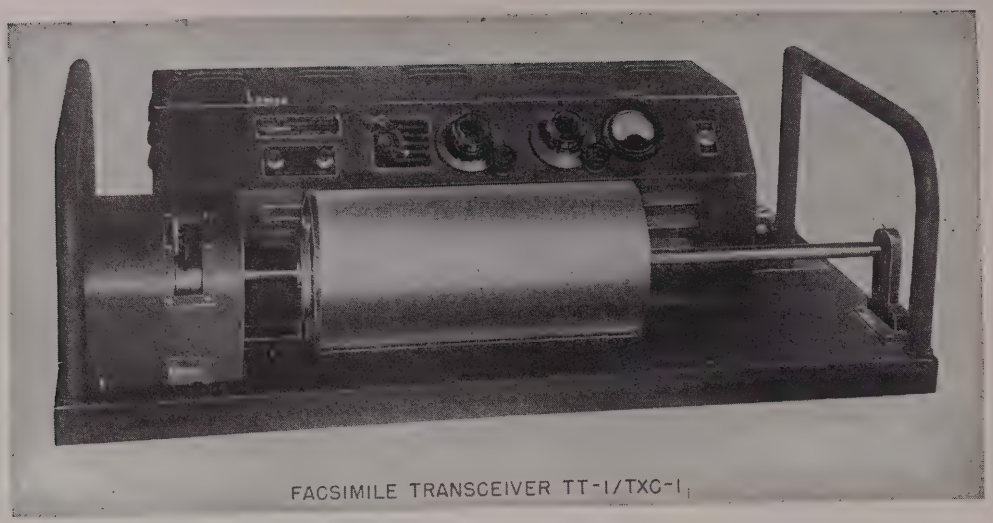
CAUTIONS.

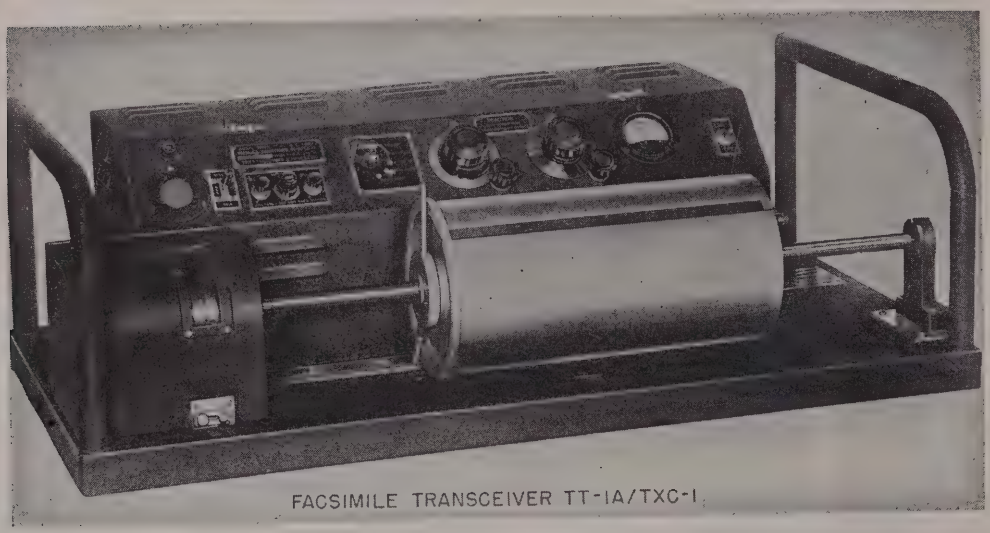
a. After the victim revives, keep him LYING QUIETLY. Any injury a person may have received may cause a condition of shock. Shock is present if the victim is pale and has a cold sweat, his pulse is weak and rapid, and his breathing is short and gasping.

b. Keep the victim lying flat on his back, with his head lower than the rest of his body and his hips elevated. Be sure that there is no tight clothing to restrict the free circulation of blood or hinder natural breathing. Keep him warm and quiet.

c. A resuscitated victim must be watched carefully as he may suddenly stop breathing. *Never leave a resuscitated person alone until it is CERTAIN that he is fully conscious and breathing normally.*

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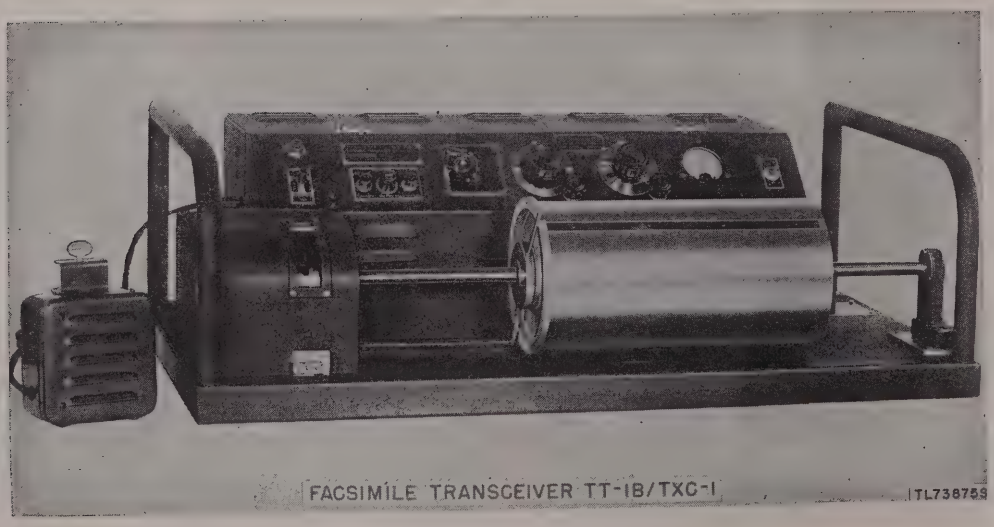


Figure 1. Facsimile transceivers.

This manual supersedes so much of TM 11–375B, 5 April 1944, including C 1, 4 August 1945, and C 2, 17 May 1946, and TM 11–4038, 6 December 1945, as pertains to Facsimile Sets AN/TXC–1 and –1A.

PART ONE
INTRODUCTION

Section I. DESCRIPTION OF FACSIMILE SET AN/TXC–1(*)

1. General

Facsimile Set AN/TXC–1 (*) is an electromechanical-optical facsimile set of the revolving drum type for the transmission and reception of page copy. It is used for transmission of maps, photographs, sketches, and printed or handwritten text over regular voice-communication channels, either wire or radio, between fixed stations. Colored copy may be transmitted but all reproduction is in black, white, and intermediate shades of gray. Received copy is recorded either directly on chemically treated paper or photographically in either negative or positive form. The equipment will transmit or receive a page of copy 12 by 18 inches (in.) in 20 minutes (min.). Principal components of Facsimile Set AN/TXC–1(*) are Facsimile Transceiver TT–1 (*)/TXC–1 (fig. 1), which serves either as transmitter or receiver, depending on the setting of a front-panel selector switch, and Rectifier Power Unit PP–86(*)/TXC–1 (figs. 9 and 10), which supplies operating power to the transceiver and operates from a nominal alternating-current (a-c) source of 115 volts at 60 cycles per second (cps).

Note. Basic nomenclature followed by the symbol (*) is used to indicate all models of an item of equipment covered in this technical manual. For example, Facsimile Set AN/TXC–1(*) indicates Facsimile Sets AN/TXC–1, AN/TXC–1A, and AN/TXC–1B.

2. Application of Facsimile Set AN/TXC–1(*)

Facsimile Set AN/TXC–1(*) may be used with either wire or radio communication circuits.

a. Wire Circuits. When used with wire lines, the facsimile transceiver may be connected direct to the line by using one of several input and output terminals of various impedances and levels; or the transceiver may be connected to the line through a coupling coil which may be magnetically coupled to the receiver of a conventional telephone handset or inductively coupled to certain types of lines having no ringing or signaling circuits. An amplitude-modulated (a-m) 1,800-cycle carrier is transmitted and received.

b. Radio Circuits. When used with radio communication circuits the facsimile set may be connected in several ways to produce different types of radio signals.

(1) *Amplitude modulation.* When transmitting, the facsimile set is connected into the microphone circuit of a conventional a-m radiophone transmitter to produce an a-m radio signal. When receiving, the output of a conventional a-m radio receiver is connected to the input of the facsimile transceiver.

(2) *Subcarrier frequency modulation.* When the facsimile transceiver is connected to auxiliary equipment, Converter CV–2(*)/TX, the converter output is fed into a conventional a-m radiophone transmitter and the radio signals are described as subcarrier frequency modulation (fm). The radio signals consist of a radio-frequency (r-f) carrier modulated by a constant-amplitude audio signal whose frequency is varied to carry facsimile intelligence. When this system is used for receiving, a conventional a-m radio receiver, the same converter, and the same facsimile transceiver are used. The converter changes the subcarrier f-m signals back to a-m signals which are fed into the transceiver. For more details see section IX.

(3) *Carrier shift modulation.* When the facsimile transceiver is used with two auxiliary equipments, Converter CV–2(*)/TX and Exciter Unit 0–5/FR, carrier-shift signals can be transmitted over a conventional continuous-wave (c-w) radio transmitter. When transmitting, the a-m output of the facsimile transceiver is fed into the converter, a varying direct-current (d-c) output is taken from the converter and fed into the oscillator, and f-m signals from the oscillator excite the c-w transmitter. Narrow-band f-m radio signals are transmitted. When receiving, a conventional a-m communications receiver, an additional auxiliary equipment, Frequency Meter BC–221, the converter, and the

facsimile transceiver are used to convert f-m signals back to a-m signals. For more details see section X.

3. Technical Characteristics

a. Facsimile Transceiver TT–1(*)/TXC–1.

Type of equipment ..... Rotating drum
Functions ..... Transmit or receive
Type of copy..... Page copy
Maximum size of copy..... 12 by $18\frac{11}{16}$ in.
Size of scanning spot..... 1/100 in.
Type of recording..... Direct, or photographic positive or negative

Speed of drum:
- Rotation ..... 1 revolution per second (sec)
- Lateral movement ..... $12\frac{1}{2}$ in. in 20 min

Scanning lines per in..... 96
Number of tubes..... 18
Audio carrier frequency..... 1,800 cps
Type of modulation..... a-m
Frequency bandwidth ..... 1,800 cps maximum
Frequency band limits..... 900 to 2,700 cps
Drum speed control..... Synchronous motor controlled by 1,800 cps fork oscillator

Signal levels:
- Input (for reception)... —45 to 0 dbm*
- Output (for transmission) ..... 0 to +25 dbm

b. Rectifier Power Unit PP–86(*)/TXC–1.

Number of tubes..... 7
Input requirements:
- Power source ..... 100-130 volts (v), 50-65 cps; 250 watts (w) at 115 v
- Signal source ..... 1,800 cps from fork oscillator unit

Output:
- Unregulated plate supply.. 450 v at 75 milliamperes (ma)
- Filament supply ..... 6.3 v, 60 cps, at amperes (amp)
- Start motor supply (PP–86/TXC–1) ..... 9 v, 60 cps, 6 amp
- Start motor supply (PP–86B/TXC–1) ..... 115 v, 60 cps, 0.5 amp

Exciter lamp supply..... 6 v, 1,800 cps, 2.75 amp

*Dbm means decibels referred to 1 milliwatt in 600 ohms.

4. Table of Components

Components of Facsimile Sets AN/TXC–1, –1A, and –1B are similar. The table in *a* below lists completely the components of Facsimile Set AN/TXC–1, *b* below lists modifications of the table for Facsimile Set AN/TXC–1A, and *c* below lists modifications of the table for Facsimile Set AN/TXC–1B.

a. Facsimile Set AN/TXC–1.

Component[1]	Required No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu ft)	Weight (lb)
Facsimile Transceiver TT–1/TXC–1, including	1	$10\frac{3}{4}$	$17\frac{5}{8}$	$34\frac{5}{8}$	3.5	85
Motor brushes	10	0.156 diam	.....	$\frac{1}{4}$		
Cord CD–1018	1	.....	.....	96		
Cord CD–1019	1	.....	.....	96		
Shielded cord	1	.....	.....	66		
Exciter lamp, Mazda No. 1129, 1 in use, 6 running spares.....	7					
UC coupling unit	1	$4\frac{1}{4}$	2	6	.....	1.8
KC coupling unit[2]	1	$1\frac{1}{4}$	$2\frac{3}{4}$	$3\frac{1}{2}$	.....	1.1
Dust cover	1					
Set of split nuts, running spares..	2					
Screw driver	1	.....	.....	$6\frac{1}{2}$		
Stylus, running spares	100	diam $\frac{1}{16}$	$\frac{1}{2}$			
Tube puller	1	diam $\frac{3}{16}$	8			
Recorder lamp No. R1130B, 1 in use, 2 running spares	3					

[1] This list is for general information only. See appropriate publications for information pertaining to requisition of spare parts.

[2] KC coupling unit supplied only with Facsimile Set AN/TXC–1, serial numbers 1 to 93.

a. Facsimile Set AN/TXC–1 (contd).

Component[1]	Required No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu ft	Weight (lb)
Tube JAN–1B46, 1 in use, 2 running spares	3					
Tube JAN–6AC5GT/G, 3 in use, 2 running spares	5					
Tube JAN–7C5, 4 in use, 1 running spare	5					
Tube JAN–7L7, 4 in use, 2 running spares	6					
Tube JAN–7N7, 2 in use, 1 running spare	3					
Tube JAN–7C7, 1 in use, 1 running spare	2					
Tube JAN–884, 1 in use, 1 running spare	2					
Tube JAN–1645, 1 in use, 1 running spare	2					
Table MT–252/TXC1	1	32	22	37	4.7	86
Rectifier Power Unit PP–86/TXC–1, including	1	9	10	12	0.62	48
Dust cover	1					
Fuse (a-c line), Littelfuse 5 amp, 1 in use, 6 running spares	7					
Tube JAN–1B47, 1 in use, 2 running spares	3					
Tube JAN–7C5, 2 in use, 2 running spares	4					
Tube JAN–7L7, 1 in use, 1 running spare	2					
Tube JAN–7N7, 1 in use, 1 running spare	2					
Tube JAN–7S7, 1 in use, 1 running spare	2					
Tube JAN–5Z3, 1 in use, 1 running spare	2					
Package Teledeltos paper	4					
Package Timefax paper	2					
Photographic Equipment PH–549/TXC–1, including	1	.....	.....	.....	.....	8.3
Bottle, 1 gal	4					
Chemical developer, Eastman Kodak type DK–60A	4 gal					
Chemical developer, Eastman Kodak type D–72	4 gal					
Paper, enlarging, Royal Bromide F–1, ½ gross	2	12	.....	18¾		
Paper, enlarging, Aero, Eastman Kodak kind 1020, ½ gross	1	12	.....	18¾		
Fixing powder, acid, 1-gal size	4					
Film, transmission, type A, 1 dozen	6	12	.....	18¾		
Thermometer, −20°F to +120°F	1					
Tray, enamel	4	19	4	24	.....	6.8

[1] This list is for general information only. See appropriate publications for information pertaining to requisition of spare parts.

b. FACSIMILE SET AN/TXC–1A. Components of Facsimile Set AN/TXC–1A are the same as those of Facsimile Set AN/TXC–1, with the following exceptions:

(1) Facsimile Transceiver TT–1A/TXC–1 replaces Facsimile Transceiver TT–1/TXC–1.

(2) Delete KC coupling unit.

(3) Add one each test cord, 6 inches long, Plug PL–55 on one end, alligator clips on other end.

(4) Add two each pilot Lamps LM–52, 6-8 volts, 0.15 amperes, Mazda 47, one in use, one running spare.

(5) Add 12 each motor fuses, type 3AG, ⅛ ampere, 1 in use, 11 running spares.

c. FACSIMILE SET AN/TXC–1B. Components of Facsimile Set AN/TXC–1B are the same as those of Facsimile Set AN/TXC–1A (*b* above), with the following exceptions:

(1) Facsimile Transceiver TT–1B/TXC–1 replaces Facsimile Transceiver TT–1A/TXC–1.

(2) Table MT–252A/TXC–1 replaces Table MT–252/TXC–1.

(3) Rectifier Power Unit PP–86A/TXC–1 replaces Rectifier Power Unit PP–86/TXC–1.

(4) Delete Tubes JAN–1B46, JAN–1B47, and JAN–6AC5GT/G and substitute the following:

(*a*) Four each Tubes 5651, two in use, two running spares.

(*b*) Five each Tubes JAN–1635, three in use, two running spares.

(5) Delete motor brushes.

(6) Add one each Loudspeaker LS–11.

(7) Change description of photographic equipment as follows:

(*a*) Delete enlarging paper kind 1020 or Aero.

(*b*) Change number of packages of enlarging paper, Royal Bromide F–1, from 2 to 3.

(*c*) Change size of film, photo paper, and recording paper to $18\frac{11}{16}$ inches long.

(*d*) Change description of developer DK–60A to call for two each, 3½-gallon containers.

(*e*) Add two each packages of contact printing paper, 12 by 19 inches.

(8) Add spring scale.

(9) Add magnifying glass.

5. Packaging Data

Facsimile Set AN/TXC–1(*) is packed for oversea shipment in four nailed wooden boxes. The items are packed approximately as follows:

Box No.	Item	Dimensions (in.)	Volume (cu ft)	Weight (lb)
1	Facsimile Transceiver TT–1(*)/TXC–1 ..	40½x15½x22½	8.4	218
2	Rectifier Power Unit PP–86(*)/TXC–1.	17½x15x15¼	2.3	89
3	Photographic Equipment PH–549/TXC–1 and spare parts ...	40x26x26	15.6	339
4	Table MT–252(*)/ TXC–1 and dust covers	40x26x20	12.0	137

Note. For dimensions of major components unpacked see figures 2 and 3.

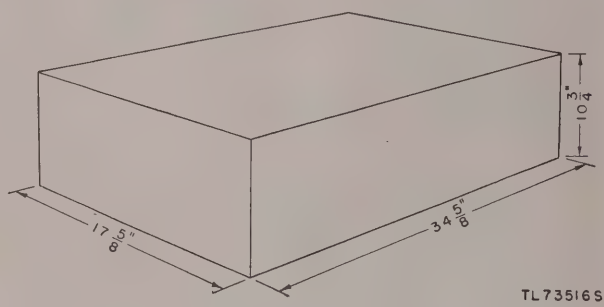


Figure 2. Facsimile Transmitter TT–1(*)/TXC–1, dimensions.

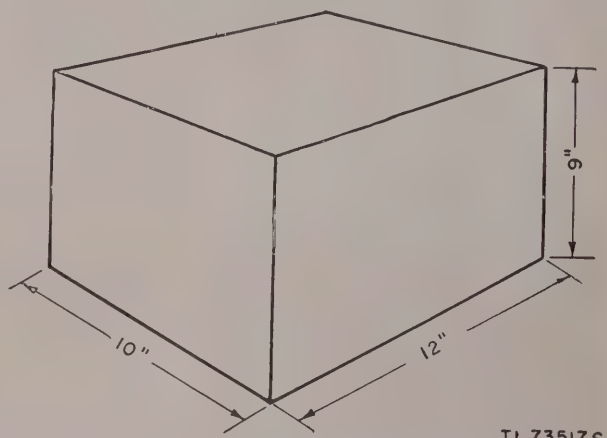


Figure 3. Rectifier Power Unit PP–86(*)/TXC–1, dimensions.

6. Description of Major Components

a. FACSIMILE TRANSCEIVER TT–1(*)/TXC–1. Facsimile Transceivers TT–1/TXC–1 (fig. 4), TT–1A/TXC–1 (fig. 5), and TT–1B/TXC–1 (figs. 6, 7, and 8) are similar in size, weight, and appearance. They differ slightly in the number of operating controls and in certain circuit features. The trans-

ceiver is mounted on a steel chassis 34⅝ inches long, 17⅝ inches deep, and 1½ inches high. Tubular guards 1 inch in diameter are welded to each end of the chassis to serve as carrying handles and to protect the equipment when it is turned on its side, back, or top for inspection and repair. Mounted to the chassis are the motor assembly, bearings which support the lead screw and drum, fork oscillator unit, regulator unit, signal and phasing circuit components, transmitting optical system, receiving optical system, various other components, the power supply connection plug, and the panel supporting the operating controls and terminal panel. Operating controls are located on a sloping portion of the front panel behind the drum. The terminal panel for input and output connections is on the right

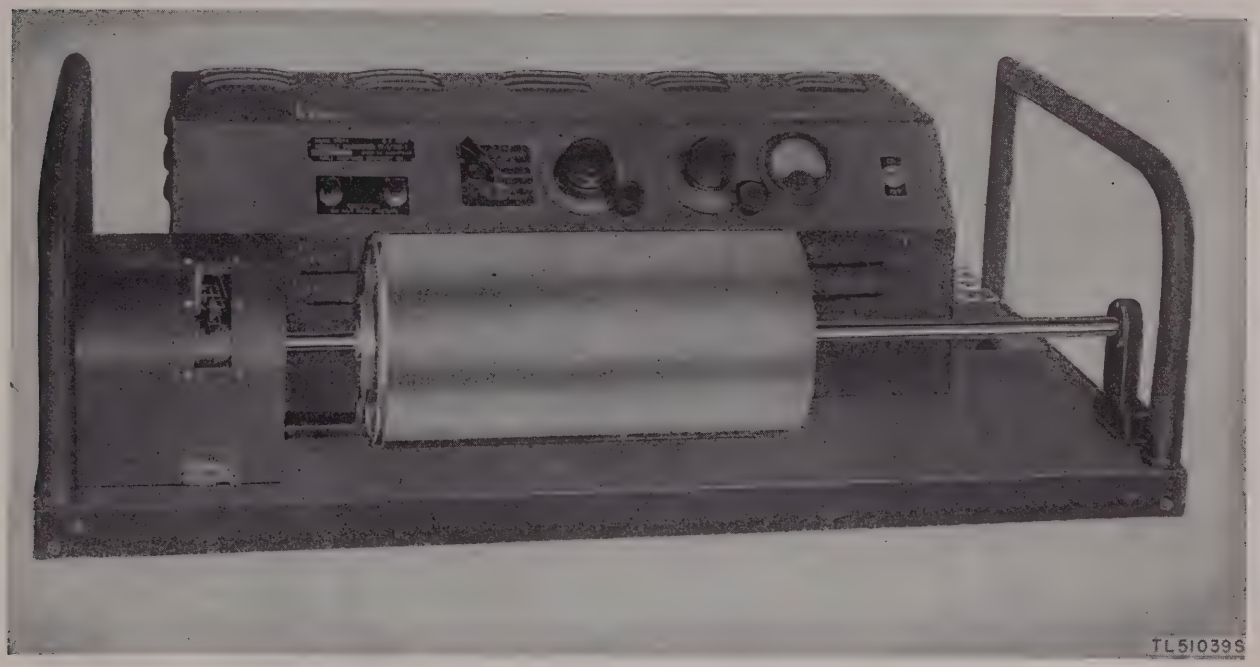


Figure 4. Facsimile Transceiver TT-1/TXC-1.

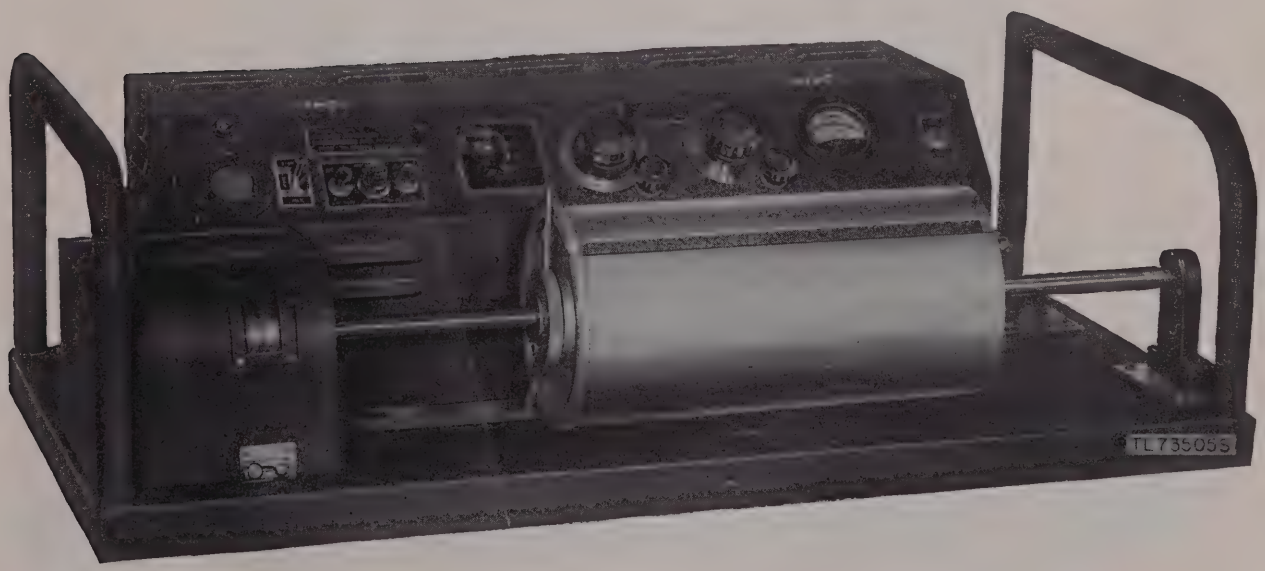


Figure 5. Facsimile Transceiver TT-1A/TXC-1.

side of the panel assembly. In Facsimile Transceiver TT–1B/TXC–1 only, the output jack for an external speaker used in the voice communication (talk-back) circuit is located on the left side of the panel assembly. The transceiver is provided with a metal base cover, mounted to the chassis with machine screws, and bearing four metal supporting feet. Metal covers protecting the motor and clutch assembly and the rear, side, and top of the transceiver are held in place with slide fasteners. A canvas cover is provided to protect the transceiver from dust when it is not in use.

b. Rectifier Power Unit PP–86(*)/TXC–1. The rectifier power unit (figs. 9 and 10) is constructed on a metal chassis 12 by 10 by 2½ inches high (some are 3 inches high). All components are mounted on the chassis, which is shielded and protected by a bottom cover plate bearing four metal feet and a ventilated top metal cover. Two cables emerge from an opening in the top cover, one a power cable to connect to the a-c line and the other a power cable terminating in a Jones plug which attaches to the transceiver. The rectifier power unit is provided with a canvas cover for protection during shipping.

Caution: Do not leave the cover on the power unit during operation, or components will overheat.

c. Table MT–252(*)/TXC–1. The collapsible metal table (fig. 11) furnished with facsimile sets is 32 inches high, 22 inches deep, and 37 inches long. It can be disassembled by removing the metal screws in the legs and side braces. The table has a masonite top, on which Facsimile Transceiver TT–1(*)/TXC–1 is mounted, and a bottom shelf which supports Rectifier Power Unit PP–86(*)/TXC–1 and Converter CV–2(*)/TX (when used). A hole in the top of the table permits easy connection of the power cable plug to the transceiver. A metal drawer is provided for storing a supply of recording paper.

d. Cords and Leads. The following cords and leads (fig. 12) are furnished with Facsimile Set AN/TXC–1B:

(1) Cord CD–1018 (fig. 12E) is an 8-foot, 2-conductor, shielded, rubber-jacketed cord terminated at each end with Plug PL–55. It is used in making input connections to the transceiver.

(2) Cord CD–1019 (fig. 12F) is an 8-foot, 3-conductor, shielded, rubber-jacketed cord terminated at each end with Plug PL–68. It is used in making output connections to the transceiver.

(3) A 5½-foot test lead (fig. 12D) is terminated on one end with a two-prong plug which fits the 1V and 6V jacks on the coupling coil, and on the other end with two alligator clips. It is used in making input and output connections to the transceiver when a high-level signal is required for certain types of wire lines.

(4) A 6-inch test cord (fig. 12B) is a 2-conductor cord terminated at one end with Plug PL–55 and at the other end with two alligator clips. It is used in connecting a wire line into the RADIO RCVR. jack during reception of high-level signals.

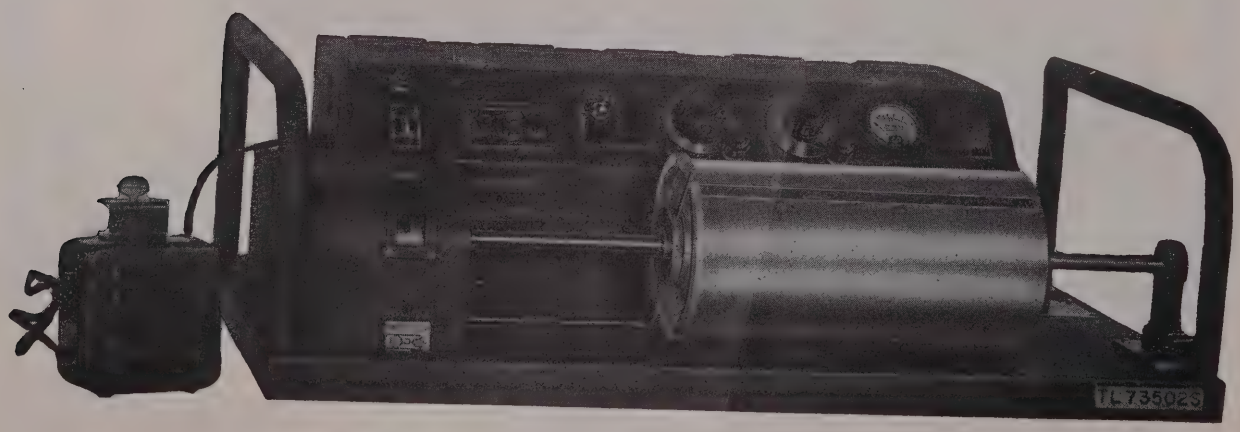


Figure 6. Facsimile Transceiver TT–1B/TXC–1.

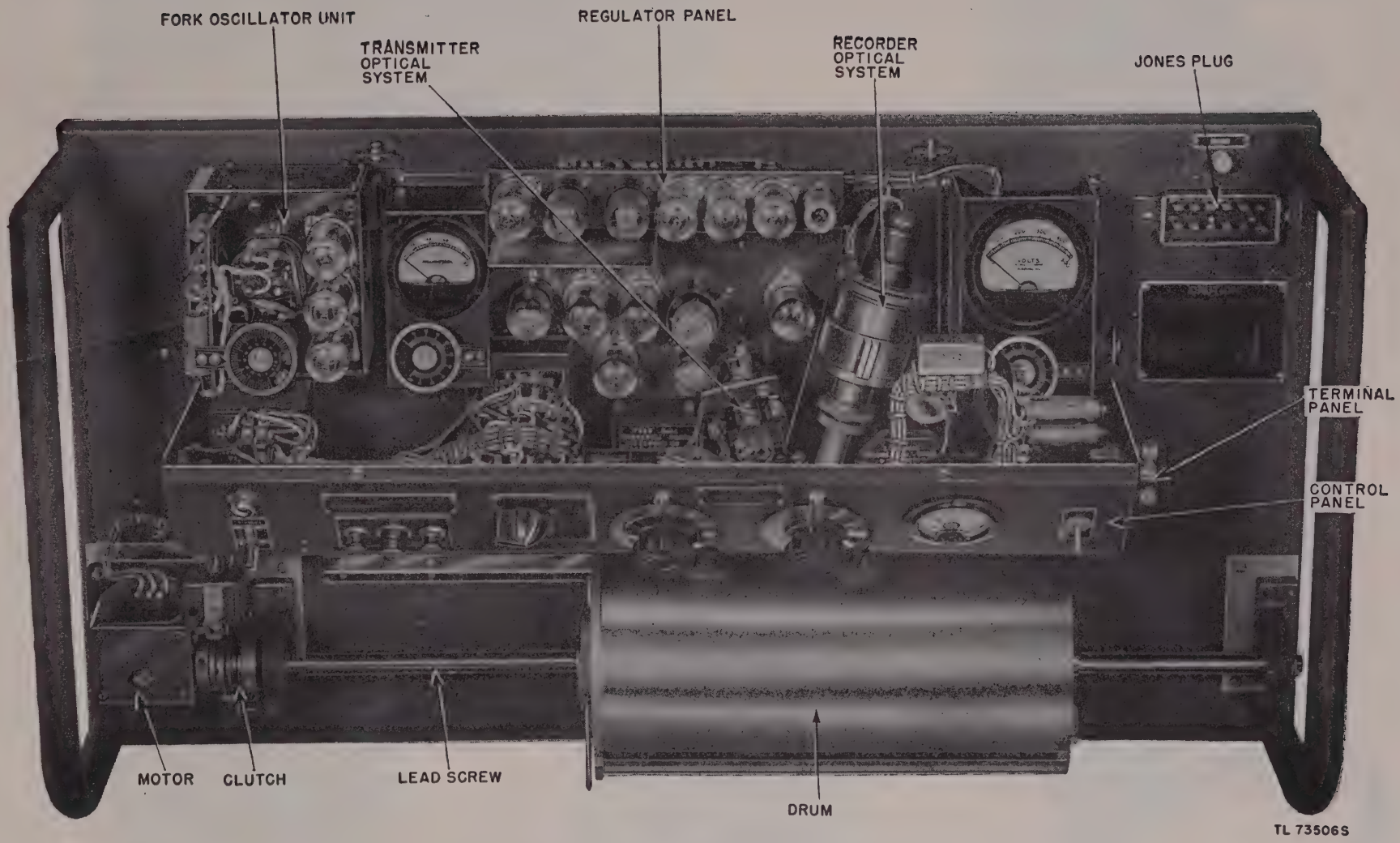


Figure 7. Facsimile Transceiver TT-1B/TXC-1, top view, cover removed.

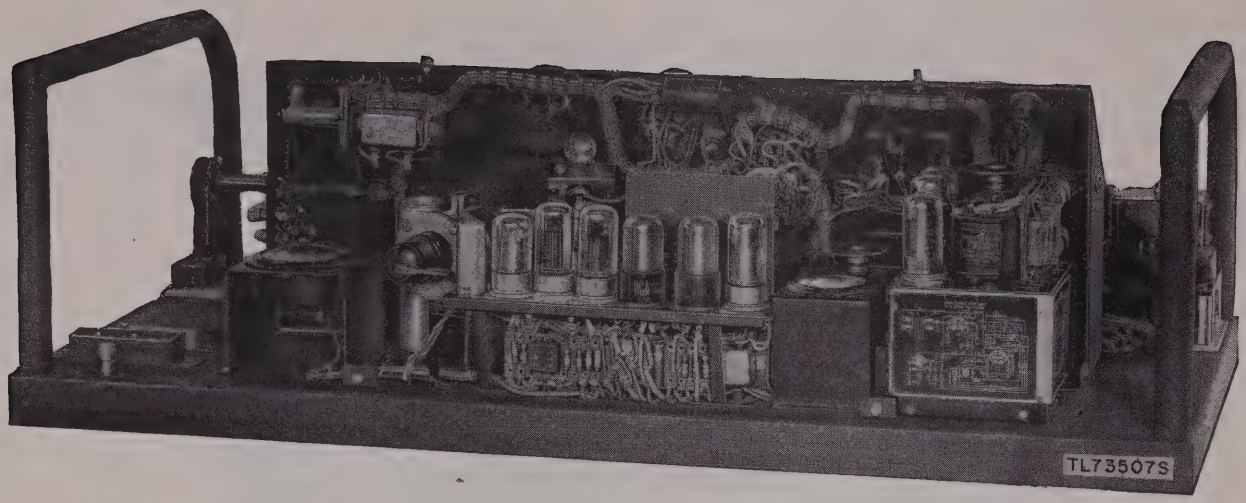


Figure 8. Facsimile Transceiver TT–1B/TXC–1, rear view, cover removed.

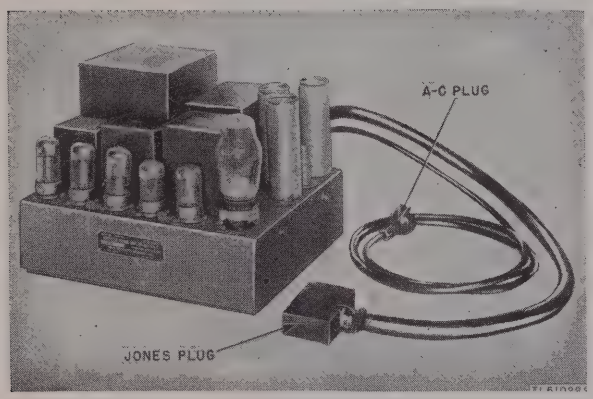


Figure 9. Rectifier Power Unit PP–86/TXC–1, cover removed.

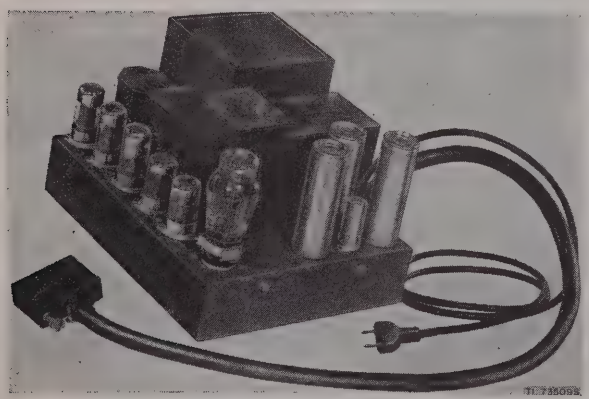


Figure 10. Rectifier Power Unit PP–86A/TXC–1, cover removed.

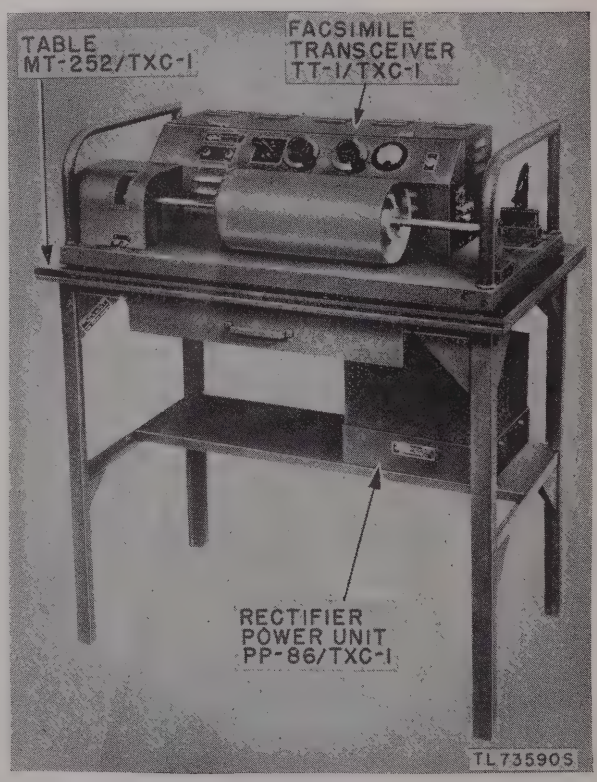


Figure 11. Facsimile Transceiver TT–1/TXC–1 and Rectifier Power Unit PP–86/TXC–1 on Table MT–252/TXC–1.

e. UC Coupling Unit. This coupling unit (figs. 12A and 20), which is used to make input and output connections to the transceiver through a telephone receiver, is supplied with a phosphor-bronze clamp for holding it in place on the telephone handset. The primary impedance is 600 ohms, matching the output of the transceiver. The full 10-ohm secondary provides an open-circuit output of 6 volts; the secondary also has a 2-ohm tap which provides an open-circuit voltage of 1 volt. The secondary terminates in two female type plugs for selecting the desired level.

f. Loudspeaker LS–11. This loudspeaker is a component of Facsimile Set AN/TXC–1B, and also of AN/TXC–1A when modified according to MWO SIG 11–375B–(1). It is not a component of Facsimile Set AN/TXC–1. This external speaker (fig. 6) is a permanent-magnetic type, 4 inches in diameter with a 250-ohm output transformer to match impedance of the transceiver talk-back circuit. The speaker and transformer are contained within a steel box 4⅝ inches square and 2 inches deep, which is fitted with a mounting clamp.

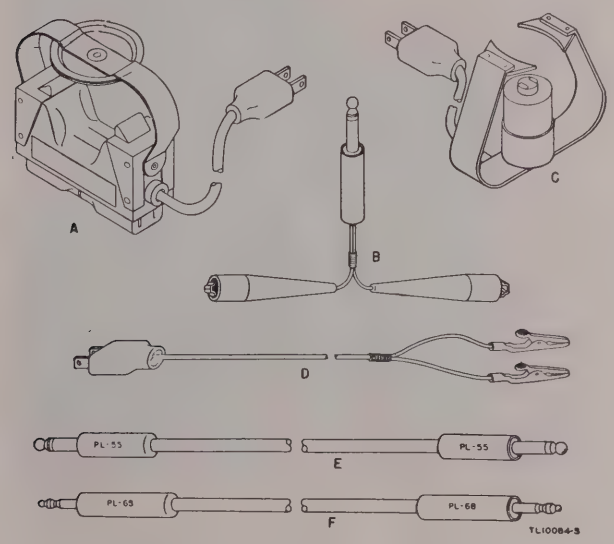


Figure 12. Cords and coupling coils.

g. Recording Paper. Two special direct recording papers are furnished for use with Facsimile Transceiver TT–1(*)/TXC–1.

(1) Teledeltos paper is used in direct recording. It is a dark paper with metallic backing and a light coating. The coating is burned off by a spark from the transceiver stylus during the direct recording operation. The paper furnished is 12 by 18 11/16 inches in size. Four packages, each containing 250 sheets of Teledeltos grade H, are furnished.

(2) Timefax paper is used in the direct recording process when copies of the received picture are to be made with a hectograph pad. This is a specially prepared paper with a high-resistance outer coating which is burned away by the spark from the transceiver stylus. The paper furnished is 12 by 18 11/16 inches in size. Two packages, each containing 250 sheets, are furnshed.

7. Differences in Models

Facsimile Sets AN/TXC–1, –1A, and –1B are similar in purpose, operation, and appearance. Later models, those carrying the A and B issue letters, include a number of improvements which are listed in the following subparagraphs and in the chart at the end of this paragraph. For full details of circuit differences see figures 146, 147, 148, and 149.

a. Fork Oscillator Unit. This unit in Transceiver TT–1/TXC–1 is unsealed in Facsimile Sets AN/TXC–1, serial numbers up to 105 on Order No. 2695–MPD–45. Starting with serial number 105, a

Ref symbol	Signal Corps stock No.	Name of part and description	Function
A	6C25–120/C8	COUPLER, FACSIMILE SET: model UC; TTE No. 90–09–00.	Induction coupler to telephone receiver; UC coupling coil.
B	3E4039–4	LEAD, TEST: 6-inch; 2-conductor; TTE No. 90–37–03.	Line connector to RADIO RECVR. jack.
C	6C25–1/C13	COUPLER, FACSIMILE SET: model KC; TTE No 90–10–00 (supplied only with Facsimile Set AN/TXC–1, serial Nos. below 93).	Induction coupler to telephone receiver; KC coupling coil.
D	3E4039–2	CABLE ASSEMBLY: special purpose; 5-foot-6-inch; 2-conductor TTE No. 90–37–02.	Line connector.
E	3E1999–18	CORD CD–1018: 8-foot, 2-conductor; with Plugs PL–55 at each end.	Connector cord to radio receiver.
F	3E1999–19	CORD CD–1019: 8-foot, 3-conductor, with Plugs PL–68 at each end.	Connector cord to radio transmitter.

sealed fork oscillator unit is used in the transceiver of the remaining models of Facsimile Set AN/TXC–1 and in all models of Facsimile Sets AN/TXC–1A and –1B. The sealed fork unit includes a revised tube line-up. The fork is sealed against changes in pressure and humidity, and the drive coils are sealed against changes in humidity. Details of both sealed and unsealed units are given in paragraphs 86 and 87. The two units are electrically and mechanically interchangeable.

b. Talk-Back Circuit. Facsimile Set AN/TXC–1 includes no talk-back circuit. Communication between transmitting and receiving operators is by means of external telephones, which may use the same wire or radio circuit as the facsimile equipment. All models of Facsimile Set AN/TXC–1A were originally produced with a built-in loudspeaker serving both as microphone and loudspeaker, the change-over of function being accomplished by a STANDBY-MON-TALK switch on the front panel. All models of Facsimile Set AN/TXC–1A are scheduled for modification, to include a front panel jack into which an external Loudspeaker LS–11 may be plugged to improve the quality of voice communication. See MWO SIG 11–375B–(1) and figure 146 for details of this modification. All models of Facsimile Set AN/TXC–1B have only the external Loudspeaker LS–11. The built-in speaker and speaker transformer T8 have been eliminated. The STANDBY-MON-TALK switch is used on the –B model as well as on the –A model.

c. Synchronous Motor. Motors on all three equipments are mechanically interchangeable, but motor parts are not interchangeable. All are synchronous motors, controlled by a 1,800-cycle signal generated in the fork oscillator unit and increased in power by the motor amplifier tubes. Facsimile Sets AN/TXC–1 and –1A use motors which are started with 9-volt, 60-cycle ac applied when the START button on the transceiver is pressed. Brushes are mechanically engaged to the start motor during the starting operation. Facsimile Set AN/TXC–1B uses an induction starting motor which operates on 110-volt 60-cycle ac (fig. 13). No brushes are required. The motor starting circuit and the power supply are different from those in the earlier models. In Facsimile Sets AN/TXC–1 and –1A the motors differ as follows:

(1) Motors with serial numbers above 1,000 have six poles rather than four.

(2) Motors with serial numbers above 1,157 have ball-bearing, side-wall bearings in place of the lower sleeve bearing.

(3) Motors with serial numbers above 1,210 have a clutch ring (B in figure 110) which has a wide inner bearing surface.

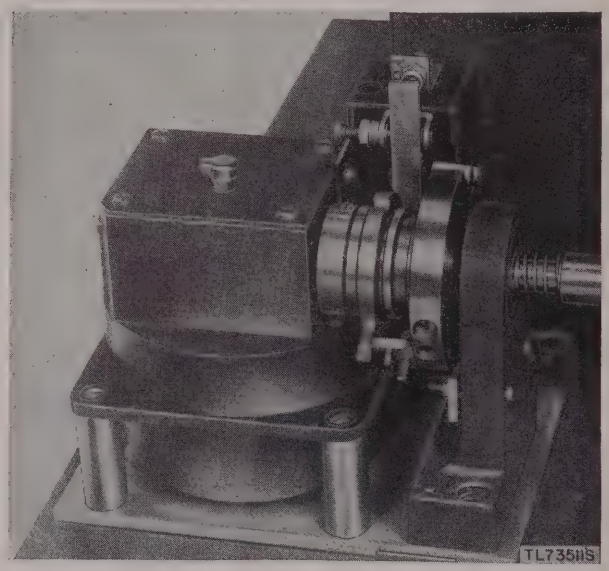


Figure 13. Motor, Facsimile Transceiver TT–1B/TXC–1.

d. Resistance and Capacitance Values. Values of resistors and capacitors in Facsimile Set AN/TXC–1 were based on old standards. The value of numerous individual components have changed a few percent in Facsimile Sets AN/TXC–1A and AN/TXC–1B, to conform with American War Standard values. However, the differences are in most cases less than the plus or minus 10 percent tolerances of the components, and are of no significance. For details, see figures 147, 148, and 149.

e. Transceiver Differences.

	Facsimile Transceiver		
	TT–1/TXC–1	TT–1A/TXC–1	TT–1B/TXC–1
Fork oscillator unit	Unsealed fork on serial Nos. up to 105 on Order No. 2695–MPD–45; sealed on later models.	Sealed	Sealed.
Talk-back circuit	None	Internal speaker; external Loudspeaker LS–11 added by MWO SIG 11–375B–(1).	External Loudspeaker LS–11 only. R98 added as stabilizer.
Start motor	9 v ac, brushes	9 v ac, brushes	110 v ac, brushes eliminated.
Drum friction mechanism	No.	No	Yes.
Motor fuse	None	On front panel	On front panel.
Meters	Single db meter	Single db meter	1. Db meter, M1. 2. Motor coil current meter, M2. 3. RB+ voltmeter, M3.
Motor amplifier output tubes V5 and V6.	JAN–6AC5GT/G	JAN–6AC5GT/G	JAN–1635.
RECORD output amplifier tube V14.	JAN–6AC5GT/G	JAN–6AC5GT/G	JAN–1635.
V25, reference voltage regulator.	R1160 or JAN–1B46	R1160 or JAN–1B46	Type 5651.
Pilot lamp on front panel	No	Yes	Yes.
RB+ potentiometer	None	None	R96.
Motor current potentionmeter	None	None	R93.
Tube V13 cathode potentiometer.	None	None	R97.

f. Rectifier Power Unit PP–86(*)/TXC–1. Rectifier Power Unit PP–86/TXC–1, a component of Facsimile Sets AN/TXC–1 and AN/TXC–1A, will operate either Facsimile Transceiver TT–1/TXC–1 or TT–1A/TXC–1, but will not operate Facsimile Transceiver TT–1B/TXC–1 unless rewired. However, Rectifier Power Unit PP–86A/TXC–1, a component of Facsimile Set AN/TXC–1B, will operate all three transceivers, Transceiver TT–1/TXC–1, TT–1A/TXC–1, and TT–1B/TXC–1. For circuit differences see figures 144 and 145.

g. Rectifier Power Unit Differences.

	Rectifier Power Unit	
	PP–86/TXC–1	PP–86A/TXC–1
Supplied with	AN/TXC–1 and –1A	AN/TXC–1B.
Used with	TT–1/TXC–1 and TT–1A/TXC–1 only.	TT–1/TXC–1, TT–1A/TXC–1, and TT–1B/TXC–1.
V23, voltage regulator	R1160 or JAN–1B47	Type 5651.
Filter capacitor C13	In parallel with C14.	In parallel with C12.
R9	75,000 ohms	150,000 ohms.
R13	250,000 ohms	51,000 ohms.

h. TABLE MT–252A/TXC–1. Table MT–252A/TXC–1, supplied with Facsimile Set AN/TXC–1B, is the same size as Table MT–252/TXC–1 supplied with Facsimile Sets AN/TXC–1 and –1A. The construction and method of dismantling, however, are slightly different.

Section II. INSTALLATION OF FACSIMILE SET AN/TXC–1(*)

8. Siting

Facimile Set AN/TXC–1(*) is intended for fixed station installation. Choose the location within the fixed station so that connections can be made conveniently to a power source of 115 volts 60 cycles per second ac, and to the wire or radio circuit which is to be used for facsimile. If the equipment is to be used to transmit copy, place it so that the sun cannot shine directly on the drum. If the equipment is to be used to receive copy by photographic processes, locate it in a dark room.

9. Uncrating, Unpacking and Checking

Take care when unpacking or handling the equipment. It may be damaged easily when it is not protected by the packing case. When unpacking, be careful to avoid damaging the packaging materials any more than is absolutely necessary. Store the inside packaging materials in the shipping container for future use. Unpack and check the equipment as follows:

a. Cut the steel straps with a suitable cutting device or twist with pliers until the straps crystallize and break.

b. Remove the nails with a nail puller and lift off the top of the shipping container. Avoid prying with a crowbar or other tool.

c. Lift the packaged equipment from the box and carefully remove the fiberboard box, the moisture-vaporproof barrier, and the other packaging material. Figures 14 and 15 show typical packing of the facsimile set.

d. If the equipment has been in storage for a long period, check lubrication of the motor before operating.

10. Terminal Panel (fig. 22)

The terminal panel located on the right end of the facsimile transceiver is used for connecting the fascimile equipment to the voice circuit.

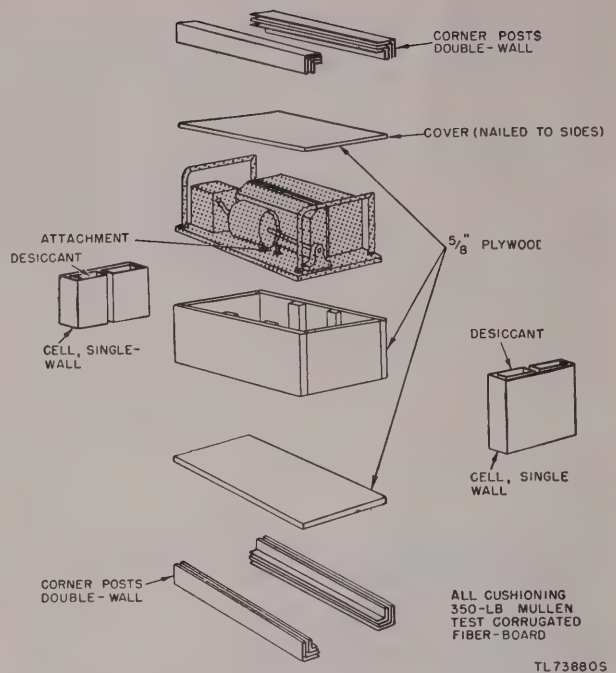


Figure 14. Packing, Facsimile Set AN/TXC–1(*).

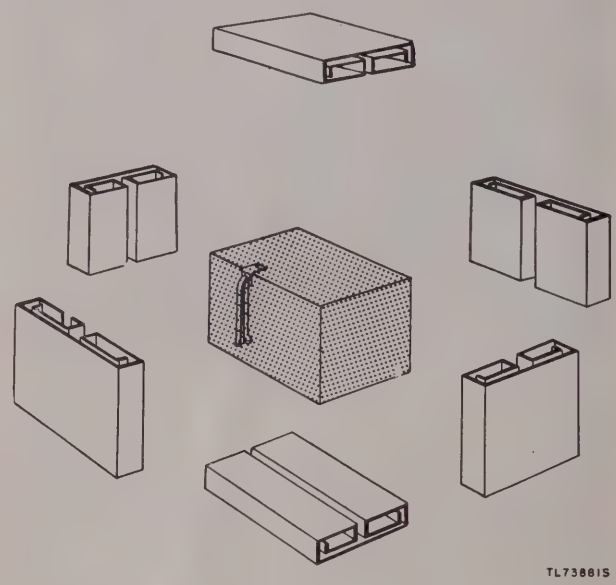


Figure 15. Packing, Facsimile Set AN/TXC–1(*).

a. PHONES JACK. This two-circuit jack, which receives Plug PL–55, is connected through a resistor attenuation network to the primary of T7, the audio-frequency (a-f) input matching transformer (1 to 1 ratio) used for coupling between the line and the transceiver. It may be used for *monitoring* the line.

b. RADIO RCVR. JACK. This two-circuit jack is wired in parallel with the PHONES jack, and

may be used with Plug PL–55 as an *input* connection to the transceiver.

c. LINE BINDING POSTS. These posts serve as input and output connections for the transceiver. When the selector switch is in either RECORD PHOTO or RECORD DIRECT position, the LINE posts are connected to the primary of *input* transformer T7. The center binding post, marked REC. C.T., connects directly to the center tap of the primary of T7 at all times. When the selector switch is in TRANSMIT position, the two outside LINE binding posts are connected through 300-ohm resistors from secondary No. 2 of the *output* transformer T2 and furnish 0.78 volt to a 600-ohm load. Directly below the LINE binding posts is a GND. post connected to the frame of the transceiver.

d. CARBON MIKE JACK. This three-circuit jack, an *output* connection which receives Plug PL–68 commonly furnished with carbon microphones, is connected to one-half of secondary No. 2 of the output transformer T2. When the selector switch is on TRANSMIT, T2 secondary No. 2 is connected to the LINE binding posts.

e. RADIO XMTR. JACK. This jack is connected in parallel with the CARBON MIKE jack and is used as a transceiver *output* connection to the radio transmitting circuit. The output level is 0.4 volt into a 100-ohm load.

f. LINE JACK. This two-circuit polarized jack requiring a special plug serves as *input and output* connector for the transceiver. The UC coupling coil polarized plug fits this jack. When the selector switch is at TRANSMIT, the line jack is connected to secondary No. 1 of T2, the transceiver *output* transformer, and provides an output of 15.5 volts into a 600-ohm line. One side of the LINE JACK, labeled GND, is always at ground potential, connected to the transceiver frame. When the selector switch is at RECORD PHOTO or RECORD DIRECT, the LINE JACK is connected to the secondary of transceiver *input* transformer T7.

g. MOTOR JACK. This three-circuit jack receives Plug PL–68 and permits breaking into the 1,800-cycle signal circuit between the motor amplifier buffer stage of the fork oscillator unit and the motor amplifier stage for test purposes or supplying an external signal to the motor amplifier.

11. Removal of Drum Chock

Before making connections to the facsimile set, remove the drum chock from its position under the lead screw and directly beneath the engaging lever. Unfasten the two machine screws holding the cap of the chock to the top of the lead screw (fig. 16) and the two machine screws holding the chock to the transceiver chassis. Slide the chock toward the front of the transceiver at right angles to the lead screw.

Caution: Do not slide the drum chock along the length of the lead screw, or aluminum chips from the chock may lodge in the threads.

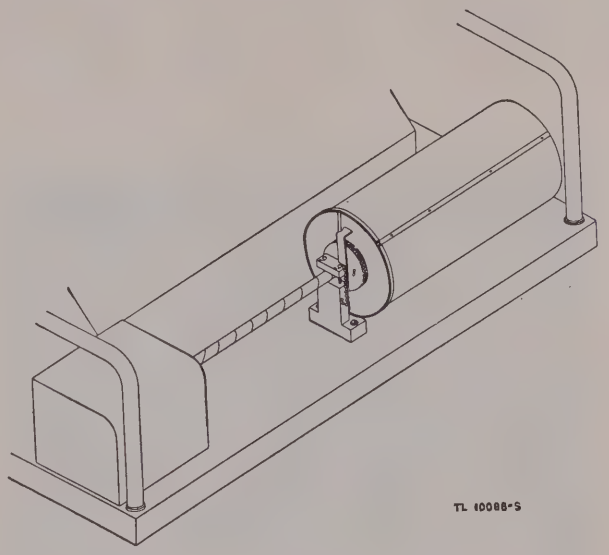


Figure 16. Drum chock in place on facsimile transceiver.

12. Interconnections of Facsimile Set AN/TXC–1(*)

Before making any connections, check to see that all tubes are in their proper locations in Facsimile Transceiver TT–1(*)/TXC–1 and Rectifier Power Unit PP–86(*)/TXC–1. Proper tube locations are shown in figures 17, 18, and 19.

a. Make sure the power ON-OFF switch on the front panel of the transceiver is at OFF.

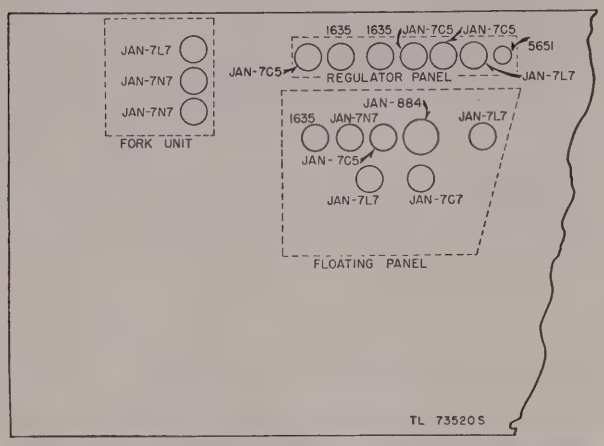
b. Connect the multiconductor cord of the rectifier power unit to the transceiver by inserting the JONES plug into the receptacle at the right-hand end of the transceiver chassis (figs. 7 and 18).

c. Connect the a-c plug on the 2-conductor power cord of the rectifier power unit to a 115-volt, 60-cps, a-c outlet (fig. 18).

13. Connections to Wire Lines

The method and equipment used to connect facsimile equipment to communication circuits depends

Figure 17. Location of tubes, Facsimile Transceiver TT–1B/TXC–1.



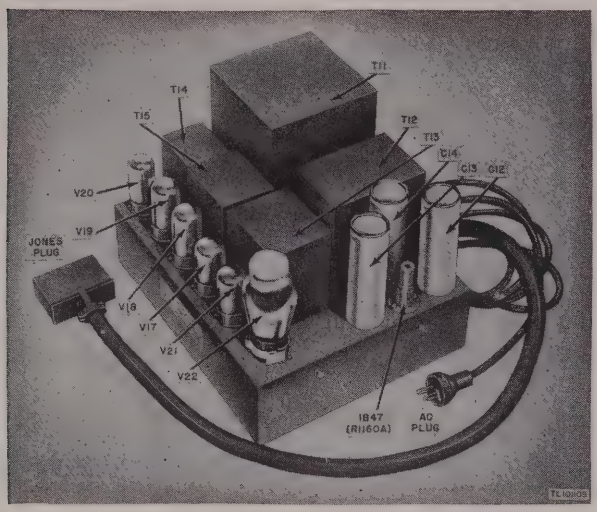


Figure 18. Location of tubes, Rectifier Power Unit PP–86/TXC–1.

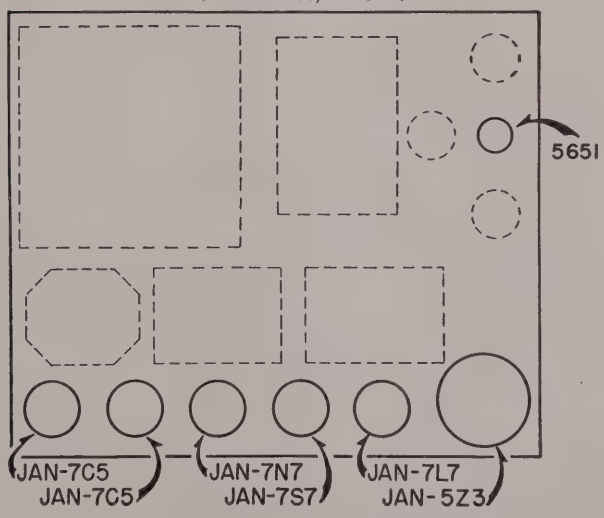


Figure 19. Location of tubes, Rectifier Power Unit PP–86A/TXC–1.

on the type of circuit, the type of terminal station equipment, and the loss and faults in the circuit. A good voice circuit will carry facsimile signals at least as far as voice signals. A line of Wire W–110–B, for example, may carry facsimile signals up to 25 miles, considerably farther than voice signals. For high quality facsimile transmission, however, circuits must be of better quality than those normally considered suitable for voice transmissions. Since the facsimile signal is an a-m, 1,800-cycle carrier, the circuit should be capable of passing both upper and lower side-band modulation frequencies, 900 to 2,700 cps, as flat as possible. Excessive delay distortion causes different rates of propagation of various frequency components, displacing the facsimile signal components and producing an objectionable distortion on the recorded copy. Changes in signal level at the receiving end which would be unobjectionable on a voice conversation may completely ruin a facsimile picture. A very low signal-to-noise ratio degrades received copy. Amplitude distortion and line reflections interfere with high quality reception.

a. Voice Circuits. Voice communication between transmitting and receiving operators can be over the same circuit used for facsimile signals. When using Facsimile Transceiver TT–1/TXC–1, telephones are used at each end of the circuit. However, Facsimile Transceivers TT–1A/TXC–1 and TT–1B/TXC–1 have talk-back circuits which eliminate the need for additional telephones. Facsimile operation is possible over so-called *blind* circuits on prearranged schedules without voice communication.

b. Permanent Installation. For a permanent installation, locate the *talking* circuit in the wiring coming into the telephone subset. This is usually the red wire and green wire, or the wire with the red tracer and the wire with the green tracer. Connect the two wires of the talking circuit directly to the two binding posts marked LINE on the facsimile transceiver. A telephone line having low loss may furnish a received signal strength higher than the LINE binding post input of the transceiver can accept. This is indicated by the necessity of setting the GAIN control near zero to obtain a +2-decibel (db) meter reading. The meter reading will jump in steps of ½ db or more when the GAIN control is varied. When this condition is encountered, connect the telephone line to a Plug PL–55 and insert the plug into the jack marked RADIO RCVR. on the transceiver for receiving only. To reduce hum, connect a wire from the

GND. terminal to the REC. C.T. terminal. Leave Plug PL–55 out of the RADIO RCVR. jack except when receiving copy.

c. Temporary Installation. (1) The UC coupling coil is designed to fit over the receiver of the handset used on Telephone EE–8–( ) and type F–1 commercial handsets (fig. 20). Fit this coil into place and connect the plug at the end of the cord from the UC coupling coil to the polarized LINE JACK on the facsimile transceiver terminal strip. When using a line of Wire W–110–B between facsimile transceivers, if closer line coupling is needed than can be obtained by using the magnetic coupling coil, connect the telephone line directly to the 1V connector on the coupling coil. If the loss on the line is exceptionally high, the connector marked 6V on the coupling coil may be used, provided the line loss is at least 18 dbm before reaching the first telephone exchange or repeater.

Warning: Do not use the coupling coil outputs marked 1V or 6V with any commercial or common-battery circuits or any circuit using signaling or ringing.

(2) The KC coupling coil, supplied only with Facsimile Set AN/TXC–1, serial numbers below 93, fits old type E–1 commercial handsets and old type telephone receivers.

14. Connections to Radio Circuits

a. With Converter CV–2(*)/TX. Converter CV–2(*)/TX is used at both transmitting and receiving ends of the normal a-m radio circuit which carries subcarrier f-m facsimile transmissions. For complete information on Converter CV–2(*)/TX and the method of connecting it, see section IX of this manual, TM 11–2252, and TM 11–4021. For carrier shift modulation, see also TM 11–2205 and section X of this manual.

b. Without Converter. When Facsimile Transceiver TT–1(*)/TXC–1 is to operate with a conventional a-m radio transmitting and receiving station, without the use of Converter CV–2(*)/TX, make connections as follows:

(1) Plug one end of Cord CD–1018 into the transceiver RADIO RCVR. jack and the other end into the phones output jack of the radio receiver. This is the receiving connection.

(2) Plug one end of Cord CD–1019 into the RADIO XMTR. jack on the transceiver and the

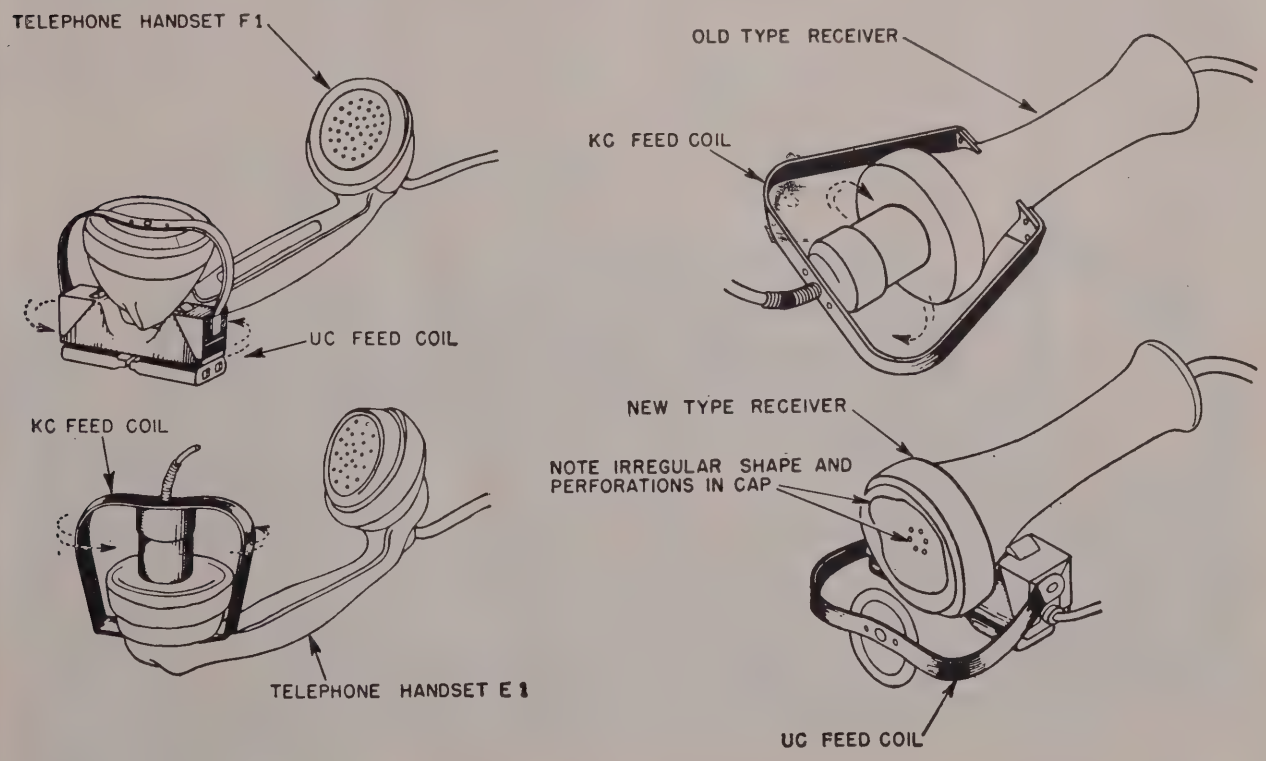


Figure 20. Coupling coils attached to telephone sets.

other end into the microphone jack of the radio transmitter. This is the transmitting connection.

(3) Plug the radio carbon microphone into the CARBON MIKE jack of the transceiver.

(4) Plug the radio headset into the PHONES jack on the transceiver. The radio transmitter and receiver may be operated normally for radio voice communication while the transceiver selector switch is at either SET RANGE or STAND BY position.

(5) If the radio receiver output is too low for the transceiver, check the label on the small circular tag screwed to the terminal board between the RADIO RECVR. and PHONES jack. Ordinarily this is set at 2,500 ohms, indicating the impedance of the RADIO RECVR. input circuit is 2,500 ohms to match the phones circuit output of the conventional radio receiver. Some radio receiver circuits, however, have a 250-ohm output. Connection of a 250-ohm receiver output to the 2,500-ohm transceiver input will be indicated by a failure to get sufficiently high reading on the transceiver db meter, even though the transceiver GAIN control may be set at maximum and the monitored signal may sound loud in the headset plugged into the PHONES jack. To change the transceiver input to match a 250-ohm receiver output circuit, proceed as follows:

a. Remove the back cover of the transceiver to gain access to the terminal board mounted inside the transceiver on the metal brace near the db meter. Connect a wire between terminals 1 and 2 of the terminal board, short-circuiting resistor R79 (figs. 147, 148, and 149).

b. Remove the green wire with orange tracer, which is soldered to terminal 3, and solder it to terminal 4. This places resistor R82 in the circuit.

c. Replace the transceiver rear cover.

d. Remove the two screws holding the round tag on the outside terminal board in place, turn the tag over so that the exposed side reads 250 ohms, and replace the screws.

Note. To avoid pick-up while receiving, it may be necessary to connect the GND. binding post to one of the line binding posts or to the REC. C.T. binding post. Remove this connection when transmitting.

(6) If the facsimile transceiver output is too high for the radio transmitter input circuit, reduce the gain of the radio transmitter preamplifier. A temporary alternative is to set up the facsimile transceiver in the normal manner, and then reduce its maximum output by turning the GAIN control until the maximum meter reading is —4 db.

15. Dark Room Installation

When Facsimile Set AN/TXC–1(*) is used for photographic reception of copy, install the equipment in a large, well-ventilated darkroom from which all light is excluded. A large sink and running water are necessary.

a. SAFELIGHT. Install a safelight equipped with a Wratten series OA filter, or its equivalent. This gives a yellowish green light. Locate the light approximately 5 feet from both the transceiver and the sink.

b. ADDITIONAL EQUIPMENT. In addition to Photographic Equipment PH–549/TXC–1 which is supplied with Facsimile Set AN/TXC–1(*), the following equipment is desirable:

1 electric print dryer.
1 gross each of contact printing paper, single weight, 12 by 18¾ inches, contrast F1, F2, F3, and F4, Eastman Kodak or equal.
2 dozen each, contact printing paper, contrast F0 and F5.
1 contact printer, 18 by 22 inches.
1 dark-room clock with second hand.
1 squeegee, 10 inches long.
2 or more ferrotype plates, chrome, to fit electric dryer.
2 print tongs.

16. Repacking Information

Clean and lubricate the transceiver before repacking. Place the drum chock beneath the lead screw (fig. 16) and fasten it securely in place. If original packaging material and shipping case are not available, use cases of good constructon and arrange for proper cushioning.

PART TWO

OPERATING INSTRUCTIONS

Note. For information on destroying the equipment to prevent enemy use, refer to the destruction notice at the front of the manual.

Section III. CONTROLS AND THEIR USE

17. General

All electrical operating controls of Facsimile Set AN/TXC–1(*) are located on the sloping front panel of Facsimile Transceiver TT–1(*)/TXC–1. Two mechanical controls, the drum engaging lever, and the clamp bar control knob, are located on the drum and its control mechanism. Controls are the same for Facsimile Transceivers TT–1/TXC–1, TT–1A/TXC–1, and TT–1B/TXC–1 except for minor differences required by changes in the talk-back circuit on the various models (figs. 21, 22, and 23). These differences are detailed in the following paragraphs. Input and output connections are located on the right-hand end of the transceiver.

18. Power ON-OFF Switch (S2)

This switch is located on the right side of the transceiver control panel. It makes and breaks one leg of the 110-volt 60 cycle, a-c line circuit feeding the primary of transformer T–11, the main power transformer for the facsimile set. This power transformer is located in Rectifier Power Unit PP–86–(*)/TXC–1, which has no operating controls. With the power ON-OFF switch in the OFF position, power is removed from all parts of the facsimile set. With the switch in the ON position, plate, filament, and screen voltages are applied to all tubes in the facsimile set and power is available for starting and operating the synchronous motor, subject to changes made by the selector switch and STAND-BY-MON-TALK switch.

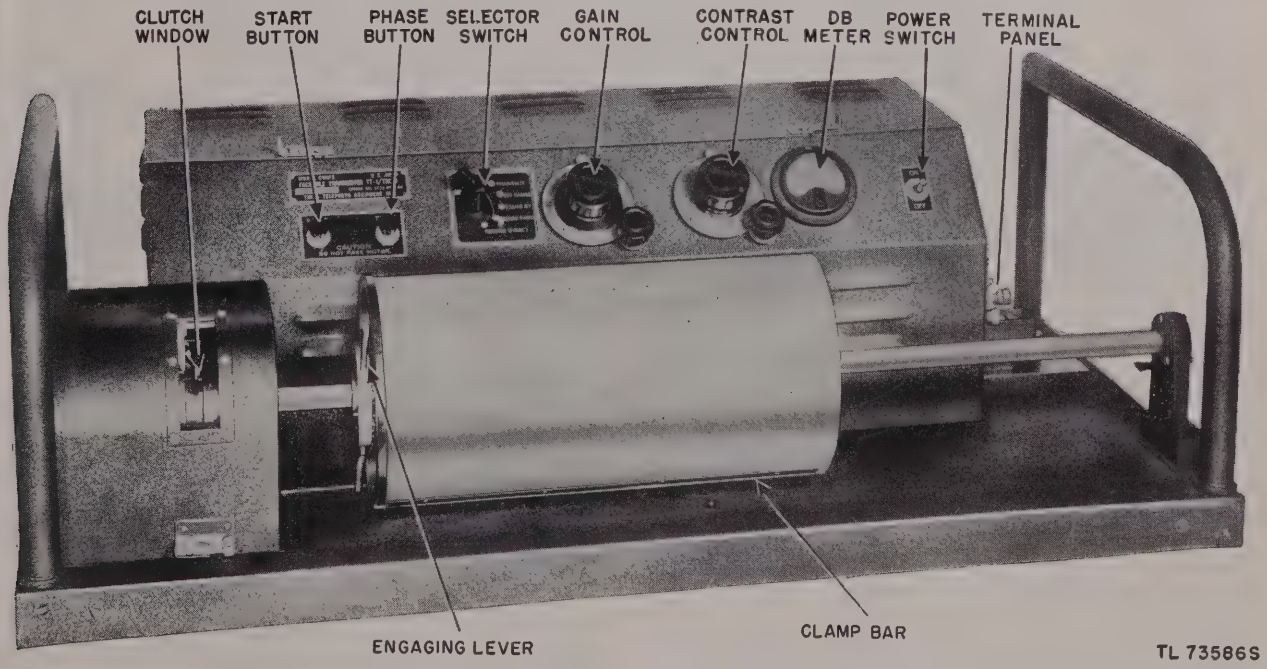


Figure 21. Controls, Facsimile Transceiver TT–1/TXC–1.

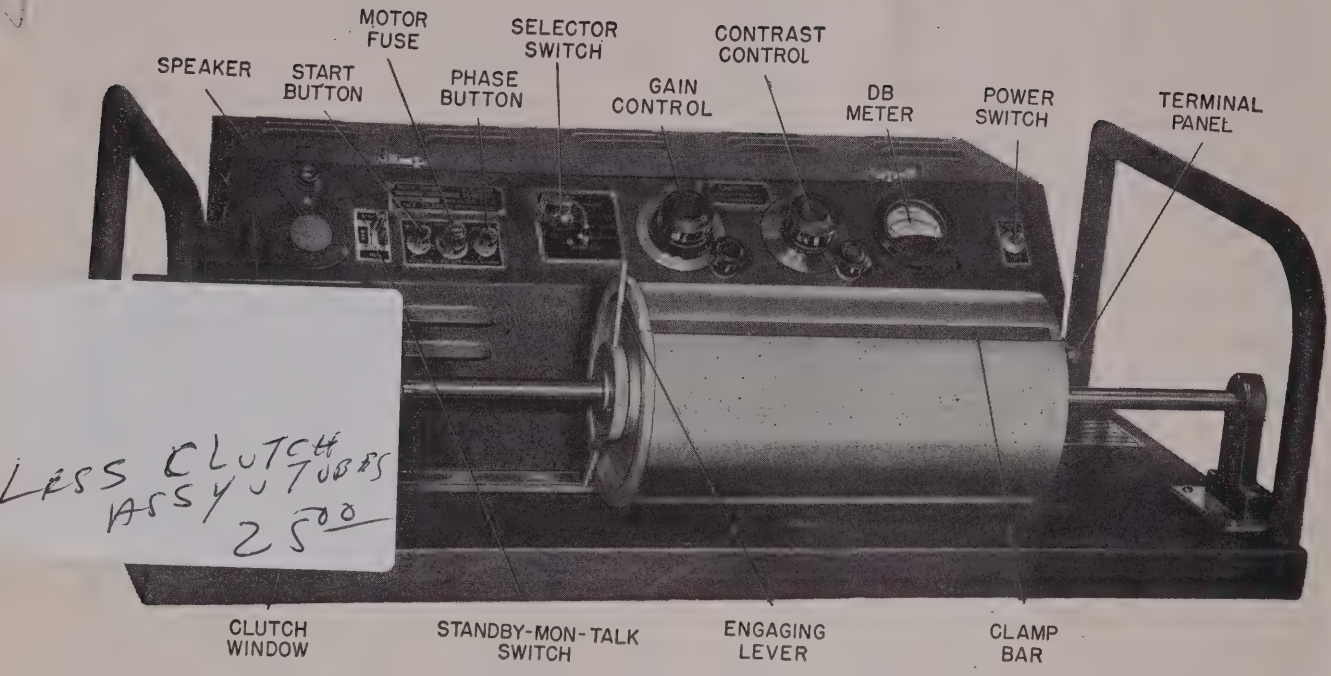


Figure 22. Controls, Facsimile Transceiver TT–1A/TXC–1.

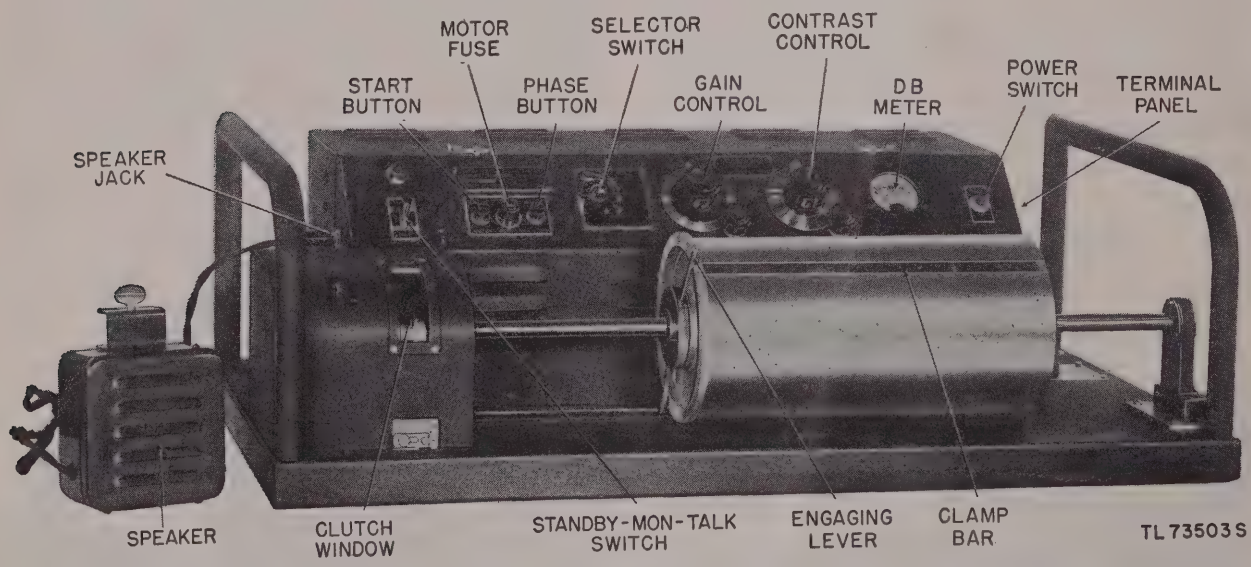


Figure 23. Controls, Facsimile Transceiver TT–1B/TXC–1.

19. STANDBY-MON-TALK Switch (S5)

This switch is included only on Facsimile Transceivers TT–1A/TXC–1 and TT–1B/TXC–1, which include a talk-back circuit, and is not found on Facsimile Transceiver TT–1/TXC–1. This is a three-position key switch located at the left on the front panel. The talk-back circuit is operative only when the selector switch is on STAND BY.

a. In the STAND BY position (upper position), the front panel speaker is connected in the circuit as a speaker, and the operator can monitor the communication channel. If the STANDBY-MON-TALK switch is in STAND BY position, and the selector switch is also in its STAND BY position, the synchronous motor will not operate. This position is used to receive voice communications when it is not necessary to have the motor running.

Warning: When using Facsimile Transceiver TT–1B/TXC–1, the motor may run at a nonsynchronous speed in any switch position, but it will run at a synchronous speed only with switches in the positions described here for other models of equipment. When the motor is running at synchronous speed, the only useful speed, the drum will revolve once each second, and an audible 1,800-cycle tone will be heard coming from the motor laminations.

b. In the MON position (middle position), the speaker is connected and the operator can monitor the communication channel. However, in this position, the motor receives power and can be started and run at synchronous speed. This is the normal position for receiving voice communications when phasing transmitting and receiving equipments preparatory to sending and receiving facsimile copy. Some 1,800-cycle interference will be noticed in the talk-back circuit.

c. In the TALK position (lower position), the speaker becomes the microphone of a voice intercommunication system. The switch must be held in the TALK position; if pressure is released it will snap back to the MONITOR position. The TALK position is used when talking to the facsimile operator on the other end of the circuit.

Note. The talk-back circuit operates only when the selector switch is at STAND BY. Voice communication cannot be carried on over this circuit when the selector switch is at TRANSMIT, SET RANGE, RECORD PHOTO, or RECORD DIRECT.

Caution: The talk-back circuit will not function over a radio circuit which uses Converter CV–2(*) TX, unless the converter is bypassed for voice communication. See TM 11–2252.

20. Selector Switch (S1)

The selector switch (S1), which is located to the left or center on the front panel of the transceiver, is the principal control for determining the function of the transceiver. It has five positions, which from top to bottom are labeled: TRANSMIT, SET RANGE, STAND BY, RECORD PHOTO, and RECORD DIRECT.

a. TRANSMIT. In the TRANSMIT position, the facsimile transmitting circuit is established, and impulses representing elements of the facsimile copy are sent out over the facsimile circuit to the receiver. This is the normal operating position when the transceiver is actually transmitting copy. In this position the switch also closes the radio transmitter relay circuit associated with the CARBON MIKE jack.

b. SET RANGE. In the SET RANGE position the transmitting circuit is established as in the TRANSMIT position, except that impulses are *not* sent out over the line. This position is used when the operator is engaged in setting the contrast range for transmitting a specific piece of copy.

Note. Since the transceiver is disconnected from the line when the selector switch is at SET RANGE, some method must be used to avoid a disconnect when operating with a commercial line. A telephone set across the line or a special telephone key will hold the line. A *dry line,* one not normally used with signaling, will not be rung off.

c. STAND BY. In the STAND BY position, the tubes are kept ready for operation of the transceiver. This is the normal setting during the periods when copy is not actually being transmitted or received.

d. RECORD PHOTO. In the RECORD PHOTO position, the receiving circuit is established to use the recorder lamp which causes recording of received copy on photographic paper. This switch position is used to set the GAIN and phase the receiving transceiver. A raised portion of the selector switch nameplate enables the operator to set the switch at RECORD PHOTO in the dark room.

e. RECORD DIRECT. In the RECORD DIRECT position, the receiving circuit is established to use the stylus instead of the recording lamp. The stylus causes recording of received copy on direct recording paper or other electrosensitive paper. Moving the selector switch to RECORD DIRECT position mechanically moves the stylus into contact with the paper on the drum.

21. START Switch (S4)

This switch is a nonlocking, multipole, push-button switch located on the front panel between the STANDBY-MON-TALK switch and the selector switch. The operator presses this button momentarily to apply power to the start motor and to bring the synchronous motor above the normal operating speed. When the START button is released, the motor slows down to its normal operating speed and continues to operate at that speed.

Caution: The motor of Facsimile Transceiver TT–1B/TXC–1 is at synchronous speed only when the 1,800-cycle tone can be heard from the motor laminations.

22. PHASE Switch (S3)

The PHASE switch is a nonlocking, multipole, push-button switch located to the left of the selector switch. The receiving operator presses this button to energize the phasing circuit of the receiving transceiver while the transmitting operator is sending phasing pulses. The operation assures that both transmitting and receiving drums are in the same position at the same instant. Once the relatively short phasing operation is completed, the machines remain synchronized because both drums are driven by motors running at the same speed.

23. CONTRAST Control (R45)

This control, a calibrated potentiometer located to the left of the db meter on the front panel of the transceiver, adjusts the contrast range (difference between minimum and maximum signal strength) of the transmitted signal by adjusting the magnitude of currents in the photocell bridge circuit. This control is operated only by the transmitting operator, although the setting he makes is determined partially by the request of the receiving operator. The dial on this control is numbered from 1 to 100 and the ranges to use for transmitting positive and negative are indicated.

24. GAIN Control (R59 and R60)

This control, located between the CONTRAST control and the selector switch, is a dual potentiometer which serves to control the level of the signal handled by the transceiver. *It does not change the contrast range.*

Note. The front panel db meter, which serves as a guide in setting GAIN and CONTRAST controls, is calibrated in db with reference to zero power level of 6 milliwatts (mw) in 600 ohms. But line power levels are commonly expressed in terms of dbm, decibels with reference to zero power level of 1 mw in 600 ohms. The db meter on this equipment does not register the true line signal level in either db or dbm. When the facsimile transceiver selector switch is at TRANSMIT and the db meter reads plus 2 db, the resultant power dissipated in a 600-ohm resistive load connected across the LINE binding posts is 1 mw, representing 0 dbm. When the facsimile transceiver is receiving, there is no fixed relationship between line power and db meter reading, for meter readings depend on the setting of the GAIN control. In paragraph 3, under technical characteristics, input and output signal levels for the transceiver are expressed in true line dbm. Elsewhere in this manual, however, the term db is used merely to express the relative level readings of the db meter, not to indicate line levels in dbm.

25. Drum Controls

Two mechanical controls are located on the drum mechanism.

a. The clamp bar control knob is located on the right side of the rotating drum. It is used to open and shut the clamps which hold copy to the drum, and can be operated only when the motor is not running and the drum is not rotating. This knob has three positions:

(1) Center position, in which both clamps are fastened. This is the normal operating position when copy or recording paper is securely fastened to the drum during either transmitting or receiving positions.

(2) Counterclockwise position, in which the clamp is open on the side toward the operator when the clamping bar is at the top of the drum. This position is used only momentarily while inserting copy and preparing to fasten it to the drum.

(3) Clockwise position, in which the clamp is open on the side away from the operator when the clamping bar is at the top of the drum. This position also is used only momentarily while fastening copy to the drum.

b. The drum engaging lever is located to the left of the drum, and is used to engage the half nuts on the rotating drum with the lead screw, causing the drum to travel from right to left during the scanning process. Pushed away from the operator, this lever disengages the drum from the lead screw, so that the drum rotates but does not travel from right to left. The disengaged position is used at all times when copy is not actually being transmitted or received. Pulled toward the operator, this lever engages the half nuts with the lead screw and causes the drum to travel slowly from right to left. This position is used during the actual transmitting or receiving of copy.

Warning: On Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1, the guide arm of the engaging mechanism may leave its track on the chassis of the transceiver if the drum is pushed to the far left with the protective housing removed from the motor and clutch. If this occurs, the drum will not feed properly on the lead screw. In Facsimile Transceiver TT–1B/TXC–1, a machine screw and nut provide a stop to prevent the guide arm from leaving the track.

Section IV. OPERATION

Note. The operating instructions in this section are based on the use of a voice-communication circuit between transmitting and receiving operators. So-called *blind* circuits, however, in which transmission and reception of facsimile copy is completed on prearranged schedules are feasible without voice communication. Experienced operators will find numerous satisfactory ways of saving time by varying the operating procedures described in this section. Only authorized operating procedures, however, should be followed.

26. Preparations

Before operating Facsimile Set AN/TXC–1(*) determine the type of circuit being used, wire or radio, and the type of transmission and reception desired. All will affect the operating procedure.

a. Circuits. (1) If a wire circuit is used between transmitting transceiver and receiving transceiver, be certain that connections are correct for the quality of line (par. 13).

(2) If a radio circuit is used, and Converter CV–2(*)/TX is in the circuit between facsimile transceiver and radio transmitter, remember that the transceiver talk-back circuit will not function in the usual manner.

b. Type of Transmission. Adjustment of the transmitting transceiver will depend on the type of transmission being made and the type of receiving process in use. Coordination is necessary between transmitting and receiving operators. Transmission can be either positive or negative. In *positive transmission, black* portion of the copy are transmitted as *high-level signals* which print at the receiving end as black (fig. 28). In *negative transmissions, white* portions of the copy are transmitted as *high-level* signals which print on the negative (fig. 28). The relative signal levels are indicated by the db meter on the transceiver. The kind of copy being sent and the use to be made of the copy at the receiving end determine whether transmissions should be negative or positive.

c. Type of Reception. (1) *Direct recording.* When the time element is important, use the direct recording method. Slight loss of detail and fidelity of half tones (shades of gray between white and black) must be tolerated. Copy received on Teledeltos paper is ready for immediate use; copy received on Timefax paper permits making duplicates by the hectograph method in a very short time.

(2) *Positive photographic recording.* When only one copy is needed, and finer detail and better half-tone reproduction than can be obtained by direct recording are necessary, use the positive photographic recording method. Copy received by this method requires photographic processing before it can be used.

(3) *Negative photographic recording.* When maximum quality of a photograph is required, use the negative photographic recording method. Copy received by this method requires photographic processing just as any negative, and positive prints can be made from the negative.

27. Transmitting, General

a. Initial Operation. (1) Cut the copy to be transmitted to a size no larger than 12 by 18⅝ inches. Keep the actual message for transmission to 12 by 17½ inches for both photographic and direct recording.

(2) Fasten captions on the copy to be transmitted with Scotch tape or write them on the copy with either ink or pencil.

(3) Throw the power ON-OFF switch of the transceiver to ON, and turn the selector switch to SET RANGE. Wait for the high-pitched 1,800-cycle tone. (There is no audible tone when the selector switch is in STAND BY position and the STANDBY-MON-TALK switch is in the STAND BY position.) Normally a 10-minute warm-up period should be allowed before actually transmitting.

(4) Press backward on the engaging lever on the left end of the drum mechanism to disengage the drum from the lead screw. Push the drum to the right-hand end of the lead screw. Turn the drum so the clamping bar is on top.

b. Placing Copy on Drum (fig. 24). (1) Raise one edge of the clamp bar by turning the knob on the right end of the drum to its clockwise position, and place the lower edge of the copy face up under the rear edge of the clamp bar. Turn the knob to its counterclockwise position to set the clamp and open its other edge. Revolve the drum forward, wrapping the copy around the drum. Insert the loose edge of the copy under the clamp, pull the copy tight around the drum with a wiping motion of the hand, and set the clamp by turning the clamping bar knob back to its center position.

(2) Make certain that there are no bulges in the copy (fig. 29). If the copy is too small to fit around the drum and into the clamping bar, fasten it to the drum with Scotch tape.

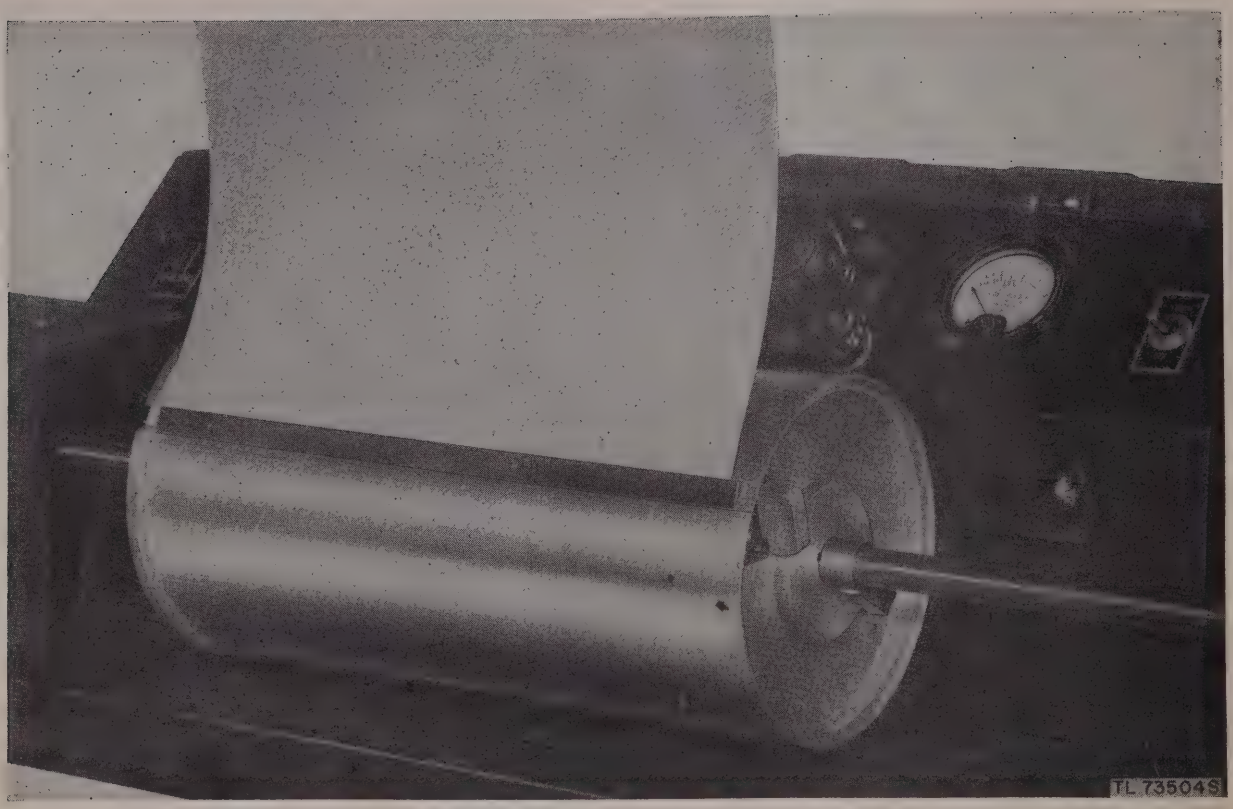


Figure 24. Loading drum with direct recording paper.

28. Transmitting Positive for Direct Recording

In transmitting positive for reception on Teledeltos or Timefax paper, proceed as follows:

a. Preparations. (1) Warm up the transceiver and load the drum as outlined in paragraph 27.

(2) Be sure the selector switch is on SET RANGE.

b. Setting GAIN and CONTRAST Controls. (1) As a starting point, set the GAIN control at 65 and the CONTRAST control near zero.

(2) Turn the drum so that the *whitest* portion of the copy is illuminated by the spot of light. Carefully turn the CONTRAST control to a higher setting until the meter reads minimum. Check the meter reading and move the drum slightly backward and forward while examining a different white portion of the copy to be sure the whitest spot is used.

(3) Move the drum so that the *blackest* portion of the copy is illuminated by the spot of light. Be sure the blackest portion actually is used by again rotating the drum slightly backward and forward while checking the meter.

(4) Adjust the GAIN control so that the meter reads +2 db.

(5) Shift back to the whitest portion of the copy and readjust the CONTRAST control for a minimum reading on the meter.

(6) Repeat steps (3), (4), and (5) above until the final adjustments of GAIN and CONTRAST controls give meter readings differing by at least 12 db between the blackest and whitest portions of the copy. The maximum reading (on black copy) must not exceed +2 db.

Note. On some lines, maximum CONTRAST range may not produce good pictures and the above procedure will have to be modified.

(7) If the UC coupling coil is used to couple the transceiver output to a telephone circuit, an additional adjustment must be made at this point. With a +2 db meter reading, indicating maximum transmitted signal, turn the selector switch to TRANSMIT. Listen closely in the telephone earpiece, and slowly rotate the coupling coil on the telephone headset until the loudest tone is heard. Be sure that the coupling coil is at least 2 feet from the transceiver, power supply, and other electrical equipment to prevent magnetic pick-up of interference.

(8) When using Facsimile Transceiver TT–1A/TXC–1 or TT–1B/TXC–1, set the selector switch at STAND BY and with the STANDBY-MON-TALK switch momentarily flipped to TALK, tell the receiving operator that maximum and minimum signals will be sent, so that he can make proper adjustments on the transceiver being used for reception. Release the STANDBY-MON-TALK switch, and it will snap back to MON position, enabling the transmitting operator to hear the receiving operator's acknowledgment. When using Facsimile Transceiver TT–1/TXC–1, use telephones for voice communication.

(9) Turn the selector switch to TRANSMIT and with the spot of light on the blackest portion of the copy, transmit a maximum signal for approximately 15 seconds. This should be enough time for the receiving operator to adjust the controls on his set. Then alternately send maximum and minimum signals (with the spot of light alternately on the blackest and whitest portions of the copy) for about 5 seconds each, so the receiving operator can check the contrast set up by the transmitting operator. Experienced operators can shorten this procedure on subsequent transmissions over the same circuit by sending only minimum signals for receiver adjustment.

c. Transmitting Phasing Pulses. (1) Move the drum so that the spot of light shines directly on the raised phasing ring at the left end of the drum. Be sure the STANDBY-MON-TALK switch is at MON and the selector switch is at SET RANGE. Push the START button and hold it engaged until the motor starts and the drum picks up speed to slightly more than 60 revolutions per minute (rpm), the normal operating speed. Do not race the motor. Then release the START button. The drum will slow down to synchronous speed of 60 rpm as indicated by the 1,800-cycle tone from the motor laminations.

Warning: The motor of Facsimile Transceiver TT–1B/TXC–1 may run at non-synchronous speed. It is at synchronous speed only when the 1,800-cycle tone can be heard from the motor laminations.

(2) If the drum stops, repeat the starting operation. The light shining on the dark phasing ring and the white phasing spot sends out phasing pulses indicated by a flicking of the db meter each time the light shines on the phasing spot. Look through the clutch window and be sure the drum is driven by the stop arm driving the dog trip arm (fig. 27). This condition should take place automatically after 5 to 10 revolutions of the drum. If the stop arm is not driving the dog trip arm, false phasing may result (fig. 30). To correct this condition exert a gentle friction with the fingers against the phasing ring on the drum until the stop arm catches up with the dog trip arm. (Facsimile Transceiver TT–1B/TXC–1 has a drum friction mechanism which makes this step unnecessary.) Switch to TRANSMIT and send about 25 phasing pulses.

d. Transmitting Copy. If the receiving operator does not request more phasing pulses, proceed to transmit copy as follows:

(1) Turn the selector switch back to TRANSMIT. Pull down the knurled engaging knob on the left end of the drum mechanism to engage the half nuts of the drum feed mechanism with the lead screw and cause the drum to move slowly from right to left on the shaft.

(2) When all copy has moved past the scanning beam, turn the selector switch to STAND BY. This stops the motor of Facsimile Transceiver TT–1/TXC–1. But if Facsimile Transceiver TT–1A/TXC–1 or TT–1B/TXC–1 is being used, the motor will continue to run until the STANDBY-MON-TALK switch also is thrown to STAND BY. Remove the completed copy from the drum. If more pictures are to be transmitted, proceed from the start, setting up new CONTRAST and GAIN settings for the new copy, and repeating the phasing procedure. If no more pictures are to be transmitted immediately, leave the selector switch in STAND BY position. When closing down, throw the power ON-OFF switch to OFF.

Caution: The phasing procedure *must* be repeated every time after the transmitting or receiving drum is stopped before transmitting another picture.

29. Transmitting Positive for Positive Photographic Recording

When transmitting positive for positive photographic reception, follow in general the procedure outlined in the preceding paragraph for transmitting positive for direct recording. However, when setting the CONTRAST control while scanning the whitest portion of the copy, turn the control only until the db meter reads —10 db. Do not set it for a *minimum* reading. *Be careful not to turn the CONTRAST control too far so that the meter passes —10 db and dips to a lower reading before rising again to —10 db.* Make final GAIN and CONTRAST control adjustments so that meter readings differ by 12 db

between blackest and whitest portions of the copy. The minimum reading (on white) should be —10 db; the maximum reading (on black) should not exceed +2 db.

30. Transmitting Negative

In transmitting negative, for reception on film, proceed as follows:

a. Preparations. Make the same initial preparations as in transmitting positive. Be sure the selector switch is on SET RANGE.

b. Setting GAIN and CONTRAST Controls. (1) As a starting point, set the GAIN control at about 65 and the CONTRAST control near 100.

(2) Turn the drum so that the blackest portion of the copy is illuminated by the spot of light. Carefully turn the CONTRAST control to a lower setting until the meter reads —6 db. Check the meter reading and move the drum backward and forward slightly while examining a different black portion of the copy to be sure the blackest spot is used.

Caution: Do not turn the CONTRAST control too far so that the meter passes —6 db, and dips to a lower reading before rising again to —6 db.

(3) Move the drum so that the *whitest* portion of the copy is illuminated by the spot of light. Adjust the GAIN control so that the meter reads +2 db. Be sure the whitest portion of the copy actually is used by again rotating the drum backward and forward slightly while checking the meter.

(4) Shift back to the blackest portion of the copy and readjust the CONTRAST control for a —6 db reading on the meter.

(5) Repeat steps 2, 3, and 4 above until the final adjustments of GAIN and CONTRAST controls give meter readings differing by 8 db between the whitest and blackest portions of the copy. The maximum reading (on white copy) must not exceed +2 db.

c. Other Steps. Other steps in the procedure for transmitting negative are the same as for transmitting positive.

31. Receiving on Teledeltos Paper (Direct Process)

Direct process recording when done on Teledeltos paper does not require reception in a dark room and provides a single received copy which can be used immediately without processing.

a. Preparations. (1) Wrap the direct process paper around the drum with the metallic side toward the drum. The drum loading operation is essentially the same as for transmitting (par. 27*b*).

Caution: Hands should be clean and dry. Do not get finger marks on the glazed surface of the paper.

(2) Warm up the transceiver as outlined in paragraph 27*a*(3).

b. Adjusting GAIN Control. (1) Turn the selector switch to RECORD PHOTO. This makes the facsimile transceiver capable of receiving signals, without operating the stylus.

(2) If the UC coupling coil is being used magnetically (coupled to a telephone receiver), direct the transmitting operator to send a maximum signal. When the maximum signal is received, adjust the GAIN control until the db meter reads near zero. Then rotate the coupling coil on the earpiece to the position giving the maximum db meter reading. Be sure the coupling coil is at least 2 feet from the transceiver, power supply, and other electrical equipment.

(3) While the transmitting operator is alternately sending maximum and minimum signals, adjust the GAIN control on the receiving transceiver so that the db meter reads from +2 to +4 db on the steady maximum tone. (The best setting can be learned by experience.) Note the difference on the receiving transceiver db meter between maximum and minimum signal levels. If the circuit is functioning properly, this difference will be the same as the difference established at the transmitting transceiver, within 2 db.

c. Phasing Receiver. (1) Be sure the STAND-BY-MON-TALK switch is at MON. Push the START button and hold it engaged until the motor starts and the drum picks up speed to slightly more than 60 rpm. Then release the START button. The drum will slow down to its synchronous speed of 60 rpm.

Warning: The motor of Facsimile Transceiver TT–1B/TXC–1 may run at a non-synchronous speed. It is at synchronous speed only when the 1,800-cycle tone can be heard from the motor laminations. If the drum stops, repeat the starting operation.

(2) The transmitting operator will send approximately 25 phasing pulses. These are indicated at the receiver by a momentary dip on the db meter which occurs once for each revolution of the drum. Be sure to wait for 10 to 15 pulses during which the transmitting machine comes into proper phase.

Then press the PHASE button and hold it engaged for about 6-10 pulses. The phasing pulses actually bring the stop arm on the clutch mechanism into phase, and from 5 to 10 more revolutions of the stop arm may be required before the drum itself falls into phase. The drum is not phased until the stop arm is driving the dog trip arm (figs. 25, 26, and 27). Check for this condition by looking at the clutch mechanism through the window on the clutch housing. If the drum is not being driven by the stop arm driving the dog trip arm after 10 revolutions following the release of the PHASE button, exert a gentle friction with the fingers against the phasing ring on the drum until the stop arm catches up with the dog trip arm. (Facsimile Transceiver TT–1B/TXC–1 has a drum friction mechanism which makes this step unnecessary.)

Note. If the receiving operator misses the phasing pulses, and is on a circuit where he cannot break the transmitting

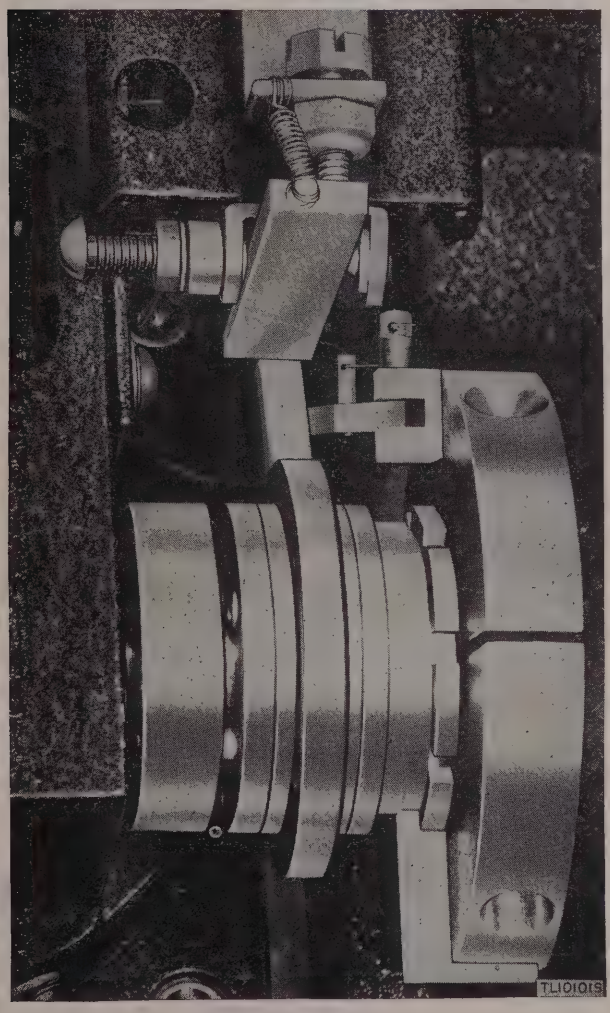


Figure 25. Clutch assembly, start of phasing.

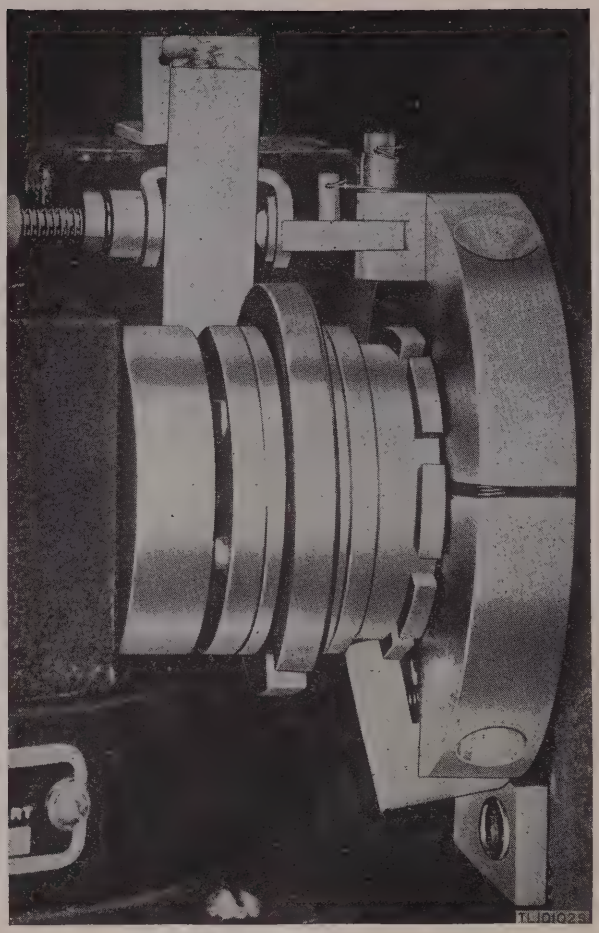


Figure 26. Clutch assembly, during phasing.

operator to ask for more phasing pulses, it may be possible to phase the receiving machine as follows. Watch the db meter for the periodic increase or decrease in reading once each second. These abrupt changes represent pulses sent when the transmitting machine scans the clamp bar. Hold the PHASE button down for a few pulses. When the receiving db meter flicks just as the clamp bar passes the stylus or recorder lamp barrel, release the PHASE button. There is a good chance that the receiving transceiver will be properly phased and a suitable picture will be recorded.

d. Receiving Copy. (1) If the receiving transceiver is properly phased, wait for transmission of the picture signals to start. When these signals start, as indicated by irregular fluctuations of the db meter, engage the drum to the feed mechanism by pulling the feed engaging lever forward, turn the selector switch to RECORD DIRECT to engage the stylus, and receive the copy.

Caution: Use care in breaking into the circuit to talk to the transmitting operator. On some circuits with several stations on a network, an attempt to talk will spoil reception at the other stations.

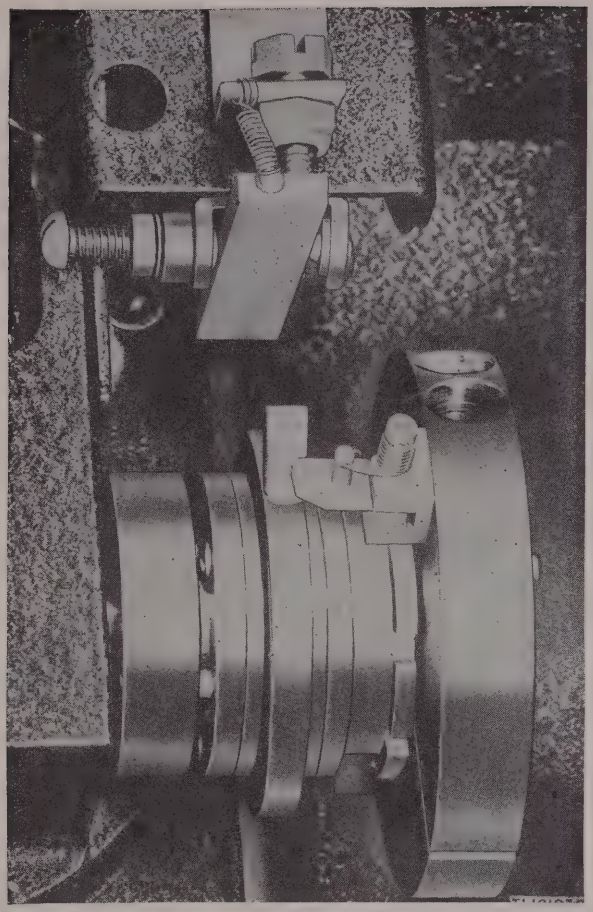


Figure 27. Clutch assembly, phasing completed.

(2) When the complete picture has been received, turn the selector switch to STAND BY. If no more pictures are to be received, throw the power ON-OFF switch to OFF. If more pictures are to be received, turn the selector switch to STAND BY. This stops the motor of Facsimile Transceiver TT–1/TXC–1. But if Facsimile Transceiver TT–1A/TXC–1 or TT–1B/TXC–1 is being used, also throw the STANDBY-MON-TALK switch to STAND BY to stop the motor. Remove the completed picture and attach new direct recording paper to the drum. Proceed from the start, setting the GAIN control anew to handle the new transmitting level, and repeating the phasing procedure.

32. Receiving, Photographic Recording

Receiving technique for photographic recording is similar to that for direct recording, except that operations must be performed in a darkroom.

a. Loading Drum. Use photographic paper, Royal Bromide F-1 for normal positive recording. Use kind 1020 (or Aero enlarging paper), contrast No. 1, for positive recording when no shrinkage of the print can be tolerated. Use Eastman transmission photographic film, type A, for negative recording.

(1) Turn the selector switch on the facsimile transceiver to STAND BY position and make initial preparations.

(2) Turn off all lights in the darkroom except the safelight.

(3) Open the box of photographic paper, remove a single sheet, and close the box. If film is used, remove one sheet of film and a piece of black paper from the box. Place the black paper next to the dull side of the film and treat the combination as paper according to the following instructions.

(4) Load the drum in the same manner as loading with direct recording paper, except be sure to leave approximately ¼ inch of space between the phasing ring and the paper.

b. Receiving Copy. Adjust the GAIN control and phase the transceiver as outlined in paragraph 31 for direct recording. In this position the selector switch is on RECORD PHOTO and the photographic paper or film may be ruined if care is not taken to perform these operations with the drum at the far right side of the lead screw so that the light from the recorder lamp falls only on the aluminum drum (fig. 28). When the signal starts, leave the selector switch in the RECORD PHOTO position. Move the drum to the right approximately ¼ inch until the beam from the recorder lamp shines on the extreme left-hand edge of the photographic paper. Then engage the drum feed mechanism. Turn off the safelight. Turn it on only intermittently as necessary to permit checking of the transceiver operation.

Warning: Light through the type OA filter will fog type A transmission film under prolonged exposure. Therefore, whenever possible set up the receiving transceiver before putting on the film. Phase the machine quickly, and turn off the safelight as quickly as possible.

33. Receiving Copy on Timefax Paper

Timefax paper is a specially prepared paper which is used for reception when duplicate copies are required. A hectograph pad is used for duplicating. Timefax paper has a high-resistance outer coating which is burned away by current from the transceiver stylus point when copy is received. The dark undercoating of the paper is conductive. Recording on Timefax paper is quicker and cheaper than the

use of photographic methods, but definition is not as good.

a. Recording. Recording on Timefax paper is similar to recording by the direct process method on Teledeltos paper. Place the paper on the recording drum with the coated side up and follow the procedure outlined in paragraph 31. Do not judge the master copy by its appearance, but rather by its performance on the hectograph pad. The master copy need not be black and distinct. Set the transceiver GAIN control so that the meter reads approximately +2 db on the black (maximum) signal for the original trial. Increase the setting if necessary but avoid too high a setting. Excessive gain will cause excessive smoking at the stylus, and will destroy the transfer dye in the undercoating. Do not change the setting of the GAIN control during the recording period.

b. Use of Hectograph Duplicator. After the master copy has been received on the Timefax paper, make copies from the master sheet, using the hectograph pad as follows:

(1) Prepare the hectograph pad for use by moistening it with a sponge and allowing the gelatine to absorb moisture for about 1 minute. Wipe off the excess water with a piece of absorbent paper. If the pad is extremely dry, two or more separate applications of water may be required. When the pad is in proper condition, the surface will be slightly slippery, not sticky.

(2) Fold back one corner of the master copy to facilitate its subsequent removal without scratching or scoring the pad, and place the master copy face down on the pad.

(3) After a minute or so, lift one corner of the master copy and check the transfer of ink to the pad. If the impression is faint, press the master back in place. Keep checking until a deep impression is obtained.

(4) When a satisfactory impression is obtained, peel the master from the pad. Make copies by following ordinary hectograph procedure. Press the paper down firmly and evenly, then peel it off. Ten or 15 copies can be made from a good impression. If more copies are desired, make another impression from the master.

(5) File the master copy in a cool, dry place, without folding.

34. Piece-by-piece Transmission

When the entire picture to be transmitted cannot be handled in a single transmission, it must be sent piece-by-piece. Copy as large as 12 by 18 inches can be received either on direct recording or photographic recording. For piece-by-piece transmission, cut the original copy into sections so that the entire picture can be recorded in the minimum number of transmissions. Procedure for piece-by-piece transmission is the same as for transmitting several successive pictures, with the following exceptions:

a. During the first contact the transmitting operator informs the receiving operator that the transmission will be piece-by-piece, and states the number of pieces.

b. In establishing desired contrast range and gain settings for the transmissions, the transmitting operator uses the phasing ring and the phasing spot on it to send maximum and minimum signal levels. He does not use the darkest and lightest portions of the picture.

c. Once the transmitting GAIN and CONTRAST controls and the receiving GAIN control are set correctly, they are not changed until the last piece of the piece-by-piece copy has been received; *however, the receiving drum must be rephased to the transmitting drum before the start of each picture.*

35. Photographic Processing

a. Developer and Hypo Solutions. Mix developer and hypo solutions according to instructions on the containers of powder. Mix developer DK–60A for film, or developer D–72 for photographic paper. The same type of hypo is used for fixing both film and paper.

b. Dark-Room Operations. Keep all lights except the safelight turned off until the photographic copy has been fixed in hypo. Arrange three trays beside the sink so that they are lighted by the safelight. Put developer in the left-hand tray, clean water in the middle tray, and hypo in the right-hand tray. Be sure there is enough solution in each tray to cover the copy being processed (at least ½ inch).

(1) *Negative (film).* Use DK–60A solution, full strength, for developer. Check the temperature of the developer with the thermometer. It must be between 60° F and 80° F for satisfactory results.

(*a*) Immerse the exposed film in the developer tray. Agitate the solution. Watch the film as the picture begins to form. After detail can first be noticed in the light portions of the lighter side of the film, continue developing for 3 or 4 minutes, making a total development time of about 5 minutes.

Then place it in the middle tray for 5 seconds. Then place it in the hypo tray.

(*b*) After all cloudy white portions of the film have cleared, lights may be turned on for a few minutes. Leave the film in the hypo for at least 15 minutes. Then wash it for at least 15 minutes in running water. After the film has been washed, hang it up to dry, using wooden clips.

Caution: Be careful in handling film to avoid getting finger marks, scratches, or dust on the emulsion. Keep wash water and tray solutions as near the same temperature as possible. Never use warm water to wash film; it removes the emulsion from the film base.

Note. For black and white copy such as maps or messages, use developer D–72 mixed to 1 to 1 instead of DK–60A. This will reduce the developing time. If rushed, fixing and washing time can be reduced if it is not necessary to preserve the film. The film must be clear before removing it from the hypo. Use of D–72 solution is *not* recommended for photographic work requiring detail in highlights and shadows.

(2) *Positive* (*paper*). Use one part of D–72 solution mixed with two parts of water for developer. Be sure the temperature of the developer is between 60°F and 80°F.

(*a*) Place the paper in the developing tray and watch the picture begin to form. When the desired density has been obtained (after about 1½ minutes), remove the picture from the developer and place it in the wash water in the middle tray.

(*b*) After about 5 seconds, remove the picture from the washing tray and immerse it in the hypo. The lights may be turned on after the paper has been in the hypo for about a minute. Leave the paper in the hypo for at least 10 minutes. Then wash it in running water for 15 minutes.

(*c*) If Royal Bromide paper is used, place the paper face down on a ferrotype plate and force out the excess water with a squeegee. Put the ferrotype plate on a dryer until the copy is dry.

(*d*) If Aero enlarging paper or kind 1020 is used, dry the paper between two blotters, not on the ferrotype plate.

c. Common Photographic Faults. The following table lists common photographic faults and their causes:

Fault	*Cause*
Print too dark	Overdevelopment; developer too warm. If contact print—exposure too great; negative too weak or thin.
Print too light	Underdevelopment; developer too cold. If contact print—exposure not sufficient; negative too dense.
Grayish whites throughout picture.	Developer too cold, requiring too long development, paper fogged.
Grayish granular appearance.	Underexposed contact print and long development; old paper; paper kept in damp place.
Brownish or greenish tones.	Developer solution either too cold, badly discolored, or exhausted.
Brown and red stains.	Developer exhausted; prints not moved about enough during fixing.
Round white spots.	Air bubbles on the surface of the paper. Prints not moved about enough during development and fixing.
White deposits on surface of prints.	Milky fixer solutions; incorrect mixing or impure chemicals.
Blisters on surface.	Print creased or broken while washing; temperature difference between solutions and wash water too great.
Yellowish stains.	Insufficient washing between developing and fixing; long development; print not kept moving when first immersed in fixer; iron in wash water, probably from rusty pipes; print exposed to air too much while developing, especially in warm weather. To remedy, try using fresh developer solution.

36. Operator Coordination

The following is a summary of the joint and individual operations required of both transmitting operator and receiving operator in the satisfactory transmission and reception of facsimile copy. Figures 28, 29, and 30 illustrate a number of operating faults.

Item No.	*Both operators*
1	Establish voice communication (radio or wire).
2	Decide what method of transmission and reception is required.
3	Check equipment connections.
4	Turn transceiver power ON-OFF switches to ON.

	Transmitting operator	*Receiving operator*
5	Places copy on transmitter drum.	Places recording paper on receiver drum.
6	Sets contrast at 8 db for negative reception, 12 db for positive photographic reception, or maximum usable contrast for direct recording paper.	
7	Sends maximum signal, then maximum and minimum signals.	Adjusts GAIN control for proper receiving level and checks contrast.
8	Sends phasing signals	Presses PHASE button to phase receiver.
9	Sends copy	Receives copy.



① *Usual positive recording.*



② *Negative reproduction.*



③ *Selector switch at "record photo" when mounting Royal Bromide paper.*

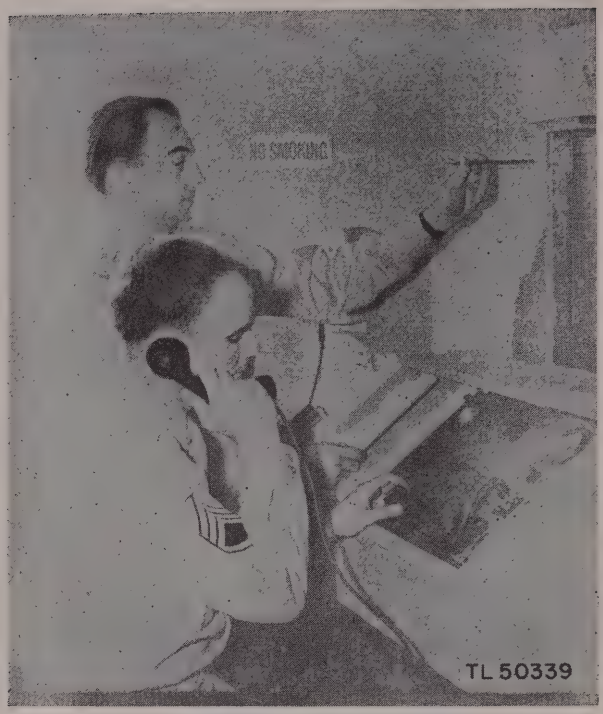


④ *Disfiguration caused by scratching and fingering photographic material.*

Figure 28. Good recordings above, operating faults below.



① *Dark area at center caused by loosely mounted original picture.*



② *Flat effect caused by insufficient contrast.*

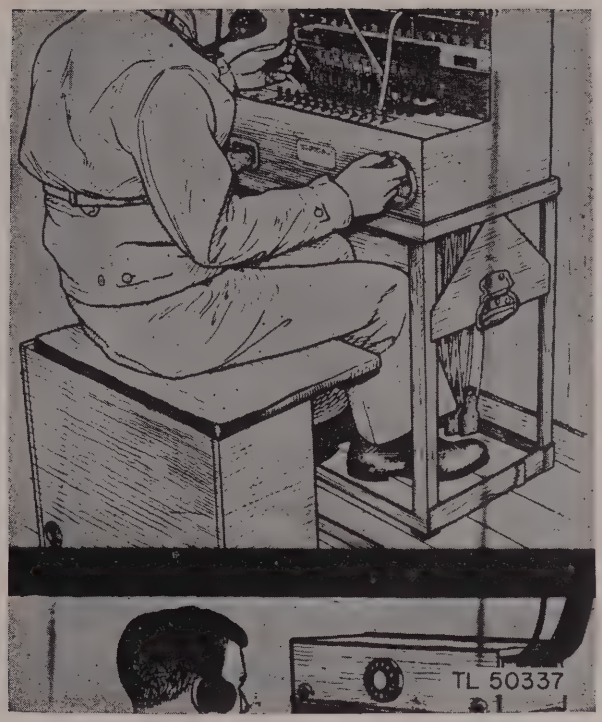


③ *Details lost and glare produced by excessive contrast.*

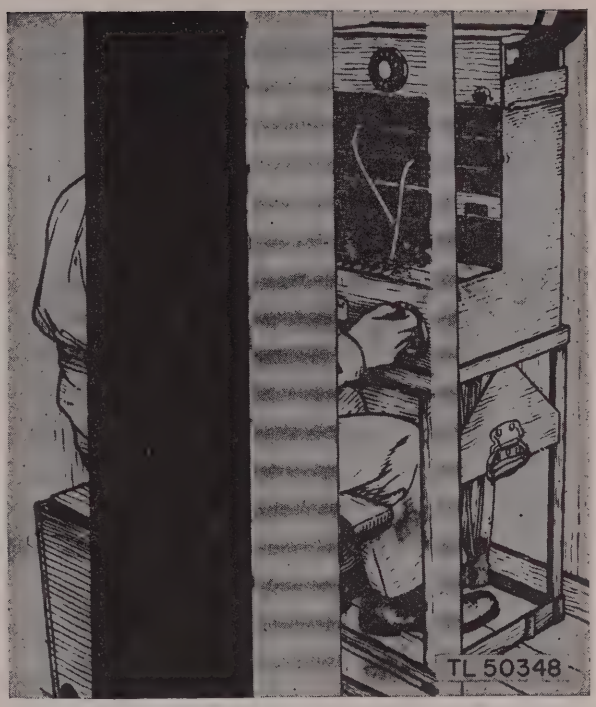


④ *Reversal of some shades produced by transmission in critical range; contrast control not properly set.*

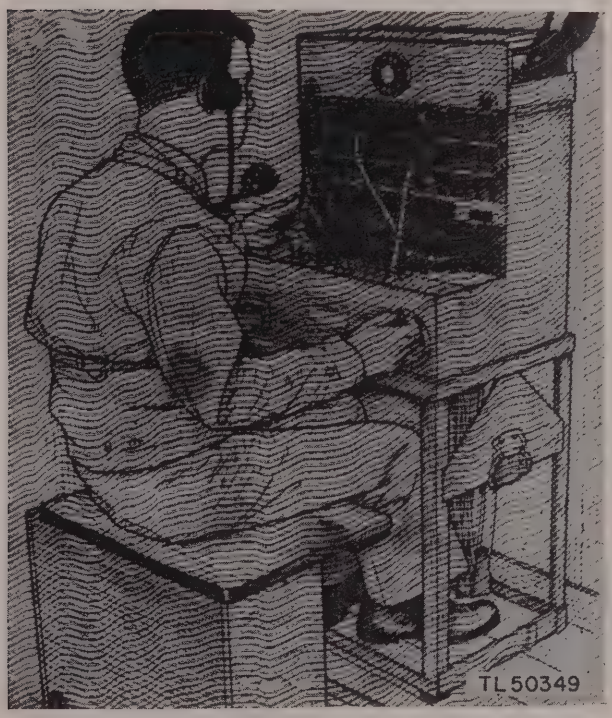
Figure 29. Operating faults.



①*Reproduction showing lack of phasing or improper phasing.*



②*Erratic recording caused by faulty coupling.*



③*Effect of induced 60-cycle impulses.*



④*Dark strips caused by induced 1,800-cycle impulses at receiver.*

Figure 30. Operating faults.

Section V. EQUIPMENT PERFORMANCE CHECKLIST

37. Purpose and Use of Equipment Performance CheckList

a. GENERAL. The equipment performance checklist (par. 38) will help the operator determine whether Facsimile Set AN/TXC–1(*) is functioning properly. The checklist gives the item to be checked, the conditions under which the item is checked, the normal indications and tolerances of correct operation, and the corrective measures the operator can take. Check items 1 and 2 before starting (before turning the equipment on), items 3 to 7 when starting, items 8 to 32 during operation, and items 33 to 35 when stopping (when turning the equipment off).

b. ACTION OR CONDITION. For some items, the information given in the action or condition column consists of the settings of various switches and controls under which the item is to be checked. For other items it represents an action that must be taken to check the normal indication given in the normal indication column.

c. NORMAL INDICATIONS. The normal indications listed include the visible and audible signs that the operator will perceive when he checks the items. If the indications are not normal, the operator should apply the recommended corrective measures.

d. CORRECTIVE MEASURES. The corrective measures listed are those the operator can make without turning the equipment in for repairs. Reference in the table to part five indicates that the trouble cannot be corrected during operation and that trouble shooting by an experienced repairman is called for. If the set is completely inoperative or if the recommended corrective measures do not yield results, trouble shooting is necessary. If the tactical situation requires that communication be maintained, however, and if the set is not completely inoperative, the operator must maintain the set in operation as long as it is possible to do so.

38. Equipment Performance CheckList

a. RECTIFIER POWER UNIT PP–86(*)/TXC–1.

	Item No.	Item	Action or condition
PREPARATORY	1	A-c power cord...	Cord plugged into an a-c receptacle.
	2	Jones plug	Jones plug connected to transceiver.

b. FACSIMILE TRANSCEIVER TT–1(*)/TXC–1.

	Item No.	Item	Action or condition	Normal indications	Corrective Measures
START	3	Connection to line.	Make connection as described in paragraph 13 or 14.		
	4	Communication ...	Establish communication with other station.		
	5	Method of recording.	Arrange method of recording with operator at other station.		
	6	Power switch	Turn power switch on	High-pitched tone is heard	Check power input and tubes (see part five).
	7	Drum	Disengage drum feed mechanism and move the drum to extreme right.		

c. Facsimile Transceiver TT–1(*)/TXC–1 (Transmitting).

	Item No.	Item	Action or condition	Normal indications	Corrective Measures
EQUIPMENT PERFORMANCE	8	Copy	Place copy on scanning drum.		
	9	Selector switch ...	Turn to SET RANGE position.		
	10	CONTRAST and GAIN controls.	Adjust CONTRAST and GAIN controls for proper contrast and correct output.	Meter indicates correct contrast (pars. 28, 29, 30).	Check balance (see part five).
	11	Selector switch ...	Turn to TRANSMIT position.		
	12	Maximum and minimum signals.	Send maximum signal for 15 seconds, then send maximum and minimum signals for 5 seconds each.	Receiving operator checks contrast and sets up his GAIN control.	Send signals again if receiving operator is not ready.
	13	START button ...	Press START button	Motor starts and drives drum 60 rpm.	See part five.
	14	Phasing pulses ...	Send phasing pulses	Pointer of db meter will flick once for each revolution of drum.	Move scanning drum so light shines on phasing ring.
	15	Phasing check	Receiving operator may ask for more phasing pulses.	.....	Send more phasing pulses.
	16	Sending copy	Turn selector switch to TRANSMIT and engage drum feed mechanism.	Scanning drum moves along lead screw.	Make sure drum is feeding properly and selector switch is set at TRANSMIT (see part five).
	17	Stopping transceiver.	When all copy has been scanned, stop the transceiver.	Receiving operator will receipt for transmission.	Check with receiving operator.

d. Facsimile Transceiver TT–1(*)/TXC–1 (Receiving, Direct Recording).

	Item No.	Item	Action or condition	Normal indications	Corrective Measures
EQUIPMENT PERFORMANCE	18	Direct recording paper.	Fasten to scanning drum	Metallic or back side toward drum.	Reverse paper.
	19	Selector switch ...	Turn to RECORD PHOTO.		
	20	GAIN control ...	When transmitting operator send maximum signal, adjust GAIN control for proper reading on db meter. Check contrast on maximum and minimum signals.	Difference in maximum and minimum should be the same as at transmitting station within 2 db.	Contact transmitting operator to check his levels. Check line if possible.
	21	Phasing	Start motor and phase transceiver..	Drum rotates, clicking sound is heard at each revolution.	Turn selector switch to STAND BY and transmitting operator to send more phasing pulses.
	22	Starting to record.	Turn selector switch to RECORD DIRECT; engage drum feed mechanism.	Signal from transmitting station starts. Stylus records.	Contact transmitting station. Check receiving transceiver (see part five).
	23	Stopping transceiver.	When no more signals are received, stop transceiver.	Db meter shows no reading.	If all copy is not received, contact transmitting operator and request retransmission.

e. FACSIMILE TRANSCEIVER TT–1(*)/TXC–1 (RECEIVING, PHOTOGRAPHIC RECORDING).

	Item No.	Item	Action or condition	Normal indications	Corrective Measures
EQUIPMENT PERFORMANCE	24	Dark room and photographic solutions.	Prepare for photographic processing (par. 32).	No light present. Solutions and pans clean and right temperature.	Make up new solutions if required.
	25	Selector switch ...	Turn to STAND BY.		
	26	Recording medium.	Place film or paper on scanning drum. Place black paper against dull side of film.	Glossy side of film or paper is out, and no wrinkles are present.	Place film on scanning drum correctly.
	27	Selector switch ...	Turn to RECORD PHOTO.		
	28	GAIN control	When transmitting operator sends maximum signal, adjust GAIN control for +2 db on db meter. Check contrast on maximum and minimum signals.	Maximum reading should be +2 db. Difference in maximum and minimum signals should be same as at transmitting station within 2 db.	Contact transmitting operator to check his levels. Check line if possible.
	29	Phasing	Start motor and phase transceiver..	Drum rotates, clicking sound is heard at each revolution.	Turn selector switch to STAND BY and ask transmitting operator to send more phasing pulses.
	30	Starting to record.	Engage drum feed mechanism	Signal from transmitting station starts. Meter reading varies.	Check receiving transceiver (see part five).
	31	Stopping transceiver.	When no more signals are received, stop the transceiver.	Db meter shows no reading.	If all copy is not received, contact the transmitting operator and request retransmission.
	32	Photographic processing.	Process received copy	Good print or negative.	See par. 35.

f. FACSIMILE TRANSCEIVER TT–1(*)/TXC–1.

	Item No.	Item	Action or condition
STOP	33	Power switch	Turn power switch off.
	34	Scanning drum....	Clean drum if dirty; move drum to left to protect lead-screw threads from dirt.
	35	Photographic equipment.	Clean dark room.

PART THREE

MAINTENANCE INSTRUCTIONS

Section VI. PREVENTIVE MAINTENANCE

39. Description of Techniques

Preventive maintenance (PM) is work performed on equipment (when not in use) in order to minimize operational failures and the need for trouble shooting and repair. The operations described in this section are organizational maintenance operations and are performed by operators and repairmen.

a. TECHNIQUES. (1) The six basic maintenance operations and their specific application to Facsimile Set AN/TXC–1(*) are explained in this paragraph.

(2) The code word FITCAL is used to indicate the six basic operations.

F—Feel
I—Inspect
T—Tighten
C—Clean
A—Adjust
L—Lubricate

(3) The Feel (F) and Inspect (I) operations may show that other operations are needed. For instance, overheating of parts (discovered by feeling) may indicate the need for lubrication; looseness of screws (discovered by inspecting) may show the need of tightening and adjusting.

(4) Local conditions determine the kind and amount of PM required. For example, dust may filter into equipment; rapid changes in temperature, excessive dampness, or other extreme conditions of climate may cause corrosion of exposed parts and surfaces.

b. FEEL. Perform this operation as soon as possible after shut-down. Check the rotating machinery, bearings, motor, transformers, and electrical connections to see whether they are overheated. The operator and maintenance man must be so familiar with the normal operating temperatures of various components that they can detect overheating at once. An overheated part may require lubrication or other work. Always perform the Feel operation before any of the other FITCAL operations.

c. INSPECT. Inspection is an important part of the FITCAL operations. Know the equipment so thoroughly that signs of defective operation are immediately apparent. Look at all components. Note their color, placement, and state of cleanliness. Inspect for the following:

(1) *Overheating.* Look for discoloration, blistering, bulging of parts or surfaces of containers; leakage of insulating compounds; oxidation of metal contact surfaces. Learn to detect odors indicating overheating.

(2) *Placement.* See that all leads, cabling, and components are in their original positions.

(3) *Cleanliness.* Examine all recesses in the units for dust, especially between connecting terminals. See that parts, connections, and joints are free of dust, corrosion, and other foreign matter. In tropical and high humidity locations look for fungus growth and mildew.

(4) *Tightness.* Test connections and mountings which appear to be loose.

d. TIGHTEN, CLEAN, AND ADJUST. These operations are self-explanatory. Specific instructions for performing them are given wherever necessary.

Caution: Tighten screws, bolts, and nuts carefully. Pressure greater than that for which they were designed may damage or break them. After tightening loose connections, apply moistureproofing and fungiproofing varnish with a small brush.

e. LUBRICATE. This operation refers to the application of grease or oil to moving parts. For details see section VII.

40. Use of Dust Covers

When equipment is in use, dust covers should be removed, folded, and stored in a clean, dust-free place. When equipment is not in operation, dust covers should be placed over the transceiver and rectifier power unit to protect the equipment.

41. Exterior of Set

a. External Surfaces of Transceiver and Power Unit. (1) Inspect for loose fittings, loose mounting screws, rust, and corrosion.

(2) Tighten loose fittings and loose mounting screws.

(3) Clean the surfaces with a clean, dry cloth or a brush. If necessary to remove oil, grease, or other foreign matter, dampen the cloth slightly with solvent, dry cleaning (SD). Dry thoroughly with a cloth. Remove rust and corrosion with fine sandpaper (par. 135).

b. Cords, Cables, and Plugs. (1) Inspect for damaged insulation, loose connections, broken plugs, and corrosion.

(2) Tighten loose connections.

(3) Clean cables with a clean, dry cloth. If necessary, dampen the cloth slightly with solvent (SD). Dry thoroughly after cleaning. Remove rust and corrosion from plugs with #0000 sandpaper.

c. Controls and Switches. (1) Inspect for excessive play or looseness, cracks, broken parts, corrosion, and rust.

(2) Tighten loose control knobs and mounting screws.

(3) Clean with a clean, dry cloth and brush. If necessary to remove oil, grease, or gummy deposits, dampen the cloth slightly with solvent (SD). Dry thoroughly after cleaning.

d. Db Meter. (1) Inspect for broken glass and loose mounting screws, and with the set disconnected check to see that the needle indicates infinity.

(2) Tighten loose mounting screws.

(3) Clean glass with a dry cloth. If necessary to remove foreign matter, dampen the cloth slightly with water.

(4) Adjust the indicator to infinity by means of the adjusting screw. Take care not to force or turn the screw too far in either direction or the meter may be damaged.

e. Jacks and Binding Posts. (1) Inspect for loose mounting nuts, loose screws, rust, and corrosion.

(2) Tighten all loose nuts and screws.

(3) Clean with a clean, dry cloth and a small amount of metal polish. Clean the inside of the jack sleeves by wrapping the cloth around an orange stick. Remove all traces of metal polish with a clean, dry cloth.

f. Scanning Drum. (1) Because graphite is deposited on the drum during the direct recording process, the scanning drum becomes dirty. Therefore after any period of operation in RECORD DIRECT position, or if dust or grease has accumulated, inspect and clean the drum.

(2) Clean carbon deposits from the face of the drum with a clean cloth dampened with water. Use only enough water to moisten with cloth. Do not wet the lead screw or the adjacent surfaces. After cleaning, dry the drum thoroughly and polish it with a clean, dry cloth.

g. Stylus and Transmitter Lens. (1) Inspect for carbon dust and dirt.

(2) Clean stylus assembly with a soft bristle brush, taking care not to disturb its adjustment. With a soft brush, clean the transmitter lens adjacent to the stylus assembly. Polish the lens with lens-cleaning tissue.

h. Lead Screw, Drum Shaft, Keyway, and Guide Rail. (1) Inspect for loose mounting screws on guide rail and lead-screw bearing supports.

(2) Release the drum feed mechanism from the lead screw and push the drum to the left. Clean the drum shaft and keyway with a cloth dampened in solvent (SD). Wipe dry with a clean, lint-free cloth. Push the drum to the right, start the motor, and clean the lead-screw threads with a small stiff brush dipped in solvent (SD). Wipe dry with a clean, lint-free cloth. Clean the guide rail with a cloth dampened in the solvent. Wipe dry with a clean, lint-free cloth.

(3) Lubricate as outlined in paragraphs 63, 64, and 70.

i. Drum Feed Mechanism. Remove the four screws in the retaining ring (fig. 111) and slide the cam plate and retaining ring free of the feed mechanism, taking care not to drag the ring over the threads of the lead screw. Remove the half-nut retainer plug and slide the half-nut and spring from its holder. Clean the holder, half-nut, and spring with a small brush dipped in solvent (SD). Dry thoroughly with a clean, lint-free cloth. Remove and clean only one half-nut at a time so there will be no mistake in restoring it to the proper holder. Clean the cam plate with a cloth dampened with solvent (SD) and dry thoroughly with a clean, lint-free cloth. Reassemble in the reverse procedure of disassembly, taking care that the half-nut retaining plugs are flush with the outer edge of the holder. This provides proper tension for the spring and allows clearance for the drum cam plate.

42. Interior of Set

Remove the top cover of the transceiver by releasing the four fasteners. Remove the bottom plate by removing the retaining screws. Remove the top cover and the bottom plate of the power unit by removing the retaining screws.

a. The following instructions in this paragraph and in paragraphs 43 through 51, inclusive, apply to both the transceiver and the power unit wherever applicable.

b. Use a soft brush to remove dust and dirt from the plain surfaces of the equipment. When necessary, slightly dampen the cloth with solvent (SD) to remove other foreign matter. If the solvent is used, dry thoroughly with a clean, dry cloth.

Caution: Do not change the setting of any control. When cleaning jack and switch contacts, be careful not to bend the contact springs.

43. Tubes and Sockets

Note. Do not work on the tubes immediately after shutdown. Severe burns may result from contact with the envelopes of hot tubes. Use caution when removing tubes from sockets. Do not jar them. Put tubes in a safe place after removing them. Be sure to replace tubes in the identical sockets from which they were removed.

a. Inspect tube envelopes, bases, and sockets for dirt and corrosion. Tubes with loose envelopes should be replaced if possible. Inspect the firmness of tubes in their sockets. Make the inspection by pressing the tubes down in the sockets and testing them in that position, *not* by partially withdrawing the tubes and jiggling them from side to side. Movement of a tube weakens the pins in the base and unnecessarily spreads the contacts in the socket. Inspect the tube sockets for breaks and cracks at the time the tubes are removed.

b. Tighten all loose connections and mounting screws.

c. Clean the tubes. Remove dust and dirt from the envelopes with a clean, lint-free cloth. Use fine sandpaper to remove corrosion and oxidation from metal parts and connections.

Note. Replace power supply rectifier tube after 500 transmissions.

44. Capacitors

a. Inspect the terminals of large fixed capacitors for corrosion and loose connections. Carefully inspect the mountings to discover loose mounting screws, studs, or brackets. Examine the leads for poor insulation, cracks, and evidences of dry rot. Cut away frayed strands of insulation. If the wire is exposed, wrap it with friction tape. See that the terminals of the capacitors are not cracked or broken. Thoroughly inspect the case of each large capacitor for leaks, bulges, and discoloration.

b. Tighten loose terminals, mountings, and connections on the capacitors. Do not break the bushing or damage the gasket.

c. Clean the cases of fixed capacitors, the insulated bushings, and all connections that are dirty or corroded. Capacitor cases and bushings can usually be cleaned with a dry cloth. If the deposit of dirt is hard to remove, however, moisten the cloth in solvent (SD). Dry thoroughly after cleaning.

45. Resistors

Various types of resistors are used in this equipment. Connections are either of the pig-tail or solder-lug type.

a. Inspect the coating of the vitreous-enameled resistors for signs of cracks and chipping, especially at the ends. Examine the bodies of all types of resistors for blistering, discoloration, and other indications of overheating. Inspect leads and all other connections for corrosion, dirt, dust, looseness, and broken strands in the connecting wires. Check the security of all mountings. Do not attempt to move resistors with pig-tail connections, because there is danger of breaking the connections at the point where they enter the body of the resistor. Such defects cannot be repaired.

b. Tighten resistor connections and mountings whenever they are found loose. If a resistor is allowed to remain loose, vibration may break the connection or damage the body.

c. Clean all resistors with a small brush. The vitreous-enameled resistors must be kept clean to avoid leakage between the terminals. Wipe them with a dry cloth. However, if the dirt deposit is unusually hard to remove, dampen the cloth slightly with solvent (SD) and dry thoroughly. Resistors with discolored bodies cannot be cleaned. Discoloration indicates that there has been overloading and overheating at some time prior to the inspection. The discoloration is probably due to circuit trouble which requires analysis and correction.

46. Fuses and Clips

a. Fuses are easily removed for inspection. See that the fuse ends are kept clean and bright. If they are not, arcing and burning will occur and make

the replacement of the complete holder necessary. Inspect the fuse caps for evidence of burning, charring, and corrosion; the fuse clips for dirt, loose connections, and loss of tension.

b. The tension of the fuse clips may be increased by pressing the sides closer together. If necessary, use pliers to adjust the tension.

c. Clean fuse ends and fuse clips with crocus cloth; then wipe them with a clean cloth. When using a file to remove deep pits on the clips, fuse ends, or contacts, always finish up with crocus cloth to leave a smooth contact surface. As a final step, wipe the surface with a clean, dry cloth.

47. Switches

a. Inspect the mechanical action of each switch and, while so doing, look for signs of dirt or corrosion on all exposed elements. In some cases, it will be necessary to examine the elements of the switch visually; in others, the action of the switch is checked by flipping the control knob or toggle, or by pressing the switch button and noting the freedom of movement and amount of spring tension. Examine the ganged switches to see that the contacts are clean. Inspection is visual. Do not pry the leaves of the switch apart. The rotary members should make good contact with the stationary members; and as the former slide into the latter, a spreading of the stationary contact leaves should be visible. Switch action should be free. Wiping action of contacts usually removes dirt at the point of contact.

b. Tighten loose mounting screws and connections.

c. Clean the external surface of toggle switches with a dry brush or cloth. With a dry brush, clean dust and dirt from rotary, key, and push-button type switches. Clean contacts of key and push-button type switches with a burnishing tool. Avoid excessive use of the burnishing tool. Do *not* burnish contacts of rotary type switches, as they are silver-plated. A dark discoloration of the rotary switch contacts is usually a coating of silver oxide and is a satisfactory conductor.

48. Potentiometers

a. Inspect the mechanical condition of potentiometers. The arm should be keyed tightly to the shaft, and the shaft should turn easily in the bushing which supports it. Inspect the assembly and mounting screws, setscrews, and nuts. Examine the insulating body for dust, dirt, cracks, and chipped places. Examine all metallic parts for dust, dirt and corrosion.

b. Tighten loose assembly or mounting screws.

c. Clean the connections and exposed surface contacts of the potentiometers whenever they are dirty or corroded. Clean the body and exposed portions with a dry brush or cloth; remove corrosion and rust with fine sandpaper.

49. Terminal Blocks

a. Inspect terminal blocks for cracks, breakage, dirt, loose connections, and loose mounting screws. Carefully examine connections for mechanical defects, dirt, and corrosion.

b. Tighten loose screws, lugs, and mounting bolts. When tightening screws, be sure to select a screw driver of correct size. Do not exert too much pressure. Tighten all loose connections.

c. Clean terminal blocks with a dry brush. If necessary to remove foreign matter, slightly dampen the cloth with solvent (SD). Dry the block thoroughly.

50. Meters

Meters are delicate instruments and must be handled carefully. They require little maintenance. They are precision instruments and ordinarily cannot be repaired in the field.

a. Inspect the leads and connections to the meters. Look for loose, dirty, and corroded connections and for cracked or broken cover glasses. Since the movement of a meter is extremely delicate, its accuracy will be seriously affected if the glass is broken and dirt and water filter through.

b. Tighten all loose connections. Use care when tightening meter connections; careless handling can easily crack the meter case.

c. Meter cases can usually be cleaned with a dry cloth. If cleaning is difficult, dampen the cloth with solvent (SD). Clean dirty connections with a small brush dipped in the solvent, or with a small piece of cloth dipped in the solvent.

d. Meters M2 and M3 should indicate zero when the equipment is turned off. Before deciding that a meter needs readjusting, tap the meter case *lightly* with the tip of one finger. This will help the needle to overcome the slight friction which sometimes exists at the bearings and prevents an otherwise normal unit from coming to rest at zero. If adjustment is needed, insert the tip of a suitable screw driver into the slotted screw head located

below the meter glass and *slowly* turn the adjusting screw until the pointer is at zero. Lightly tap the meter case again and view the meter face and pointer *full on;* not from either side. Avoid turning the screw too far, because the needle may be bent or the hairspring damaged.

51. Power Transformer, Filter Chokes, and Audio Transformers

Since the power transformer, filter chokes, and audio transformers are of similar potted construction, preventive maintenance for them is similar.

a. As soon as possible after shut-down, feel these parts for abnormal heating which may indicate an overloaded condition or imminent failure due to moisture absorption or other causes.

b. Inspect power transformers, filter chokes, and audio transformers for signs of blistering, bulging, or leakage of potting compounds. Inspect for external signs of electrolytic action or corrosion.

c. Tighten all loose mounting bolts or screws, but not to the point that threads are destroyed.

d. Clean power transformers, filter chokes, and audio transformers with a dry cloth or brush. Be sure that no dirt, lint, thread, or foreign material is present between terminals. Dirt, lint, and thread absorb moisture which may provide a leakage path for high voltages between the terminals.

52. Optical System

a. Inspect lenses and lamps for dirt, dust, and oil. Lenses must be kept scrupulously clean to insure consistent operation of the equipment. Dust on lamps reduces their effective brilliance. Check to make sure that the lens assemblies are securely mounted.

b. Tighten mounting screws of lens assemblies. *Do not tighten adjusting screws.*

c. Clean lenses with lens paper or a very soft, clean, lint-free cloth. Do not use anything that may be abrasive, such as dirty rags. Moisten lens paper or a clean cloth with lens-cleaning fluid to wipe off fingerprints. Water or alcohol may be used if lens-cleaning fluid is not available. Avoid touching lamps with bare fingers. Be sure to clean off fingerprints before operating the equipment; otherwise, they will bake on.

d. Replace exciter lamp E1 after each 500 transmissions. Make no adjustment of lenses in the field unless absolutely necessary. Adjustments should be made only by qualified personnel. See paragraphs 123 and 124 for instructions.

53. Motor and Drive Unit

a. Inspect to see that mounting screws, connections, and motor parts are securely fastened.

b. Wipe inside and outside of the motor and clutch cover with a clean, dry cloth. If necessary, slightly dampen the cloth with solvent (SD). Be sure to dry thoroughly. Polish the clutch window. Clean external surfaces of motor and clutch unit with a dry cloth. For complete details of disassembly, cleaning, and lubrication, see section VII.

54. Coupling Coils

a. Inspect external surfaces for dirt and corrosion. See that cable connections are tight and that plugs and jacks fit together properly.

b. Clean housing, cable, and connections with a clean, dry cloth.

55. Photographic Equipment

a. Inspect all photographic equipment before use as well as at regular intervals.

(1) Inspect developer and hypo solutions for cleanliness. See that stoppers are in place and that they fit tightly.

(2) Inspect trays and tanks for corrosion, deterioration, dirt, or grease.

(3) Store stocks of photographic supplies in dry places not exposed to direct sunlight. Never remove outer wrappers until ready to use contents. Inspect these supplies to make sure that they are stored correctly to be ready for use when wanted.

b. Clean rust and corrosion from photographic trays with fine sandpaper or emery cloth. If the protective coating has worn off and the trays corrode, replace the trays if possible. In an emergency, corroded trays may be coated with paraffin or wax. Warm the tray, and flow on the paraffin or wax.

56. Tools and Materials

The following PM tools and materials may be secured through regular supply channels:

Item	*Signal Corps Stock No.*
BURNISHER: contact; pen type with pocket clip	6R41065C
BRUSH: cleaning; ½" wd x 5 27/32" lg	6Z1415
BRUSH: oval; sash; 1" x 9¾" lg; bristles 1¾" lg	6Z1566-1
SCREW DRIVER: 2½" blade, 5/32" tip, 5" over-all; w/2 blades; Starrett No. 552	6R15371

Item	Signal Corps stock No.
SCREW DRIVER TL–359/U: 6″ blade; 11¾″ lg over-all	6R16013
TUBE PULLER TL–201	6R7442
Expendable supplies	
ABRASIVE: crocus cloth; 9″ x 11″ sheet	6Z2000
BRUSH TL–72: camel's-hair; ½″ wd; flat	6Z1372
CARBON TETRACHLORIDE: technical grade; in 8-oz metal screwtop can	6G184
CLEANER: lens; Kodak; 1-oz bottle	8A819
CHEESECLOTH: bleached; lint-free; 36″ wd	6Z1989
LENS TISSUE: 3″ x 5″; in pads of 100 sheets	8A2559
ORANGE STICK: WECo No. KS–6320	6Z7360
PAPER: sand; flint; No. 0000	6Z500–0000
POLISH: metal; paste	6G1516
SOLVENT: dry-cleaning (SD); (QMC 51–S–4385); Fed spec No. P–S–661a.	

Note. Gasoline will not be used as a cleaning fluid for any purpose.

57. Preventive Maintenance Check List

The following checklist is a summary of the PM operations to be performed on Facsimile Set AN/TXC–1(*). The time intervals shown on the checklist may be reduced at any time by the local commander. For best performance of the equipment, perform operations at least as frequently as called for in the checklist. The last column indicates which operations are performed by operators and which are performed by maintenance personnel. Operations are indicated by the letters of the word FITCAL. For example, if the letters ITCA appear in the Operations column, the item to be treated must be Inspected (I), Tightened (T), Cleaned (C), and Adjusted (A).

Note. Where climatic conditions are extreme, increase the frequency of preventive maintenance procedures.

Item No.	Operations	Item	When performed		Performed
			Daily	Weekly	
1	ITC	External surfaces of transceiver and power unit.	X	.....	O
2	ITC	Cords, cables, and plugs	X	.....	O
3	ITC	Controls and switches	X	.....	O
4	ITCA	Db meter	X	.....	O
5	ITC	Jacks and binding posts	X	.....	O
6	IC	Scanning drum	X	.....	O
7	IC	Stylus and transmitter lens	X	.....	O
8	ICL	Lead screw, drum shaft, keyway, and guide rail.	X	.....	O
9	IC	Drum feed mechanism	.....	X	M
10	IC	Internal surfaces of transceiver and power unit.	.....	X	M
11	ITC	Tubes and sockets	.....	X	M
12	ITC	Capacitors	.....	X	M
13	ITC	Resistors	.....	X	M
14	ITC	Fuses and clips	.....	X	M
15	ITC	Switches	.....	X	M
16	ITC	Potentiometers	.....	X	M
17	ITC	Terminal blocks	.....	X	M
18	ITCA	Meters	.....	X	M
19	FITC	Power transformer, filter chokes, and audio transformers.	.....	X	M
20	ITC	Optical system	.....	X	M
21	ITCL	Motor and drive unit	.....	X	M
22	ITC	Coupling coils	X	.....	O
23	IC	Photographic equipment	X	.....	O

F	I	T	C	A	L
Feel	Inspect	Tighten	Clean	Adjust	Lubricate

Note. X indicates when operations are to be performed, O indicates operator, and M indicates maintenance personnel.

Section VII. LUBRICATION

58. Department of the Army Lubrication Orders

Department of the Army Lubrication Orders (DALO's) are illustrated, numbered, and dated cards or decalcomania labels which prescribe approved organizational lubrication instructions for mechanical equipment which requires lubrication by using organizations. Current DALO's which are available are listed in the latest issue of FM 21–6. Lubrication orders should be requisitioned in conformance with instructions and lists in FM 21–6.

59. Compliance with Department of the Army Lubrication Orders

Instructions contained in DALO's are mandatory and supersede all conflicting lubrication instructions of an earlier date. Applicable DALO's which are available will be obtained, carried with the equipment at all times, and fully complied with. Difficulties experienced in obtaining and complying with such orders will be reported through technical channels.

60. Location of Department of the Army Lubrication Order

The DALO for Facsimile Set AN/TXC–1(*) (when published) will be located on the top side of the chassis base of Facsimile Transceiver TT–1(*)/TXC–1, right-hand side, under the lead-screw shaft.

61. Approved Lubricants for Facsimile Set AN/TXC–1(*)

The following table lists the lubricating materials necessary in servicing Facsimile Set AN/TXC–1(*).

Symbol	Standard nomenclature
PL–SPECIAL	OIL, lubricating, preservative, special.
GL	GREASE, lubricating, special.
OCW	OIL, clock and watch.

62. Cleaning

Before applying lubricants to any parts, clean the parts thoroughly, making sure that they are free from dirt, dust, corrosion, and old lubricants. The following paragraphs outline the methods, procedures, and materials to be used in cleaning the equipment preparatory to lubrication. The instructions are applicable in common to Facsimile Sets AN/TXC–1, –1A, and –1B unless otherwise noted. For additional information on cleaning, see section VI on preventive maintenance.

63. Lead Screw, Guide Rail, Drum Shaft, and Keyway (Items 1, 2, and 3)

Disassembly is not required for cleaning and lubricating the lead screw, guide rail, drum shaft, and keyway. Thoroughly clean these parts as outlined in paragraph 41*h*. Lubricate as outlined in the chart (par. 70).

64. Secondary Clutch (Item 4)

No parts need be removed or any adjustments disturbed to clean the dog latch cam plate. Clean the cam plate with a lint-free cloth dampened in solvent (SD). Any portion not readily accessible can be cleaned by covering an orangewood stick with the cloth. Dry thoroughly with a lint-free cloth, and lubricate according to the chart (par. 70).

65. Motor Worm and Gear (Item 5)

Clean the motor worm and gear with a lint-free cloth dampened with solvent (SD). Clean in between the teeth by covering an orangewood stick or equivalent with the dampened cloth and running it between the teeth. Dry with a lint-free cloth, and lubricate according to the chart (par. 70). To perform this operation on Facsimile Set AN/TXC–1B, first remove the gearcase cover.

66. Clutch (Items 6, 7, 8, and 9)

Disassembly of the clutch for cleaning should be performed only by qualified personnel. Organizational personnel should clean the external surfaces of the clutch daily with a lint-free cloth slightly dampened in solvent (SD). Dry thoroughly with a dry lint-free cloth. Lubricate the clutch in accordance with the chart in paragraph 70. Clean the clutch internally every 3 months. Refer to figure 110 for location of parts, and use the following procedure to disassemble the clutch for cleaning:

a. Remove the motor from its mountings (par. 69) and place it in a convenient position for working on the clutch.

b. Remove the three screws P (fig. 110) from the secondary clutch bearing N, being careful not to lose the pressure springs O.

c. Remove the secondary clutch bearing N and secondary clutch ring Q.

d. Remove the three flathead screws K from the retainer H.

e. The remaining retainers and plates will slide free. It will not be necessary to remove the hub for cleaning purposes; the hub can be cleaned while on the drive shaft.

f. Thoroughly clean all parts with a clean, lint-free cloth dampened in solvent (SD). Thoroughly dry with a clean, lint-free cloth.

g. Lubricate the rings in accordance with the chart in paragraph 70 and reassemble in the reverse order of disassembly.

h. Run the motor for a few minutes with the clutch stop arm stopped. Wipe off excess oil and adjust tension of both primary and secondary clutches (par. 120). Run the motor at least 15 minutes with the clutch locked up. Again measure the tension of both clutches. If the tension of the clutches is not stabilized, repeat adjustments and running-in process.

67. Drive Shaft Bearings (Item 10)

a. Equipment with Sealed Bearings. Disassembly of equipment using sealed bearings (later models) is not required for lubrication. Place 1 or 2 drops of oil (PL–SPECIAL) on the drive shaft and casing, wipe off the excess.

b. Equipment with Unsealed Bearings. Disassembly of the drive shaft of equipment using unsealed bearings (earlier models) should be performed only by qualified personnel. Disassemble as follows:

(1) Remove the motor from its mounting posts (par. 69).

(2) Remove the clutch from the shaft (par. 66).

(3) Remove the retainer plate from the clutch end of the shaft and the thrust plate from the other end of the shaft.

(4) The shaft and bearings will slide free of the motor casing. Do not remove the gear from the shaft.

(5) Clean the bearings and shaft by flushing or immersion in solvent (SD). Dry throughly with a clean, lint-free cloth. Use air pressure, if available, to dry the interior of the bearings.

(6) Repack the bearings with grease (GL) in accordance with the chart in paragraph 70 and wipe off the excess.

(7) Reassemble in the reverse procedure to disassembly, and make proper adjustments.

68. Lead-Screw Bearings (Item 11)

a. Equipment with Sealed Bearings. Disassembly of equipment with sealed bearings (later models) is not required for lubrication. Place 1 or 2 drops of oil (PL–SPECIAL) on the shaft and casing, and wipe off the excess.

b. Equipment with Unsealed Bearings. Disassembly of the lead screw of equipment using unsealed bearings (earlier models) should be performed only by qualified personnel. Disassemble as follows:

(1) Remove the mounting screws that secure the bearing brackets to the chassis base.

(2) Rotate the drum so that the clutch dog trip arm and dog latch are in a horizontal position with relation to the chassis base. Release the secondary clutch dog latch.

(3) Lift the entire lead screw and drum assembly clear of the chassis. Be careful not to damage the lead-screw threads or to bend the shaft. Place the assembly on a suitable bench for the balance of the cleaning operation.

(4) Loosen the setscrew that secures the dog trip arm assembly to the lead-screw shaft and remove the dog trip arm assembly from the shaft.

(5) Slide the bearing assemblies free of the shaft, remove the retaining plates, and clean the the assemblies by flushing or immersion in solvent (SD). The bearings need not be removed from the mounting brackets for this operation.

(6) Dry with a clean, lint-free cloth. Use air pressure, if available, to dry the interior of the bearing. Repack the bearings with grease (GL) as outlined in the chart in paragraph 70 and wipe off all excess grease.

(7) Reassemble in the reverse procedure of disassembly. Check all adjustments.

Note. When the dog trip arm assembly is finally positioned on the lead-screw shaft, the secondary clutch dog latch should be in line with the keyway in the lead-screw shaft.

69. Motor (Item 12)

Motors used in Facsimile Sets AN/TXC–1 and –1A use brushes on the starting motor and require cleaning and lubrication quarterly. Motors used in Facsimile Set AN/TXC–1B have no brushes and require cleaning and lubrication semiannually.

a. Motors in Facsimile Sets AN/TXC–1 and –1A. The following instructions are applicable to the motors which use brushes:

(1) *Disassembly.* Disassemble as follows:

(*a*) Remove the four screws securing the motor to the mounting posts.

(*b*) If care is taken not to put any undue strain on the connecting leads, they need not be unsoldered.

(*c*) Remove the four screws that secure the bottom bell to the motor case and carefully remove the bell. Be careful not to lose the thrust ball.

(*d*) Carefully withdraw the rotor, rotating it in a counterclockwise direction as it is being withdrawn.

(2) *Cleaning.* Clean as follows:

(*a*) Clean the exterior of the motor with a dry, clean cloth. If necessary, slightly dampen the cloth with solvent (SD), but be careful not to get any of the solvent on the coils or windings. Dry all parts thoroughly after using the solvent. Carefully clean the interior with a lint-free cloth and a clean, dry soft-bristle brush. Clean the accumulated dirt, carbon dust, and grease from the coils and high-voltage terminals, being careful to clean the portions under the terminals. Also clean the upper end bell.

(*b*) Clean the commutator with a clean, dry cloth. If necessary, the commutator can be polished with a piece of crocus cloth or rubber eraser. Do not use emery cloth or sandpaper. Clean dirt, grease, and metallic particles from the spaces between the segments of the commutator. If the surface of the commutator is dark in color, smooth, and highly polished, and the commutation is satisfactory, the commutator surface should be left alone. This condition should not be mistaken for a burned condition.

(*c*) Clean the brushes with a clean, lint-free cloth.

(*d*) Clean the upper motor bearing with a cloth dampened in solvent (SD).

(*e*) Clean the lower bearing with the solvent.

(3) *Lubrication.* Lubricate the bearings in accordance with the chart (par. 70). Before reassembling the motor, coat the bearing with a light film of grease. Between cleaning periods lubricate by applying one or two drops of oil to the top bearing without disassembling the motor. The amount of oil and the frequency of application will depend largely on operating conditions. Take care not to overlubricate, as excessive oiling will cause gum to form on the commutator.

(4) *Reassembly.* Reassemble the motor by reversing the disassembly procedure. Check for proper alinement with the lead screw.

b. Motor in Facsimile Set AN/TXC–1B. Instructions for the brushless motor in Facsimile Set AN/TXC–1B are similar to those above, with the exception that instructions concerning brushes and commutator do not apply.

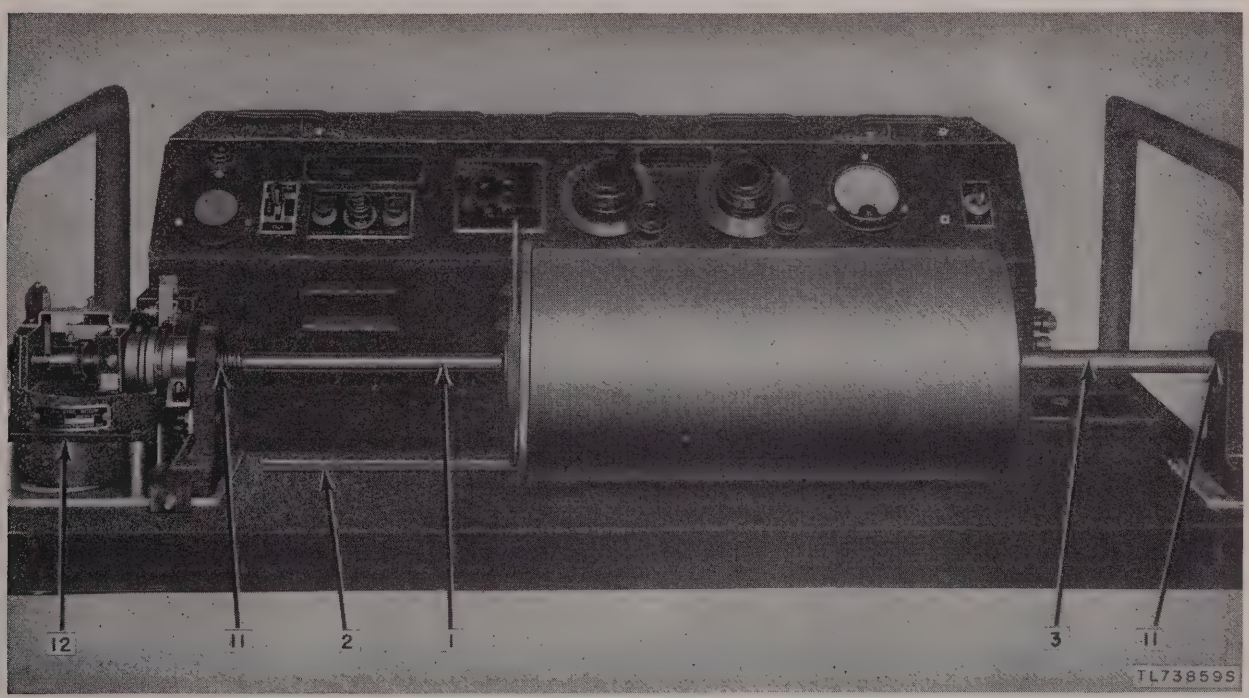


Figure 31. Lubrication points, Facsimile Transceiver TT–1(*)/TXC–1.

70. Lubrication Chart

a. General. Follow the lubrication chart below in applying lubricants after the cleaning outlined in previous paragraphs of this section has been completed. Use the chart with figures 31 and 32, which show the location of lubrication points by item number as listed in the chart.

b. Time Intervals. The lubrication chart is based on 8-hour normal use daily. When the equipment is in use more than 8 hours daily or is used in tropical climates, it should be lubricated more often. Items 4 through 12 especially should be lubricated more frequently under conditions of increased use or adverse climate. For example, if the equipment is in use 16 to 20 hours daily, the interval should be cut in half. In tropical climates the lubrication periods can best be determined by frequent inspection of *all* lubrication points. In tropical climates the interval between lubrication periods should be half or less than in temperate climates.

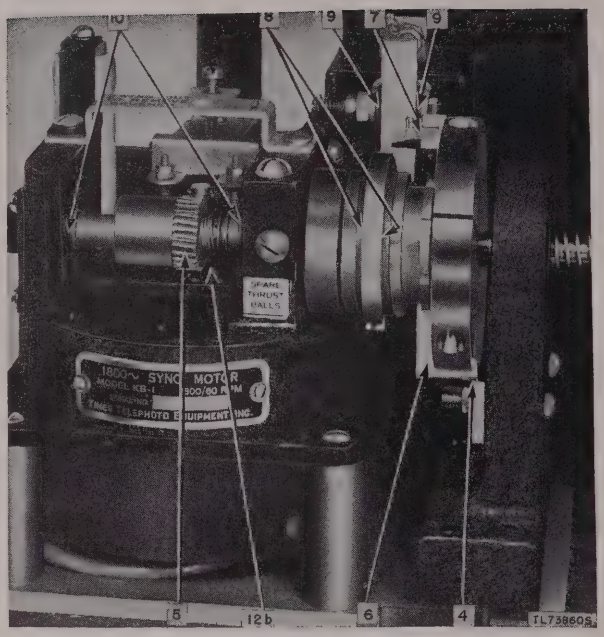


Figure 32. Lubrication points, Facsimile Transceiver TT–1(*)/TXC–1.

c. Lubrication Chart (figs. 31 and 32).

Item No.	Lubrication Point	Lubricant	Amount	Interval	Performed by*	
1	Lead screw	PL–SPECIAL	Thin film	Daily	Org	O
2	Guide rail	PL–SPECIAL	Thin film	Daily	Org	O
3	Drum shaft and keyway	PL–SPECIAL	Thin film	Daily	Org	O
4	Secondary clutch dog latch cam plate.	GL	Thin film	Weekly	Org	M
5	Motor worm and gear	GL	Thin film	Weekly	Org	M
6	Secondary clutch dog latch pivot	PL–SPECIAL	1 drop	Monthly	Org	M
7	Dog trip arm pivot	PL–SPECIAL	1 drop	Monthly	Org	M
8	Clutch rings	OCW	1 or 2 drops	Monthly	Org	M
9	Phase magnet armature pivots	OCW	½ drop	Semi-annually	Org	M
10	Drive shaft bearings:					
	a. Sealed bearings	PL–SPECIAL	1 or 2 drops	Semi-annually	Field	M
	b. Unsealed bearings	GL	Pack	Semi-annually	Field	M
11	Lead-screw bearings:					
	a. Sealed bearings	PL–SPECIAL	1 or 2 drops	Semi-annually	Field	M
	b. Unsealed bearings	GL	Pack	Semi-annually	Field	M
12	Motor bearings:					
	a. AN/TXC–1 and –1A, top and bottom bearings.	GL	Thin film (par. 69)	Quarterly	Field	M
	b. AN/TXC–1 and –1A, top bearing (no disassembly required).	PL–SPECIAL	1 or 2 drops (par. 69)	Monthly	Org	M
	c. AN/TXC–1B	PL–SPECIAL	1 or 2 drops	Semi-annually	Field	M
	d. Synchronous rotor bearing	OCW	1 or 2 drops	Semi-annually	Field	M

*Org indicates organizational maintenance.
M indicates maintenance personnel.
O indicates operator.

Section VIII. WEATHERPROOFING

71. General

Signal Corps equipment, when operated under the severe climatic conditions which prevail in the tropical, Arctic, or desert regions, requires special treatment and maintenance.

72. Tropicalization

Because fungus growth, insects, corrosion, salt spray, and excessive moisture affect most materials harmfully, a special moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. Refer to TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment, for a detailed description of the varnish-spray method of moistureproofing and fungiproofing and the supplies and equipment required in this treatment. The following problems may be encountered:

a. Resistors, capacitors, coils, chokes, transformer windings, etc., fail because of the effects of fungus growth and excessive moisture.

b. Electrolytic action, often visible in the form of corrosion, takes place in resistors, coils, chokes, transformer windings, etc., causing eventual breakdown.

c. Hook-up wire insulation and cable insulation break down. Fungus growth accelerates deterioration.

d. Moisture forms electrical paths on terminal boards and insulating strips, causing flash-overs and crosstalk.

73. Moistureproofing and Fungiproofing Facsimile Transceiver TT–1(*)/TXC–1

a. PREPARATION. Make all repairs and adjustments necessary for proper operation of the equipment.

b. DISASSEMBLY. (1) Remove the top and bottom covers of the unit.

(2) Slide the drum to the extreme left end of the lead screw and engage the drum feed mechanism to the lead screw by pulling the engaging lever forward. This protects the lead-screw threads from damage during treatment.

(3) Remove the four screws holding the fork oscillator assembly. Do not remove any wires.

c. CLEANING. Clean all dirt, dust, rust, and fungus from the equipment. Clean all oil and grease from the surfaces to be varnished.

d. MASKING. Mask the following items (figs. 33 and 34):

(1) Jones plug receptacle and the MOTOR JACK.

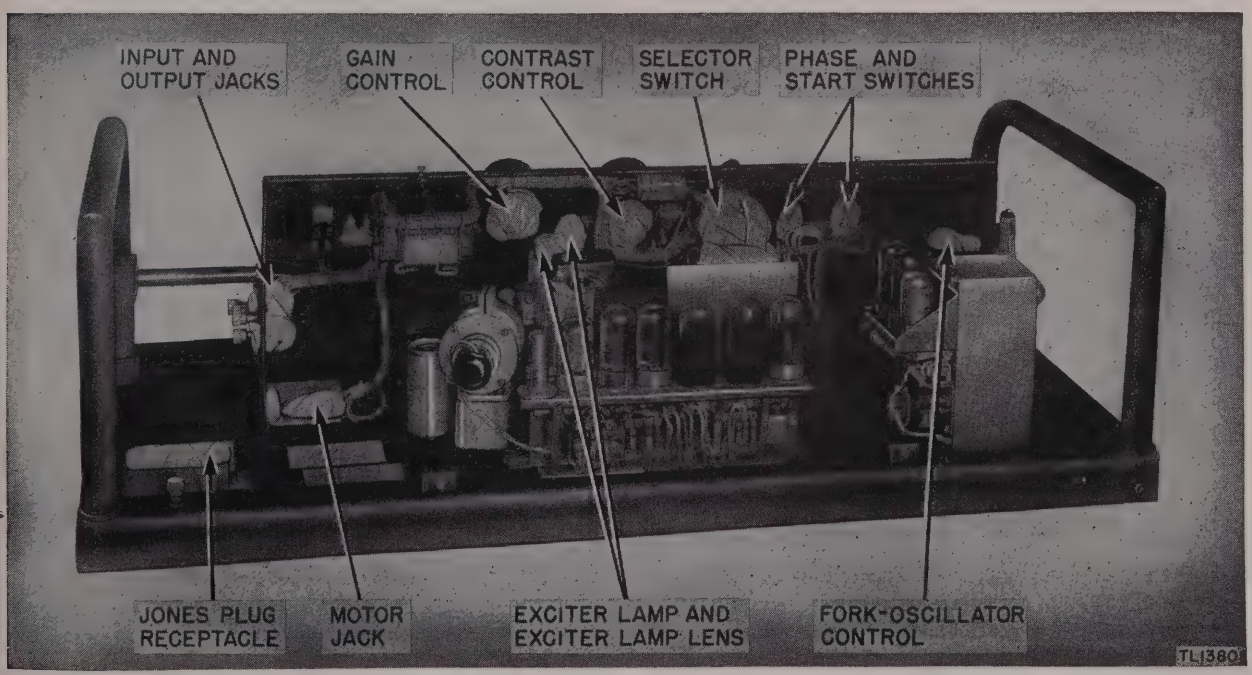


Figure 33. Masking top of chassis, Facsimile Transceiver TT–1/TXC–1.

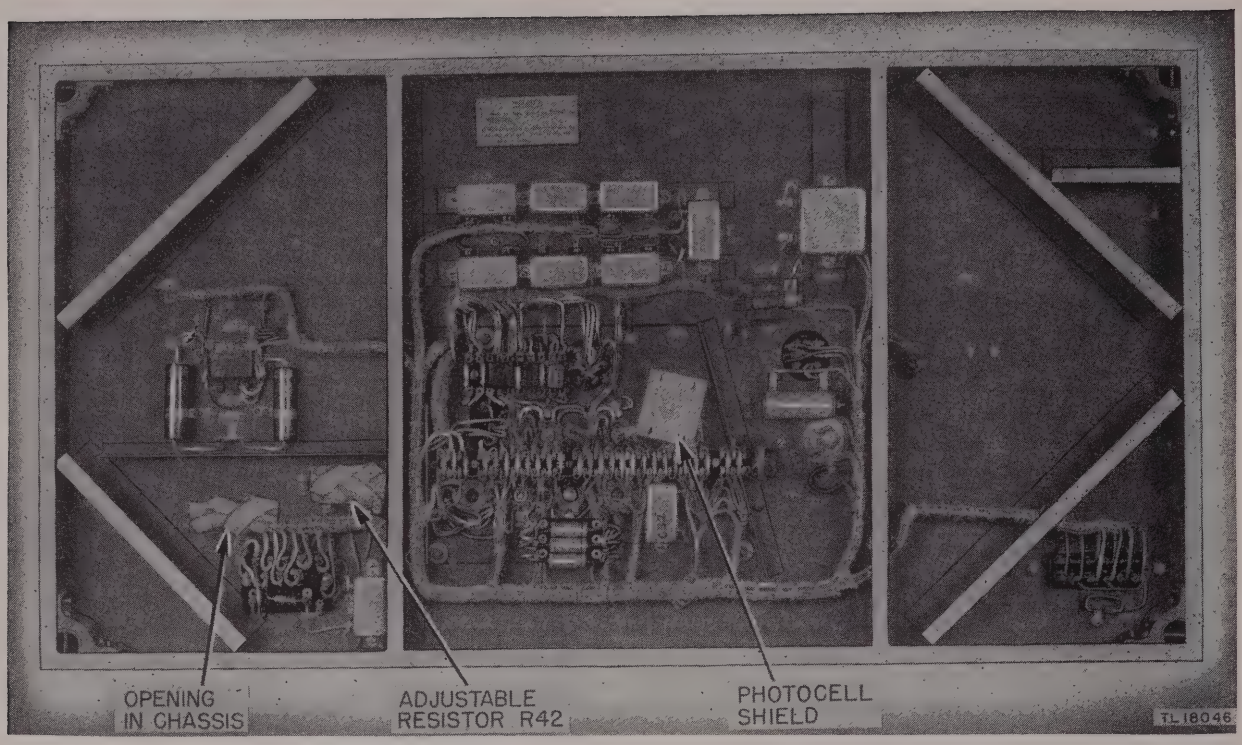


Figure 34. Masking bottom of chassis, Facsimile Transceiver TT–1/TXC–1.

(2) Input and output jacks.

(3) Optical system (photocell lens, exciter lamp and exciter lamp lens, and recorder lens). To avoid damage to the optical system, cover all parts with soft cloths or lens paper before masking.

(4) CONTRAST and GAIN controls.

(5) PHASE and START switches and the selector switch.

(6) Fork oscillator frequency control.

(7) STANDBY-MON-TALK switch (Facsimile Transceivers TT–1A/TXC–1 and TT–1B/TXC–1 only).

(8) Speaker jack (Facsimile Transceiver TT–1A/TXC–1 when modified, and TT–1B/TXC–1 only).

(9) Potentiometer R42.

(10) Opening in bottom of chassis below fork oscillator unit.

(11) All transformer terminals and all sockets.

e. Drying. Place the equipment in an oven or under heat lamps and dry for 2 to 3 hours at 140°F. *Do not exceed* 140°F on this equipment.

f. Varnishing. (1) Apply three coats of moistureproofing and fungiproofing varnish (Lacquer, Fungus-Resistant, spec. No. 71–2202 (stock No. 6G1005.3) or equal). Allow each coat to dry for 15 or 20 minutes before applying the next coat.

(2) Apply varnish immediately after the equipment is dried. If the equipment is not varnished immediately, moisture condenses on the equipment. Varnish applied over moisture peels off readily after the varnish has dried.

(3) Treat the bottom of the chassis with spray or brush.

(4) After the bottom of chassis has been treated, remove the photocell shield and treat the photocell connections with a brush.

(5) Treat the top of the chassis with a brush.

(6) Treat the fork oscillator unit with a brush.

(7) After removing the masking, treat solder joints with a brush.

(8) Do not attempt to treat the selector switch, STANDBY-MON-TALK switch, motor, clutch, magnet, relay, gears, or moving parts.

Caution: Varnish spray may have poisonous effects if inhaled. To avoid inhaling spray, use a respirator if available; otherwise fasten cheesecloth or other cloth material over nose and mouth. Never spray varnish or lacquer near an open flame. Do not smoke in a room where varnish or lacquer is being sprayed. The spray may be highly explosive.

g. REASSEMBLY. (1) Remove all masking tape, being careful not to peel varnish from nearby areas.

(2) Before making any tests, allow the equipment to stand idle for 24 to 36 hours.

(3) Reassemble the unit and test its operation.

h. MARKING. Mark the letters MFP and the date of treatment near the nameplate on the front panel above the START and PHASE switches.

Example: MFP—5 July 1947.

74. Moistureproofing and Fungiproofing Rectifier Power Unit PP–86(*)TXC–1

Follow the general directions given for testing Facsimile Transceiver TT–1(*)/TXC–1, with the following exceptions:

a. Remove Tube JAN–5Z3(V22) from its socket.

b. Mask the rectifier tube socket (top and bottom) and the exciter lamp control, R15 (fig. 35).

c. Carefully spray the entire chassis.

d. Mark the letters MFP and date of treatment near the nameplate on the side of the chassis.

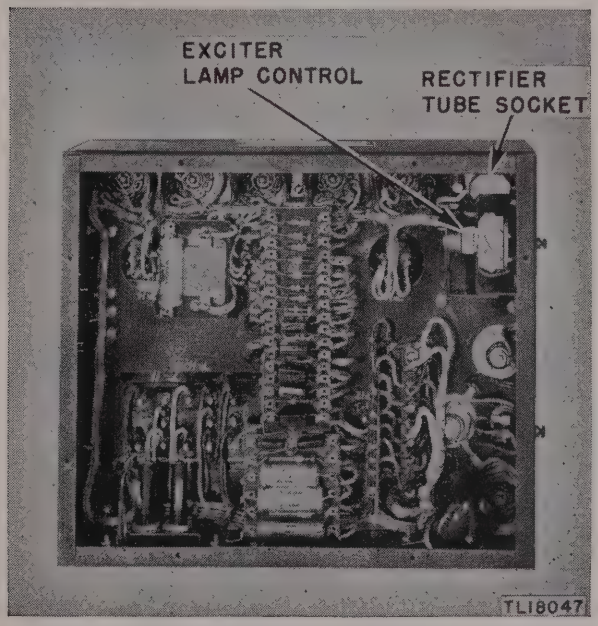


Figure 35. Masking bottom of chassis, Rectifier Power Unit PP–86/TXC–1.

75. Moistureproofing and Fungiproofing After Repairs

If the coating of protective varnish has been punctured or broken during repair and if a complete treatment is not needed to reseal the equipment, apply a brush coat to the affected part. Be sure the break is completely sealed.

76. Winterization

Special precautions are necessary to prevent poor performance or total operational failure of equipment in subzero temperatures. Most signal equipment can be used in winter if difficulties common in low temperatures are anticipated and precautions taken to prevent them. For operation purposes, place equipment in heated rooms whenever possible. Wrap the equipment in blankets when on the march to protect it from winds and freezing temperatures. Refer to TB SIG 66, Winter Maintenance of Signal Equipment, for complete information The following problems may be encountered:

a. Steel shrinks and becomes brittle in subzero temperatures.

b. Glass is especially susceptible to sudden temperature changes. The difference between a low air temperature and the warmth of a man's breath may be sufficient to shatter a lens.

c. Prewar rubber resists cold weather well, but certain types of synthetic rubber are unreliable and become brittle.

d. Canvas freezes and loses its pliability in cold weather.

e. Lubricants become stiff, causing drag and also causing moving parts to stick. Refer to section VII for detailed lubrication instructions.

77. Dustproofing

Signal Corps equipment operated in desert localities is affected by the extremely high temperatures and the amount of dirt, dust, sand, and other foreign matter in the air. Take care to keep such elements from filtering into lubricated parts. Cover the equipment when it is not in use. Thorough cleanliness is imperative. Instead of merely adding new lubricants at regular intervals, whenever practicable, clean and lubricate all moving parts. If possible, inspect and clean the equipment daily. In any case, inspect the air filters and similar protective devices every day and clean them whenever necessary. Refer to TB SIG 75, Desert Maintenance of Ground Signal Equipment. Some of the problems encountered are the following:

a. Lubricants become thin and drain from moving metal and fiber parts rapidly. Refer to section VII for detailed lubrication instructions.

b. Foreign matter, such as dirt, dust, and sand, acts as an abrasive causing excessive wear, clogging air cleaners, and impeding the flow of air.

PART FOUR

AUXILIARY EQUIPMENT

Section IX. CONVERTER CV–2(*)/TX

78. Converter CV–2(*)/TX

Converter CV–2(*)/TX (fig. 36) is an electronic device which is used between the facsimile transceiver and the radio circuit in transmission and reception of facsimile signals by the subcarrier f-m method. When transmitting, the converter changes 1,800-cycle a-m signals from the facsimile transceiver into frequency-modulated voice-frequency signals which modulate a conventional radiophone transmitter (fig. 37). The transmitted radio signal consists of a radio-frequency carrier on which is superimposed a constant-level audio-frequency (a-f) modulation. The frequency of the a-f modulation is varied in accordance with the facsimile signals. When receiving, the radio signal is picked up by a conventional communication receiver. The receiver output, which is fed into the converter, consists of

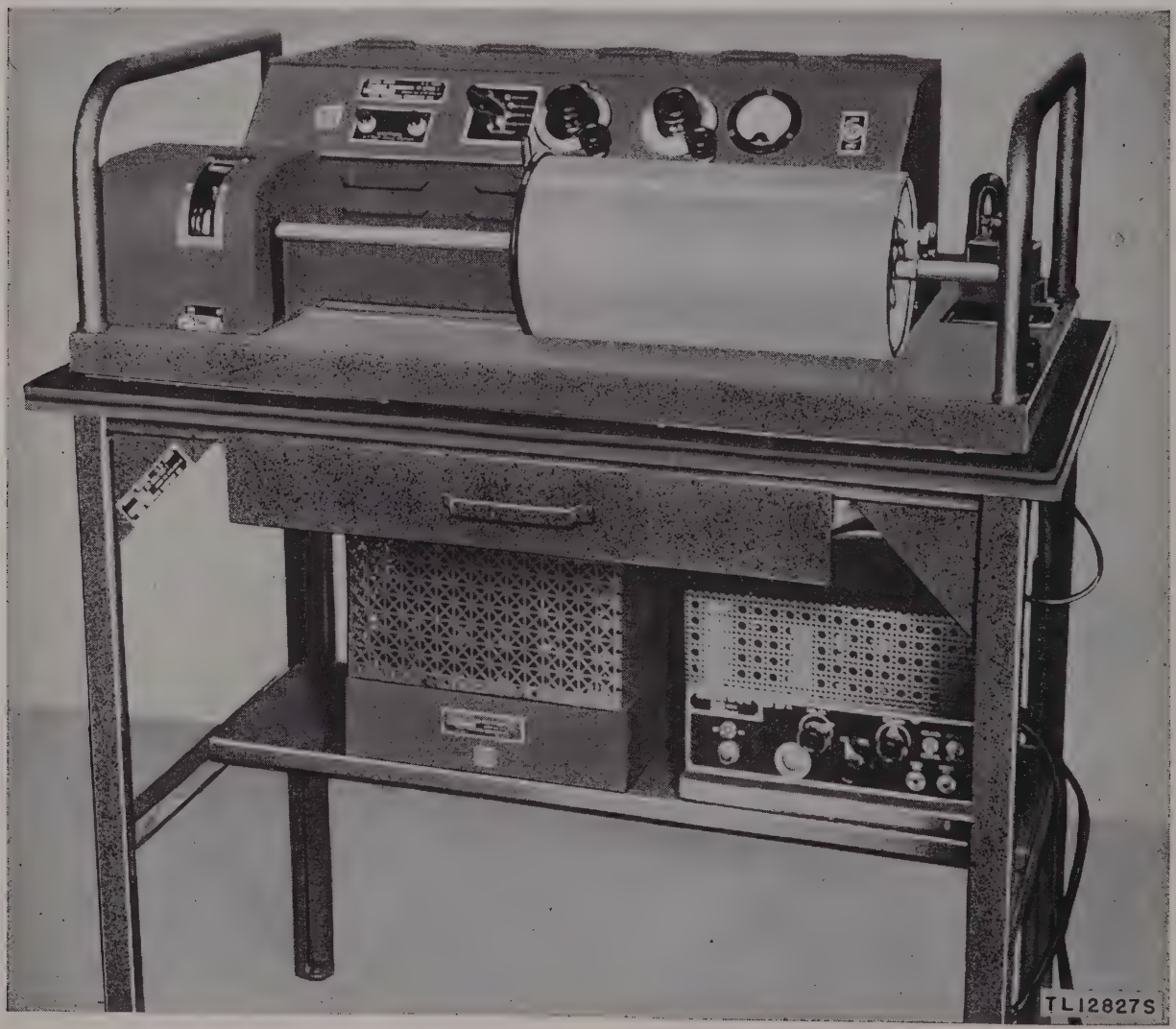


Figure 36. Converter CV–2/TX, lower right, in use with Facsimile Transceiver TT–1/TXC–1.

frequency-modulated voice-frequency signals. The converter changes these signals into amplitude-modulated signals which are fed to the receiving facsimile transceiver. Transmissions using subcarrier fm are less subject to fading and interference than transmissions using conventional am. Complete information on Converter CV–2(*)/TX is contained in TM 11–2252 and TM11–4021. A schematic diagram is hown in figure 38 of this manual.

Note. When Converter CV–2(*)/TX is used in a radio facsimile circuit, the talk-back circuit of the facsimile transceiver is inoperative. However, a carbon microphone and a radio headset may be plugged into the converter to permit voice communication and transmitter control.

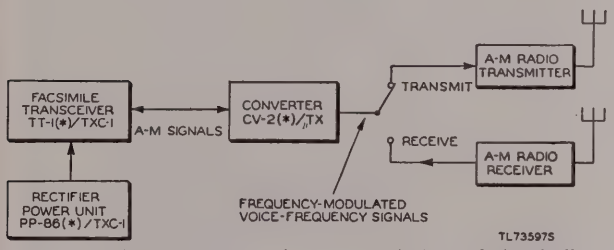


Figure 37. Subcarrier f-m transmission of facsimile signals, block diagram.

Section X. EXCITER UNIT 0–5/FR

79. Description

Exciter Unit 0–5/FR (fig. 39) is an electronic device which uses the principle of frequency shift to obtain the mark and space characters for radioteletype operation. After minor changes have been made in the circuit (fig. 41), the exciter unit can be used with Converter CV–2(*)/TX to permit transmission of carrier shift facsimile signals over a continuous-wave radiotelegraph transmitter when using Facsimile Set AN/TXC–1(*). Complete information on Exciter Unit 0–5/FR is contained in TM 11–2205. A schematic diagram is shown in figure 42 of this manual.

80. Application

Figure 40 is a block diagram which shows how Converter CV–2(*)/TX and Exciter Unit 0–5/FR are used in carrier shift transmission of facsimile signals, and how Converter CV–2(*)/TX and Frequency Meter BC–221 are used in reception of carrier-shift facsimile signals.

a. Transmitting. When transmitting, the 1,800-cycle a-m signals from Facsimile Transceiver TT–1(*)/TXC–1 are fed into Converter CV–2(*)/TX, where they are rectified. A special connection to the converter permits taking its output in the form of a varying d-c signal representing the envelope of the modulated 1,800-cycle carrier. This varying d-c signal is applied through a special input connection to the oscillator control tube in Exciter Unit 0–5/FR. The output of the exciter unit is a frequency-modulated r-f signal, which serves as the radio-frequency excitation for the continuous-wave transmitter. The transmitter output is a narrow-band f-m signal, swinging a total of 1,200 cycles, 600 cycles above and 600 cycles below the assigned radio carrier frequency. Carrier-shift transmissions are advantageous because they are less subject to fading and interference than transmissions using conventional arm, and in addition the r-f channel width required is less than that when subcarrier fm is used.

b. Receiving. When receiving carrier-shift facsimile signals, the conventional communications receiver picks up the f-m radio signal, and also a constant-frequency r-f signal applied to its input from Frequency Meter BC–221. The two signals beat together in the receiver to produce an output at audio frequencies swinging from 1,800 to 3,000 cps. These frequency-modulated voice-frequency signals are applied to the conventional input circuit of Converter CV–2(*)/TX, which converts them into amplitude-modulated audio-frequency signals which are fed to the input of the receiving facsimile transceiver.

81. Operation

After circuit changes shown in figure 41 have been made and the equipments have been interconnected as shown in figure 40, the following operating instructions apply. An a-f oscillator with outputs at 1,200 cps, 1,800 cps, and 3,000 cps is required. A direct-reading audio-frequency meter such as Hewlett-Packard electronic frequency meter type 500A is helpful.

Note. Allow at least a ½-hour warm-up period for stabilization of Frequency Meter BC–221 and Exciter Unit 0–5/FR before making operating adjustments.

a. Transmitting. Negative transmission of facsimile copy is preferable, although copy may be transmitted either negative or positive. The controls of the facsimile transceiver are used in their normal manner to select either positive or negative transmission as required. In either case, adjust the system so that a *minimum* amplitude signal output from

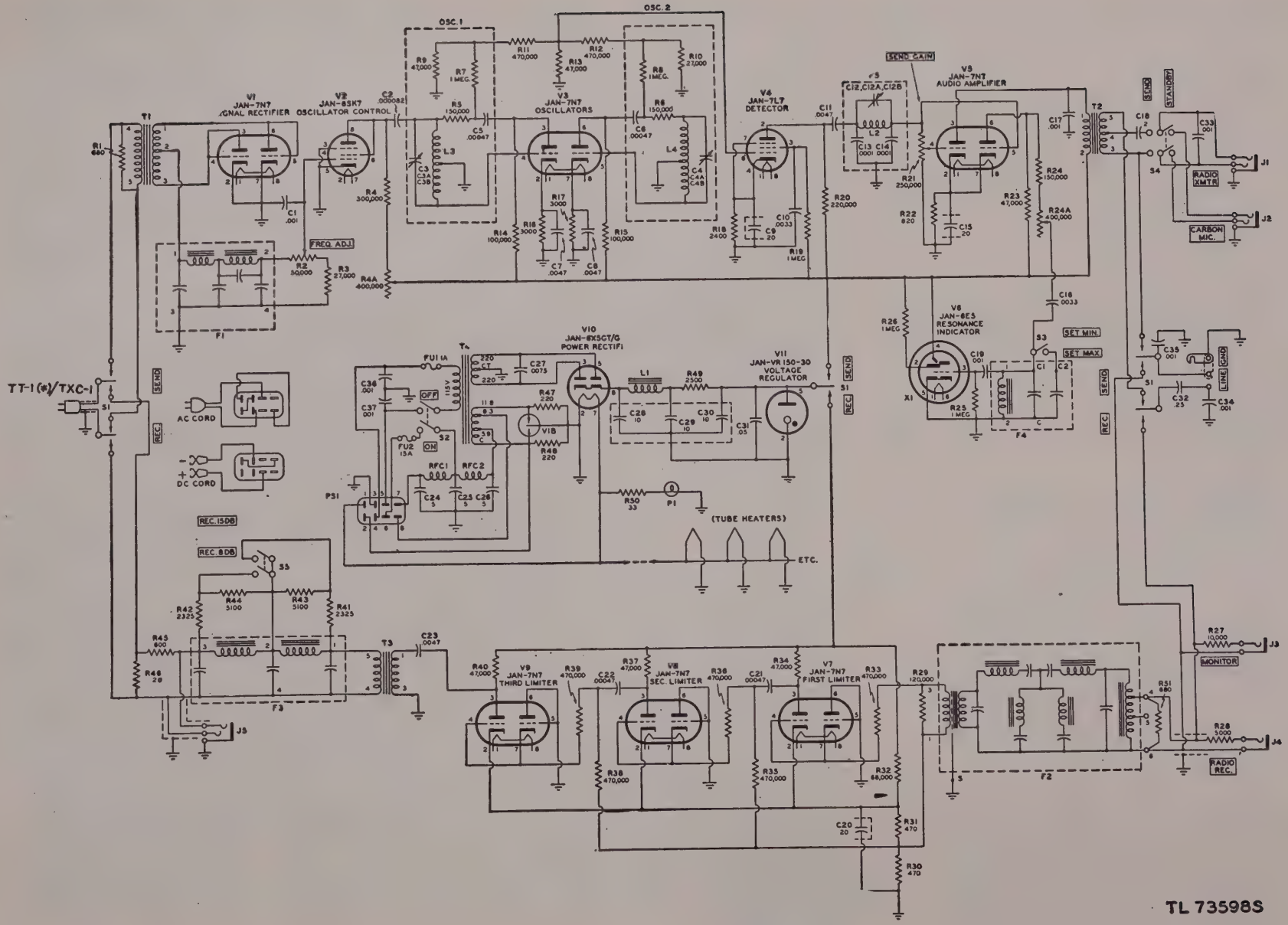


Figure 38. Converter CV-2A/TX, schematic diagram.

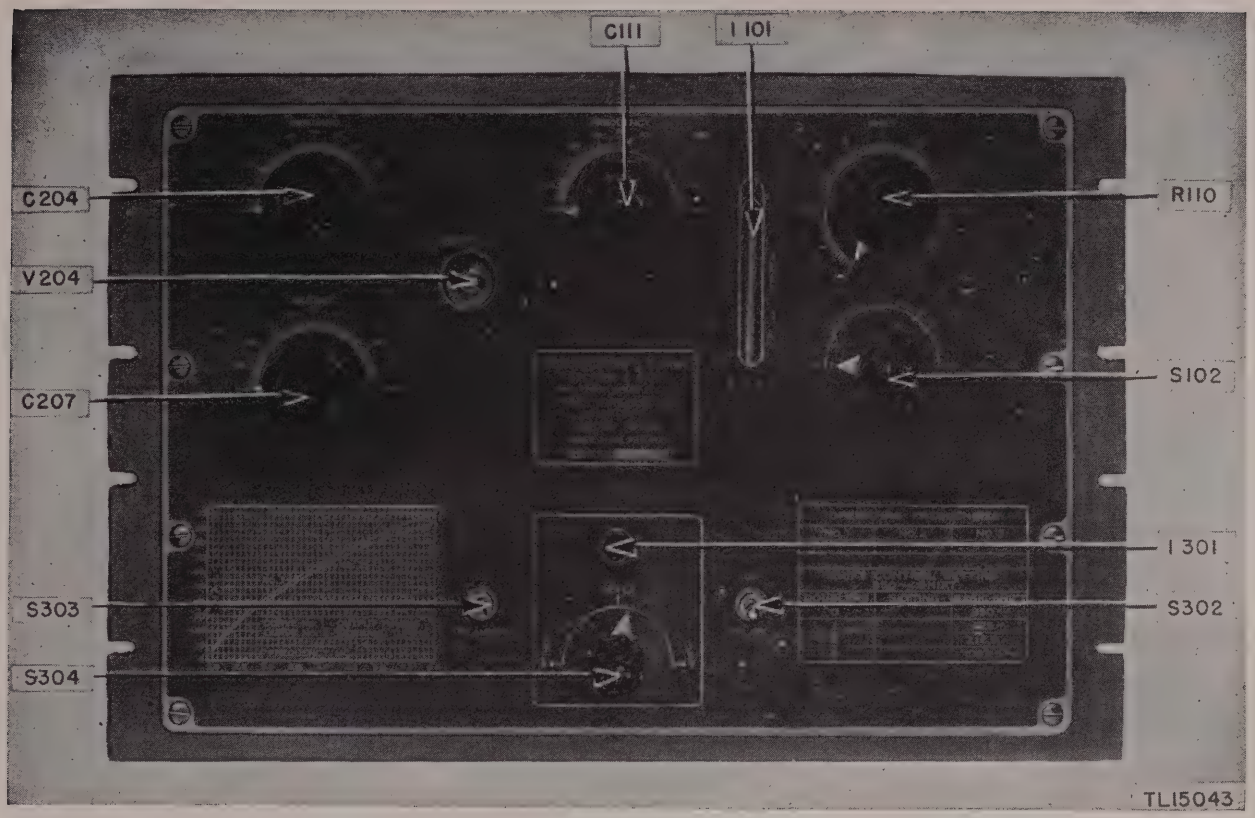


Figure 39. Exciter Unit 0–5/FR, front view.

the facsimile transceiver produces the *lowest* output frequency from Exciter Unit 0–5/FR, and a *maximum* amplitude signal output from the facsimile transceiver produces the *highest* output frequency from Exciter Unit 0–5/FR. The frequency and also the frequency deviation at the output of Exciter Unit 0–5/FR will be multiplied by the radio transmitter frequency multipliers, but the transmitter output frequency must be kept to a total frequency swing of 1,200 cps. This requires that the transmitter output frequency be 600 cps *below* the assigned carrier frequency when a minimum facsimile signal is sent, and 600 cps *above* the assigned carrier frequency when a *maximum* facsimile signal is sent. The actual output frequency of the transmitter will vary between these two extremes from instant to instant in accordance with the brightness or darkness of the transmitted copy being scanned on the facsimile transceiver drum. Assuming that the assigned radio carrier frequency is 7,500 kc, the following table shows the actual transmitter output frequencies for maximum and minimum facsimile signals, regardless of whether positive or negative facsimile transmissions are being made:

Assigned carrier frequency	*Amplitude of facsimile signal*	*Transmitter output frequency*
7,500 kc	Minimum	7,499.4 kc
7,500 kc	Maximum	7,500.6 kc

The procedure for setting controls of the facsimile transceiver, the converter, and the exciter unit to produce the required carrier shift follows:

(1) With maximum signal of +2 db from the facsimile tranceiver, adjust the exciter unit and the FREQ. ADJ. control of the converter so that the transmitter output frequency is 600 cps *above* the assigned carrier frequency. Check by using Frequency Meter BC–221 and tuning for zero beat.

(2) With *minimum* signal from the facsimile transceiver, adjust the facsimile transceiver until the transmitter output is 600 cps *below* the assigned carrier frequency. This will require adjustment of the CONTRAST and GAIN controls of the facsimile transmitter. While adjusting transceiver controls, check again to make certain that the maximum transceiver signal is maintained at +2 db. Do not make any further frequency control adjustments on the exciter unit or the converter. Use Frequency Meter BC–221 to ascertain that the change from

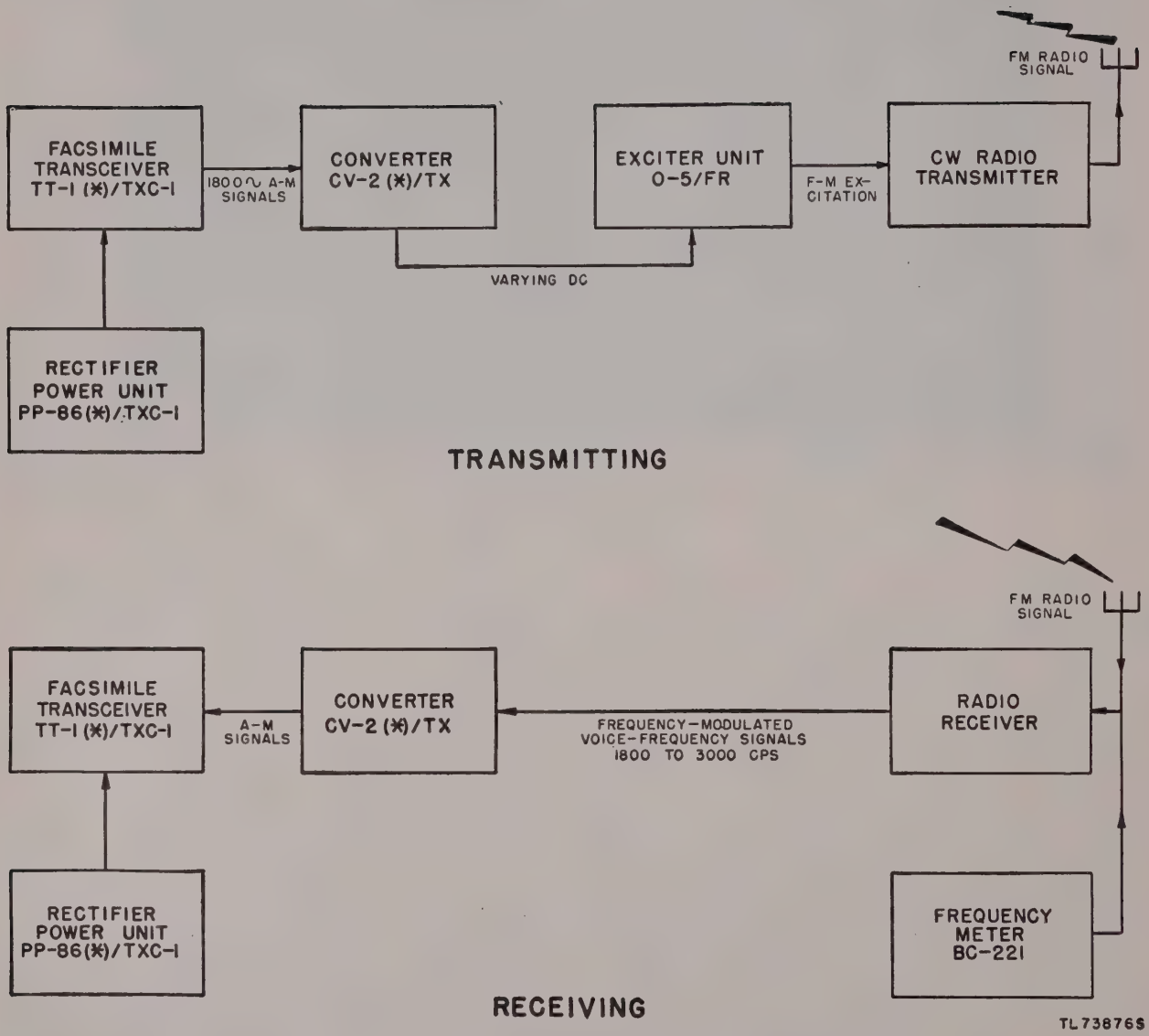


Figure 40. Carrier shift transmission of facsimile signals, block diagram.

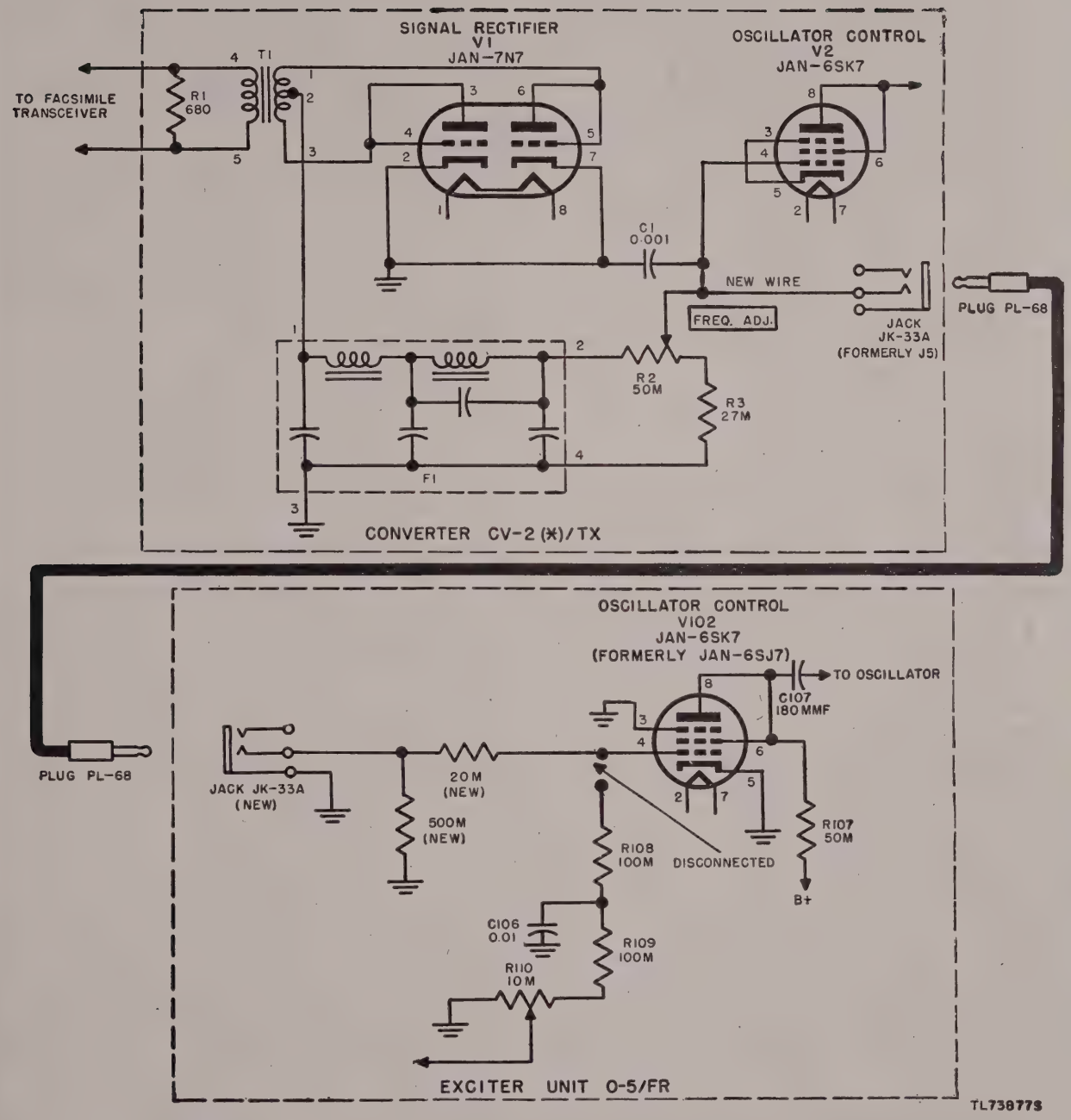


Figure **41.** ***Partial schematic diagram showing connections between Converter CV-2(*)/TX and Exciter Unit O-5/FR.***

minimum facsimile signal to maximum facsimile signal increases the transmitter output frequency by 1,200 cps. This can be done by leaving the frequency meter tuned as in step (1) above, and measuring the frequency of the beat note produced by the beating of the frequency meter signal with the transmitter output signal. The frequency of this 1,200-cycle note can be measured either on a direct-reading audio-frequency meter or by comparison with a 1,200-cycle signal from an audio oscillator, using the beat-note method.

(3) To check accuracy of the adjustments and to assist the receiving operator in adjusting his station, send a series of maximum and minimum level signals (high and low frequency signals), followed by a series of phasing pulses. Then repeat this sequence two or three times before actually transmitting the copy.

b. RECEIVING. The receiving station must be adjusted so that the highest received frequency is interpreted as a maximum amplitude signal at the receiving facsimile transceiver, and the lowest received frequency is interpreted as a minimum amplitude signal at the receiving facsimile transceiver. To obtain this desired relationship, Frequency Meter BC–221 must be properly adjusted to the *high-frequency* side of the received r-f signal. Proper adjustment of the frequency meter produces a high-frequency beat note (3,000 cps) at the receiver output when the received r-f signal is at its lowest frequency, and a low-frequency beat note (1,800 cps) at the output of the receiver when the received r-f signal is at its highest frequency. Improper adjustment of the frequency meter can produce reversal of shades on the recorded copy. Again assuming that the assigned radio carrier frequency is 7,500 kc, the required frequency relationships at the receiving station are:

Frequency of received carrier	*Frequency of frequency meter*	*Frequency of receiver output*	*Amplitude of recovered facsimile signal*
7,499.4 kc	7,502.4 kc	3,000 cps	Minimum
7,500.6 kc	7,502.4 kc	1,800 cps	Maximum

Note that the received carrier frequencies are the same as those assumed for the transmitting station and that they produce the desired facsimile signals at the input of the facsimile transceiver. The received carrier, of course, swings over a total of 1.2 kc (1,200 cps). The frequency meter signal is steady, and must always be on the *high* side of the received carrier. The difference between the received carrier frequency and the frequency meter frequency is the frequency of the receiver output and varies from 3,000 cps to 1,800 cps. The low-pass filter in Converter CV–2(*)/TX changes the 3,000 cps signal into a minimum amplitude output signal and the 1,800 cps signal into a maximum amplitude output signal. Received carrier frequencies between the low extremity (7,499.4 kc) and the high extremity (7,500.6 kc), of course, produce amplitudes in between minimum and maximum, which the receiving facsimile transceiver prints as intermediate shades of gray between black and white. If the frequency meter is set on the *low* side of the received carrier, the received picture tones will be reversed. A positive transmission will be received as a negative, and vice versa. The procedure for setting the frequency meter to the *high* side of the received carrier follows:

(1) With the transmitting operator sending steady *minimum* signal (7,499.4 kc in this example), adjust Frequency Meter BC–221 until the a-f output signal from the radio receiver is exactly 3,000 cps. Be certain that the frequency meter is tuned 3,000 cps (3 kc) *above* the incoming signal (to 7,502.4 kc in this example). Check this by varying the frequency meter dial through zero beat, and turning it to the highest frequency setting of the two settings that will produce a 3,000-cps receiver output signal. Check the accuracy of the 3,000-cps signal either on a direct-reading a-f meter or by comparing it with the signal from an audio oscillator.

(2) With the transmitting operator sending steady *maximum* signal (7,500.6 kc in this example), and without changing the setting of the frequency meter, the receiver output signal should be exactly 1,800 cps. This can be checked with the direct-reading a-f meter or by comparison with the signal from an audio oscillator.

Note. The facsimile transceiver itself produces an audible 1,800-cycle tone which is highly accurate. This can be used for checking the 1,800-cycle signal from the receiver.

(3) Check the accuracy of the adjustments by listening to the series of maximum signals, minimum signals, and phasing pulses which the transmitting operator will repeat two or three times.

(4) When phasing pulses are being received on positive transmissions (maximum signal on black), the radio receiver output will be a steady 1,800-cps tone, interrupted once each second by a 3,000-cps pulse. On negative transmissions, during phasing, the radio receiver output will be a steady 3,000-cps tone, interrupted once each second by a 1,800-cps pulse.

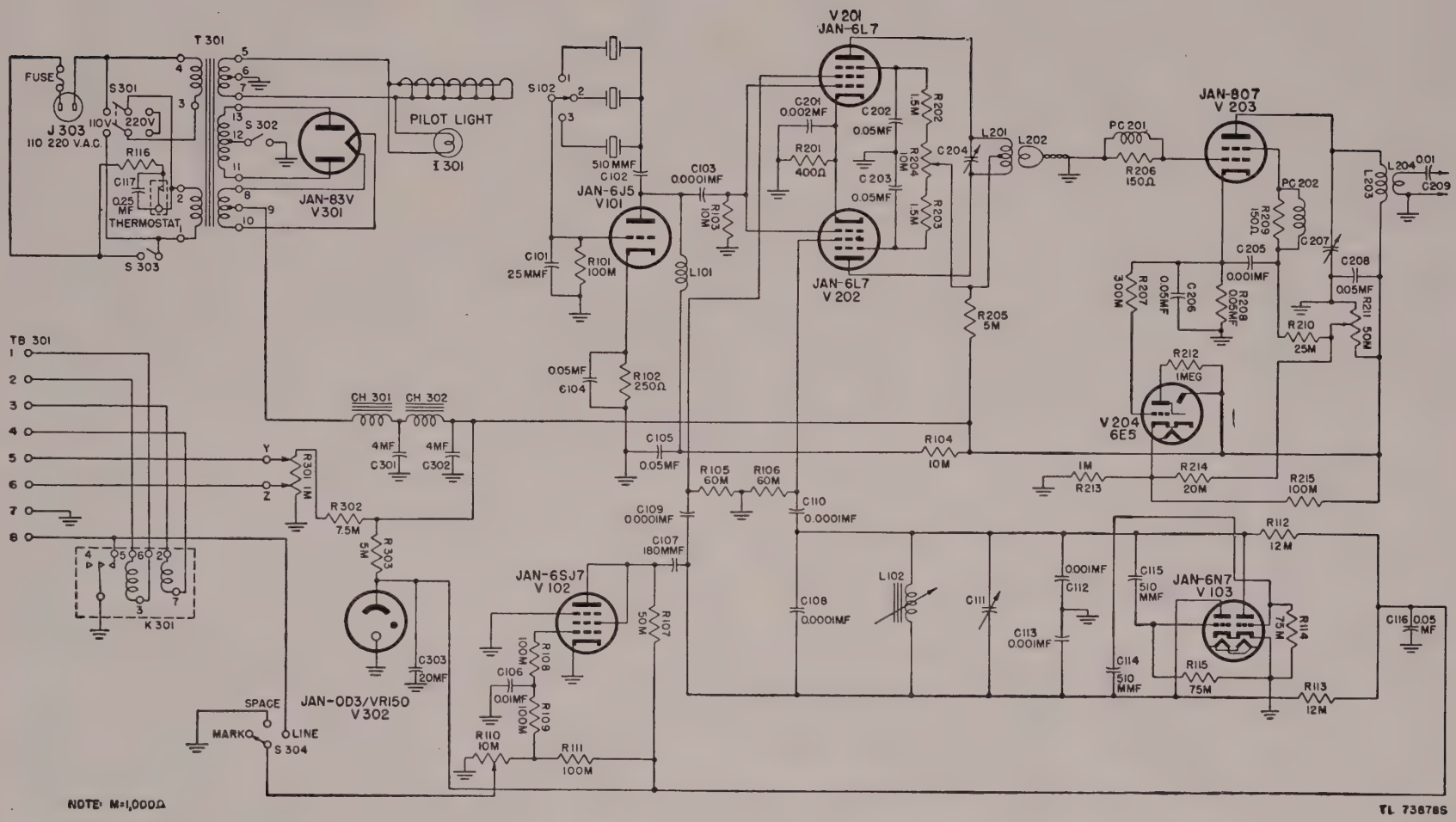


Figure 42. Exciter Unit 0-5/FR, schematic diagram.

PART FIVE

REPAIR INSTRUCTIONS

Section XI. THEORY OF EQUIPMENT

82. Fundamentals of Facsimile

Facsimile equipment is used to transmit still images over an electrical communication system. These images, called pictures or copy in facsimile terminology, may be maps, photographs, sketches, typewritten or printed text, or handwriting.

a. Operations Performed. The still image serving as facsimile copy or picture cannot be transmitted instantly in its entirety. Three distinct operations are required in transmitting and recording the picture. They are—

(1) The breaking up of the picture in an orderly manner into a large number of elemental areas of varying shades. This process is called scanning and is accomplished by the facsimile transmitter.

(2) Transmission of electrical signals, representing these individual elemental areas, to the facsimile receiver. Facsimile signals are transmitted over ordinary wire and radio circuits.

(3) The interpreting of these electrical signals and the rebuilding and recording of the original picture from them. This reversal of the transmitter scanning process is accomplished by the facsimile receiver. The receiver must be accurately synchronized with the transmitter to assure a faithful reproduction.

b. Facsimile Set AN/TXC–1(*). Facsimile Set AN/TXC–1(*) performs the basic operations outlined in *a* above in the following manner:

(1) The picture to be transmitted is mounted on a cylindrical drum, which revolves at the rate of one revolution per second, and travels along a lead screw at the rate of 12½ inches in 20 minutes (the screw has 96 threads per inch). Light from an exciter lamp illuminates a small area of the moving picture and is reflected by the picture through an aperture to a photocell. During the transmission of a complete picture, this light traverses every portion of the picture as the drum slowly spirals past the fixed lighted area.

(2) At any instant, the amount of light reflected back to the photocell is a measure of the lightness or darkness of the tiny spot of picture which is being scanned. The photocell transforms varying amounts of light into corresponding electrical signals, which are amplified and transmitted over the facsimile circuit.

(3) Electrical signals received by the facsimile receiver are amplified and serve to actuate a recording mechanism which makes a permanent record, spot by spot, on the recording paper on the synchronized receiver drum until the complete original picture is reproduced. Facsimile Set AN/TXC–1(*) reproduces either photographically, with a controlled light source shining on photographic paper or film, or directly by burning a white protective coating from specially prepared black recording paper. Synchronization is obtained by constantly driving both receiving and transmitting drums with synchronous motors operating at identical speeds. Phasing is accomplished by transmitting a series of phasing pulses just prior to each transmission. These pulses operate a clutch mechanism which phases the receiving drum to the transmitting drum.

83. Block Diagrams

Figures 43 through 49 show the functions of various stages of Facsimile Set AN/TXC–1(*).

a. Electrical Circuits. The complete electrical circuit of Facsimile Set AN/TXC–1(*), including Facsimile Transceiver TT–1(*)/TXC–1 and Rectifier Power Unit PP–86(*) /TXC–1, may be broken down by functions into the following eight principal circuits (fig. 49):

(1) *Signal source at 1,800 cycles.* The fork oscillator unit (V1, V2, and V3) generates a steady 1,800-cycle audio signal for use in several other circuits.

(2) *Photocell bridge modulator.* The photocell

bridge modulator circuit, built around a photocell Tube JAN–1645 (V24), is used on transmission only. It amplitude-modulates the 1,800-cycle signal in accordance with variations in light intensity of the small portion of the transmitted copy being scanned at any instant.

(3) *Signal amplifier circuit.* The signal amplifier circuit (V10, V11, V12, V13, and V14) amplifies the 1,800-cycle a-m signal (fig. 61). On transmissions the circuit is fed by the photocell bridge modulator and feeds the line. On reception it is fed by the signal on the line and drives either the stylus for direct recording or the recorder lamp for photo recording. The signal amplifiers also are used in the talk-back circuit.

(4) *Phasing circuit.* The phasing circuit (V15 and V16) is used only for phasing the facsimile receiver. A series of phasing pulses from the transmitter actuate a clutch mechanism and phase the receiving drum to the transmitting drum (fig. 45).

(5) *Motor circuit.* The motor circuit (V4, V5, and V6) amplifies the 1,800-cycle signal from the fork oscillator unit and drives the synchronous motor at a constant speed.

(6) *B+ regulator circuit.* The B+ regulator circuit (V7, V8, V9, and V25), provides a closely regulated voltage of 250 volts from the rectifier power unit supply of 450 volts. Regulated B+ voltage is used on critical transceiver circuits.

(7) *Rectifier power supply.* The rectifier power supply (V22 in Rectifier Power Unit PP–86(*)/TXC–1) provides 450 volts unregulated B+ and 6.3 volts ac for transceiver operation, and also another a-c voltage used only in starting the synchronous motor.

(8) *Exciter lamp supply.* The exciter lamp supply (V17, V18, V19, V20, V21, and V23 in Rectifier Power Unit PP–86(*)/TXC–1) amplifies and regulates the 1,800-cycle signal from the fork oscillator unit to provide a steady power supply for

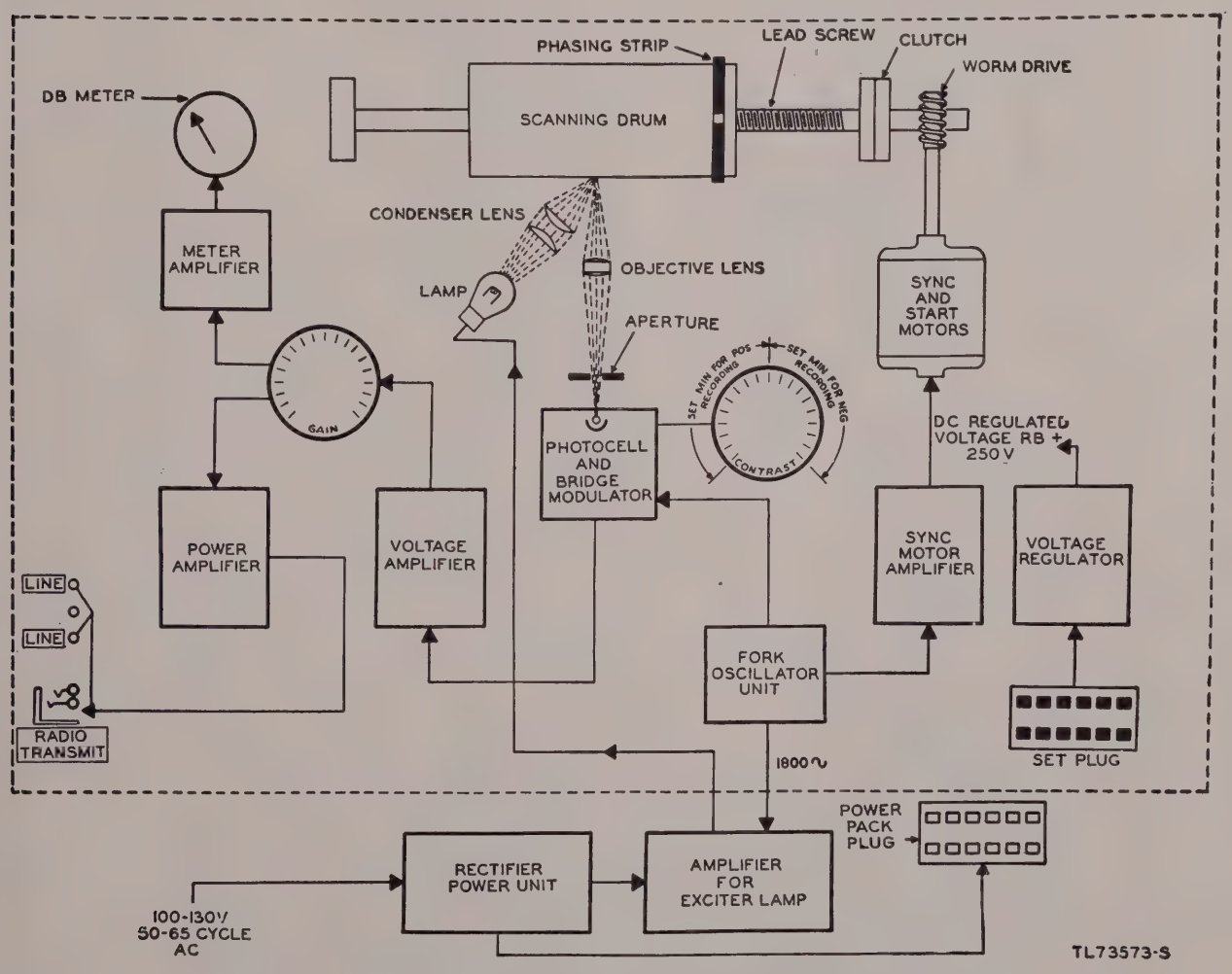


Figure 43. Facsimile Transceiver TT–1(*)/TXC–1, transmitting block diagram.

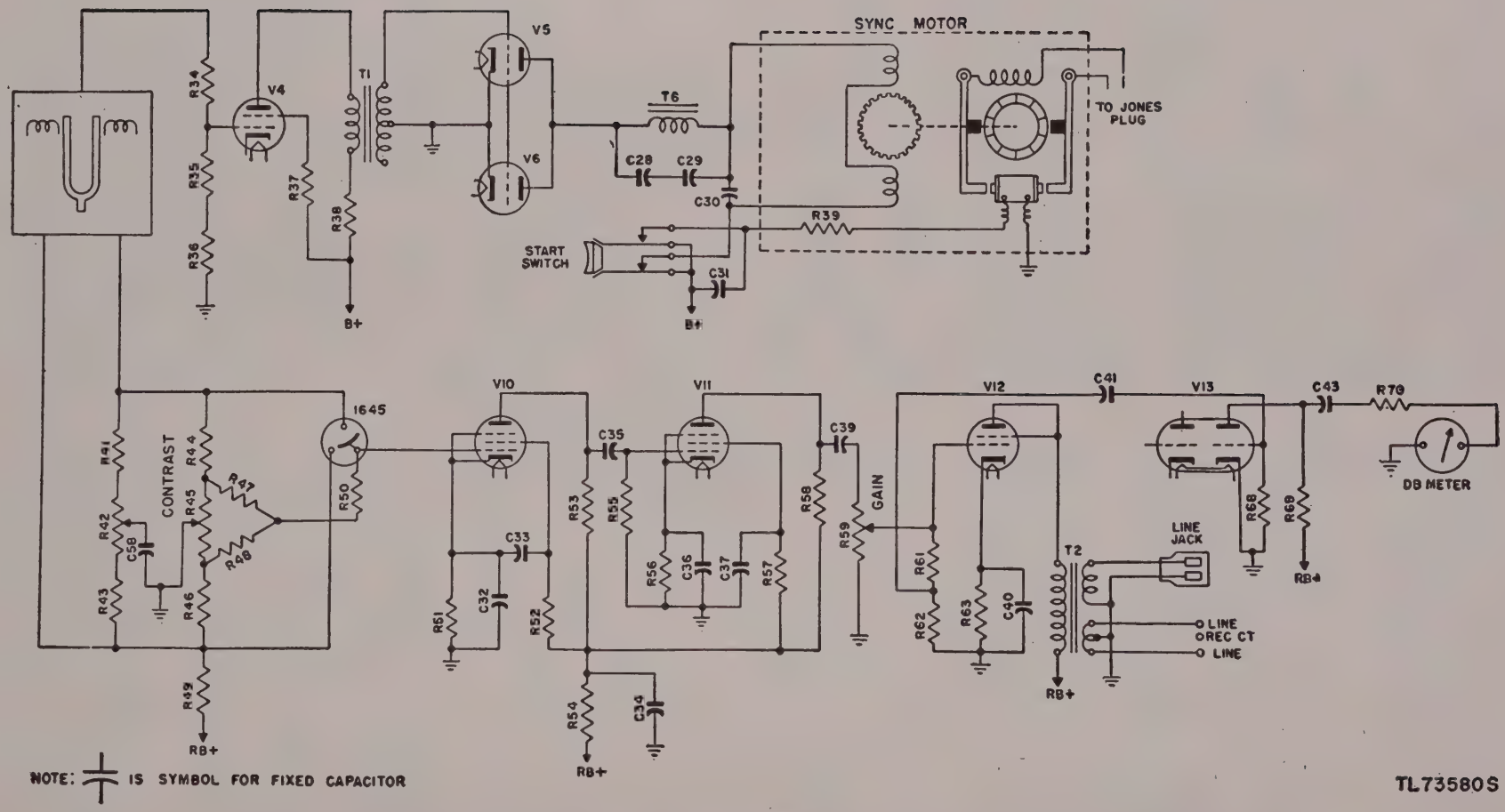


Figure 44. Transmitting, simplified stage schematic, Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1.

the transceiver exciter lamp, which illuminates the transmitted copy with a constant brilliancy.

b. Mechanical System. The mechanical system of the facsimile transceiver (figs. 43 and 45) consists of a motor which drives the rotating drum through a clutch arrangement. Operation of the clutch during the phasing operation is described in paragraph 92.

c. Transmitting. Figures 43 and 44 show functions of the various stages of the facsimile set during transmitting. The picture being transmitted is affixed to the rotating drum, on which the condenser lens system focuses light originating at the exciter lamp. Varying amounts of light are reflected back through the objective lens and aperture to the photocell and bridge modulator. Here varying light intensities are converted into varying electrical signals. A 1,800-cycle carrier signal from the fork oscillator unit is amplitude-modulated in the bridge modulator. This modulated signal is amplified in the voltage amplifier, the proper level is established by the gain control, and the signal is further boosted by the power amplifier before going out onto the line. A separate meter amplifier drives the db meter which indicates the relative signal level. The fork oscillator unit, besides furnishing the carrier signal to the photocell bridge modulator, supplies a 1,800-cycle tone which is amplified in the exciter lamp power supply (part of Rectifier Unit PP–86 (*)/TXC–1) (fig. 47) and keeps the exciter lamp at constant brilliancy. The 1,800-cycle tone also is amplified and used to operate the synchronous motor which drives the drum at a constant speed. The rectifier power unit supplies the necessary operating voltages for the set from a 115-volt, 60-cycle a-c source. The voltage regulator, which supplies 250 volts B+ from a 450-volt source supplied by the rectifier power unit, is physically located within the transceiver.

d. Receiving. Functions of the various stages in

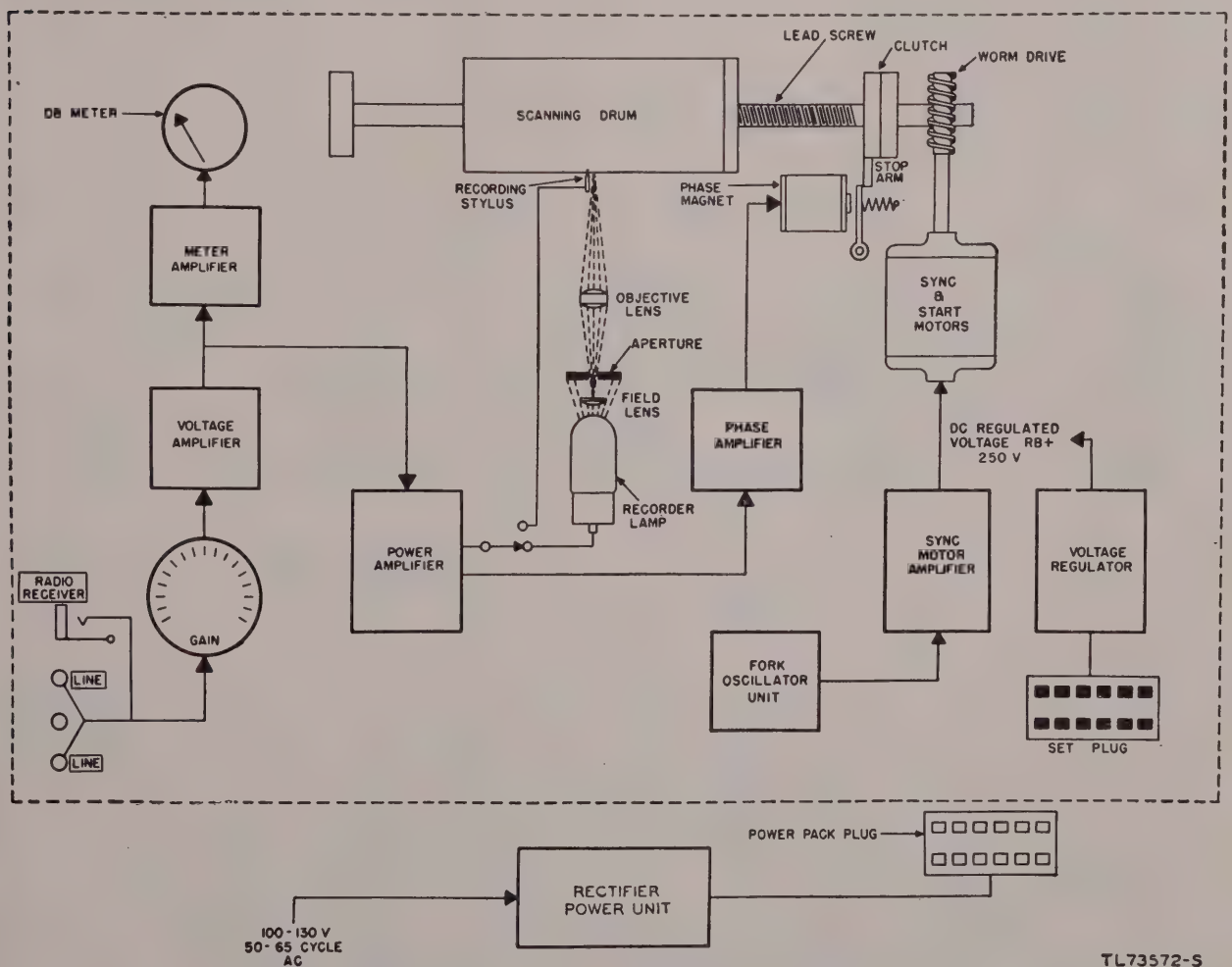


Figure 45. Receiving block diagram, Facsimile Transceiver TT–1(*)/TXC–1.

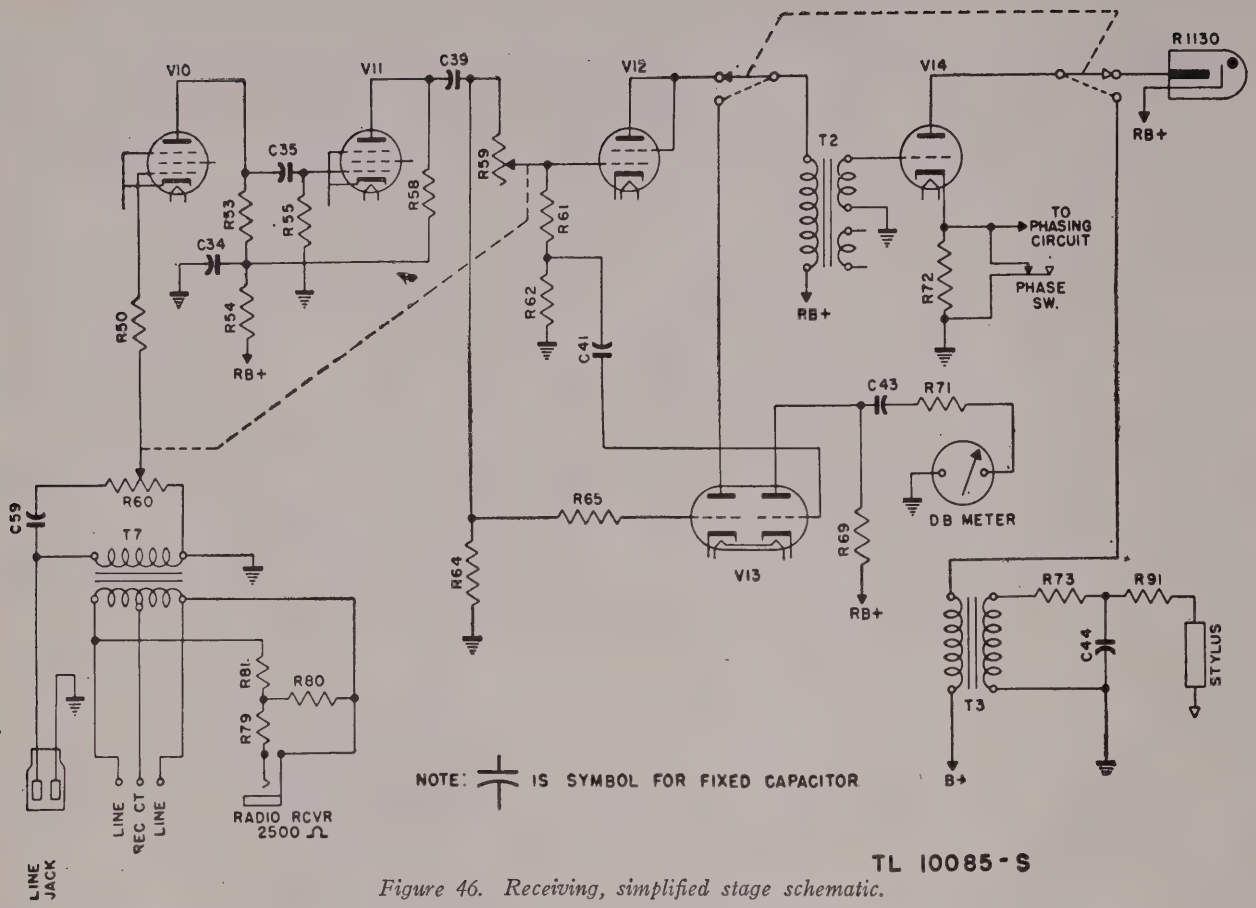


Figure 46. Receiving, simplified stage schematic.

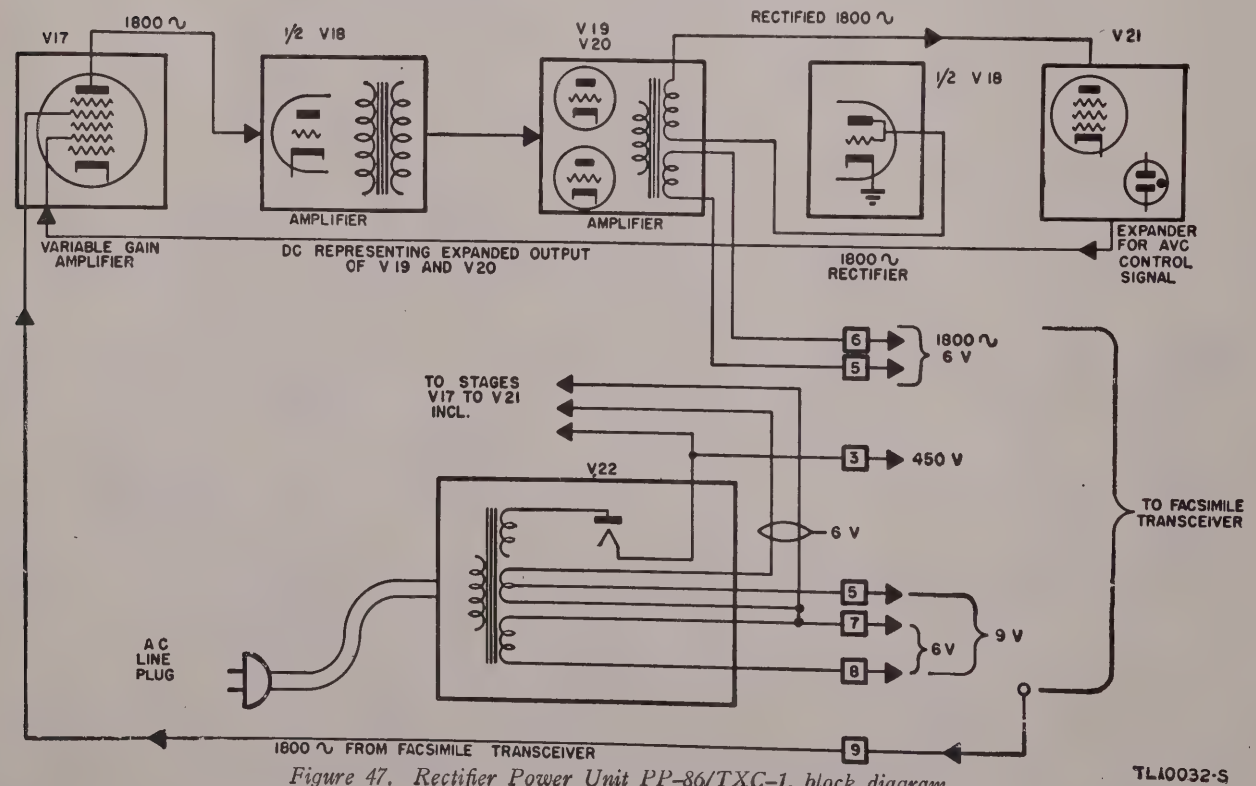
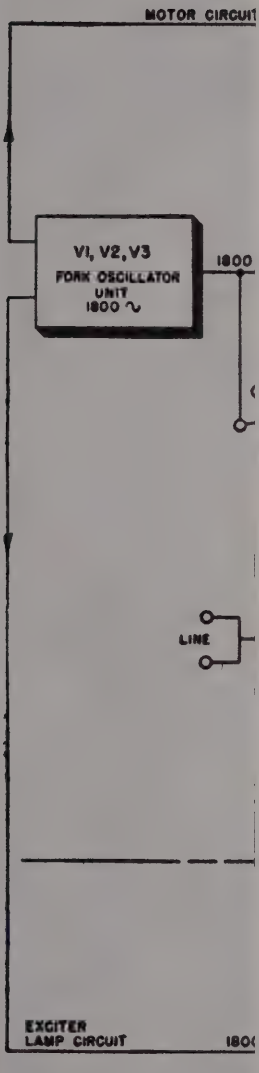


Figure 47. Rectifier Power Unit PP-86/TXC-1, block diagram.


MOTOR CIRCUI
V1, V2, V3
FORK OSCILLATOR
UNIT
1800 ∿
1800
LINE
EXCITER
LAMP CIRCUIT
115 V
60 ∿
AC LINE

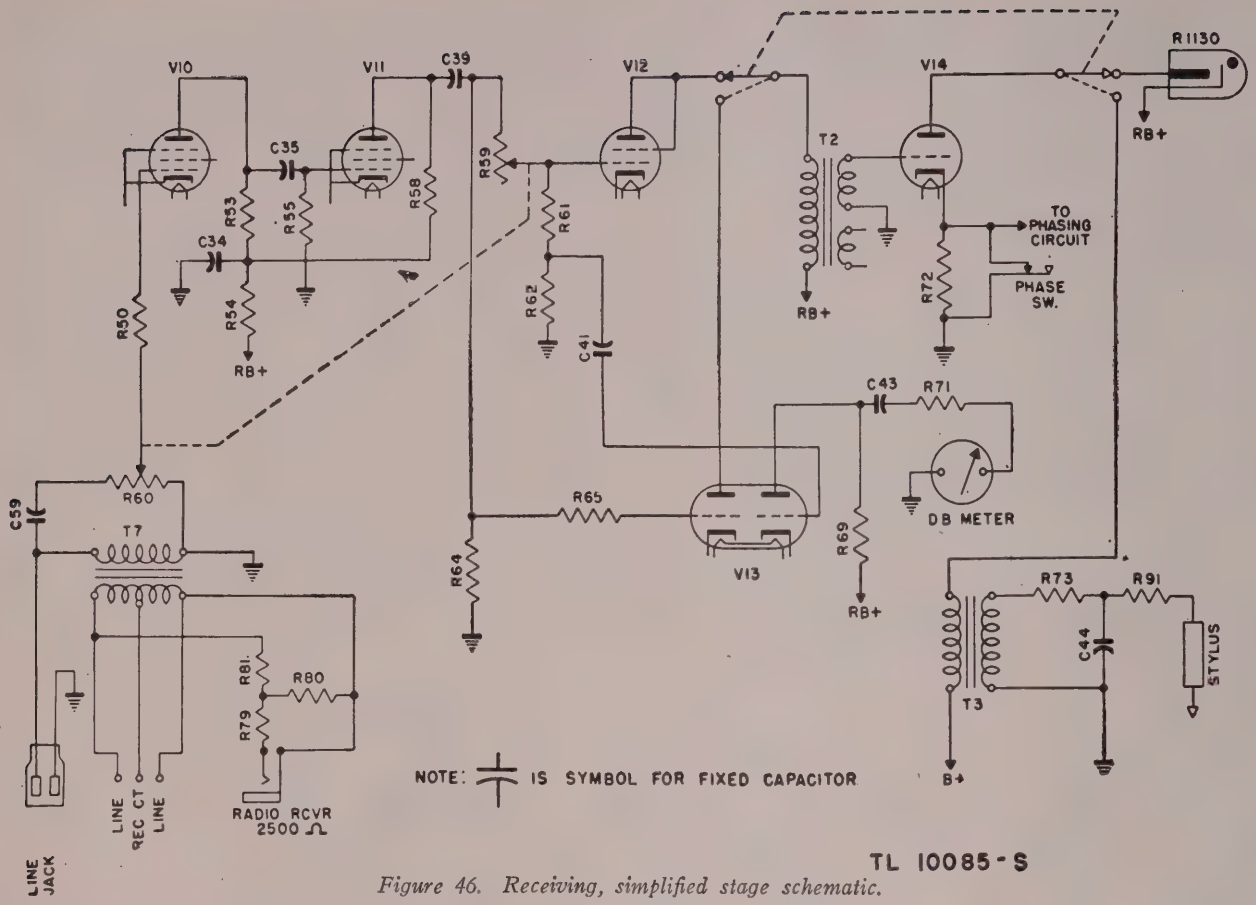


Figure 46. Receiving, simplified stage schematic.

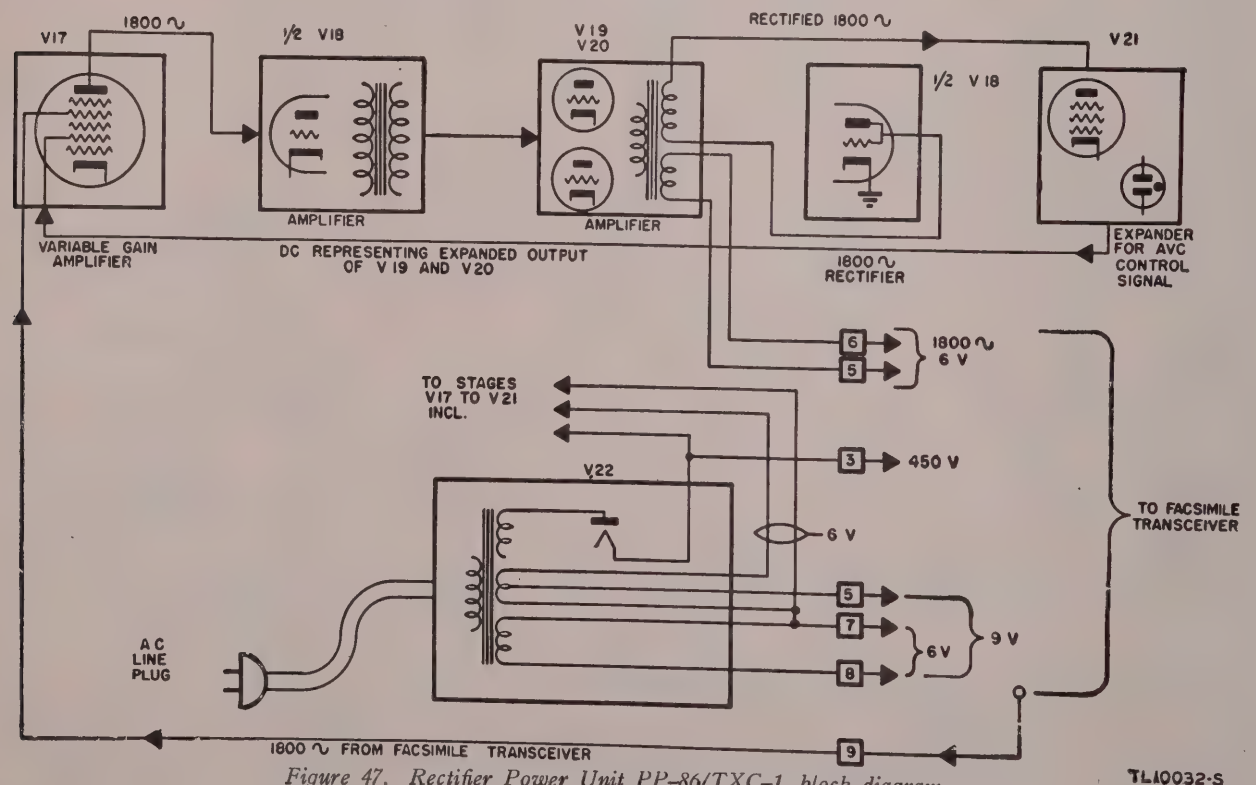
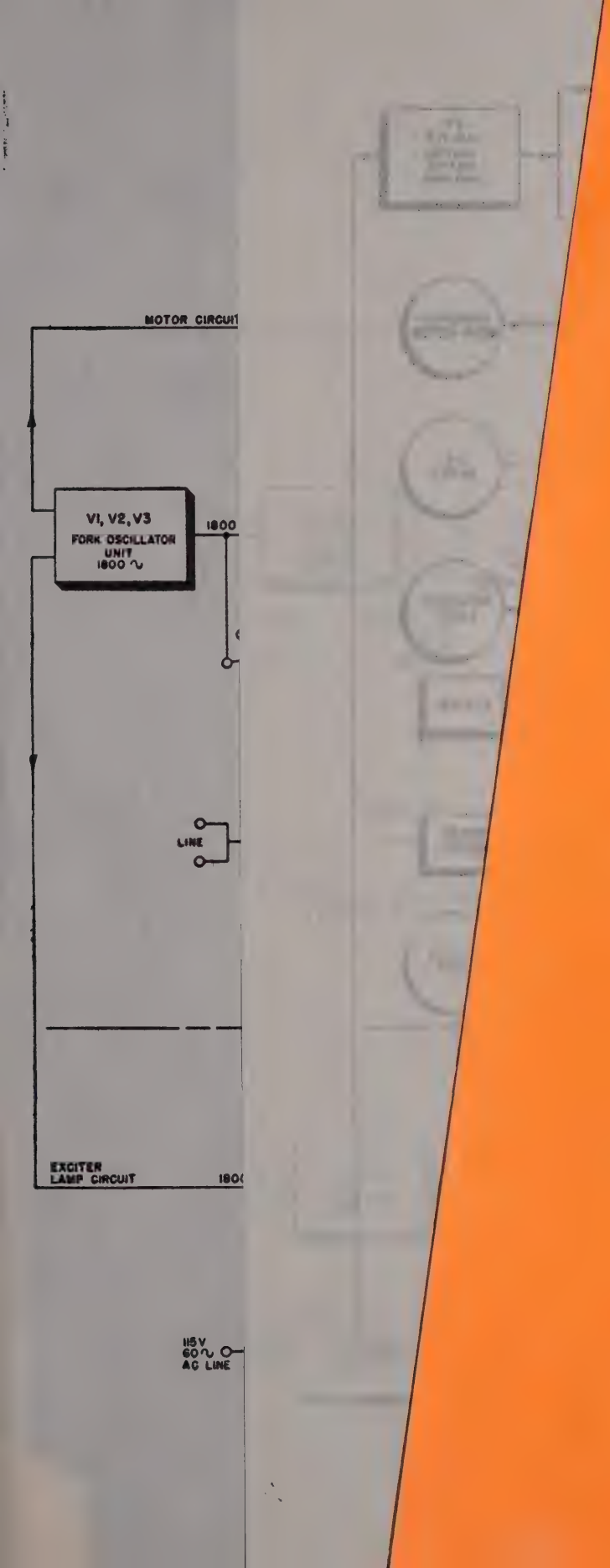


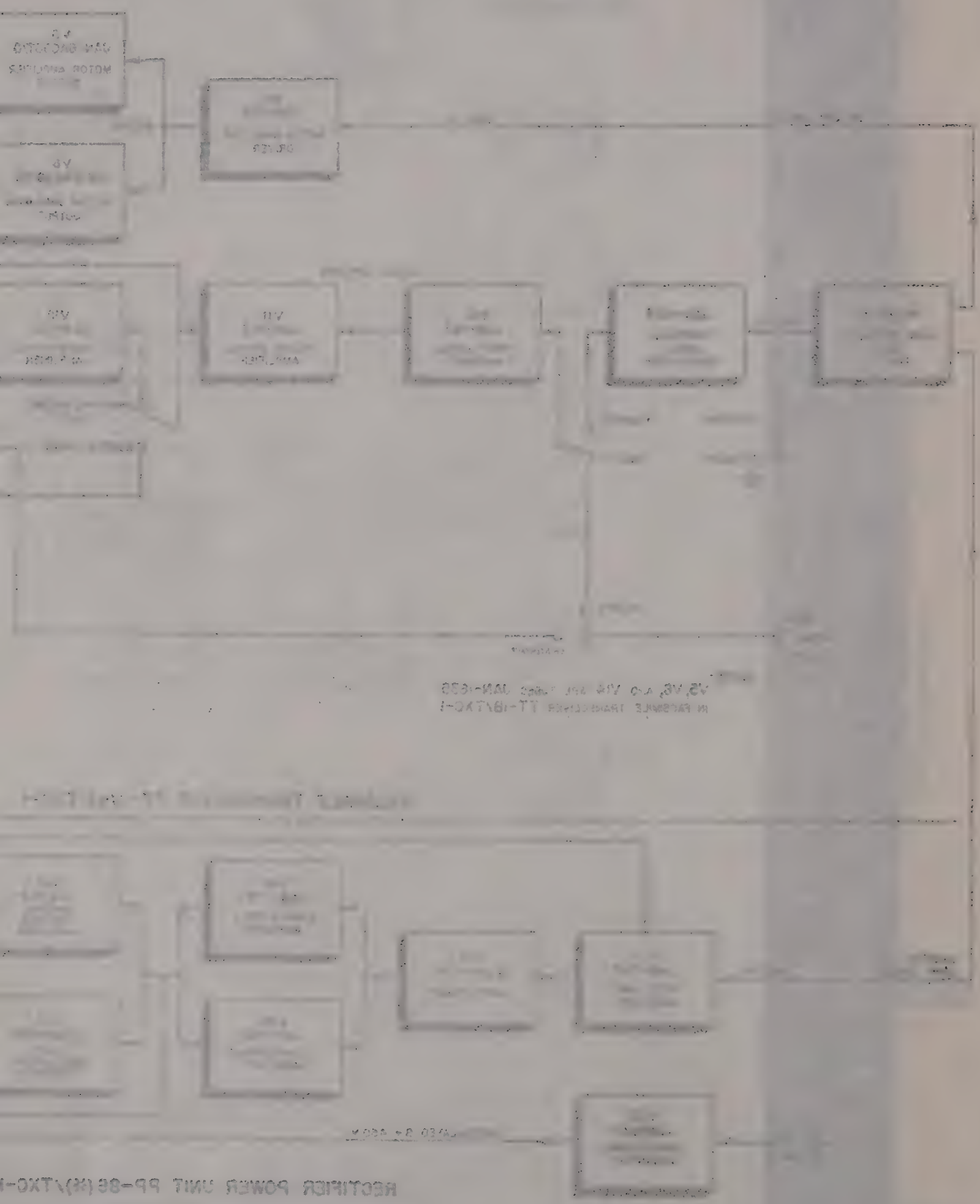
Figure 47. Rectifier Power Unit PP-86/TXC-1, block diagram.



Insert

Foldout / M

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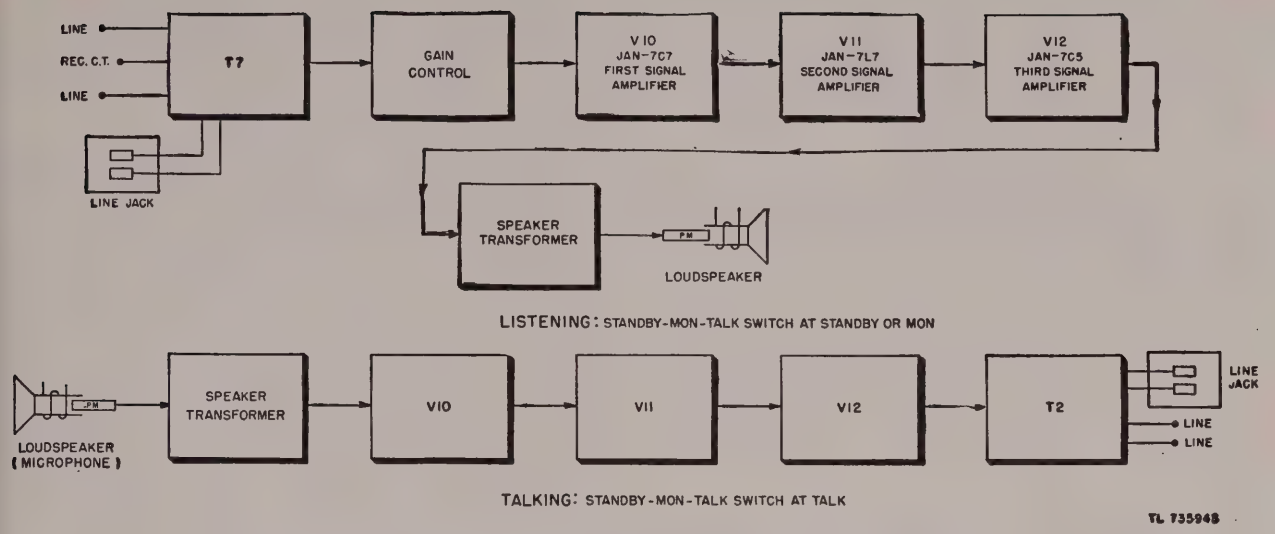


Figure 48. Talk-back circuit in Facsimile Transceivers TT–1A/TXC–1 and TT–1B/TXC–1, block diagram.

the receiving transceiver are shown in figures 45 and 46. The signal from the line is attenuated at the GAIN control, then amplified in the voltage amplifier and power amplifier. The db meter, driven by a separate amplifier, indicates the relative level of the signal being used for recording. The power amplifier drives either the recorder lamp for photographic recording, or the recording stylus for direct recording. Another connection from the power amplifier sends phasing pulses to the phase amplifier circuit which operates the phase magnet and clutch during the phasing process just before each picture transmission. The fork oscillator unit serves a single purpose on receiving. It generates a 1,800-cycle signal which is amplified to operate the synchronous motor at the same speed as the motor in the transmitting transceiver.

e. Talk-Back Circuit. The talk-back circuit (in Facsimile Transceivers TT–1A/TXC–1 and TT–1B/TXC–1 only) (fig. 48) is operative with the selector switch at STAND BY. For normal reception of voice over this circuit, the STANDBY-MON-TALK switch is at MON (if the motor is to be in operation) or at STAND BY (which makes synchronous motor operation impossible). In either of these positions the signal from the line is amplified by three audio stages, V10, V11, and V12, before it reaches the speaker. The GAIN control is in the voice circuit. When the STANDBY-MON-TALK switch is at TALK, the speaker becomes a microphone, and the signal is amplified by V10, V11, and V12 before it is fed to the line.

f. Complete Block Diagram. A complete block diagram of the facsimile set, showing stage names, tube identification, and signal flow, is found in figure 49. For simplicity, the talk-back circuit is not shown here.

84. Stage Names

Facsimile Set AN/TXC–1(*) uses 25 electron tubes, 18 of which are located in Facsimile Transceiver TT–1(*)/TXC–1 and 7 of which are located in Rectifier Power Unit PP–86(*)/TXC–1. The following outline shows the stage number, JAN type tube used, and the functional name of the stage.

a. Facsimile Transceiver TT–1(*)/TXC–1. Stages in the transceiver are:

(1) *Fork oscillator unit. (a) Unsealed (Facsimils Set AN/TXC–1 only).*

V1	7L7	Fork input amplifier
V2	7C5	Fork driver
V3	7N7	Fork output buffers
		1. Motor amplifier buffer
		2. Modulator buffer

(b) Sealed (other models).

V1	7L7	Second fork amplifier
V2	7N7	Fork amplifier-driver
		1. Fork input amplifier
		2. Fork driver
V3	7N7	Fork output buffers
		1. Motor amplifier buffer
		2. Modulator buffer

(2) *Motor circuit.*

V4	7C5	Motor amplifier driver
V5	1635 or 6AC5GT/G	Motor amplifier output
V6	1635 or 6AC5GT/G	Motor amplifier output

Note. V5 and V6 are Tubes JAN–6AC5GT/G in Facsimile Sets AN/TXC–1 and –1A; Tubes JAN–1635 in Facsimile Set AN/TXC–1B.

(3) *B+ voltage regulator.*

V7	7C5	Voltage regulator output
V8	7C5	Voltage regulator output
V9	7L7	Control voltage amplifier
V25	R1160A, 1B46, or 5651	Reference voltage regulator

Note. V25 is R1160A or Tube JAN–1B46 in Facsimile Sets AN/TXC–1 and –1A; 5651 in Facsimile Set AN/TXC–1B.

(4) *Signal circuit.*

V24	1645	Photocell
V10	7C7	First signal amplifier
V11	7L7	Second signal amplifier
V12	7C5	Third signal amplifier
V13	7N7	Signal-meter amplifier 1. RECORD DIRECT amplifier driver 2. Meter amplifier
V14	1635 or 6AC5GT/G	RECORD output amplifier

Note. V14 is Tube JAN–6AC5GT/G in Facsimile Sets AN/TXC–1 and –1A; Tube JAN–1635 in Facsimile Set AN/TXC–1B.

(5) *Phasing circuit.*

V15	7L7	Pulse amplifier
V16	884	Trigger tube

b. Rectifier Power Unit PP–86(*)/TXC–1. Stages in the power unit are—

(1) *Exciter lamp supply.*

V17	7S7	First lamp amplifier
V18	7N7	Driver-rectifier 1. Lamp driver 2. Voltage regulator rectifier
V19	7C5	Lamp output amplifier
V20	7C5	Lamp output amplifier
V21	7L7	Control voltage amplifier
V23	R1160A, 1B47, or 5651	Reference voltage regulator

Note. V23 is R1160A or Tube JAN–1B47 in Facsimile Sets AN–TXC–1 and –1A; 5651 in Facsimile Set AN/TXC–1B.

(2) *B+ power supply.*

V22	5Z3	Power supply rectifier

85. Partial Schematic Diagrams

A series of partial schematic diagrams showing components of individual stages of the facsimile transceiver and rectifier power unit accompanies the text in this section. These diagrams are applicable to all models of equipment unless otherwise noted. Slight changes in resistor and capacitor values, made in later models of equipment to conform with American War Standard values, are in general not reflected in these partial schematics. These slight differences in values are not significant, however, inasmuch as the changes in most cases are well within the plus or minus percent tolerance of the components. For exact component values, see the complete schematic diagrams (figs. 142 through 149).

86. Fork Oscillator Unit (Unsealed) (V1, V2, V3)

The fork oscillator unit (fig. 50) generates a highly stable 1,800-cycle audio signal to supply the photocell bridge modulator circuit, the motor amplifier circuit, and the exciter lamp circuit. The unsealed unit, used in Facsimile Set AN/TXC–1 only (serial Nos. up to 105 on order No. 2695–MPD–45), consists of three stages: a fork input amplifier (V1), a fork driver (V2), and a dual tube (V3) whose sections serve as output buffers (figs. 50 and 142). All three stages are supplied regulated B+ voltage. The sealed unit is described in paragraph 87.

a. Tuning Fork. The frequency-determining device is a bimetallic tuning fork whose natural period of vibration is 1,800 cps. The fork is kept in vibration by a drive coil which is fed a 1,800-cycle signal of constant amplitude from the fork driver stage. A second coil, a pick-up coil, is coupled to the vibrating fork in such manner that the fork vibrations generate a 1,800-cycle alternating current in the coil. This coil feeds the grid of the fork input amplifier stage through a transformer. The fork thus becomes a feedback unit, controlling the frequency in the oscillator circuit composed of the fork, V1, and V2.

b. Fork Input Amplifier (V1). This stage, V1, using Tube JAN–7L7 (fig. 51), amplifies the feeble oscillations from the tuning fork and drives tube V2, the fork driver, and also the two output buffer sections of V3. Energy from the fork pick-up coil is coupled through transformer T4 directly to the

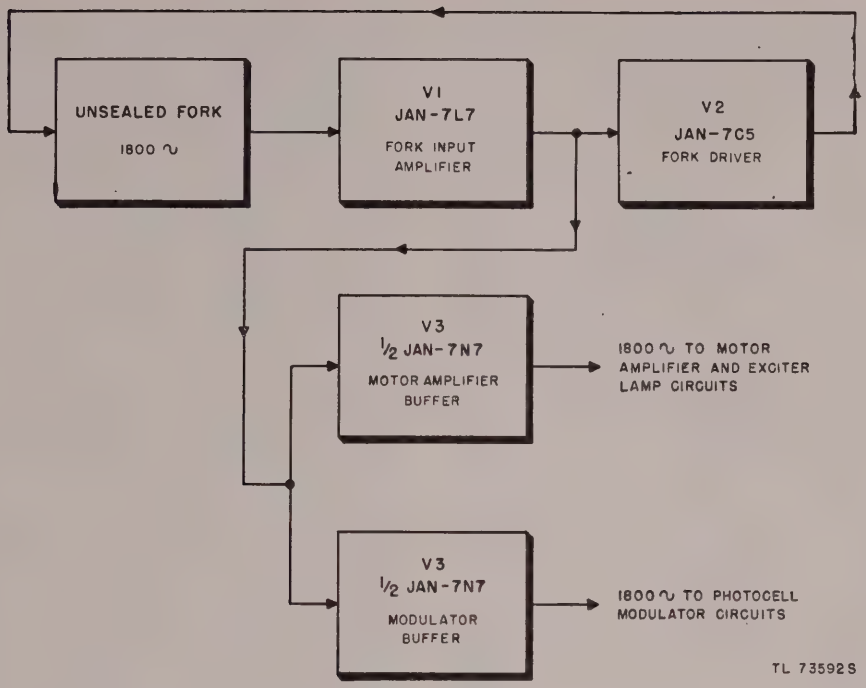


Figure 50. Unsealed fork oscillator unit, block diagram.

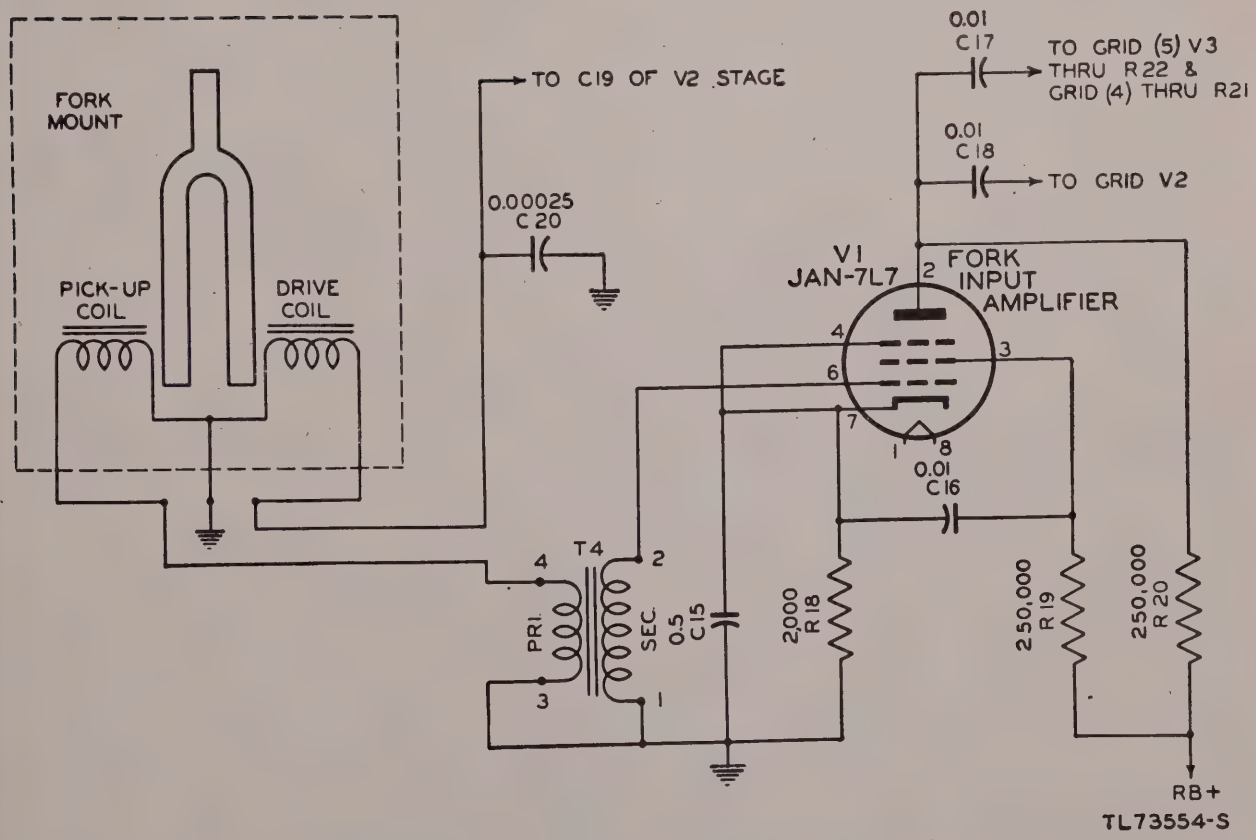


Figure 51. Fork input amplifier, unsealed fork oscillator unit.

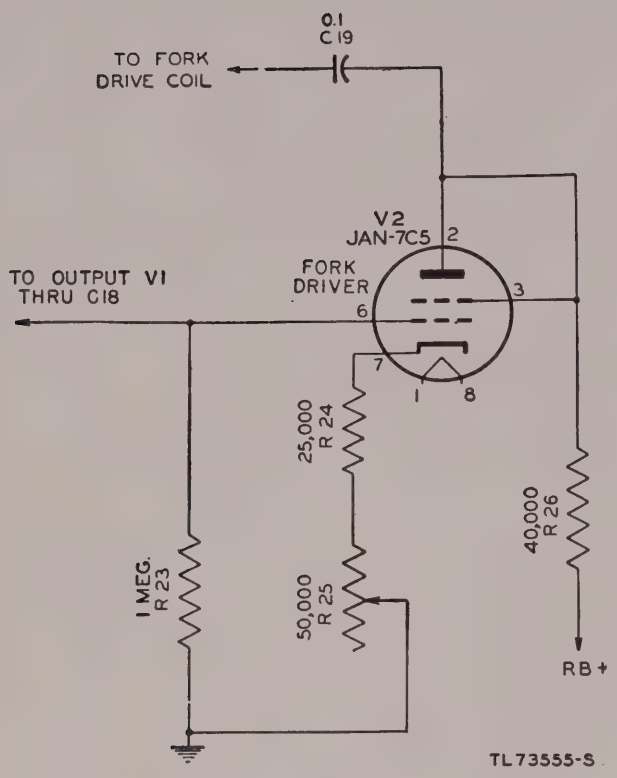


Figure 52. Fork driver, unsealed fork oscillator unit.

grid of V1. T4 steps up the voltage from approximately 0.4 volt to 1.0 volt. The tube is biased by the flow of plate current through the cathode resistor R18 which is bypassed by C15. Screen current is fed through resistor R19 and plate current through resistor R20. Sine wave voltage developed across R20 is coupled from the plate through capacitor C18 to the grid of V2 and through C17 to the output buffers. C20, a bypass capacitor across the fork drive coil, suppresses harmonics of the 1,800-cycle signal.

c. Fork Driver (V2). This stage, V2, using Tube JAN–7C5 (fig. 52), further amplifies the output of stage V1 and supplies energy to the drive coil which keeps the tuning fork vibrating. V2 is driven so hard that variations in amplitude at the input have practically no effect on its output. The constant output from V2 to the fork drive coil is one of the requirements for frequency stability. V2 is driven at the grid, with R23 serving as the grid resistor. Two resistors, R24 and a variable resistor R25, form the cathode circuit of V2. They are left unbypassed to provide degenerative feedback in the stage, giving a stabilizing effect on the output. R25 is variable to permit minor adjustments in frequency of the fork oscillator to compensate for variations in circuit

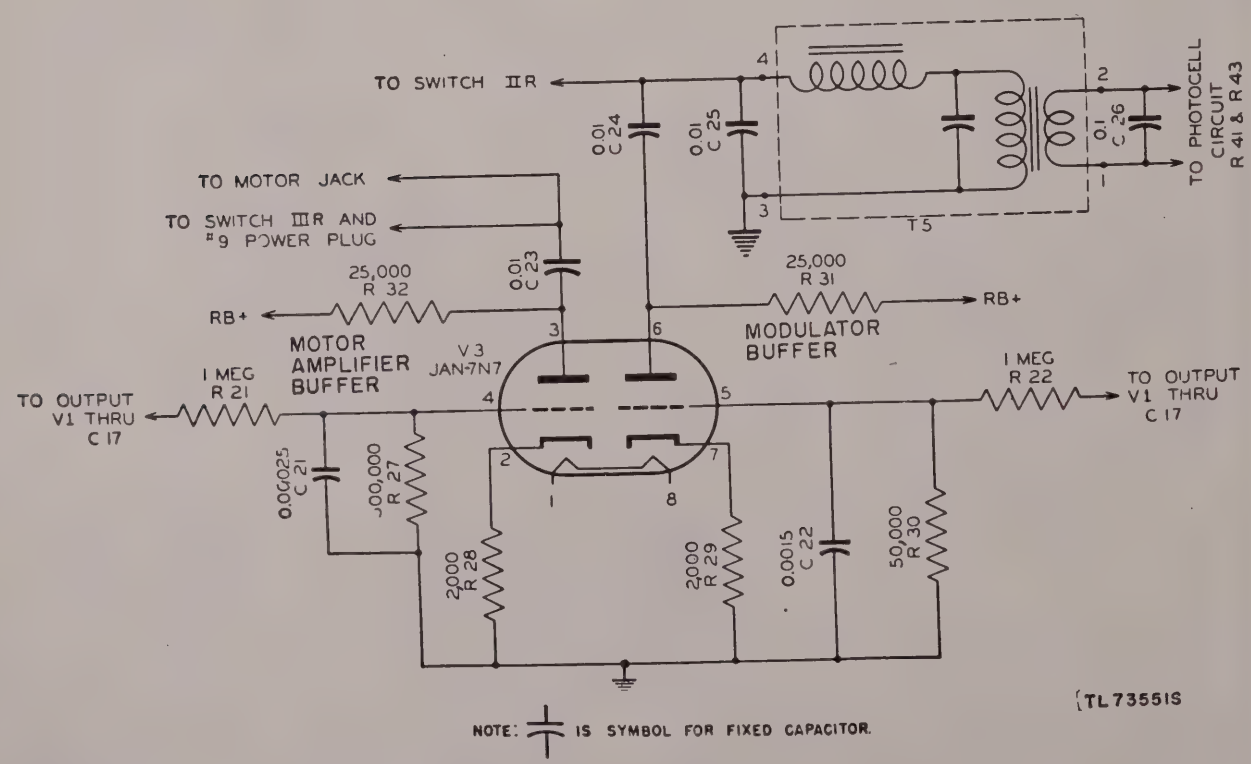


Figure 53. Output buffers, unsealed fork oscillator unit.

components. Plate and screen of V2 are connected together for triode operation. R26 is the plate load resistor and the output voltage developed across it is coupled back to the fork drive coil through C19.

d. Fork Output (V3). This stage, V3, using dual triode Tube JAN–7N7 (fig. 53), consists of two buffer-amplifiers which are fed by the fork input amplifier V1 and supply 1,800-cycle signal to the motor amplifier stage V4, the exciter lamp circuit, and the photocell bridge modulator circuit (fig. 50). The buffer action prevents load variations from affecting the fork oscillator.

(1) *Motor amplifier buffer.* The first section of tube V3 is the motor amplifier buffer. Its grid receives 1,800-cycle energy from the plate of V1 through coupling capacitor C17 and limiting resistor R21. R27 is the grid resistor, and the grid is bypassed for high frequencies by C21. The cathode resistor R28 is left unbypassed to provide degeneration. R32 is the plate load resistor, and output from the plate is coupled through C23 to the motor amplifier stage V4 via the MOTOR JACK. C23 also couples 1,800-cycle energy to the exciter lamp circuit. A connection to IIIR of the selector switch short circuits the 1,800–cycle supply to the motor circuit and the exciter lamp circuit when the switch is in STAND BY position.

(2) *Modulator buffer.* The second section of tube V3 is the modulator buffer. Its grid receives 1,800-cycle energy from the plate of V1 through coupling capacitor C17 and limiting resistor R22. R30 is the grid resistor, and the grid is bypassed for high frequencies by C22. R31 is the plate load resistor. The output coupling circuit includes a low-pass filter and output transformer T5 to eliminate harmonics of the 1,800-cycle frequency. Components of this low-pass filter include C25, which is across the input terminals of T5, an audio choke, capacitor, output transformer, and output capacitor C26. The output to the modulator is sine wave. A connection to IIR of the selector switch short circuits the input of T5, removing 1,800-cycle energy from the photocell circuit when the selector switch is in RECORD PHOTO or RECORD DIRECT position.

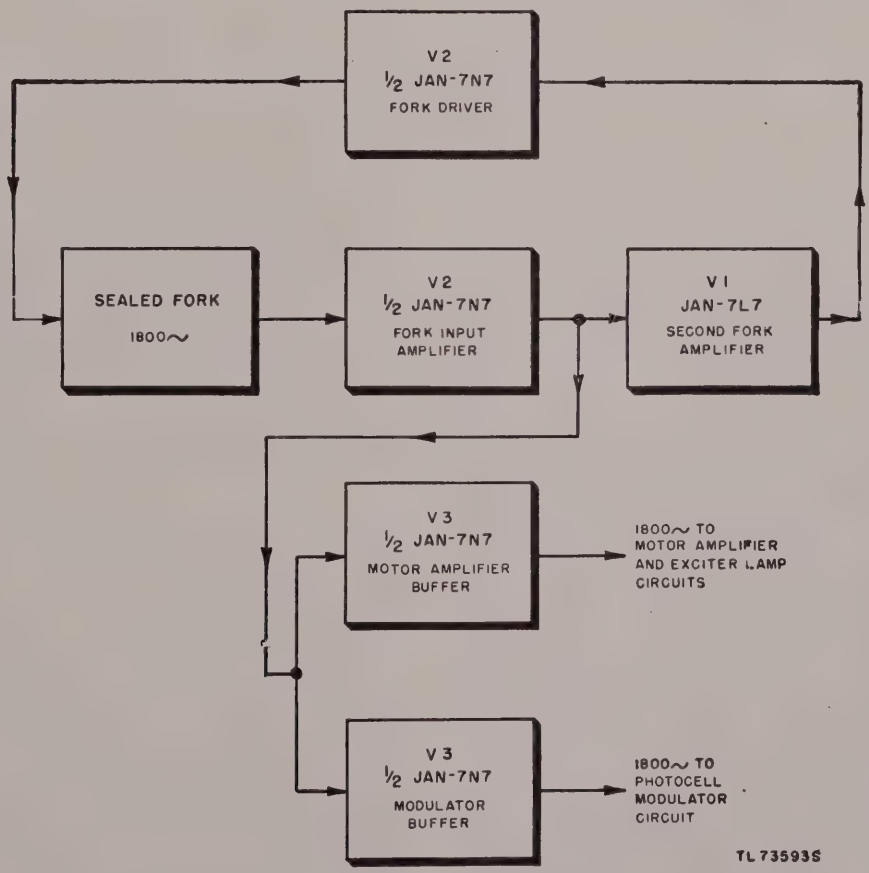


Figure 54. Sealed fork oscillator unit, block diagram.

87. Fork Oscillator Unit (Sealed) (V1, V2, V3)

The sealed fork oscillator unit, used in Facsimile Sets AN/TXC–1 above serial number 105 on Order No. 2695–MPD–45, and in all Facsimile Sets AN/TXC–1A and AN/TXC–1B, is similar in purpose and performance to the unsealed unit described in paragraph 86. However, the stability of this tuning fork is improved by using a temperature-compensated, bimetallic fork which is vacuum sealed to minimize the effects of atmospheric and barometric changes. The frequency must be maintained with extreme accuracy, because a slight variation will cause a change in motor speed and a failure of synchronization between transmitting and receiving machines. A deviation in frequency of one cycle in 10 seconds will cause a skew of more than 1 inch in the received copy. The sealed fork oscillator unit consists of three stages: one a fork input amplifier and driver, the second another fork amplifier, and the third a dual output buffer. All stages are supplied regulated B+ voltage.

a. Block Diagram. Figure 54 shows in block diagram form the signal paths in the sealed fork oscillator unit. The first half of V2 picks up the weak signal from the fork, and amplifies it enough to drive V1 sufficiently so that the output of V1 is constant despite minor variations in input. The constant-level output of V1 is amplified in the second half of V2, whose output feeds the drive coils of the tuning fork. Part of the output of V1 is impressed on V3, one section of which feeds the motor amplifier and exciter lamp circuit, and the other section of which feeds the photocell bridge modulator circuit. The complete schematic diagram of the sealed fork oscillator unit is shown in figure 143.

b. Fork Amplifier-Driver (V2). This dual triode, Tube JAN–7N7, serves as fork input amplifier and also as fork driver.

(1) *Fork input amplifier.* The first section of V2, the fork input amplifier, is fed at the grid by 1,800-cycle energy generated in the pick-up coil by the vibrating fork. R302 is the unbypassed cathode resistor of this stage. R301 is the plate load resistor, and output developed across it is coupled from the plate of this section through C304 to the grid of V1.

(2) *Fork driver.* The second section of V2 is the fork driver, which receives energy at the grid from the plate of V1 through coupling capacitor C303 and series resistor R305. R305, a limiting resistor, and R306, the grid resistor, serve as a voltage divider for the input to this section of V2. R307 is the plate load resistor, and output from the plate is coupled through C301 to the drive coil which keeps the fork oscillating. The cathode circuit consists of two unbypassed resistors, R303, whose value is fixed, and R304, a variable resistor which is adjustable to permit minor changes in frequency of the fork.

c. Second Fork Amplifier (V1). The second fork amplifier V1, Tube JAN–7L7, is an amplifying link in the oscillator circuit composed of the fork, input amplifier, second fork amplifier, and fork driver. The grid of V1 is fed from the plate (pin 3) of V2 through coupling capacitor C304, the grid voltage being developed across grid resistor R313. The cathode resistor, R310, is bypassed by C306. Screen current is supplied through resistor R311, and the screen is bypassed back to cathode by C305. The plate load resistor is R312, and the 1,800-cycle output from the plate is coupled through C303.

d. Fork Output Buffers (V3). The fork output stage V3, using dual triode Tube JAN–7N7, consists of two buffer-amplifiers which are fed by the fork amplifier V1 and supply 1,800-cycle signal to motor amplifier stage V4, the exciter lamp circuit, and the photocell bridge modulator circuit.

(1) *Motor amplifier buffer.* The first section of V3 is the motor amplifier buffer. Its grid receives 1,800-cycle energy from the plate circuit of V1 through coupling capacitor C303 and limiting resistor R314. The grid resistor is a combination of R315 and R318, with the grid of the second section of V3 fed from a tap between these resistors. C310 is a high-frequency bypass for the grid. R316 is the unbypassed cathode resistor. Signal at the plate developed across load resistor R308 is coupled through C302 to the motor amplifier stage V4 via the MOTOR JACK and also the exciter lamp circuit. A connection to IIIR of the selector switch short circuits the 1,800-cycle supply to the motor circuit and the exciter lamp circuit when the selector switch and STANDBY-MON-TALK switches are both at STAND BY.

(2) *Modulator buffer.* The second section of V3 is the modulator buffer. Its grid receives 1,800-cycle energy developed across R318 as explained in (1) above. R317 is the unbypassed cathode resistor. Plate circuit energy developed across load resistor R309 is coupled through C309 to the low-pass filter and output transformer T5. C308 across the input and C307 across the output of T5 assist in removing high-frequency components of the signal. A connection to IIR of the selector switch short circuits

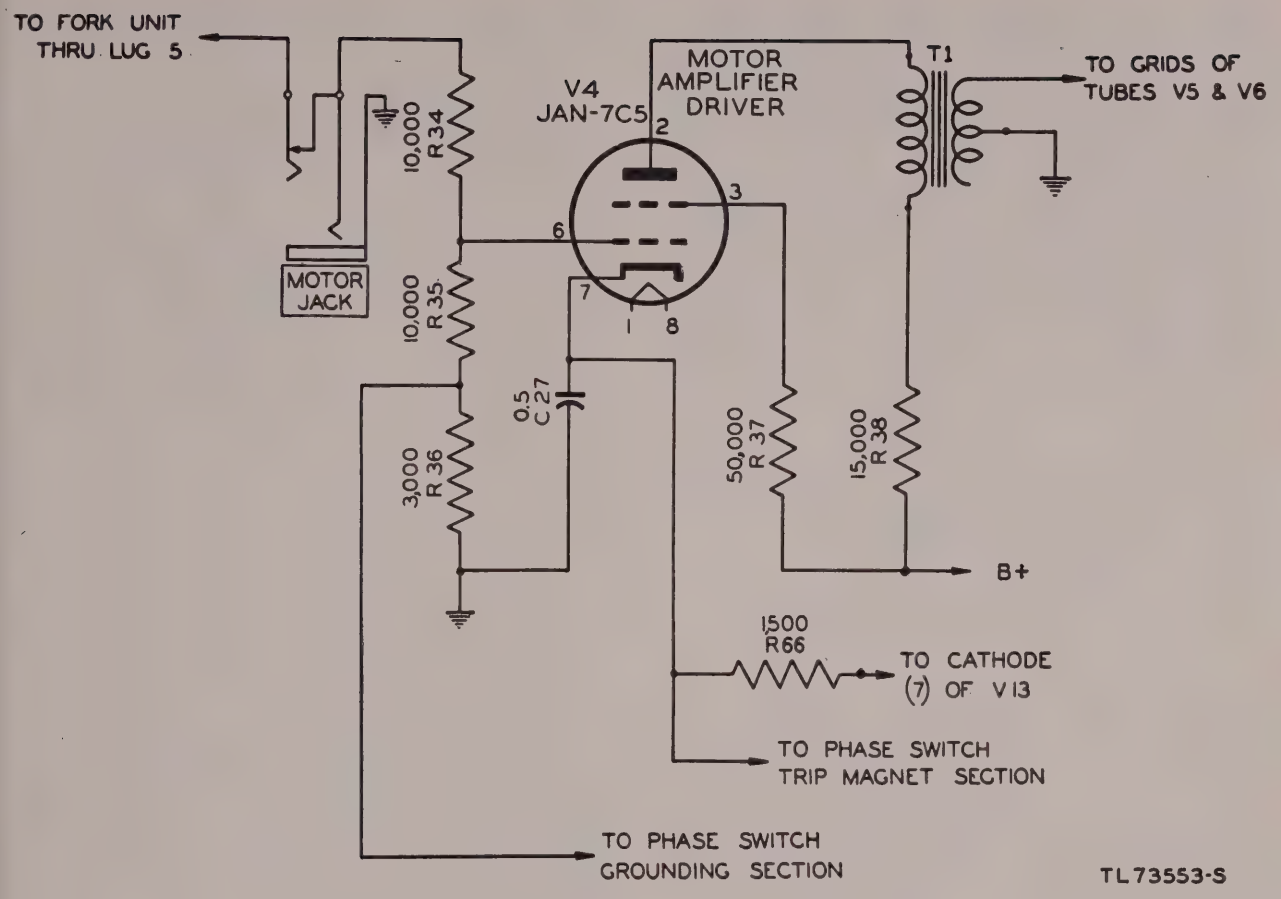


Figure 55. Motor amplifier driver, Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1.

the input to T5, removing the 1,800-cycle energy from the photocell circuit, when the selector switch is in RECORD PHOTO or RECORD DIRECT position in Facsimile Transceiver TT–1/TXC–1 (also in STAND BY position in Facsimile Transceivers TT–1A/TXC–1 and TT–1B/TXC–1).

88. Motor Amplifier Driver and Output Stages (V4, V5, V6)

Stages V4, V5, and V6 amplify the 1,800-cycle signal supplied by the fork oscillator unit, and furnish a-c power to operate the synchronous motor. Input to the motor amplifier stage V4 is approximately 25 volts. The voltage across the motor, however, may be as high as 1,000 volts.

a. Motor Amplifier Driver (V4). (1) Facsimile Sets AN/TXC–1 and –1A. Stage V4, which uses a Tube JAN–7C5 (fig. 55), is fed the 1,800 cycle signal from the fork oscillator unit through the MOTOR JACK to the voltage divider network composed of resistors R34, R35, and R36 in Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1. Normally the junction between resistors R35 and R36 is shorted to ground through a contact of the PHASE button so that R36 is out of the circuit. The voltage across R35 is applied to the tube control grid. When the PHASE button is pressed during the phasing operation, however, R36 becomes part of the voltage divider, and the voltage to the grid of tube V4 is increased. Increasing the input to V4 results in increasing the drive on parallel tubes V5 and V6, furnishing additional power to the synchronous motor. During the phasing operation the motor requires additional power because of the additional load created by friction in the clutch mechanism. During normal operation, with the PHASE button released, cathode current of V4 flows through the phasing magnet coil associated with tube V16 and also through the series resistor combination R66 and R67 (stage V13) which is in parallel with this coil. The flow of current through the coil holds the armature against the phasing magnet, so that it does not actuate the clutch mechanism used in the phasing operation. The flow of current through R67 adds to the bias of tube V13, which

requires bias beyond the cut-off value. When the PHASE button is pressed during the phasing operation, the phasing magnet is disconnected from the cathode circuit of V4, and the armature is released to play its part in the phasing operation. To compensate for the removal of the phasing magnet coil from the cathode circuit, resistor R40 is connected in parallel with the series combination R66 and R67 during the phasing operation. C27 is the cathode bypass capacitor for tube V4. Screen current is fed through resistor R37 and plate current through dropping resistor R38 and the primary of class B driver transformer T1. The screen is not bypassed to ground.

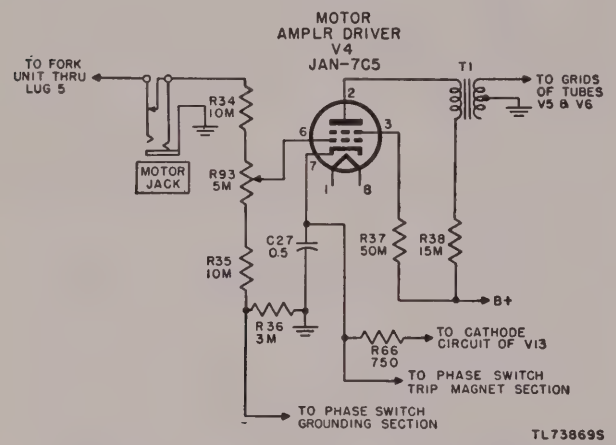


Figure 56. Motor amplifier driver, Facsimile Transceiver TT–1B/TXC–1.

(2) *Facsimile Set AN/TXC–1B.* The motor amplifier driver circuit of Facsimile Transceiver TT–1B/TXC–1 is similar to that described in (1) above for earlier models of equipment, except that the grid and cathode circuits of tube V4 have been redesigned (fig. 56). A new potentiometer, R93, has been introduced into the grid circuit of V4, so that proper adjustment may be made of input to V4, which in turn affects the drive of stages V5 and V6. R93, located on meter M2, is adjusted for proper motor current reading on this meter. Cathode current of stage V14 in Facsimile Transceiver TT–1B/TXC–1 flows through the series combination of R66, R97 (new potentiometer), and R67 of stage V13. See paragraph 91 for details of V13 cathode circuit.

b. Motor Amplifier Output Stage (V5 and V6). V5 and V6 are Tubes JAN–6AC5GT/G in Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1 (fig. 57), and are Tubes JAN–1635 in Facsimile Transceiver TT–1B/TXC–1 (fig. 58). In all equipments they are connected in parallel, and serve as single-ended, zero-bias class B power amplifier tubes whose output drives the synchronous motor. They are driven by V4 through class B driver transformer T1.

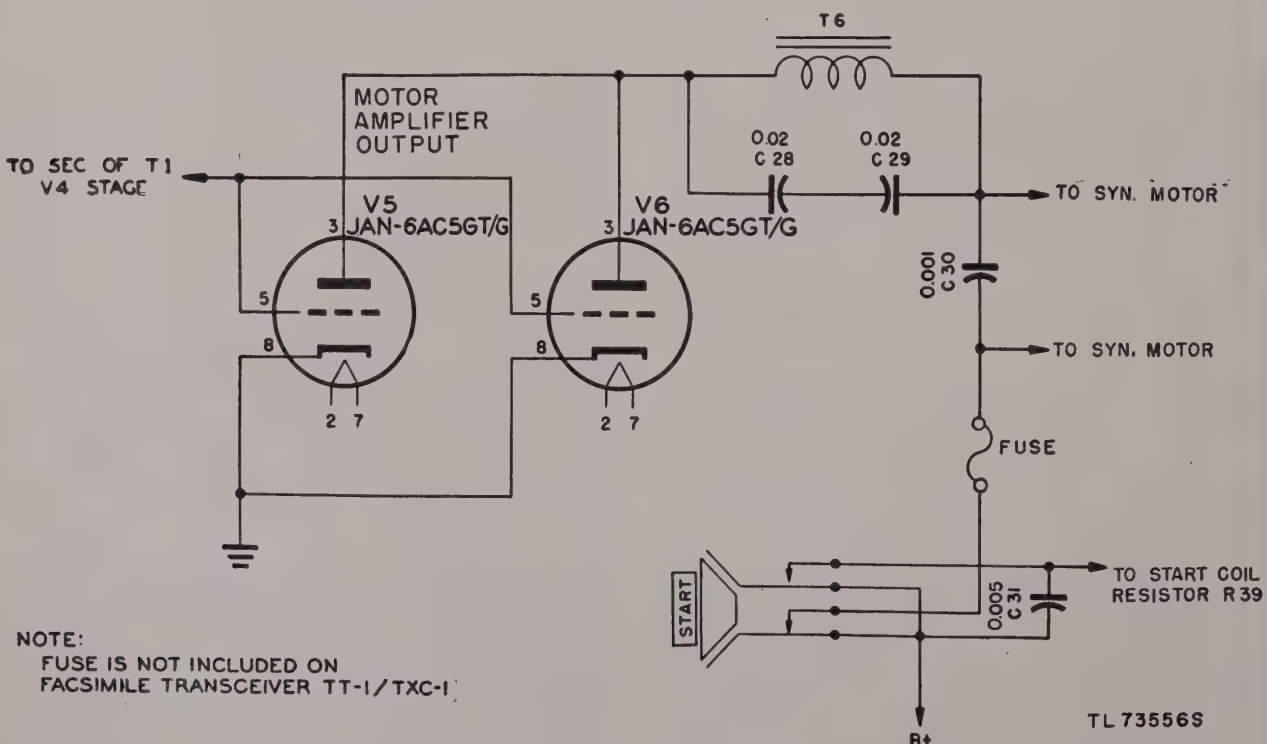


Figure 57. Motor amplifier output stage, Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1.

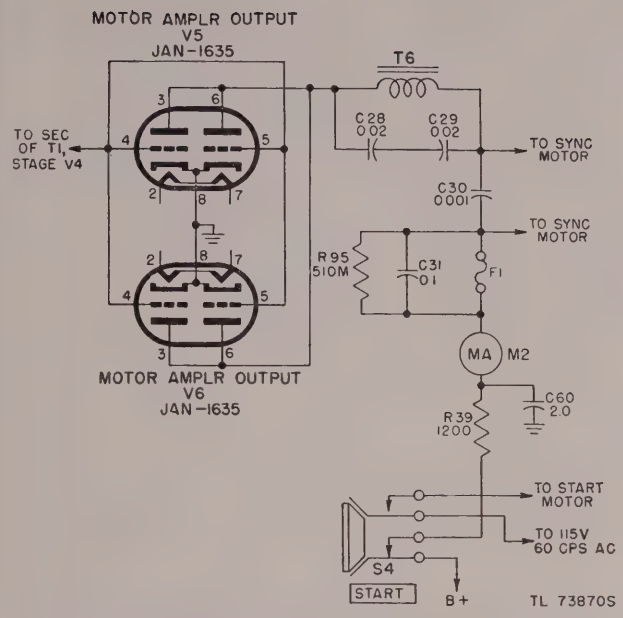


Figure 58. Motor amplifier output stage, Facsimile Transceiver TT–1B/TXC–1.

(1) *Plate circuit.* The plate circuit of V5 and V6 consists of two circuits, a d-c circuit to supply plate current to the tubes, and a series-resonant circuit at 1,800 cycles to power the motor. The d-c circuit consists of the synchronous motor winding and choke T6. The series-resonant circuit consists of the synchronous motor winding, which is shunted by capacitor C30 to limit transients, and two series capacitors, C29 and C28. Note that the synchronous motor winding is common to both circuits. The motor current is a series of d-c pulses, which reoccur 1,800 times per second, for tubes V5 and V6 conduct only on the positive half-cycles of the 1,800-cycle input wave. Choke T6 is not a part of the series-resonant circuit; its a-c impedance is high and it may be considered a device for shunt-feeding stages V5 and V6. Voltage across the synchronous motor winding and across T6 is approximately equal and may rise as high as 1,000 volts. Capacitor C30, by limiting transients, prevents high peak voltages which might break down insulation of the motor winding.

(2) *Switching circuit.* Normally the B+ circuit to the plates of V5 and V6 is completed through the START switch contacts. But when the START button is pressed to energize the separate start windings, the synchronous winding of the motor is disconnected and the plates of V5 and V6 are not energized.

(3) *Differences in models.* In Facsimile Transceiver TT–1/TXC–1, a capacitor C31 is placed across START switch contacts to prevent arcing. In Facsimile Transceiver TT–1A/TXC–1, a motor fuse has been added to the plate circuit of stages V5 and V6. In Facsimile Transceiver TT–1B/TXC–1, the fuse is bypassed by C31 and a high-value resistor, R95, has been placed in parallel with this capacitor. Also a motor current meter M2 has been placed in the circuit. A series resistor, R39, limits motor current, and bypass capacitor C60 keeps this part of the circuit at a-c ground potential.

89. Synchronous Motor

The synchronous motor in Facsimile Transceiver TT–1(*)/TXC–1 is basically a Lacour phonic wheel motor; its speed is held constant at 1,800 rpm by the 1,800-cycle power supplied by the plate circuit of tubes V5 and V6. The worm on the motor shaft is meshed with a gear which drives the lead screw at 60 rpm through the clutch mechanism.

a. Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1. In these models of equipment the starting motor operates on 9 volts, 60 cycles, ac, which is supplied by Rectifier Power Unit PP–86/TXC–1. Pressing the START switch applies B+ voltage through limiting resistor R39 to a magnet which moves the start motor brushes into contact with the start motor commutator (figs. 147 and 148). The START switch also disconnects the supply of power from the synchronous motor. The START switch is pressed until the drum speed rises above 60 rpm. Then the switch is released, the start motor is disconnected, the synchronous motor circuit is re-energized, and the drum slows down to 60 rpm and continues to run at that constant speed.

b. Facsimile Transceiver TT–1B/TXC–1. In this model of equipment, which uses a redesigned motor, the operation of the synchronous motor is similar to that described above, but the start motor section is completely different (fig. 149). The start motor is a capacitor-start induction motor which operates on 115 volts, 60 cycles ac. No start brushes are required. Pressing the START button disconnects the synchronous motor and applies 115 volts ac, brought up from Rectifier Power Unit PP–86A/TXC–1, to the start motor. Note that the capacitor winding of the start motor is in the circuit at all times. This winding also furnishes part of the power for the motor while it is running at synchronous speed, but the major part of the power is developed by the synchronous motor, which also

controls the speed. Because this capacitor winding is in the circuit at all times, it is possible for this motor to run at a nonsynchronous speed. The operator must guard against operating the transceiver with the motor running at nonsynchronous speed. A 1,800-cycle tone from the motor laminations is the best assurance that the motor is running at synchronous speed.

90. Photocell Circuit (V24)

Photocell Tube JAN–1645 is the heart of the photocell bridge modulator circuit, which is used only on transmitting. The photocell, V24, and its associated circuit (fig. 49) cause amplitude modulation of the 1,800-cycle signal supplied from the fork oscillator unit. Amplitude modulation follows the lights and shadows on that portion of the transmitted copy being scanned. After modulation of the 1,800-cycle signal is accomplished in the photocell bridge modulator circuit, the modulated signal is fed to the grid of stage V10, the first signal amplifier. V10 and the following signal amplifiers not only amplify the modulated signal, but use a series of differentiating circuits (small coupling capacitors and large grid resistors) to remove undesirable low-frequency signal components generated in the modulator circuit.

a. Simplified Bridge Modulator Circuit. Figure 59 is a very simplified equivalent of the photocell bridge modulator circuit shown in complete form in figure 60. In the simplified circuit, the 1,800-cycle carrier signal from the fork oscillator unit is fed to points A and C of the resistance-capacitance bridge. Output from the bridge is the voltage developed across R50, between points D and B. This voltage is the grid-cathode or input voltage of stage V10. A small capacitance (CT) exists between the cathode and active anode of V24, and this is effectively balanced out by the neutralizing capacitance (CN) which is the capacitance existing between the cathode and the second or neutralizing anode within the photocell. When the bridge is perfectly balanced, there is no output of 1,800-cycle signal to be applied to V10; but when increased light shines on the photocell, it causes increased electron emission from the cathode, producing unbalance of the bridge and a greater 1,800-cycle signal.

b. Optical System. At any instant, the light reaching the photocell is determined by the lightness or darkness of the small area of transmitting copy being scanned. Light from the constant source of illumination, the exciter lamp shown in the transmitting block diagram (fig. 43), is concentrated onto a small portion of the copy by the condenser lens system. The illuminated area is approximately the size of the filament in the exciter lamp. The objective lens focuses an image of the illuminated area of copy onto a screen having a small hole or aperture that permits only the light from an area approximately 1/100th of an inch square to pass on to the photocell in back of the aperture. As the drum and copy move during transmission of a picture, each scanned element of picture reflects a different amount of light back to the photocell. The photocell and bridge modulator circuit change each level of light into its equivalent electrical signal.

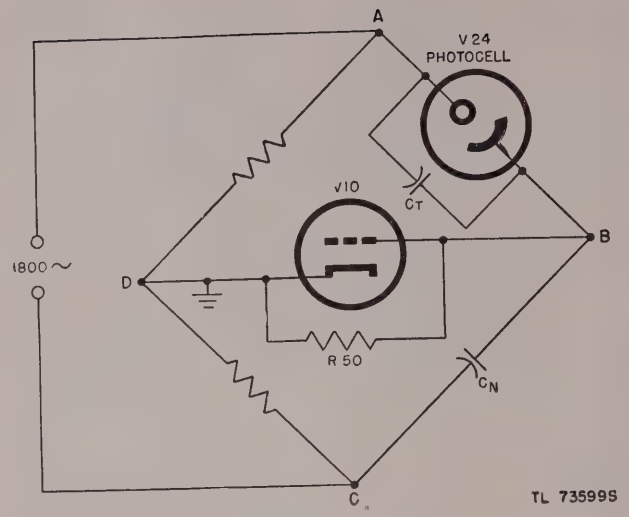


Figure 59. Simplified bridge modulator circuit.

c. Complete Schematic Diagram. The complete schematic diagram of the photocell bridge modulator circuit is shown in figure 60. The output of the bridge, the voltage across R50, is a varying d-c signal consisting of the keying or modulating frequency on which is superimposed the 1,800-cycle carrier frequency. This varying d-c signal is always of such polarity that the grid end of R50 is positive with respect to the other end. This is due to the increased emission from the photocell when increased light strikes it. The conventional modulation envelope, consisting of the 1,800-cycle signal varied in amplitude both above and below the zero axis, first appears in a somewhat distorted form at the grid of stage V11.

(1) *Resistor networks.* Between points A and C of figure 60, where the unmodulated 1,800-cycle carrier signal is applied, are two resistor networks, one consisting of R41, R42, and R43 in series and

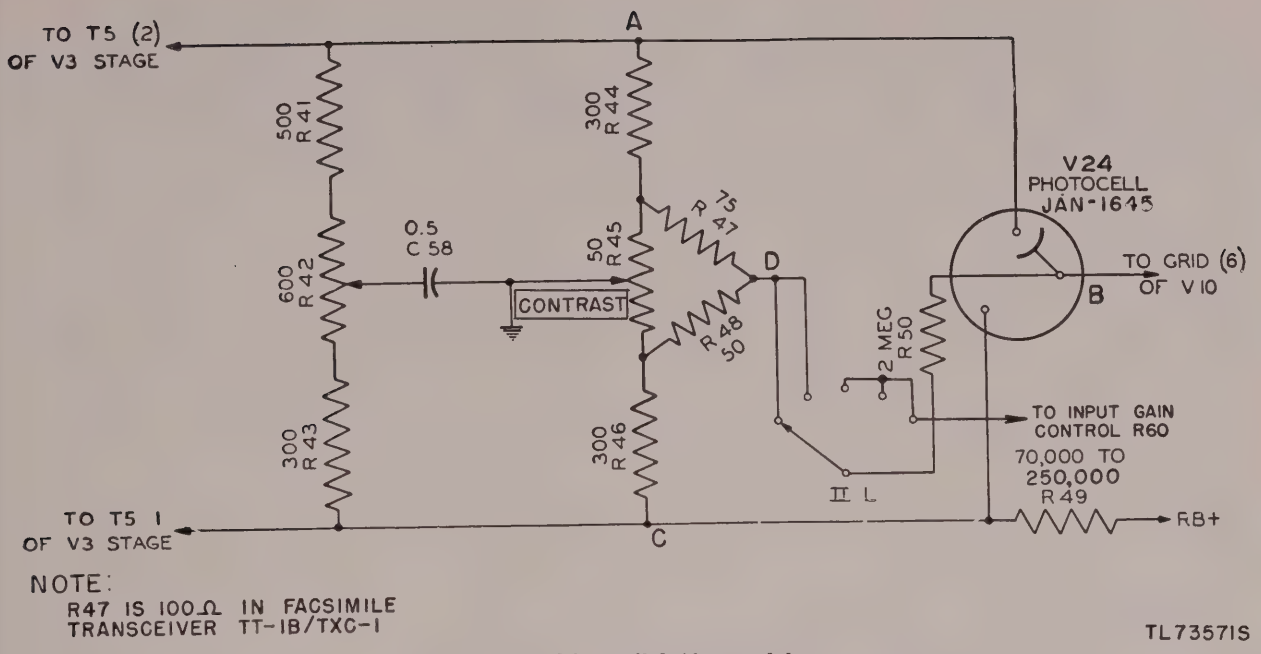


Figure 60. Photocell bridge modulator.

the other consisting of R44, R45, and R46 in series and having resistors R47 and R48 in series across R45. The first of these networks includes variable resistor R42, which serves as a neutralizing control and is used in balancing out the capacitive effect of the photocell. Its effect on the circuit is the same as making CN variable. R42 is an alinement control and is located beneath the chassis of the facsimile transceiver. It is set to the proper value when the photocell is changed; it is not used as an operating control. Capacitor C58 provides capacitive reactance to ground for the slide arm of R42, thereby permitting close adjustment of the null point. Variable resistor R45 in the second network across the input of the bridge is the CONTRAST control, a front panel operating control used in setting the original contrast range at the facsimile transmitter. This control may be adjusted either to balance the bridge on maximum light (positive transmission: minimum signal on white, maximum on black) or on minimum light (negative transmission: minimum signal on black, maximum on white).

(2) *Other components.* Resistors R47 and R48 are used in lieu of the proper tap on CONTRAST control R45; they serve merely to keep point D electrically at a predetermined relationship with respect to R45. Resistor R49, which may be shunted by R49A, R49B, or R49C or combinations thereof, is a portion of a voltage divider between the regulated B+ voltage and ground. This divider serves to keep both anodes of the photocell at a slight positive potential (0.3 to 0.6 volt) with respect to the photocell cathode. This bias extends the linear portion of the photocell curve and makes possible the use of an increased 1,800-cycle input into the bridge. R50 is the grid resistor of tube V10, the high side connecting both to the cathode of the photocell and to the grid of V10. Its low potential side reaches ground through R47, R48, and R45, when the selector switch (IIL) is in TRANSMIT or SET RANGE position. On other settings of the selector switch the bridge circuit continuity is interrupted.

91. Signal Amplifiers (V10, V11, V12, V13, V14)

Facsimile Transceiver TT–1(*)/TXC–1 has five stages of signal amplification. Various stages are used for various functions, as determined by the setting of the selector switch and as illustrated in figure 61. V10, V11, and V12 are class A signal amplifiers. The first half of V13 is operated as a class C threshold limiter and serves as a driver for V14, a class B output amplifier. V10 and V11 are used for all functions, V12 on TRANSMIT and RECORD PHOTO, V13 on RECORD DIRECT, and V14 on RECORD DIRECT and RECORD PHOTO. The use of V10, V11, and V12 in the talk-back circuit is explained in paragraph 97.

a. First Signal Amplifier (V10). Stage V10 (fig. 62) is a high-gain pentode voltage amplifier,

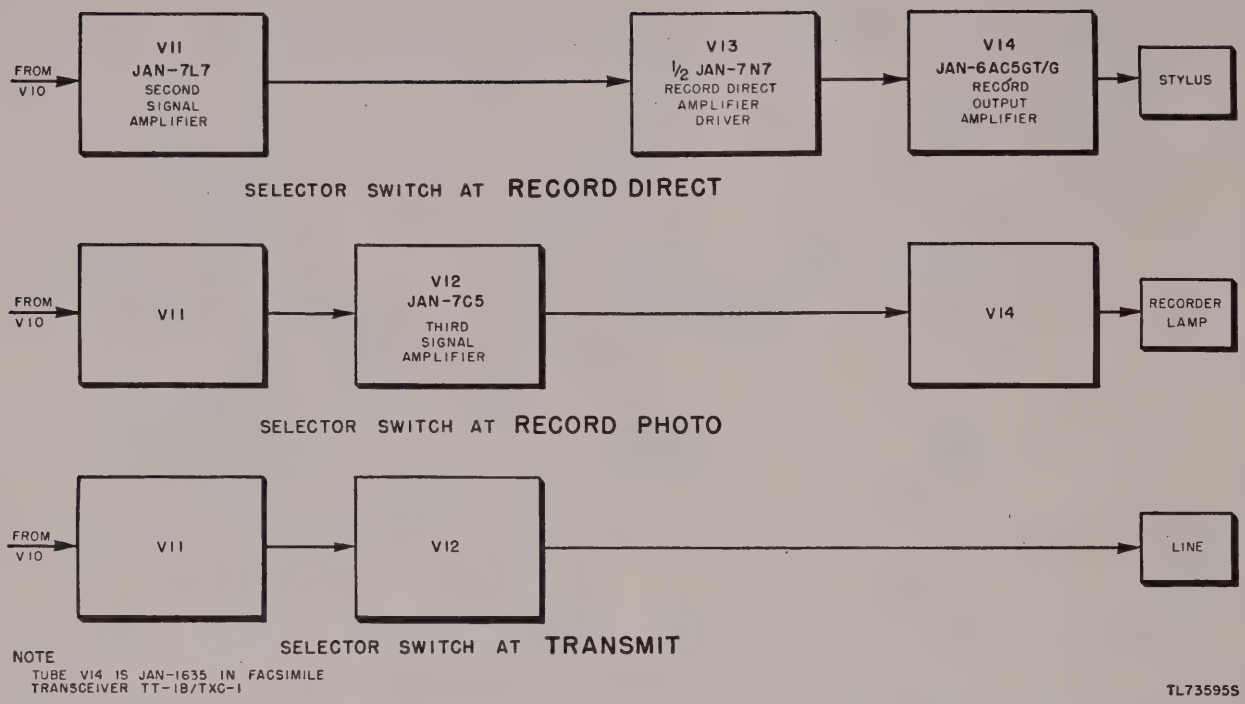


Figure 61. Block diagram of signal amplifiers used in various positions of selector switch.

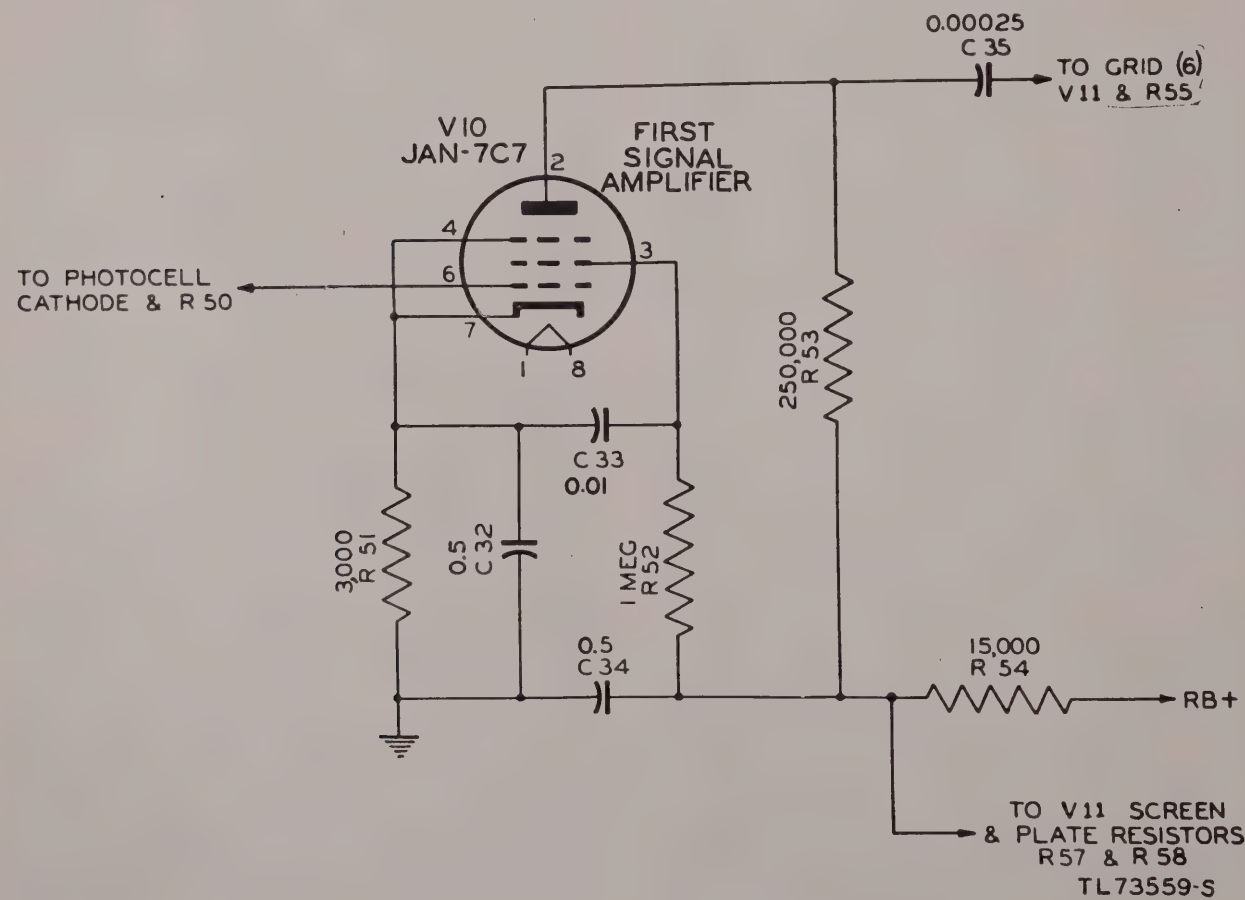


Figure 62. First signal amplifier.

Tube JAN–7C7, biased for class A operation and used for both transmitting and receiving.

(1) *Transmitting.* With the selector switch at TRANSMIT or SET RANGE the grid of V10 is fed by the photocell bridge modulator circuit as explained in paragraph 90. R50 serves as the grid resistor, across which the modulated 1,800-cycle signal is developed and applied to the grid. Cathode bias is developed across R51 and filtered by C32. The screen is fed through R52 and bypassed directly to cathode by C33. R53 is the plate load resistor across which an amplified, modulated 1,800-cycle signal is developed and applied to the grid of tube V11 through output coupling capacitor C35. R54 and C34 form an R–C decoupling network between the stage and the source of regulated B+ plate and screen voltage.

(2) *Receiving.* With the selector switch in the recording positions, the modulator is inactive and the control grid of V10 is connected through R50 as a series resistor to the arm on potentiometer R60, that half of the dual GAIN control which serves as an input gain control across the secondary of the input transformer T7 (figs. 147, 148, and 149). Input to the transceiver is either through this line matching transformer T7 from the LINE binding posts or to the high end of R60 from the LINE JACK, depending upon the input connections in use (par. 13). The rest of the circuit of V10 is the same for receiving as transmitting.

b. Second Signal Amplifier (V11). Stage V11 (fig. 63) is a second pentode voltage amplifier, Tube JAN–7L7, biased for class A operation, and used without circuit changes for both transmitting and receiving. It is fed by stage V10 and its output feeds V12 through the transmitting portion of the dual GAIN control and also both triode sections of V13, the signal-meter amplifier. The input signal, the modulated 1,800-cycles from V10, is applied through C35 and across grid resistor R55 to the control grid of V11. C35 is of low capacitance, 0.001 mf, to attenuate unwanted low frequencies from the previous stage. Cathode bias for class A operation is developed by current flow through the cathode resistor R56, which is bypassed at audio frequencies by C36. Screen current is supplied through screen resistor R57, and the screen is bypassed to ground by C37. Regulated plated voltage is applied to R58, the plate load resistor. The amplified 1,800-cycle signal developed across R58 is applied through C39 to the output GAIN control potentiometer R59, and through C38 to the grid circuit of the signal amplifier half of dual triode tube V13.

c. Third Signal Amplifier (V12). Stage V12 (fig. 64) is a triode-connected class A signal amplifier using Tube JAN–7C5 which serves as the transceiver output amplifier on transmitting and as a driver stage for V14 (class B stage) on photo

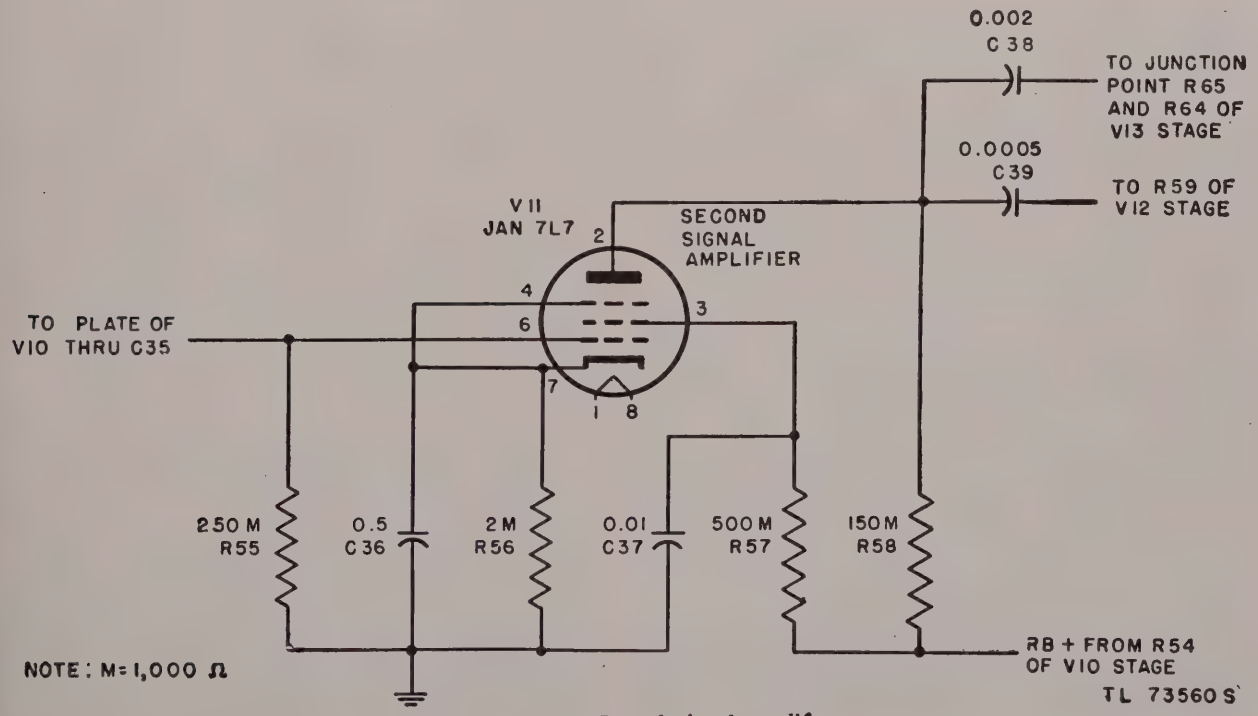


Figure 63. Second signal amplifier.

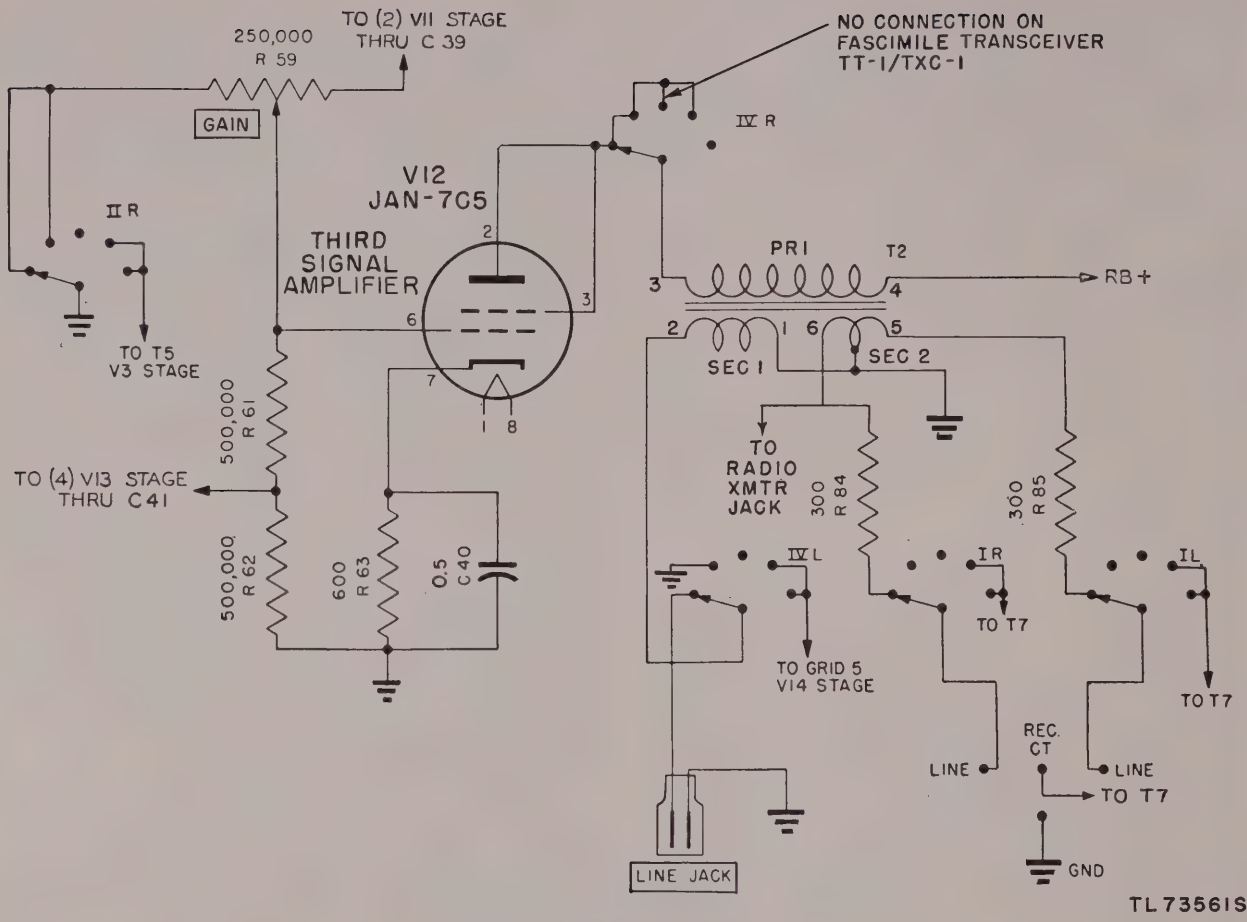


Figure 64. Third signal amplifier.

recording. V12 is in the facsimile *signal* circuit only when the selector switch is at TRANSMIT, SET RANGE, and RECORD PHOTO positions. The stage amplifies modulated 1,800-cycle signals in both transmitting and receiving functions. The stage is also used in the talk-back circuit of Facsimile Transceivers TT–1A/TXC–1 and TT–1B/TXC–1.

(1) *Transmitting.* With the selector switch set on TRANSIT or SET RANGE, the control grid of V12 is fed the signal coupled through C39 from the plate of tube V11 and developed across R59, the transmitting half of the dual GAIN control. The slider on R59 selects the portion of voltage across R59 which is to be applied to the grid of V12. R61 and R62 in series constitute a voltage divider across the input circuit of V12. Half of the V12 grid voltage is applied from the junction of R61 and R62, through capacitor C41, to the grid of the meter amplifier half of V13. V12 is biased by cathode current flowing through the cathode resistor R63, which is bypassed at audio frequencies by C40. Transformer T2 is the output transformer for stage V12. Plate current flows through the primary from the regulated B+ supply. Signal variations at the plate of V12 cause signal voltages to be induced in the two secondaries of T2. In the TRANSMIT position of the selector switch only, secondary No. 1 is connected to the LINE JACK, one side of which is grounded; and secondary No. 2 is connected to the LINE binding posts through attenuator resistors R84 and R85. In the SET RANGE position of the selector switch, the LINE binding posts and LINE JACK are disconnected, and secondary No. 1 is short-circuited and grounded.

(2) *Receiving.* When the selector switch is at any other position than TRANSMIT or SET RANGE, the low side of R59, the output GAIN control, is ungrounded, removing its effectiveness as a gain control but still permitting V12 to be fed by V11. V12 serves as a received signal amplifier only for photographic recording. With the selector switch in RECORD PHOTO position the plate circuit of V12 is established through the primary of transformer T2. Secondary No. 2 of T2 is open-circuited,

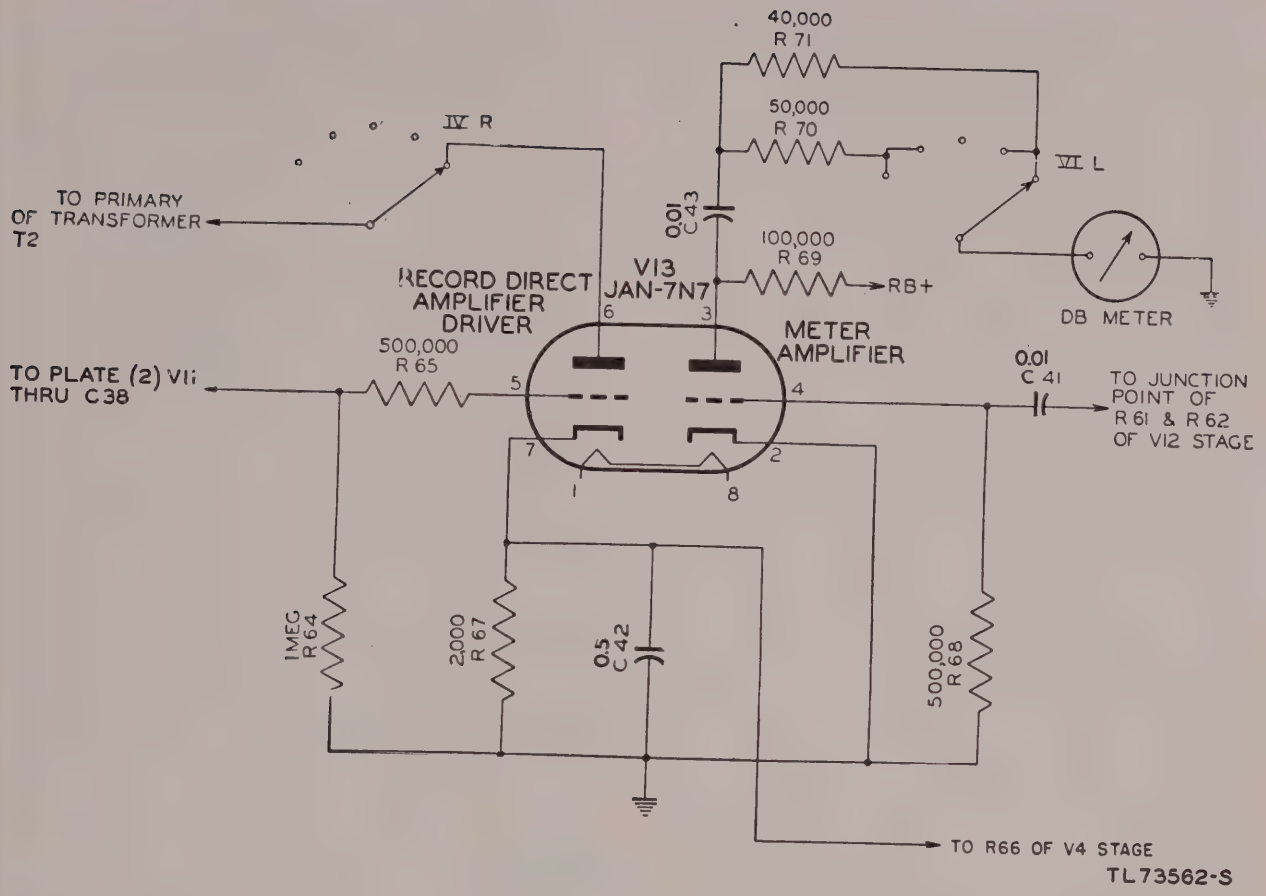


Figure 65. RECORD DIRECT amplifier driver and meter amplifier, Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1.

but secondary No. 1 of T2 is in the grid circuit of V14, the output amplifier for recording.

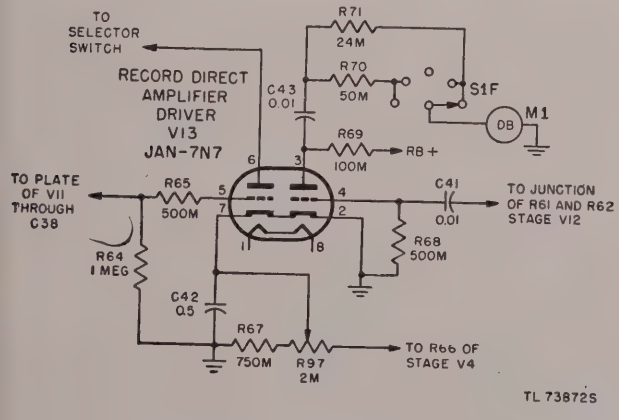


Figure 66. RECORD DIRECT amplifier driver and meter amplifier, Facsimile Transceiver TT-1B/TXC-1.

d. Signal-meter Amplifier (V13). Stage V13 (figs. 65 and 66) is a dual-triode Tube JAN-7N7. The first triode section (pins 6, 5, and 7) serves as the class C RECORD DIRECT amplifier-driver stage which drives stage V14. The second triode section (pins 3, 4, and 2) serves as the meter amplifier, providing a vacuum-tube voltmeter circuit for measuring input and output signal levels in decibels.

(1) *RECORD DIRECT Amplifier Driver.* Although the grid of the first section of tube V13 is fed a modulated 1,800-cycle signal at all times, the stage is operative only when the selector switch is in the RECORD DIRECT position. The stage is operated as a threshold limiter; that is, it is biased considerably beyond cut-off and prevents an output signal until the input signal reaches a predetermined level. This is advantageous in controlling the signal used on direct recording. The grid (pin 5) is fed from the plate of V11 through coupling capacitor C38 and resistor R65. R65 is in the circuit to prevent the grid from drawing current when the plate circuit is not energized, that is when the selector switch is in some other position than RECORD DIRECT. During operation of the stage, the grid is not fed sufficient signal to drive the grid positive and cause grid current to flow through the grid

resistor R64. Bias for the stage (approximately 18 volts) is developed by the flow of cathode current in both stages V13 and V4. In Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1, V4 cathode current flows through resistors R66 and R67 (fig. 65). The bias on V13 is the voltage developed across R67. In Facsimile Transceiver TT–1B/TXC–1, V4 cathode current flows through resistors R66, R67, and R97 (fig. 66). The bias on V13 is the voltage developed across R67 and that portion of potentiometer R97 which is in the V13 cathode circuit. R97 can be adjusted for best operation of the stage. The cathode resistor is bypassed by capacitor C42. Only when the selector switch is in RECORD DIRECT position is plate current supplied to this section of V13, through switch IVR and the primary of transformer T2 which now becomes the class B driver transformer for stage V14.

(2) *Meter amplifier.* The grid of the meter amplifier tube, second triode section of V13, is fed at all times by the voltage across R62 in the grid circuit of stage V12. C41 is the input coupling capacitor and R68 the grid resistor for this section of V13. The db meter, an a-c meter with a self-contained copper oxide rectifier, receives its signal from the shunt-fed plate circuit of the stage. The plate is supplied current from the regulated B+ supply through plate load resistor R69. Blocking capacitor C43 couples the modulated 1,800-cycle signal from plate to the meter, through R70 for TRANSMIT and SET RANGE positions of the selector switch, and through R71 for RECORD PHOTO and RECORD DIRECT settings of the selector switch. The meter is disconnected in the STAND BY position of the selector switch.

e. RECORD OUTPUT AMPLIFIER (V14). The RECORD output amplifier, V14, a class B power stage, drives the recorder lamp on RECORD PHOTO setting of the selector switch and drives the stylus on the RECORD DIRECT setting of the selector switch. These two outputs are plate circuit outputs. A separate cathode circuit output is taken during the phasing operation, when the PHASE button is pressed, and is applied to the cathode-driven pulse amplifier stage V15 (par. 92). Stage V14 is driven through secondary No. 1 of transformer T2 by stage V12 in the RECORD PHOTO function, and by stage V13 in the RE-

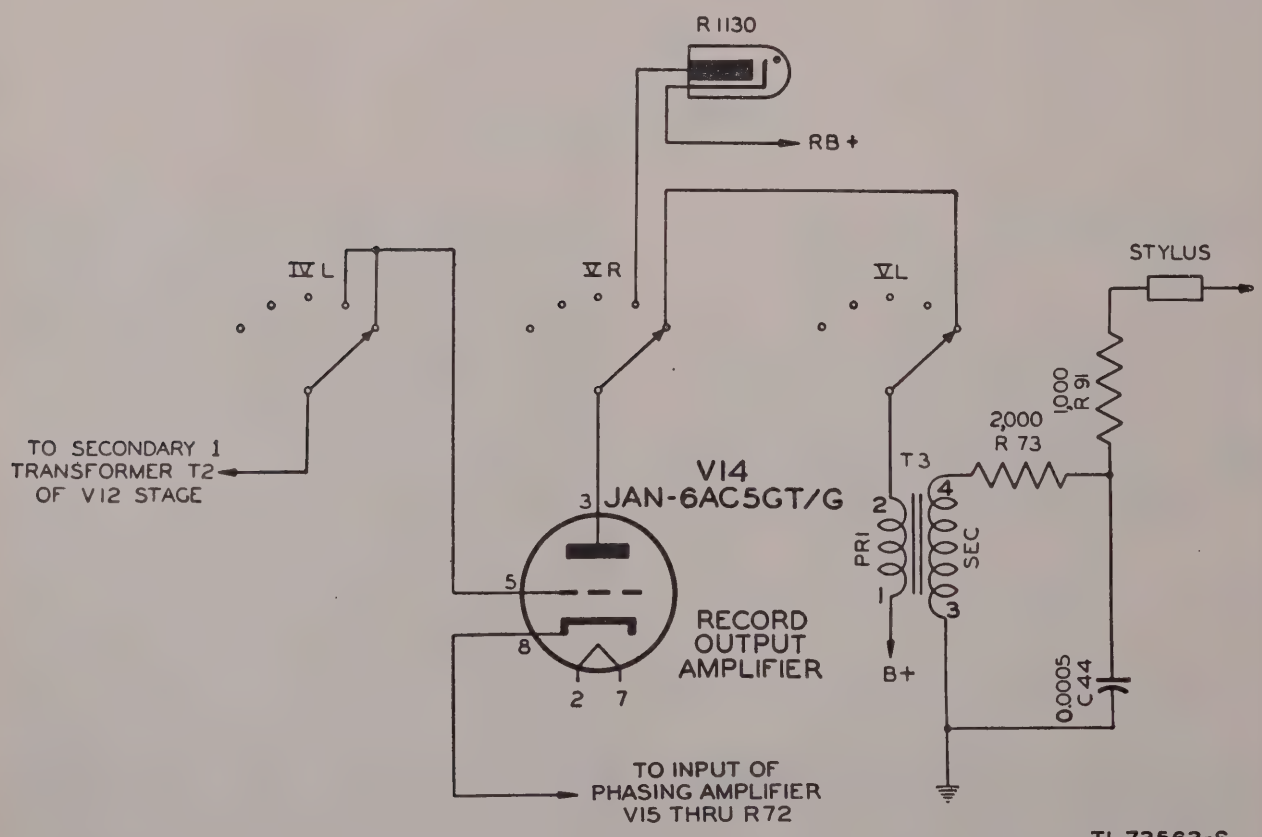


Figure 67. RECORD output amplifier, Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1.

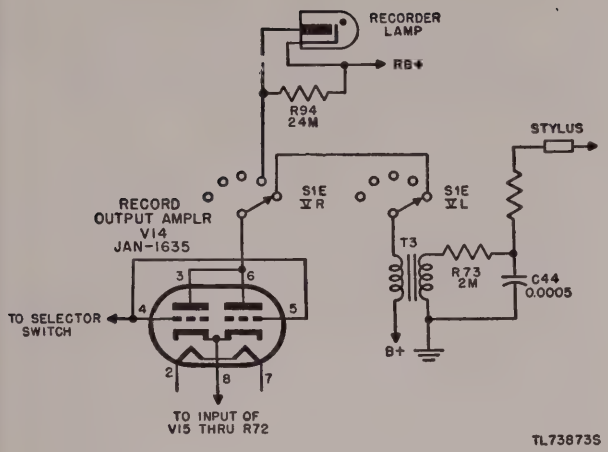


Figure 68. RECORD output amplifier, Facsimile Transceiver TT–1B/TXC–1.

CORD DIRECT function. In Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1, V14 is Tube JAN–6AC5GT/G (fig. 67); in Facsimile Transceiver TT–1B/TXC–1, V14 is Tube JAN–1635 (fig. 68).

(1) *RECORD PHOTO.* In this function, plate current is supplied to V14 from the regulated B+ supply (250 volts) through the recorder lamp. The stage is biased class B, so that with no signal input, the recorder lamp produces only a slight glow. In Fascimile Transceiver TT–1B/TXC–1 only, resistor R94 shunts the recorder lamp to divide the V14 plate current between the lamp and the resistor. The recorder optical system uses the recorder lamp E2, Tube JAN–R1130B, which is a neon-filled lamp capable of converting varying signal intensities into varying amounts of light. The lamp is mounted in a housing (fig. 114) which opens into an aperture plate and field lens at one end of a lens barrel. On the other end of the barrel is an objective lens which focuses the light passing through the aperture to a small spot on the film or photographic paper. The recording beam produces exposures in accordance with its intensity.

(2) *RECORD DIRECT.* In this function, plate current is supplied V14 from the unregulated B+ supply (450 volts) through the primary of stylus transformer T3. One side of the secondary is grounded, and the stylus is connected to the high side of the secondary through an r-f suppressor composed of resistors R73 and R91 and capacitor C44, which reduce electrical interference from the spark. The audio output voltage sparks between the stylus and the grounded metal drum of the transceiver, burning the white covering from the black recording paper.

(3) *Cathode circuit.* In normal operation of stage V14 the cathode is connected directly to ground, through contacts of the PHASE button. This permits normal zero-bias operation of the class B stage. When the PHASE button is pressed, however, resistor R72 is connected into the cathode circuit of V14 and becomes a coupling resistor between stages V14 and V15. Phasing pulses from the transmitter are thus transferred from the output of V14 to the input of V15.

92. Phasing Circuit (V15, V16)

The phasing operation is performed jointly by the transmitting and receiving operator. The transmitting operator turns the selector switch of the transmitting transceiver to TRANSMIT and causes the scanning system to scan the phasing ring on the scanning drum. A pulse, in the form of an abrupt increase or an abrupt decrease in the amplitude of the 1,800-cycle carrier signal, is generated by the transmitter each time it scans the white spot on the dark phasing ring (once each second). The transmitting operator does *not* press the PHASE button on his machine. The receiving operator phases his machine to the transmitting machine by turning the selector switch to RECORD PHOTO and pressing the PHASE button. The remainder of this paragraph describes functioning of the facsimile receiver circuits during the phasing operation.

a. PHASE SWITCH. The receiver phasing circuit (fig. 69) is operative only when the PHASE switch is pressed. Pressing this switch makes the following circuit changes:

(1) Removes the phasing magnet from the cathode circuit of V4, halting the flow of holding current through the magnet. The magnet armature then engages the stop arm on the clutch, causing the receiving drum to rotate slower than the transmitting drum.

(2) Substitutes R40 in the cathode circuit of V4 to compensate for the removal of the phasing magnet (par. 88).

(3) Disconnects the short circuit across R36 in the grid circuit of V4, providing increased drive to V4 (par. 88).

(4) Disconnects the short circuit across R72, coupling stage V14 into stage V15.

b. ELECTRICAL CIRCUIT. The phasing pulse received over the facsimile circuit is amplified by stages V10, V11, V12, and V14 of the receiving transceiver and is rectified by the combination of

tube V14 and the recorder lamp (figs. 147, 148, and 149). The 1,800-cycle component is removed by a filter in the input circuit of V15. This tube amplifies the pulse, which is applied to the input of the thyratron, V16. Each pulse causes V1 to arc, pulling the armature to the phasing magnet and releasing the primary clutch stop arm. The transmitter sends the phasing pulse just as the stop arm on the transmitting machine is passing the phasing magnet. Since the receiving stop arm is released by the phasing pulse at this same instant, the transmitting and receiving transceivers are phased.

c. Pulse Amplifier (V15). Stage V15 uses Tube JAN–7L7 (fig. 69) as a pulse voltage amplifier in an inverted circuit. When the PHASE button is pressed, the pulse voltage developed across R72, cathode resistor of V14, is applied between cathode and grid of V15. The cathode is at signal input potential and the grid is at ground potential for signal input. The phasing pulse (a sudden decrease or increase in the 1,800-cycle signal) is smoothed into a d-c pulse by the filter action of a 50-mf capacitor C45 across R72, C46 between cathode and grid, and C47 between plate and ground. R47 serves as the grid resistor. Screen current is fed through screen dropping resistor R75 which is bypassed by C48. The d-c pulse developed across plate load resistor R76 is coupled to the grid of V16 through coupling capacitor C49. Both plate and screen are supplied regulated B+ voltage. See figures 97, 98, and 99 for waveforms.

d. Trigger Tube (V16). V16 is a gas-filled thyratron Tube JAN–884 (fig. 70), connected in such a way that each phasing pulse applied to its grid causes the tube to arc and energize the phasing magnet. When the PHASE button on the transceiver is pressed, the normal holding current from the cathode circuit of tube V4 is removed, permitting the magnet armature to engage the stop arm on the primary clutch. V16 has a positive potential of 250 volts applied directly to its plate from the regulated B+ supply. In the absence of a phasing pulse, the cathode is approximately 57 volts positive with respect to ground, being tapped onto the voltage divider composed of R17 and R78 across the regulated B+ supply. Since the tube grid is at ground potential, there being no voltage drop across grid resistor R77, the grid is effectively negative with respect to the positive cathode and the tube is nonconductive. Capacitor C50 is charged 57 volts positive, for it and the phasing magnet coil in series are across the cathode resistor R78. When a phasing

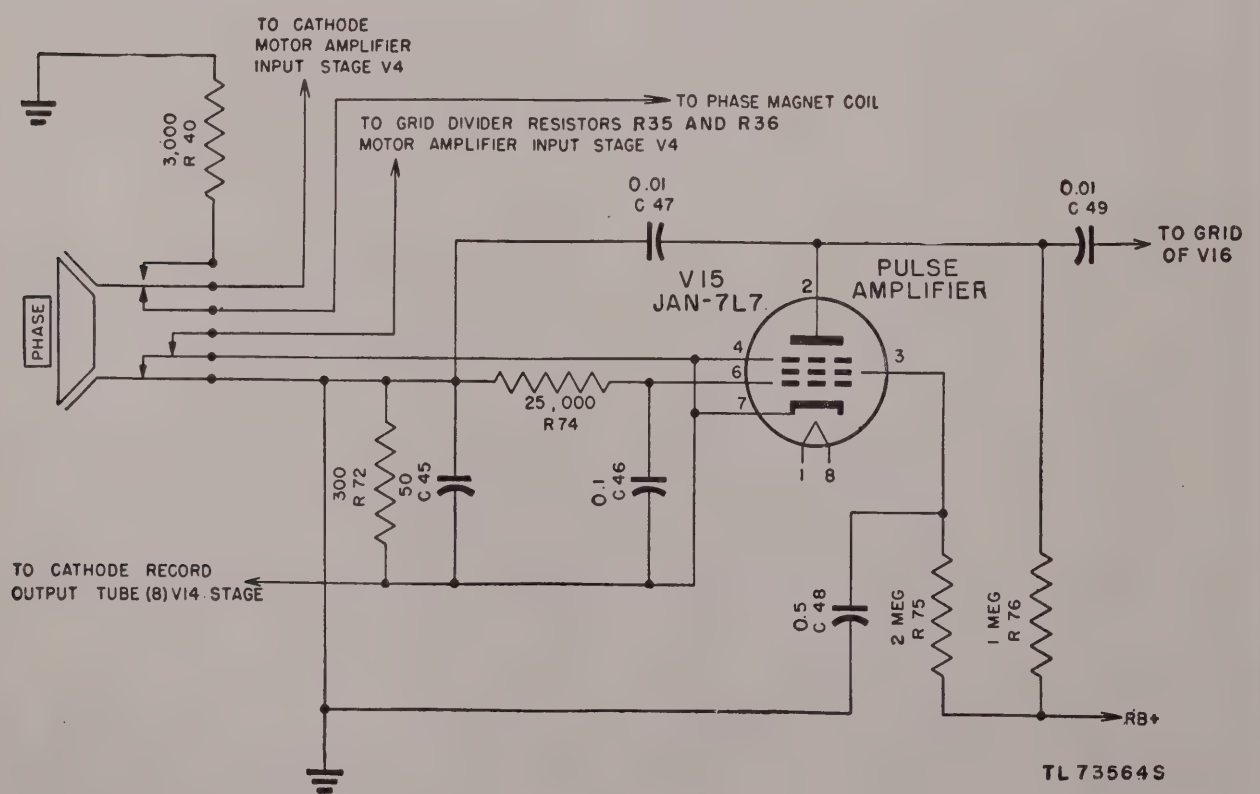


Figure 69. Pulse amplifier.

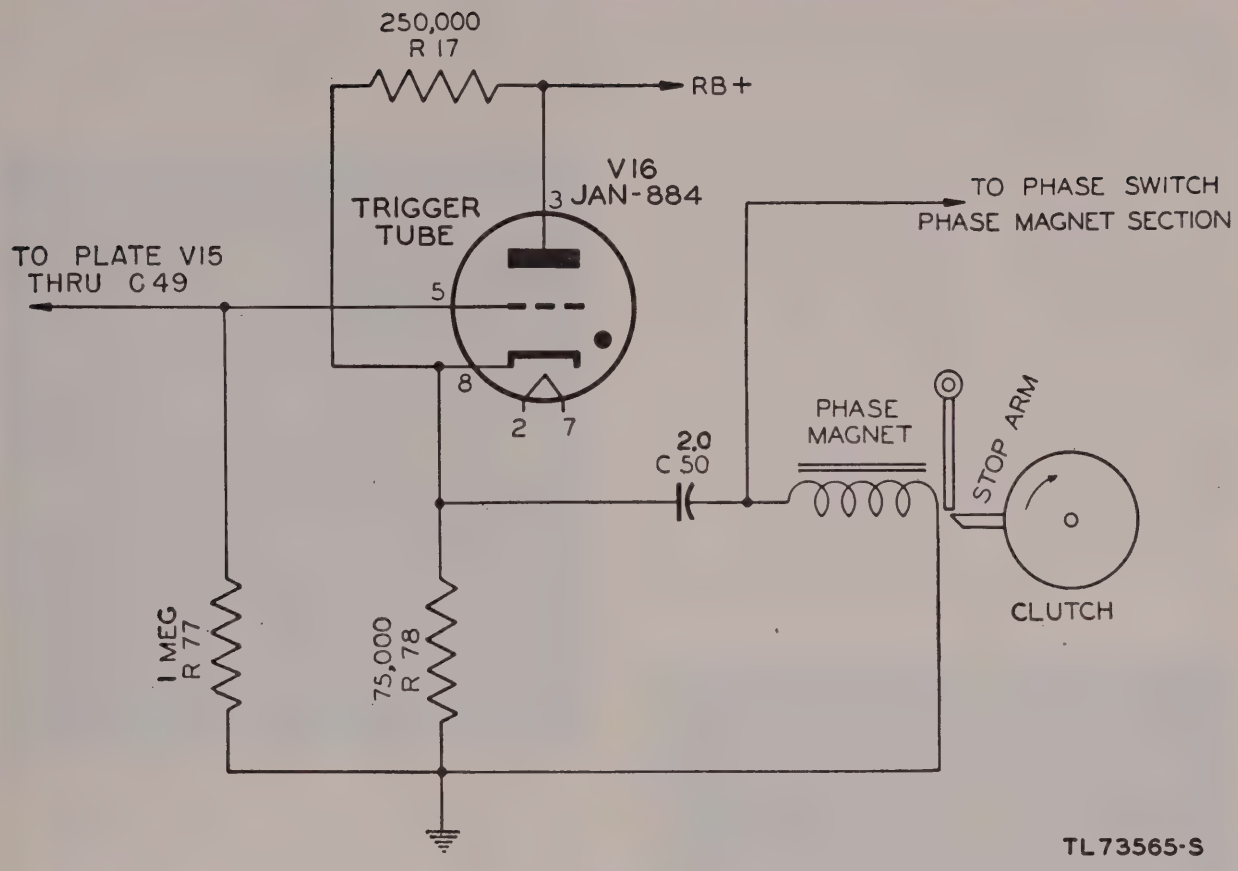


Figure 70. Trigger tube.

pulse on the grid of V16 causes the tube to arc, the voltage drop across the tube, and also across R17, is suddenly reduced to 16 volts, the characteristic voltage drop across this tube when it arcs. The cathode potential then suddenly becomes 234 volts, increasing approximately 177 volts in a positive direction. This sudden change in potential across C50 causes sufficient electron flow through the phasing magnet to attract the armature and release the stop arm on the clutch; but as soon as the charge on capacitor C50 is equalized by the current flow through the phasing magnet, the impedance of the cathode circuit again becomes very high, with R78 serving as a current-limiting resistor and the tube arc is extinguished. The negative grid of the tube then resumes control, keeping the tube nonconductive and the phasing magnet unenergized until the next phasing pulse arrives. C49 and R77 constitute a differentiating circuit, serving to sharpen the peak of the useful positive pulse.

(1) *Phasing error.* Actually the phasing pulses are transmitted at slightly different times when transmitting for negative reception and when transmitting for positive reception. When transmitting for positive reception (maximum signal on black), a positive voltage large enough to make V16 arc is developed immediately *after* scanning of the phasing spot. This is at the instant when the scanning changes from the white of the phasing spot (minimum signal) to the black of the phasing ring (maximum signal). However, when transmitting for negative reception (maximum signal on white), the necessary positive voltage pulse is developed at the very beginning of the scanning of the phasing spot. This is at the instant when the scanning changes from the black of the phasing ring (minimum signal) to the white of the phasing spot (maximum signal). Therefore, the exact phasing point of positive recording is displaced from the exact phasing point for negative recording by the length of the phasing pulse (length of the phasing spot on the phasing ring).

(2) *Correction of error.* To divide this error evenly, the dog trip arm is so positioned that it splits the two pulses (positive and negative) evenly on each side of center. The error then is so small

on both positive and negative transmissions that no appreciable portion of the picture is obscured by the image of the clamp bar.

e. Clutch Operation. When the PHASE button is pressed and before a phasing pulse arrives, the holding current normally applied to the phasing magnet from the cathode circuit of V4 is removed and the phasing magnet armature is released and stops the travel of the stop arm (fig. 71) which is friction-driven by the motor through the primary clutch. The stop arm, on which the phasing operation actually is performed, normally drives the dog trip arm which causes the drum to rotate. However, once the PHASE button is pressed and the stop arm is held stationary by the phasing magnet armature, the drum is driven at a slower rate by action of the secondary clutch which permits intermittent slippage. During a part of each revolution the drum is driven by the secondary clutch, the drive being active only when the dog latch is engaged in the secondary clutch ring. But during the rest of each

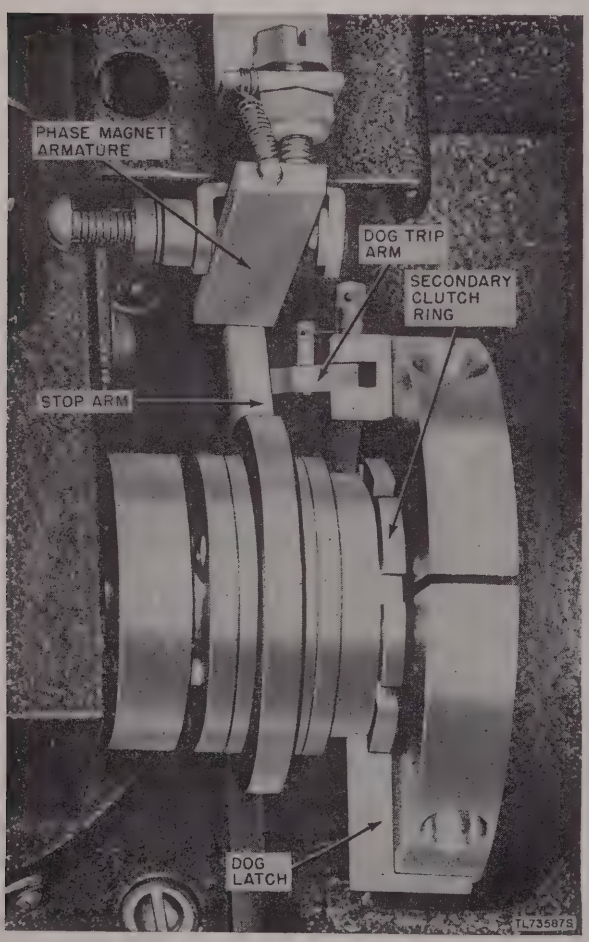


Figure 71. Clutch assembly at start of phasing operation; stop arm engaged by phase magnet armature, dog latch engaged with secondary clutch ring.

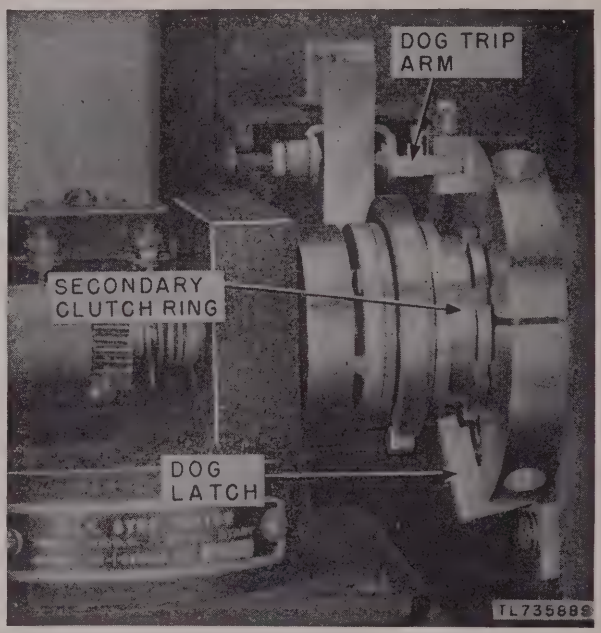


Figure 72. Clutch assembly during phasing operation; stop arm engaged by phase magnet armature, dog latch released from secondary clutch ring.

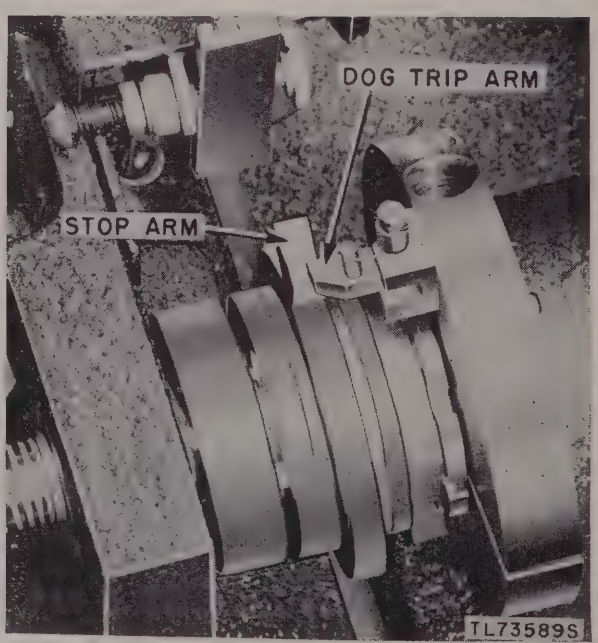


Figure 73. Clutch assembly at completion of phasing operation; stop arm released from phase magnet armature and driving dog trip arm.

revolution, a cam operating on the dog latch disengages the dog latch from the secondary clutch ring, permitting the slippage (fig. 72). When a phasing pulse from the transmitting station energizes the phasing magnet, the phasing magnet armature is drawn to the magnet, the travel of the stop arm is no longer impeded, and the primary clutch resumes rotation. The first phasing pulse may serve to phase the stop arm to the transmitting drum correctly, although several are allowed. Once the correct phasing is established, additional phasing pulses pull the phasing magnet armature out of the way just as the stop arm approaches it on each revolution. The PHASE button then can be released. However, the entire phasing operation is not complete until the stop arm actually engages the dog trip arm (fig. 73). Only then is the receiving drum itself, as well as the stop arm, phased to the transmitting drum. For this reason the operator must allow a few extra revolutions for the stop arm to catch up with the dog trip arm and transfer the drum drive from the secondary clutch to the primary clutch before assuming that phasing is complete.

93. Rectifier Power Unit PP–86(*)/TXC–1

The rectifier power unit (figs. 144 and 145) serves three purposes:

a. Provides unregulated B+ d-c voltage at 450 volts and filament voltage at 6.3 volts for operation of the transceiver, from a normal source of 115 volts, 60 cycles ac.

b. Provides voltage for starting the synchronous motor, 9 volts at 60 cycles ac for the motors in Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1, and 115 volts at 60 cycles ac for the motor in Facsimile Transceiver TT–1B/TXC–1.

c. Provides closely regulated voltage for the exciter lamp, 6 volts at 1,800 cycles, from a 1,800-cycle signal supplied by the fork oscillator unit.

94. Rectifier Power Supply (V22)

The rectifier power supply (fig. 74), located physically within Rectifier Power Unit PP–86(*)/TXC–1, furnishes 6.3 volts ac for transceiver filaments and 450 volts unregulated dc for transceiver plate and screen circuits. The 450 volts unregulated

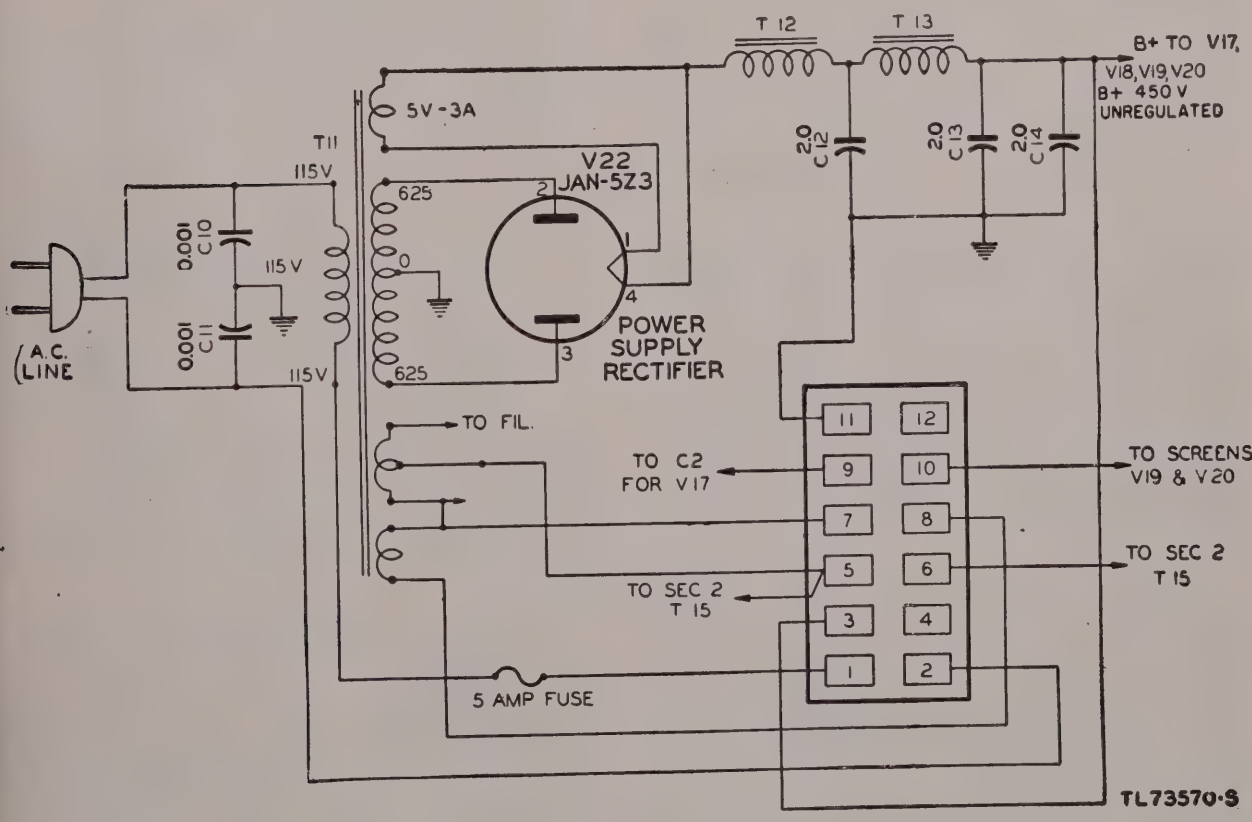


Figure 74. Rectifier power supply, part of Rectifier Power Unit PP–86/TXC–1.

dc also is the source of voltage for the voltage regulator located on the transceiver chassis (par. 95), which furnishes regulated B+ voltage at 250 volts for critical transceiver circuits. V22, Tube JAN–5Z3, is connected in a conventional full-wave rectifier circuit. Power supply transformer T11 transforms the 115-volt a-c input on the primary side to high voltage for the plates of V22, 5 volts for the filament of V22, 6.3 volts for filaments of other pulses in the rectifier power unit, and 6.3 volts for the transceiver filaments. The starting voltage for the motors in Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1 is 9 volts taken from one 6.3-volt winding and a portion of the second 6.3-volt winding. The primary of T11 is fused. The primary circuit is completed through the ON-OFF switch on the transceiver operating panel. Two capacitors, C10 and C11, form a high-frequency suppressor at the transformer input. The rectified ac from the cathode of V22 is filtered by swinging input choke T12, choke T13, and filter capacitors C12, C13, and C14. In Rectifier Power Unit PP–86/TXC–1, filter capacitor C13 is in parallel with the output filter capacitor C13 (figs. 74 and 144). In Rectifier Power Unit PP–86A/TXC–1, C13 is in parallel with the first filter capacitor C12 (fig. 145).

95. B+ Voltage Regulators (V7, V8, V9, V25)

The B+ voltage regulator, located in Facsimile Transceiver TT–1(*)/TXC–1 (figs. 147, 148, and 149), drops the 450-volt d-c input from the rectifier power unit to regulated B+ voltage at 250 volts for critical transceiver circuits.

a. V7 and V8 (fig. 75), Tubes JAN–7C5, two triode-connected voltage regulator output tubes, are connected in parallel with their plates at 450-volt potential and their cathodes at 250-volt potential. In this way their plate-cathode impedance forms a variable series dropping resistor to drop the 450 volts to 250 volts. The value of this dropping resistor is automatically varied by varying grid bias of the tubes to provide a constant output voltage. V9, Tube JAN–7L7, a pentode control voltage amplifier tube, amplifies voltage changes in the 250-volt supply and controls the grids of regulator tubes V7 and V8. The gaseous voltage regulator tube V25 in the cathode circuit of V9 provides a constant voltage drop (approximately 70 volts), serving as a reference level for stabilizing the 250-volt output. This tube is type R1160A or Tube JAN–1B46 in Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1 and type 5651 in Facsimile Transceiver TT–1B/TXC–1. The output voltage may be stabilized anywhere between 240 and 255 volts, but once established, it will not vary more than 2 volts under normal operating conditions.

b. To understand the functioning of the circuit in Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1, assume that the 250-volt output of the regulator suddenly changes to some higher voltage.

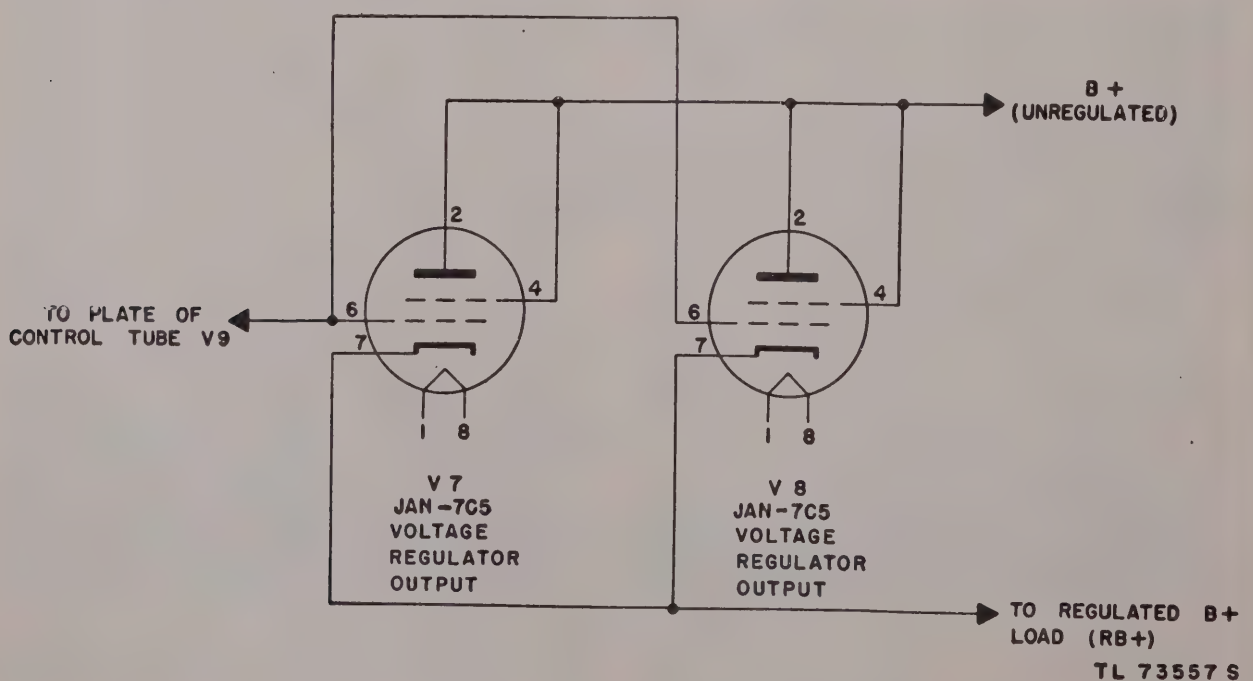


Figure 75. Voltage regulator output stage, RB+ circuit.

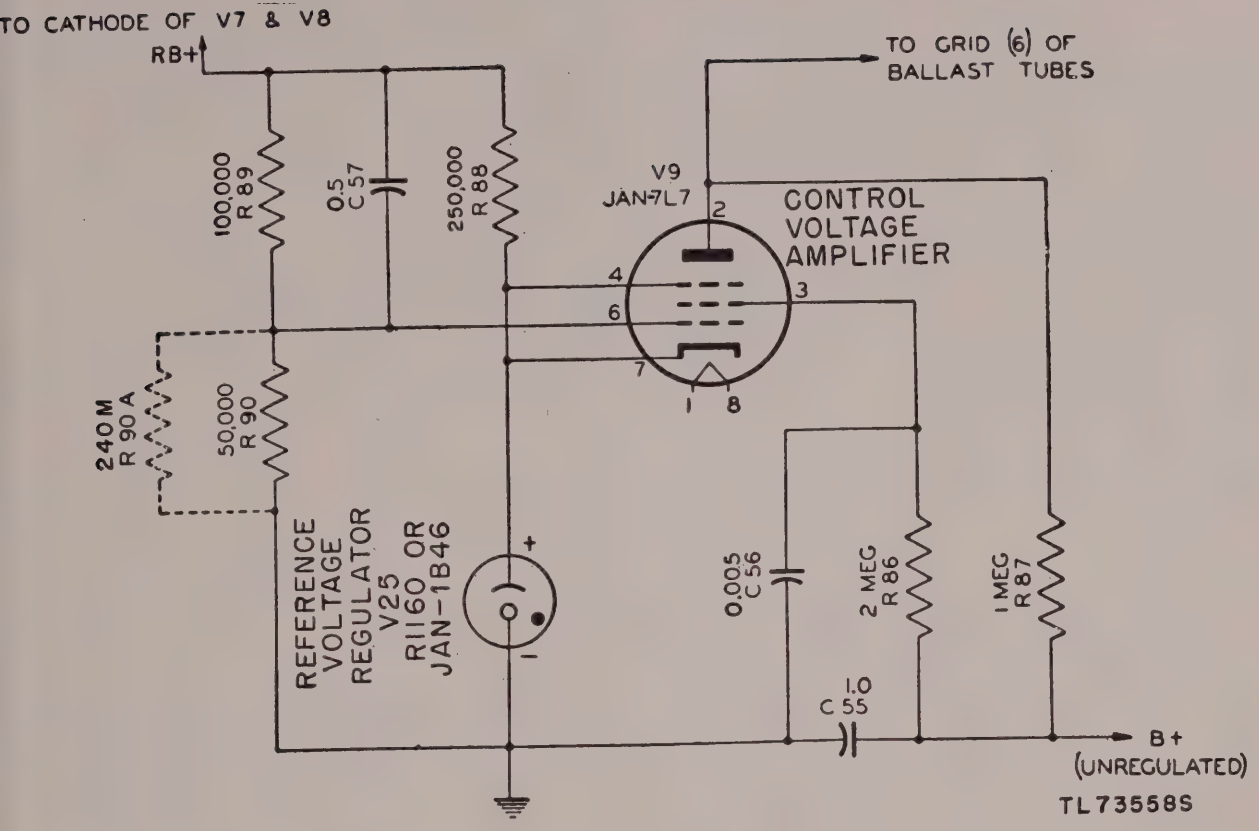


Figure 76. Control voltage amplifier, RB+ circuit, Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1.

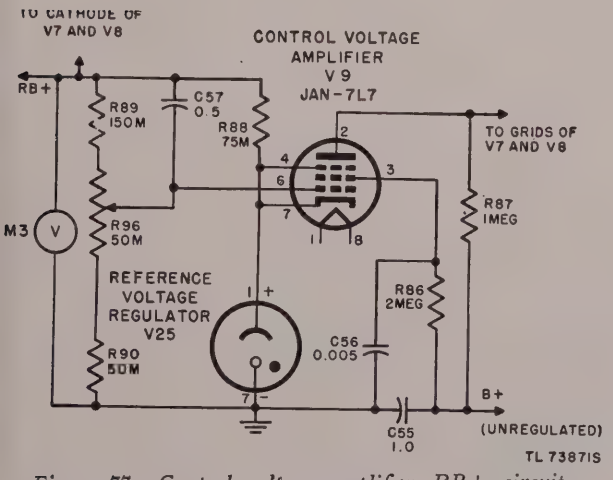


Figure 77. Control voltage amplifier, RB+ circuit, Facsimile Transceiver TT-1B/TXC-1.

The grid bias on tube V9 (fig. 76) is the difference in potential between the cathode and the grid of the tube. In this circuit that potential difference consists of the difference between the voltage drop across V25 and the voltage drop across the parallel combination, R90 and R90A. This combination is part of the voltage-divider circuit which also includes R89 and is across the regulated 250-volt output. But the voltage drop across R90 and R90A is opposite in polarity to that across V25 when the cathode-grid circuit is considered. The voltage drop across R90 and R90A changes approximately one-third as much as the voltage of the 250-volt supply. The drop across V25 is constant. Normally the bias on V9 is about —3 volts. When the output voltage rises slightly above 250 volts, the bias on tube V9 increases in a positive direction. More positive grid voltage causes V9 to conduct more current, producing a greater voltage drop across its plate load resistor R87. The voltage change at the plate of V9 is in a negative direction, and greater in magnitude than the voltage change in a positive direction on the grid. This increased negative voltage at the plate of V9 is directly applied to the grids of V7 and V8, causing their plate-cathode impedance to increase. This increase in impedance drops the regulated output voltage back to a normal 250 volts.

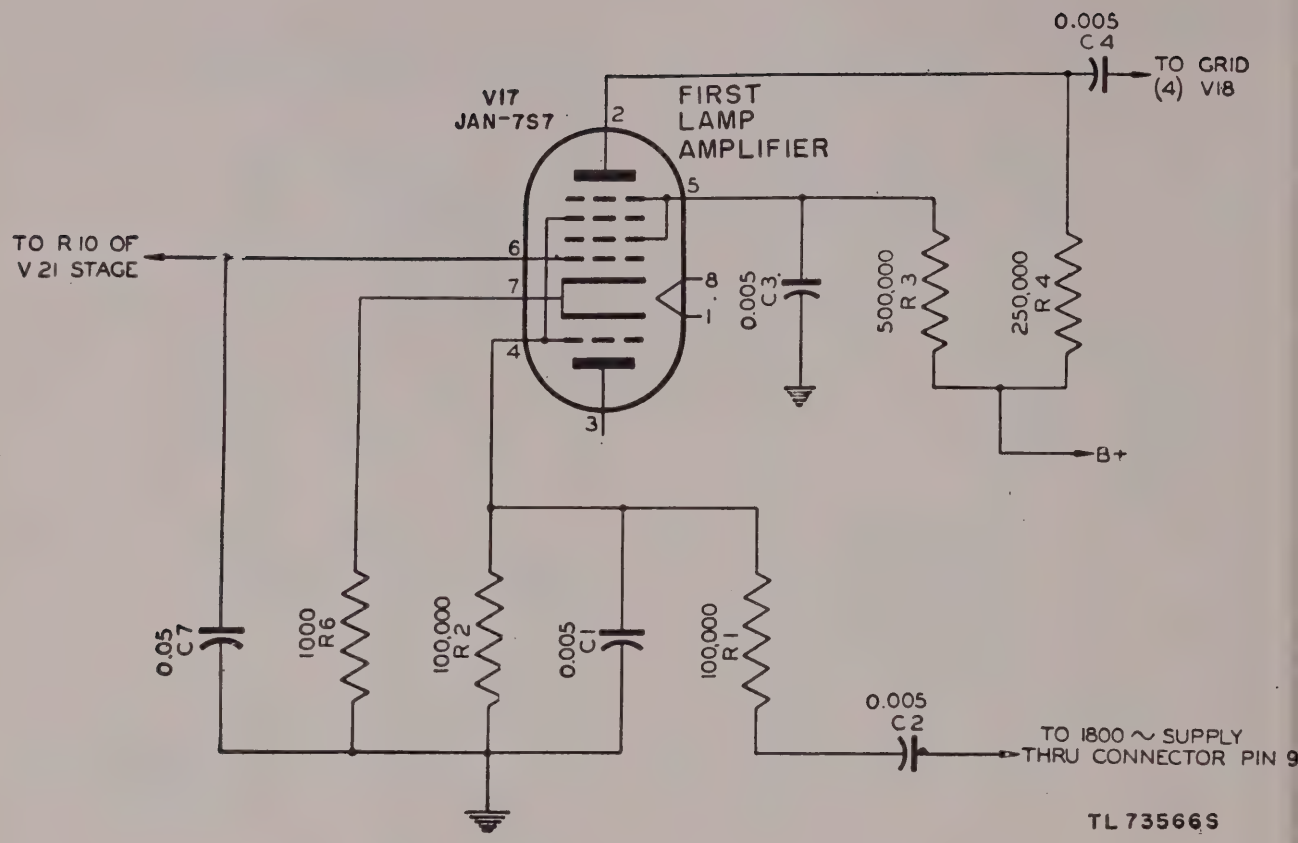


Figure 78. First lamp amplifier, exciter lamp supply.

c. R86 is the V9 screen resistor and is bypassed to ground by C56 to prevent oscillation. R90A is in parallel with R90, and its value may be changed to adjust the value of the regulated output voltage. C57 bypasses R89 as a smoothing filter capacitor. C55 serves as a smoothing filter capacitor across the 450-volt input to the voltage regulator. R88 serves to supply sufficient current to V25 to keep it operating in its normal range.

d. The B+ voltage regulator circuit in Facsimile Transceiver TT–1B/TXC–1 operates in the same manner as that described above. However, potentiometer R96 has been inserted into the grid circuit of stage V9 (fig. 77) to permit easy control of the output voltage and to eliminate the necessity of shunting R90 with R90A to obtain the correct voltage. This potentiometer, R96, is located on the regulated B+ voltmeter M3, which also is a component only of Facsimile Transceiver TT–1B/TXC–1. The value of R88 has been modified so that it still provides minimum stabilization current for the reference voltage regulator tube V25, which in this model of equipment is type 5651.

96. Exciter Lamp Supply (V17, V18, V19, V20, V21, V23)

The exciter lamp supply, located in Rectifier Power Unit PP–86(*)/TXC–1 (figs. 47, 144, and 145), receives a constant-frequency input signal of 1,800 cycles from the fork oscillator unit, amplifies and regulates it, and supplies the exciter lamp with a 1,800-cycle signal which remains steady at 6-volt amplitude. The voltage must be well regulated, for the exciter lamp must maintain constant brilliancy since it serves as the source of light which is reflected from the facsimile copy to the photocell during transmission of a picture. The exciter lamp is illuminated only when the selector switch is in the TRANSMIT or SET RANGE position. Input voltage is applied to V17, which amplifies the signal and applies it to one section of V18 which serves as the driver for the push-pull class AB_1 tubes V19

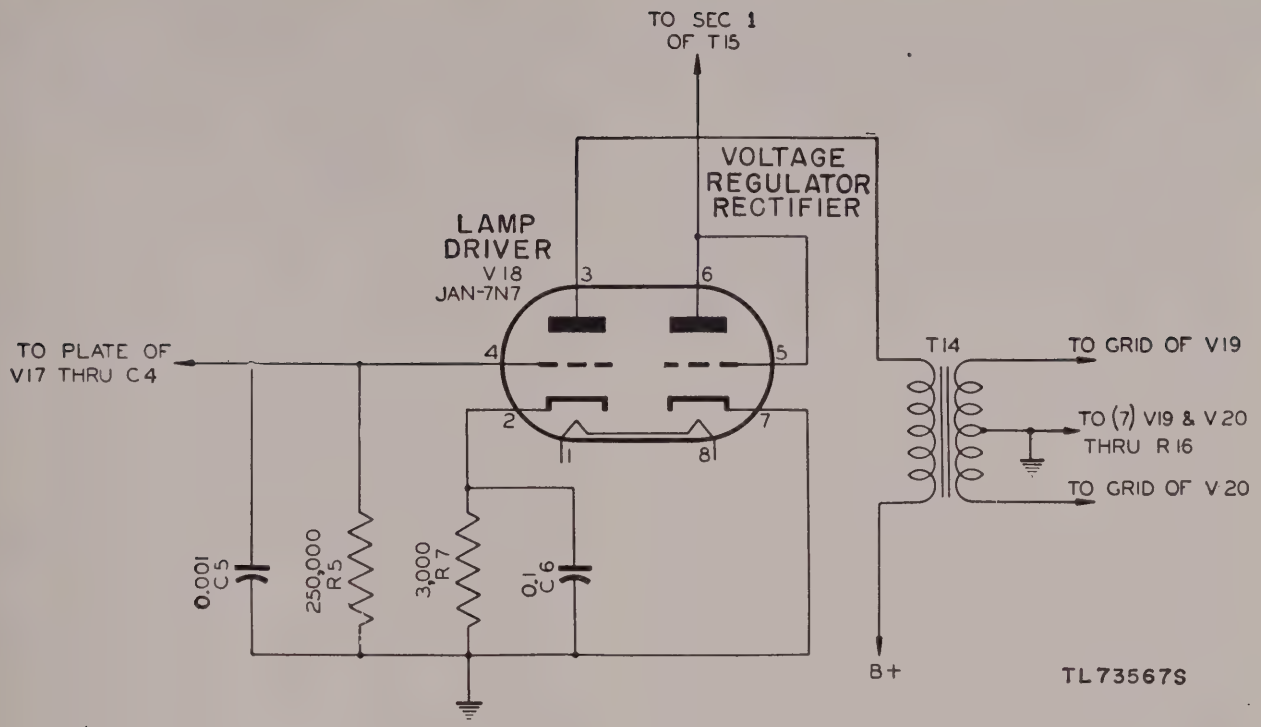


Figure 79. Lamp driver and voltage regulator rectifier, exciter lamp supply.

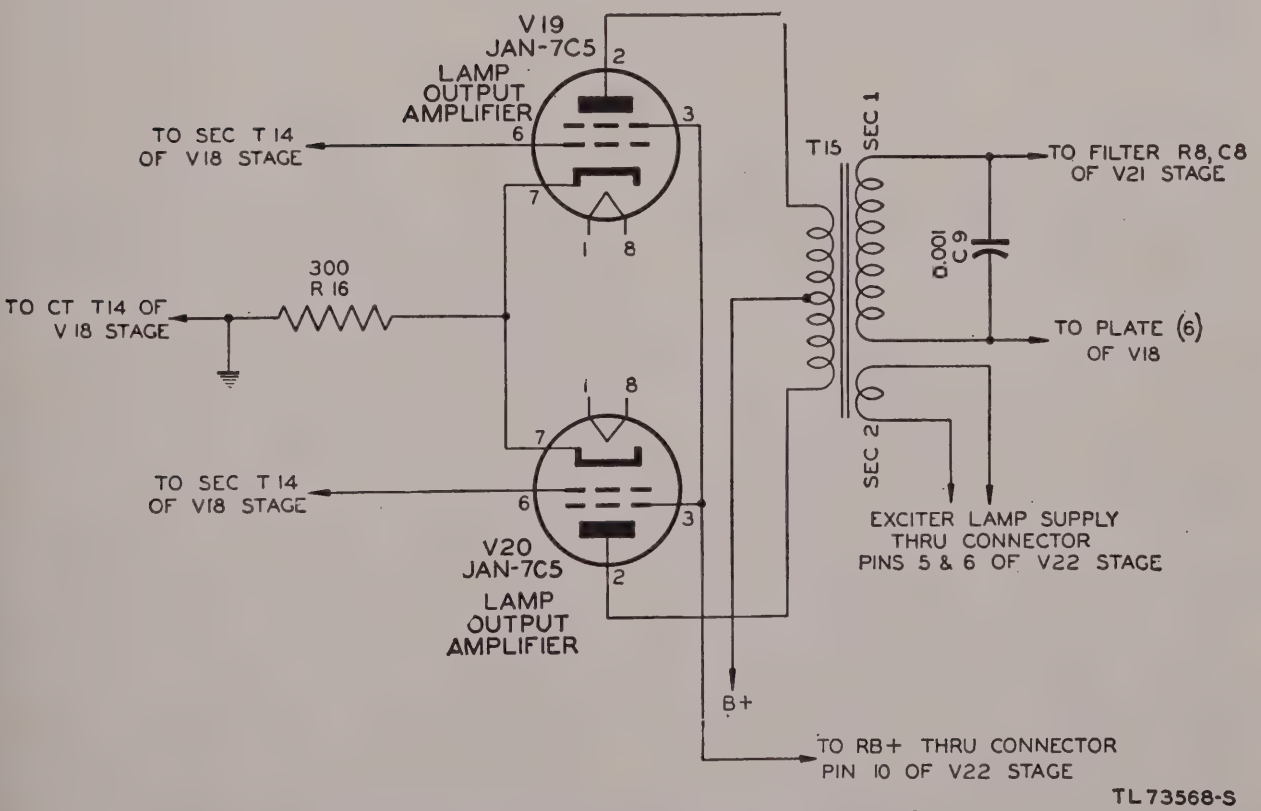


Figure 80. Lamp output amplifiers, exciter lamp supply.

and V20. The output of these tubes is applied to the lamp through one secondary on T15, and to the control voltage amplifier, V21, through the other secondary. V21 varies the amplification of tube V17 in an automatic voltage control circuit.

a. First Lamp Amplifier (V17). The 1,800-cycle signal from the motor amplifier buffer (half of tube V3) in the fork oscillator unit is applied to the injection grid of V17, Tube JAN–7S7, through pin 9 of the power supply plug, coupling capacitor C2, and the voltage-divider circuit composed of resistors R1 and R2 (fig. 78). The grid is bypassed to ground by C1 to suppress high frequencies. R6 is the unbypassed cathode resistor. The control voltage to regulate the amplification of V17 is coupled from the control voltage amplifier, V21, directly to the control grid of tube V17. C7 is a smoothing capacitor for the control voltage. Unregulated B+ voltage is supplied to the screen of V17 through resistor R3, which is bypassed to ground by C3, and to the plate through plate load resistor R4. The amplified 1,800-cycle voltage developed across R4 is applied through coupling capacitor C4 to the grid (pin 4) of the first triode section of V18.

b. Lamp Driver (V18). The grid of the lamp driver section of V18, Tube JAN–7N7, is driven by the voltage from V17 which is applied across grid resistor R5 (fig. 79). C5 serves as a high-frequency suppressor. This section of V18 is biased by flow of plate current through cathode resistor R7, which is bypassed by C6. The primary or transformer T14 is the plate load.

c. Lamp Output Amplifiers (V19 and V20). Voltage developed across the secondary of driver transformer T14 drives the grids of push-pull class AB_1 tubes V19 and V20, which are Tubes JAN–7C5 (fig. 80). This is a power output stage, biased by cathode resistor R16. Screen voltage is applied directly from the regulated B+ 250-volt supply through pin 10 of the power plug when the selector switch is in TRANSIT or SET RANGE position. However, on other settings of the selector switch the screens are not energized, and there is no output. The output transformer T15 has two secondaries, one feeding the exciter lamp and the other driving the control voltage amplifier stage V21.

d. Exciter Lamp. The exciter lamp is a 6-volt lamp drawing approximately 2.75 amperes of current. It has an incandescent filament which emits steady light because of the well-regulated supply. While 1,800-cycle voltage is applied, thermal inertia of the heavy filament is high and a 3,600-cycle light ripple is present but does not affect operation in any way.

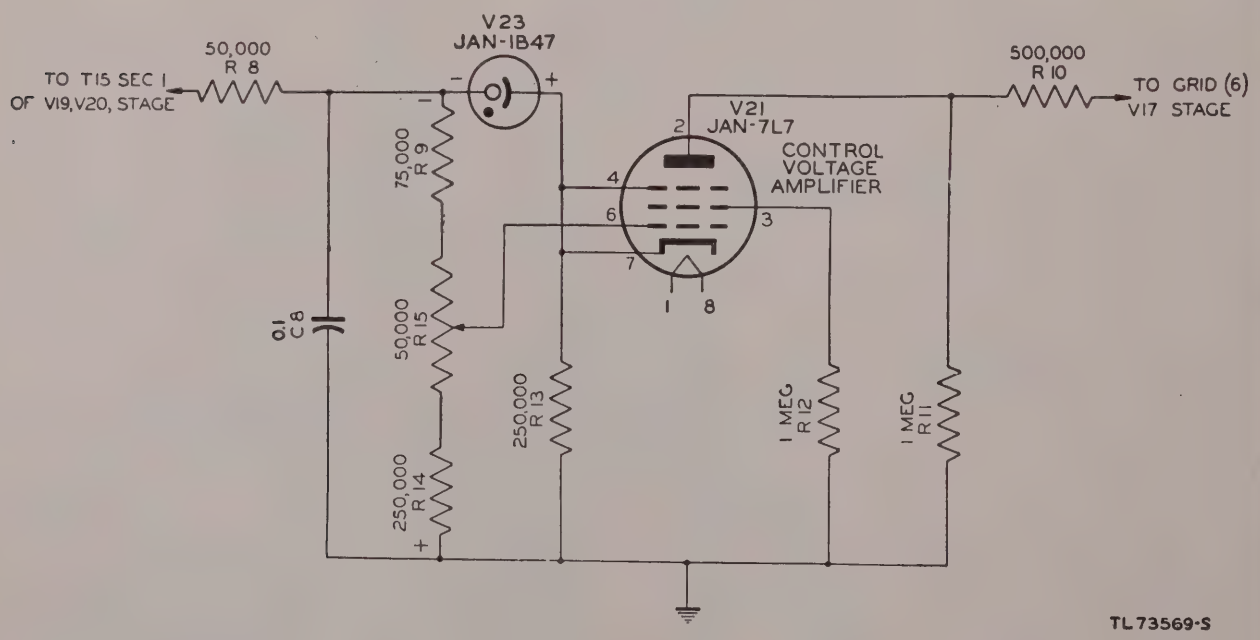


Figure 81. Control voltage amplifier, exciter lamp supply, Rectifier Power Unit PP–86/TXC–1.

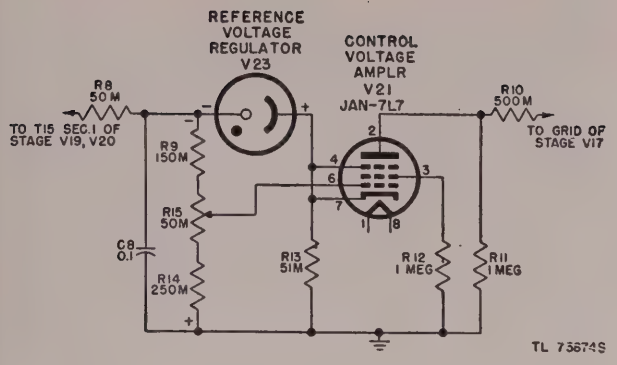


Figure 82. Control voltage amplifier, exciter lamp supply, Rectifier Power Unit PP–86A/TXC–1.

e. Voltage Regulator Rectifier (V18). Secondary No. 1 of transformer T15 and the second half of V18, Tube JAN–7N7 (fig. 79), form a d-c power supply for the control voltage amplifier V21. Plate and grid of the second section of V18 are tied together and form a diode used as a half-wave rectifier on the 1,800-cycle signal. The grounded cathode is the positive terminal of this power supply. C9 is across secondary No. 1 of T15 to suppress high peak voltages.

f. Control Voltage Amplifier (V21, V23). Negative voltage for the operation of V21, Tube JAN–7L7, control voltage amplifier, is applied to the cathode through filter dropping resistor R8 and the gaseous voltage regulator tube V23 (figs. 81 and 82). The plate of V21 is positive with respect to the cathode, for it is connected to ground, the positive side of the voltage source, through plate resistor R11. R12 is the screen resistor. A voltage dividing network in the grid circuit is composed of resistors R9, R15, and R14. R15 is variable to provide adjustment of the regulated output voltage. Any variations in the voltage are amplified by tube V21 and applied through resistor R10 direct to the grid of the first lamp amplifier V17. If the voltage becomes higher than normal, the output at secondary No. 1 of T15 will increase, and the rectified supply voltage for stage V21 will increase. The bias on V21 is the voltage developed between cathode and grid, across V23, resistor R9, and that portion of R15 between R9 and the slider on R15. But the voltage across V23 (about 70 volts) is opposite to that across the resistors. Consequently the true bias on V21 is the difference between the voltage developed across V23 and that developed across R9 and a portion of R15. When the supply voltage increases, some 70 percent of the increase is developed across R9 and the portion of R15 and is applied as bias in a positive direction to the grid of V21. The reference voltage across V23, of course, remains constant. Hence V21 becomes more conductive, the drop across its plate load resistor R11 increases, and the bias applied to the control grid of V17 becomes more negative. This reduces amplification of stage V17 and brings the output voltage down to normal. In Rectifier Power Unit PP–86/TXC–1 tube V23 is type R1160 or Tube JAN–1B47 (fig. 81). In Rectifier Power Unit PP–86A/TXC–1 tube V23 is type 5651, which requires a different value of R13 to provide minimum stabilization current for the tube and a different value of R9 (fig. 82).

97. Talk-Back Circuit

The talk-back circuit, which is found only on Facsimile Transceivers TT–1A/TXC–1 and TT–1B/TXC–1, is controlled by the STANDBY–MON–TALK switch on the front panel. The circuit is operative only when the selector switch is at STAND BY. When the STANDBY-MON-TALK switch is in the TALK position, the loudspeaker becomes a magnetic microphone and transforms speech sound waves into electrical currents which are transferred to the line through the speaker transformer, amplifier stages V10, V11, and V12, and the output transformer T2 (fig. 48). For reception of voice signals with the switch in either the STAND BY or MON position, the signal from the line is fed through input transformer T7, the GAIN control, amplifier stages V10, V11, and V12, and through the speaker transformer to the speaker. The STANDBY-MON-TALK switch (figs. 148 and 149) makes the following circuit connections:

a. STAND BY. (1) The LINE binding posts are connected to the primary of input transformer T7.

(2) The LINE JACK is connected to the secondary of input transformer T7.

(3) The slider on the receiving GAIN control R60 connects through R50 to the grid of the first signal amplifier V10.

(4) V10 feeds V11, V11 feeds V12, and the output of V12 through transformer T2 (secondary No. 1) is connected to the speaker transformer.

(5) The 1,800-cycle signal from the fork oscillator unit to the motor amplifier circuit is grounded through the exciter lamp and filament transformers, and the synchronous motor does not operate.

b. MON (Monitor Position). In this position of the switch the same connections are completed

as in the STAND BY position except that the 1,800-cycle supply to the motor amplifier circuit is not grounded, and the motor can operate.

c. TALK. (1) The LINE binding posts are disconnected from input transformer T7 and connected to output transformer T2 (secondary No. 2) through 300-ohm dropping resistors R84 and R85.

(2) The LINE JACK is disconnected from input transformer T7 and connected to output transformer T2 (secondary No. 1).

(3) The receiving GAIN control R60 is disconnected from the first signal amplifier V10. There is no gain control in the talking end of the talk-back circuit.

(4) The loudspeaker serves as a microphone and is connected through the speaker transformer to the grid of the first signal amplifier V10.

(5) V10 feeds V11, V11 feeds V12, and the output of V12 through transformer T2 is connected to the LINE JACK (T2, secondary No. 1) and through 300-ohm resistors R84 and R85 to the LINE binding posts (T2, secondary No. 2).

(6) The 1,800-cycle signal from the fork unit is supplied to the motor amplifier circuit, and the motor can operate.

(7) The push-to-talk relay control circuit on the CARBON MIKE jack is closed to put the transmitter on the air when a radio circuit is used.

(8) R98 (in Facsimile Transceiver TT–1B/TXC–1 only) is disconnected as a shunt across R92 and is shunted across the LINE JACK terminals.

Section XII. TROUBLE SHOOTING

98. General Trouble-Shooting Information

No matter how well equipment is designed and manufactured, faults occur in service. When such faults occur, the repairman must locate and correct them as rapidly as possible. This section contains general information to aid personnel engaged in trouble shooting.

a. TROUBLE-SHOOTING DATA. Take advantage of the material supplied in this technical manual. Consult the block diagrams, partial and complete schematic diagrams, wiring diagrams, signal tracing charts, voltage and resistance charts, and the drawings and photographs showing location of parts.

b. TROUBLE-SHOOTING STEPS. The first step in servicing defective equipment is to *sectionalize* the fault. Sectionalizing means tracing the fault to the particular component or circuit responsible for abnormal operation. The second step is to *localize* the fault. Localization means tracing the fault to the particular *part* responsible for defective operation. Some faults such as burned-out resistors, arcing, and shorted transformers can be located by sight, smell, and hearing. The majority of faults, however, must be located by checking voltage and resistance.

(1) *Sectionalizing trouble.* Information on sectionalizing trouble is found in paragraph 101.

(2) *Localizing trouble.* Information on localizing trouble is found in the remainder of the paragraphs in this section.

c. PRECAUTIONS AGAINST HIGH VOLTAGE. Precautions must be followed when measuring voltages above a few hundred volts. High voltages are dangerous and may prove fatal. When voltages to be measured are higher than 200 to 300 volts, proceed as follows:

(1) Turn off the power.

(2) Select the proper meter range for the measurement.

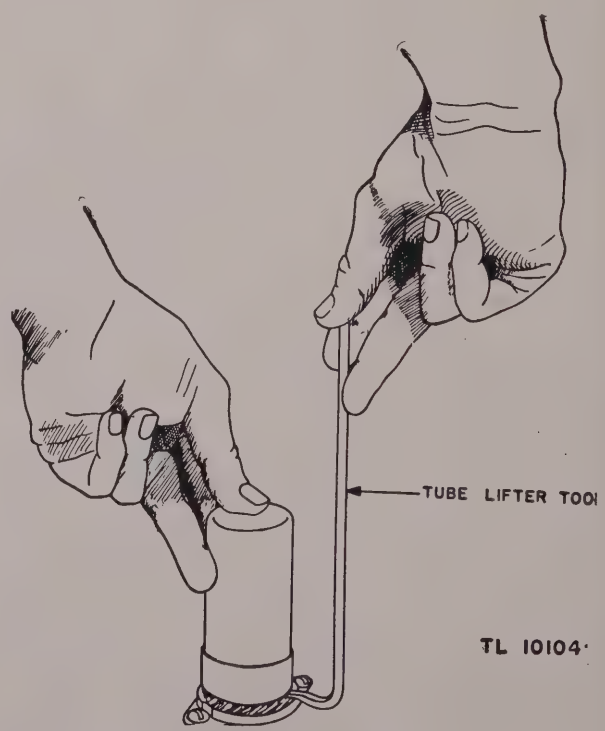


Figure 83. Use of tube lifter.

(3) Connect the meter test leads to the points on the equipment where the voltage is to be measured.

(4) Step away from the voltmeter and leads, turn on the power, and note the reading on the voltmeter. Do not touch any part of the voltmeter or the leads while the power is turned on.

(5) When the test has been completed, turn off the power before removing the connections.

99. Initial Procedures

a. Inspection and repair of facsimile equipment must be done only by qualified personnel under favorable conditions. The technician responsible for the work must thoroughly study this manual.

b. Secure the equipment listed in the next paragraph. Final tests must be made with photographic transmissions and receptions. This necessitates the use of a darkroom.

c. Before making operational tests, examine the equipment for obvious defects such as—

(1) Tubes out of sockets.
(2) Tubes loose in sockets.
(3) Broken exciter lamp.
(4) Damage to lead screw.
(5) Blown rectifier power supply fuse.
(6) Blown motor fuse (Facsimile Transceivers TT–1A/TXC–1 and TT–1B/TXC–1 only).

100. Tools, Testing, and Cleaning Equipment

a. Test sets and equipment required for shooting trouble are listed below.

Item	*Description*
Cathode-ray oscilloscope	Tube size: 5- or 3-inch. Oscilloscope TS–239/UP.
Test meters	Ranges: 0 to 250 ma dc; 0 to 250 and 0 to 1,000 volts dc; 0 to +30 db, 1,800 cps; 0 to 50, 0 to 250, and 0 to 1,000 volts at 1,800 cps. Test Set I–176.
Vacuum-tube voltmeter	Range: 0.00025 to 100 volts. Input impedance: 500,000 ohms. Electronic Multimeter ME–6/U (Ballantine Model 300) with multiplier.
Audio signal generator	Capable of output at 1,800 cps. Oscillator I–151.
Headset	High-resistance, magnetic type. Headset HS–30 and Cord CD–605.
Radio receiver	Capable of receiving WWV, Washington, D. C., on 2.5, 5, 10, 15, 20, 25, 30, or 35 mc. Radio Set SCR–704.
Facsimile equipment	Facsimile Set AN/TXC–1(*) known to be in good operating condition.
Photographic equipment	Photographic equipment PH–549/TXC–1.
Dark-room equipment	Darkroom equipped with Lamp PH–207–A, Safelight PH–364, series OA Wratten filter, and 25-watt frosted bulb for use in safelight.

b. Tools and equipment required for alinement and adjustment are listed below.

Item	*Signal Corps stock No.*	*Description*
Spring scale	4T138–58	Measures up to 32 ounces.
Screw driver	6R16013	6 inches long, ¼-inch blade.
Tube Puller TL–201	6R7442	Replacement for tube lifter shown in figure 83.
Pliers TL–103	6R4603	Diagonal pliers, 6 inches long.
Pliers TL–126	6R4626	Long-nose pliers, 3½-inch nose.
Hammer	6Q49710	10 ounces.
Pin punch	6R7503	0.05-inch diameter.
Eraser	6M413	Rubber.
Cloth	6Z1989	Lint-free.
Glyptal cement	6G187	
Magnifying glass	6Z6924-9	4- to 10-power.
Solvent, Dry Cleaning (SD)		Federal specification P–S–661–A, QM issue.
Compressed air		Pressure: 40 to 80 pounds.

101. Sectionalizing Trouble

The table below lists in sequence of probable occurrence a number of common troubles which may be encountered when making a test run.

Trouble	Cause
a. Motor.	
(1) Fails to start	(1) Brushes not making contact (except in TT-1B/TXC-1).
	START switch contacts dirty.
	No start voltage.
	Jones plug loose.
	Bearings frozen.
	Rotor hitting stator.
	Phase magnet not releasing clutch.
	Start magnet resistor R39 open (except in TT-1B/TXC-1).
	Flexible brush leads broken (except in TT-1B/TXC-1).
(2) Fails to synchronize...	(2) Motor fuse burned out (except in TT-1/TXC-1).
	Phase magnet not releasing clutch.
	No a-c signal from motor amplifier.
	MOTOR JACK contacts dirty.
	START switch contacts dirty.
	Drum load excessive.
	Synchronous rotor too loose or too tight on shaft.
(3) Stops after synchronizing, during phasing, or during operation.	(3) Clutch too light.
	Tubes V5 and V6 weak.
	Drum load excessive.
	Motor defective.
	Low a-c signal from motor amplifier.
	Dog latch binding.
b. Signal amplifier.	
(1) No output	(1) No input from photocell circuit in TRANSMIT position.
	No input from line in RECORD position.
	Tubes defective.
	Transmitter optical system grounded to case, short circuiting R51.
	GAIN control defective.
	No plate voltage.
(2) Low output in TRANSMIT position.	(2) Output load excessive.
	Tubes defective.
(3) Insufficient contrast in TRANSMIT position.	(3) Exciter lamp improperly alined.
	Dirty lens in optical system.
	Low voltage across exciter lamp.
	Defective photocell (especially if subjected to high humidity).
	R42 improperly alined.
(4) Low output in RECORD position.	(4) Low input.
	Tubes defective.
c. Exciter lamp.	
(1) No light	(1) Lamp burned out.
	Socket corroded.
	Tubes defective.
	Jones plug loose.
	Transformer T15 defective.
	No input signal to V17.
(2) Insufficient or flickering light.	(2) Socket corroded.
	V23 or other tube defective.
	Low input.
	Jones plug loose.
d. Recorded copy.	
(1) Uniform skew	(1) Fork oscillator unit improperly adjusted or defective.
	Clutch slipping.
(2) Nonuniform skew or jumps in phasing.	(2) Clutch slipping.
	Obstacle touching drum.
	Lead screw dirty.
(3) Light and dark columns lengthwise on background of picture.	(3) Stray coupling into receiver causing fork beat.
(4) Wavy lines crosswise in background of picture, about ¼ inch apart.	(4) 60-cycle hum pick-up through coupling coil.
	Power supply unit too close to transceiver.
	Line pick-up from power line.

Trouble	Cause
(5) Random light and dark streaks throughout picture.	(5) Voltage regulator unstable. Recorder lamp level changing. Flaw in lead screw.
(6) Reversal of picture tones.	(6) CONTRAST control on transmitter set improperly.
(7) Elemental area rectangles overlapping one another.	(7) Spot size too large or too small because objective lens of recording optical system is misalined.
(8) Fuzzy areas	(8) Copy not tightly wrapped around drum.
(9) Poor contrast on received copy.	(9) CONTRAST control improperly set at transmitter. Received copy improperly developed Developer too old or too cold.
(10) Fogged photographic reception.	(10) Photographic medium ruined by heat or light. Developer too cold.
(11) Final photographic copy too light, even with paper development.	(11) Recorder lamp defective.
(12) Background and fuzziness on direct recordings; poor contrast.	(12) Bias too low on V13. Increase size of cathode resistance in 500-ohm steps.
(13) Mottled reception on direct recordings, or intermittent reception.	(13) Stylus needle pressure too low.

102. Voltage and Resistance Measurements

Follow the voltage and resistance charts (figs. 84 through 94) when localizing trouble. Make readings with the meter connected between chassis and the indicated socket lug or component lug. Make all voltage tests with the tubes in place, the power ON-OFF switch at the ON position and, unless otherwise noted on the chart, with an input signal sufficient to cause a reading of +2 on the db meter. For d-c voltage measurements use a 1,000 ohms per voltmeter and for a-c signal measurements use a vacuum-tube voltmeter, unless otherwise noted. Line voltage should be 115 volts; if it is higher or lower, make allowances in measuring voltages affected by line voltage. For resistance tests, disconnect the power cord from the a-c line and remove the tubes. Make all tests from the bottom of the chassis.

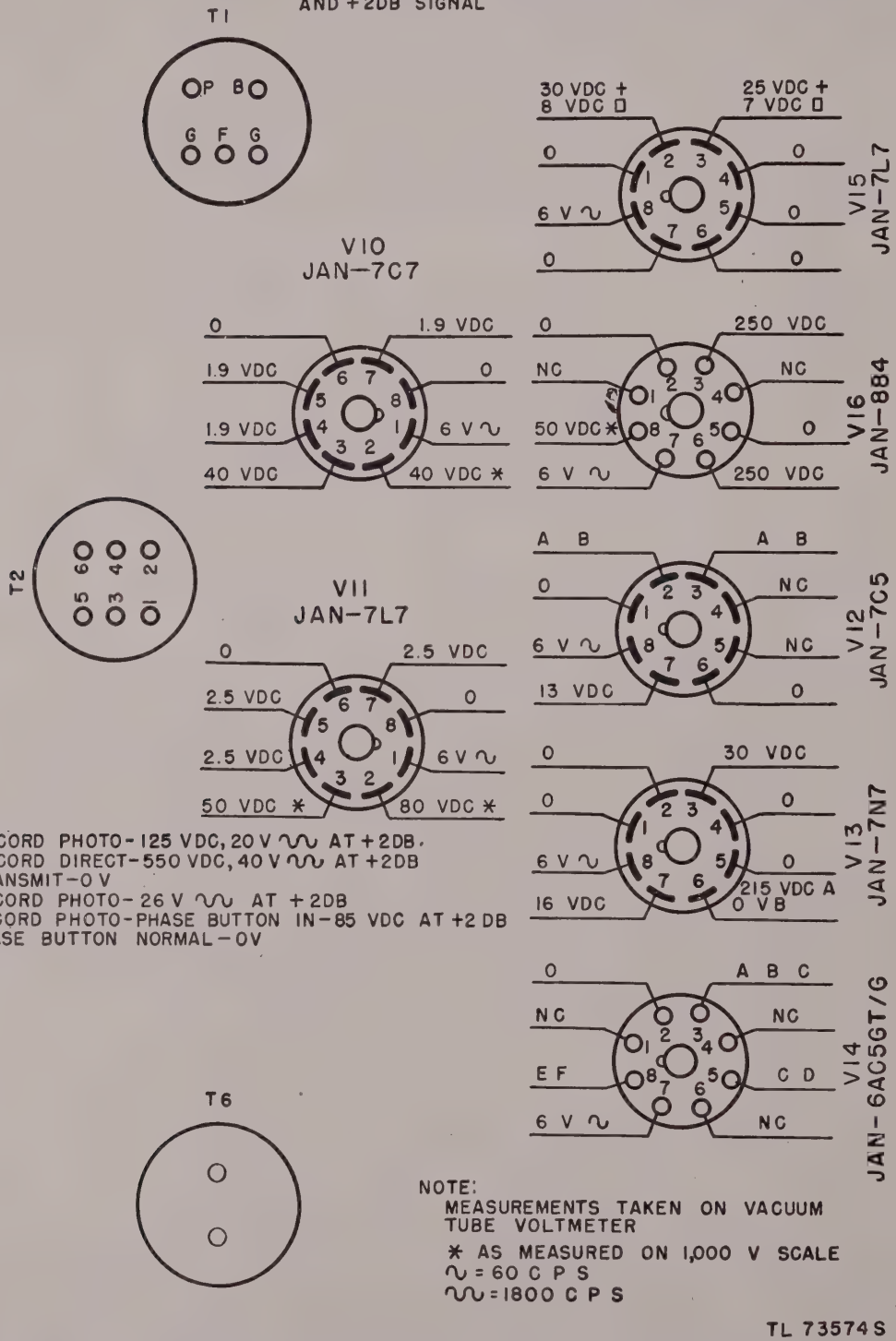
a. Only the following circuits are affected by higher or lower line voltages within normal limits: filaments; unregulated B+; V14 stage when selector switch is at RECORD DIRECT; regulator stages V7, V8, V9, and V21; start motor; start coil; and motor amplifier stages V4, V5, and V6.

b. The motor amplifier is somewhat self-regulating so that the motor current varies little over a wide range of line voltages. The effect of the line voltage on this circuit is complex; in some cases the motor current or voltage increases as the line voltage decreases.

V12-A- TRANSMIT, SET RANGE, RECORD PHOTO-215 VDC, 65 V ∿∿
B-STAND BY, RECORD DIRECT-0V

V13-A- RECORD DIRECT-215 VDC
B- OTHER POSITIONS- 0V

V15-+- PHASE BUTTON IN-+2DB SIGNAL
□- PHASE BUTTON IN, NO SIGNAL
OTHER READINGS WITH PHASE BUTTON IN OR OUT AND +2DB SIGNAL



V14-A- RECORD PHOTO-125 VDC, 20 V ∿∿ AT +2DB
B- RECORD DIRECT-550 VDC, 40 V ∿∿ AT +2DB
C- TRANSMIT-0 V
D- RECORD PHOTO- 26 V ∿∿ AT +2DB
E- RECORD PHOTO-PHASE BUTTON IN-85 VDC AT +2 DB
F-PHASE BUTTON NORMAL-0V

NOTE:
MEASUREMENTS TAKEN ON VACUUM TUBE VOLTMETER
* AS MEASURED ON 1,000 V SCALE
∿ = 60 C P S
∿∿ = 1800 C P S

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Figure 84. Voltage measurement chart, stages V10–V16, Facsimile Transceiver TT-1/TXC-1 and TT-1A/TXC-1.

NOTES:

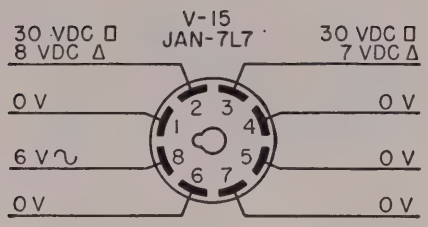
INPUT .003 V ∿∿
GAIN DIAL AT 100, +2 DB ON SET METER

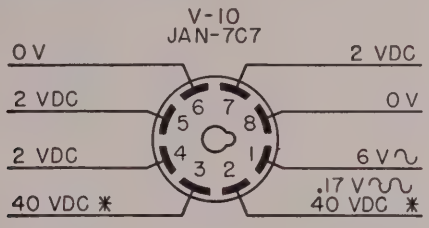
ALL READINGS TAKEN AT 115 V LINE

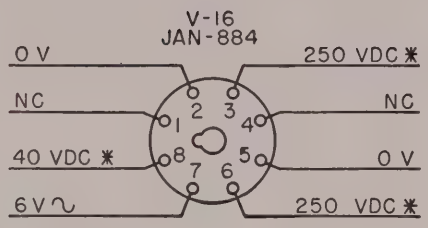
ALL READINGS TAKEN FROM TUBE SOCKET PINS TO CHASSIS GROUND

V-15

□ PHASE BUTTON IN +2 DB SIGNAL
Δ PHASE BUTTON IN NO SIGNAL
OTHER READINGS WITH PHASE BUTTON IN OR OUT

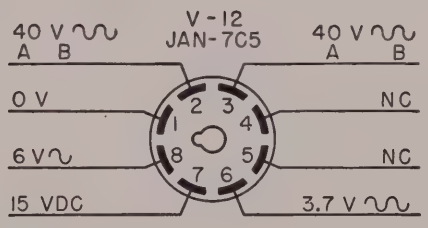


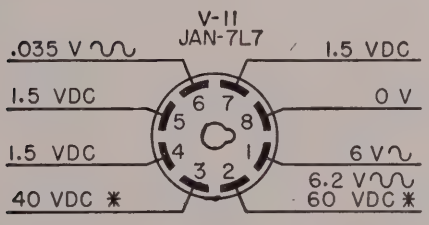




V-12

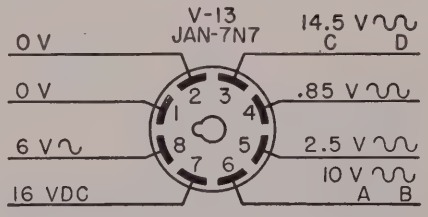
A- RECORD DIRECT 0 VDC
B- ALL OTHER POSITIONS 235 VDC ✱





V-13

A- RECORD DIRECT 240 VDC ✱
B- ALL OTHER POSITIONS 0 VDC
C- RECORD PHOTO, STANDBY, REC. DIRECT 40 VDC ✱
D- TRANSMIT, SET RANGE 50 VDC ✱

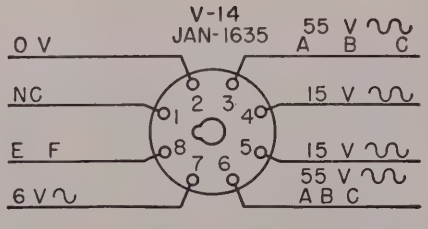


V-14

A- RECORD PHOTO 175 VDC ✱
B- TRANSMIT, SET RANGE, STANDBY 0 VDC
C- RECORD DIRECT 510 VDC ✱
E- RECORD PHOTO PHASE BUTTON IN 5 VDC
F- PHASE BUTTON OUT 0 VDC

∿∿ READINGS TAKEN ON RECORD PHOTO
✱ AS MEASURED ON 1,000 V SCALE USING 1,000 OHMS PER VOLT METER
AC AND SIGNAL VOLTAGES MEASURED WITH BALLANTINE VACUUM TUBE VOLTMETER

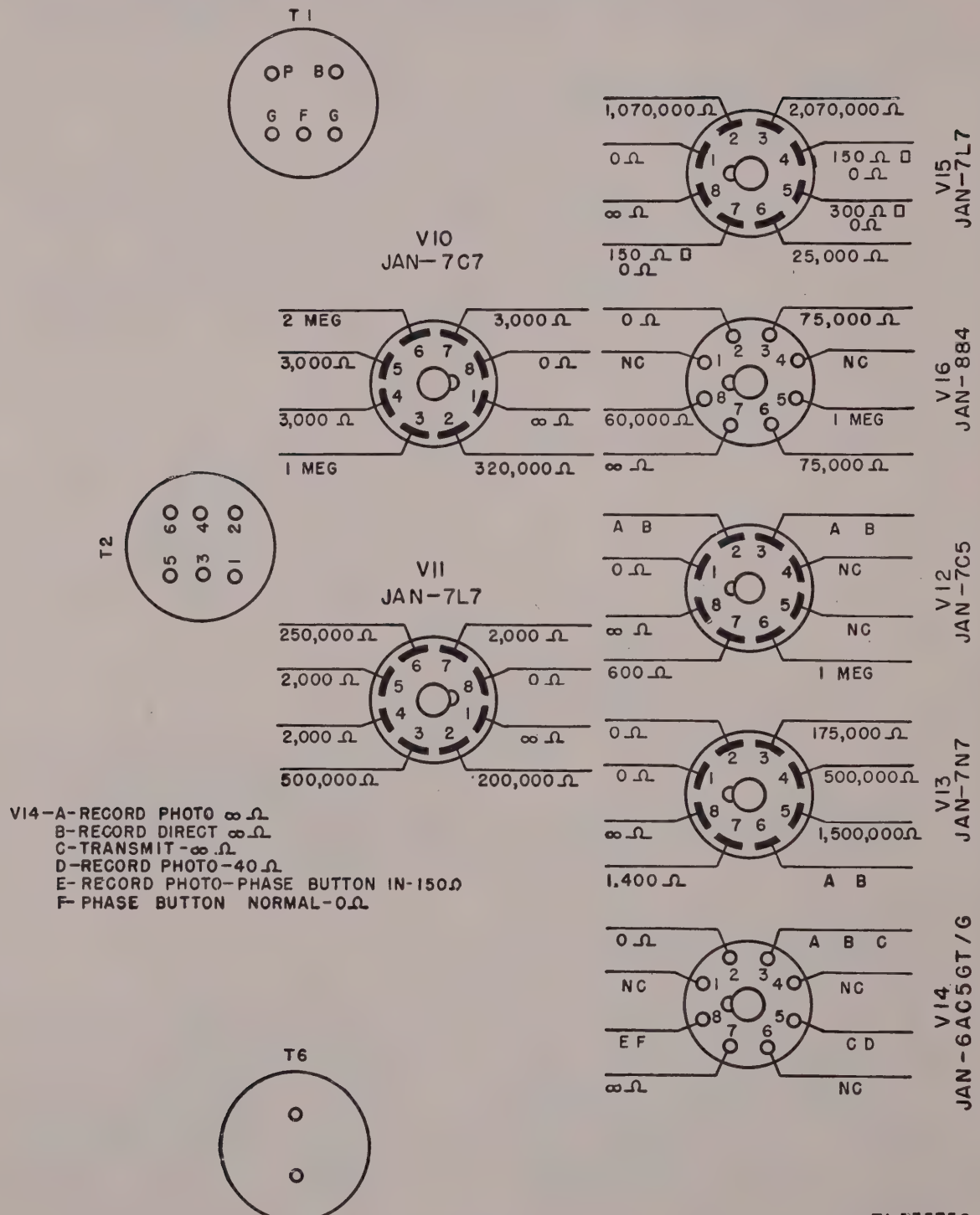
∿ = 60 ∿
∿∿ = 1800 ∿ SIGNAL VOLTS



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Figure 85. Voltage measurement chart, stages V10–V16, Facsimile Transceiver TT–1B/TXC–1.

V12-A-TRANSMIT SET RANGE, RECORD PHOTO-75,000 Ω
B-STAND BY, RECORD DIRECT-∞ Ω
V13-A-RECORD DIRECT 75,000 Ω
B-OTHER POSITIONS-∞ Ω
V15-□-PHASE BUTTON IN, NO SIGNAL
OTHER READINGS WITH PHASE BUTTON IN OR OUT



V14-A-RECORD PHOTO ∞ Ω
B-RECORD DIRECT ∞ Ω
C-TRANSMIT-∞ Ω
D-RECORD PHOTO-40 Ω
E-RECORD PHOTO-PHASE BUTTON IN-150 Ω
F-PHASE BUTTON NORMAL-0 Ω

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Figure 86. Resistance measurement chart, stages V10–V16, Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1.

V-15

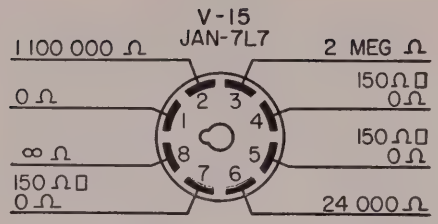
□ PHASE BUTTON IN
OTHER READING WITH PHASE BUTTON IN OR OUT

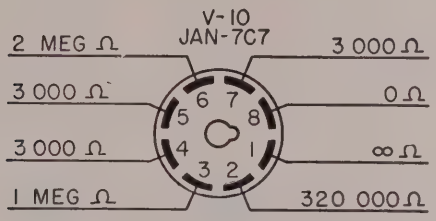
V-13

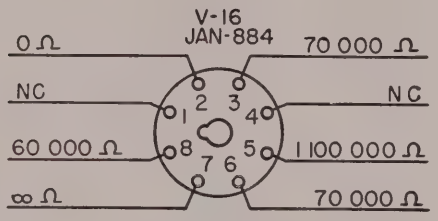
A - RECORD DIRECT 65 000 Ω
B - ALL OTHER POSITIONS ∞ Ω

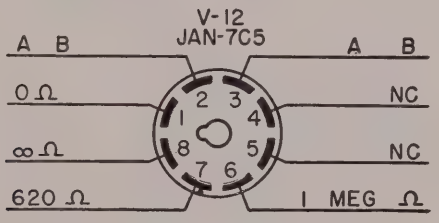
V-12

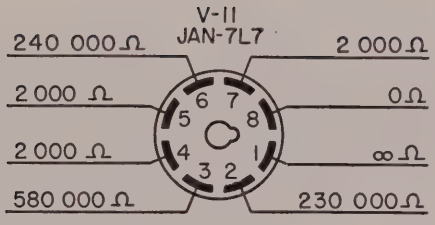
A - RECORD DIRECT ∞ Ω
B - ALL OTHER POSITIONS 65 000 Ω

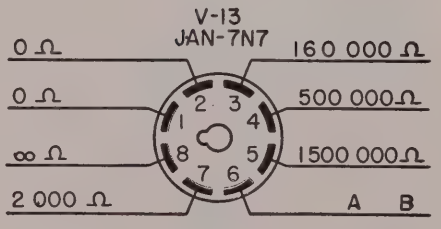












V-14

A - RECORD PHOTO 85 000 Ω
B - RECORD DIRECT ∞ Ω
C - TRANSMIT ∞ Ω
D - RECORD PHOTO 40 Ω
E - RECORD DIRECT 40 Ω
F - PHASE BUTTON IN 150 Ω
G - PHASE BUTTON OUT 0 Ω

ALL MEASUREMENTS TAKEN FROM TUBE SOCKET PINS TO CHASSIS GROUND

ALL MEASUREMENTS TAKEN WITH TUBES REMOVED FROM THEIR SOCKETS

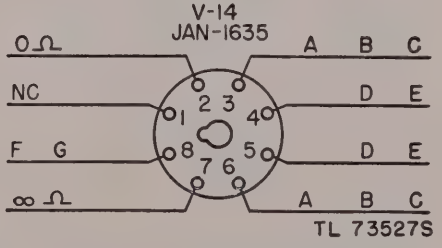


Figure 87. Resistance measurement chart, stages V10–V16, Facsimile Transceiver TT-1B/TXC-1.

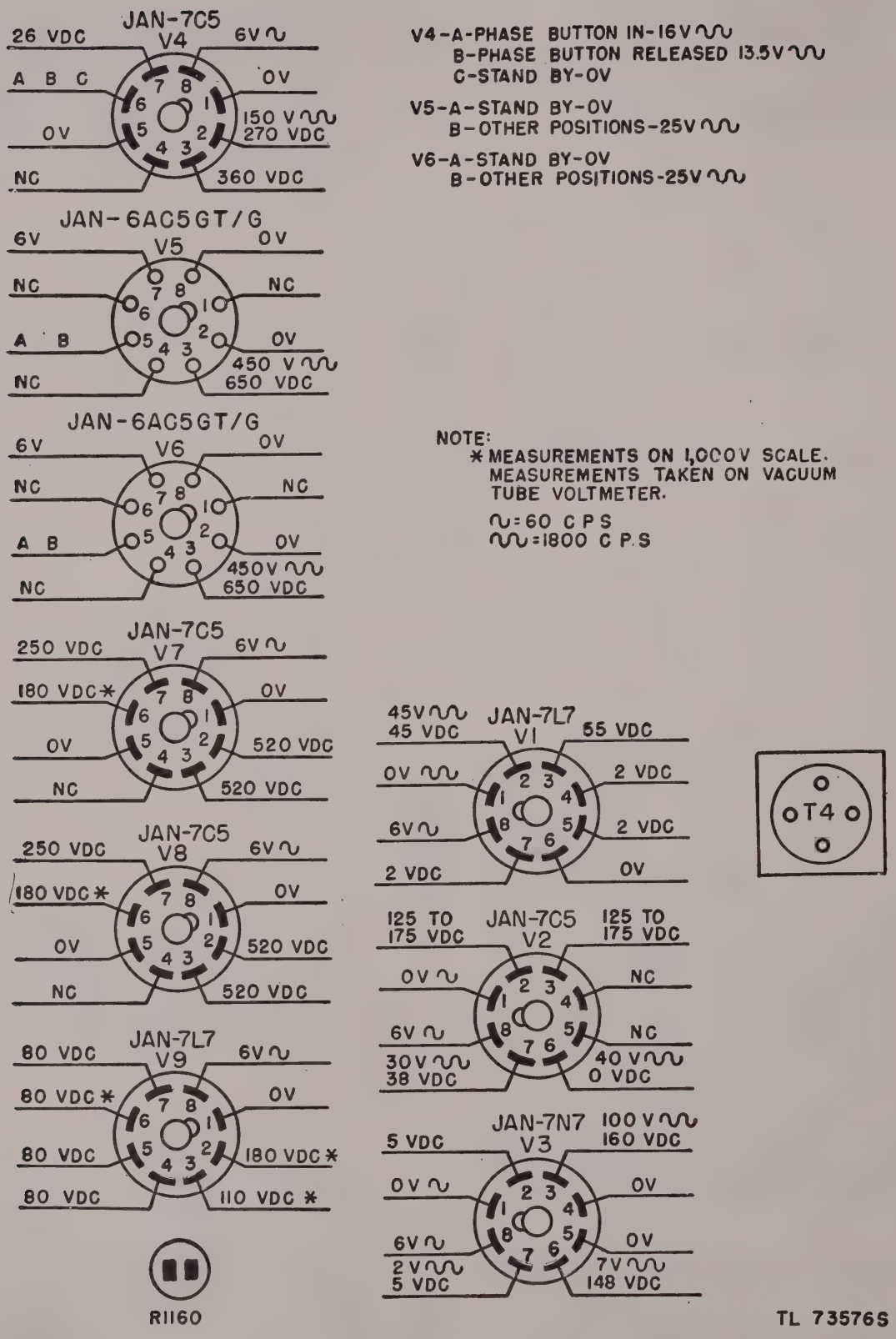


Figure 88. Voltage measurement chart, stages V1–V9, Facsimile Transceiver TT–1/TXC–1 with unsealed fork oscillator unit; data for stages V4–V9 also applicable to Facsimile Transceiver TT–1A/TXC–1.

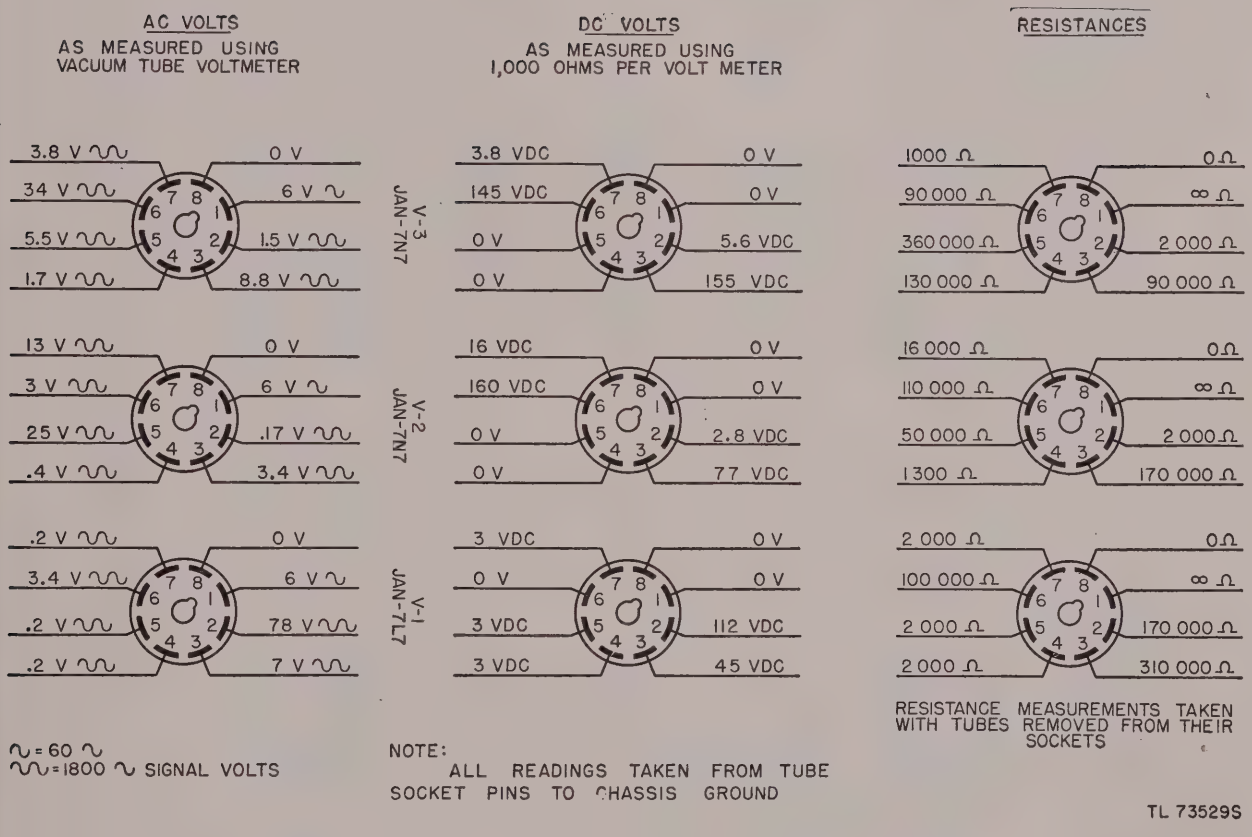
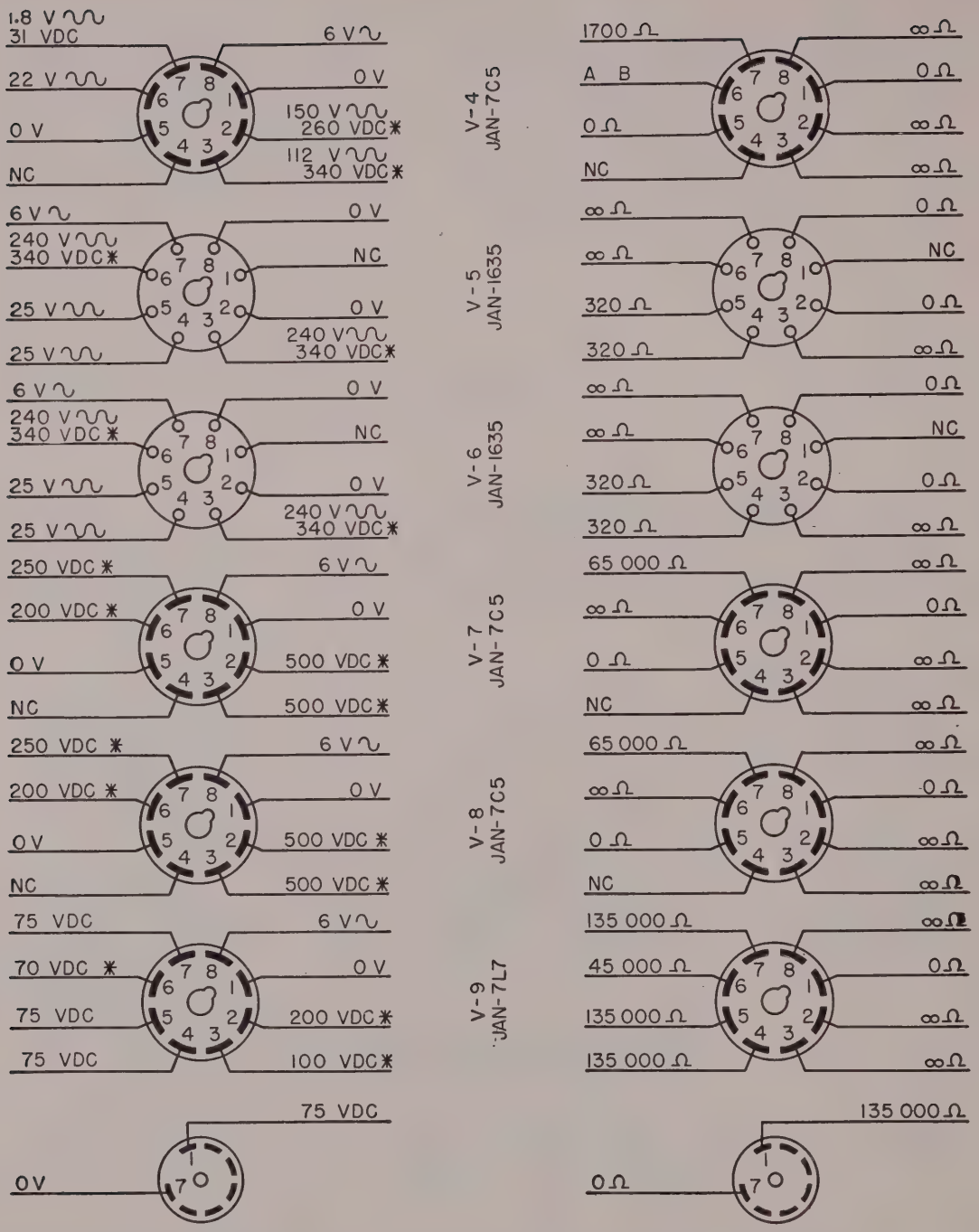


Figure 89. Voltage and resistance measurement chart, stages V1–V3, sealed fork oscillator unit.



ALL MEASUREMENTS TAKEN FROM TUBE SOCKET PINS TO CHASSIS GROUND
V-4, V-5, AND V-6 VOLTAGE READINGS TAKEN WITH 80 MA MOTOR CURRENT
* AS MEASURED ON 1,000 V SCALE
RESISTANCE MEASUREMENTS TAKEN WITH TUBES REMOVED FROM THEIR SOCKETS
ALL VOLTAGE MEASUREMENTS TAKEN AT 115 V LINE
∿ = 60 ∿ ∿∿ = 1800 ∿ SIGNAL VOLTS
AC AND SIGNAL VOLTAGES MEASURED WITH BALLANTINE VACUUM TUBE VOLTMETER

V-4
A- PHASE BUTTON IN 13 500 Ω
B- PHASE BUTTON OUT 10 000 Ω

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Figure 90. Voltage and resistance measurement chart, stages V4–V9, Facsimile Transceiver TT–1B/TXC–1.

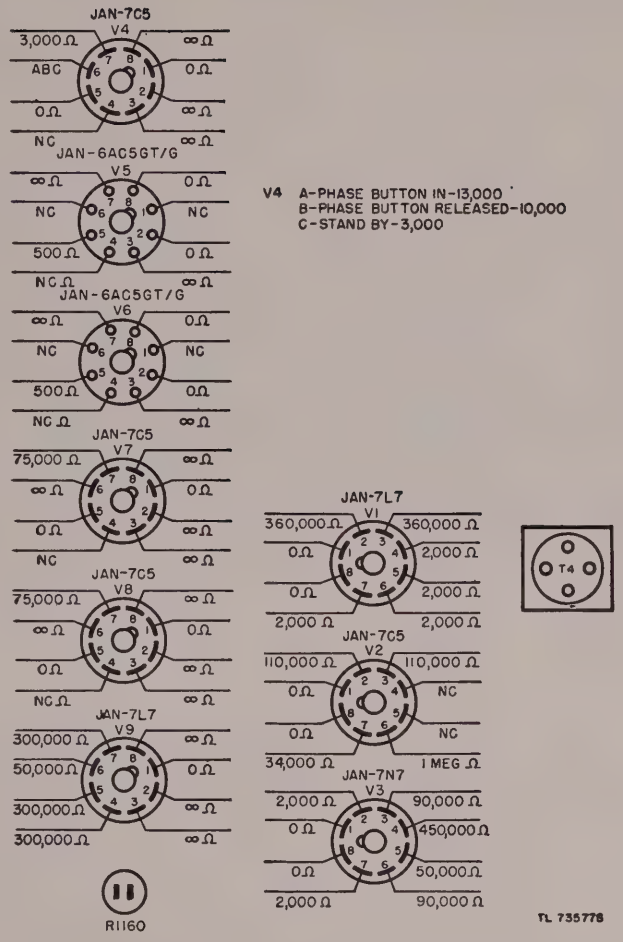


Figure 91. Resistance measurement chart, stages V1–V9, Facsimile Transceiver TT–1/TXC–1 with unsealed fork oscillator unit; data for stages V4–V9 also applicable to Facsimile Transceiver TT–1A/TXC–1.

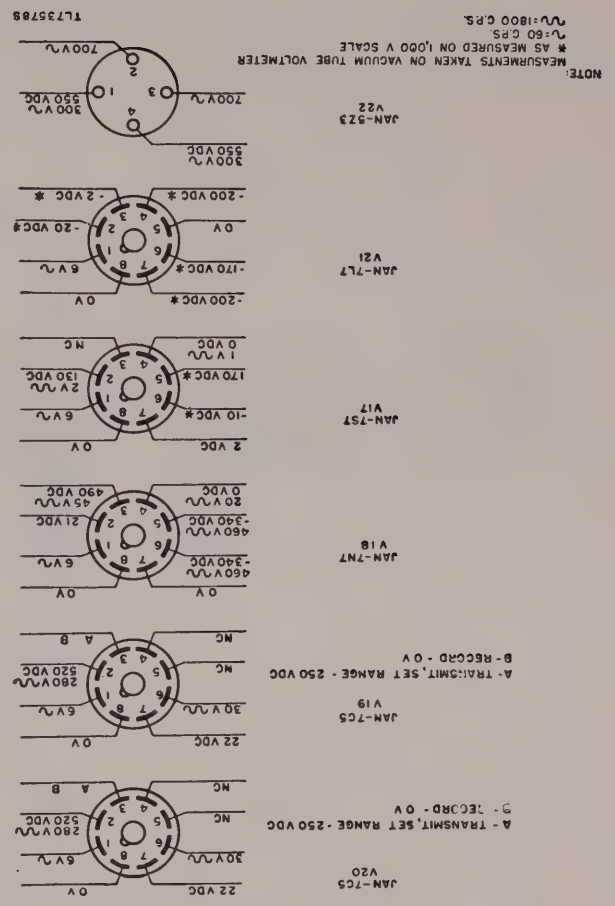


Figure 92. Voltage measurement chart, Rectifier Power Unit PP–86/TXC–1.

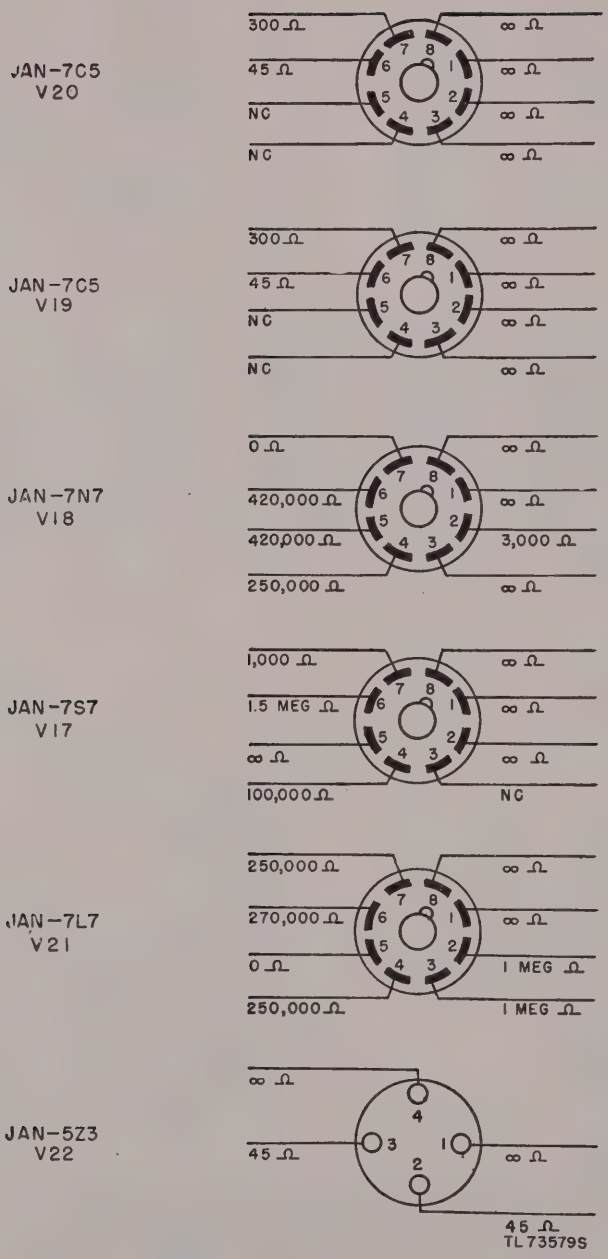


Figure 93. Resistance measurement chart, Rectifier Power Unit PP-86/TXC-1.

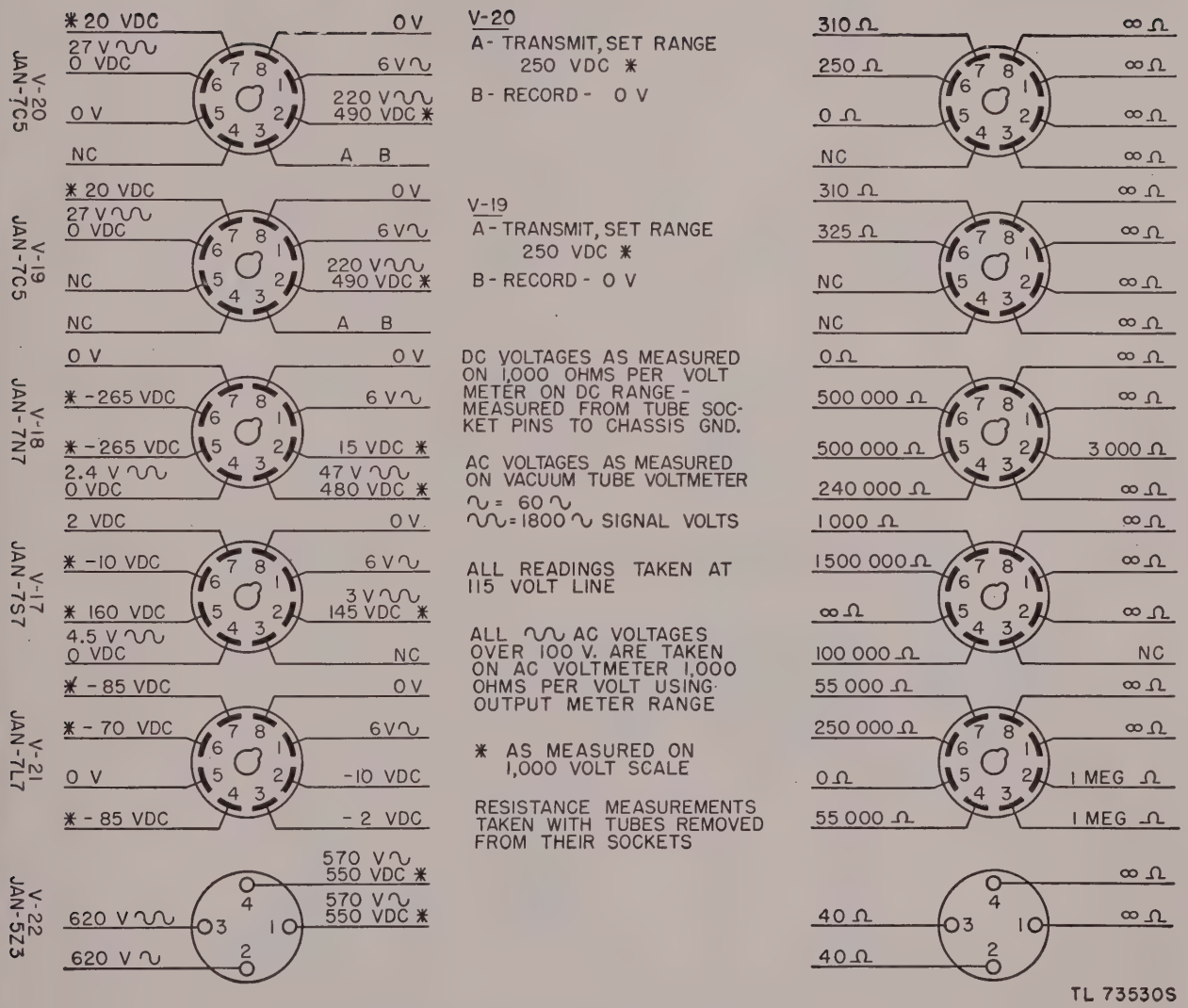


Figure 94. Voltage and resistance measurement chart, Rectifier Power Unit PP-86A/TXC-1.

103. Use of Signal Tracing Charts

To determine whether a circuit is performing in accordance with the requirements, it is necessary to measure the signal voltages and in some cases to observe the waveforms at various points. Use an oscilloscope and a vacuum-tube voltmeter. Use of signal tracing charts in figures 95 through 100 is described where applicable in the text of this manual. General conditions for signal tracing unless otherwise directed in the text or on the chart are—

a. Set turned on.

b. Motor running.

c. Input signal sufficient to cause +2-db reading on db meter.

d. Selector switch on one of the recording positions.

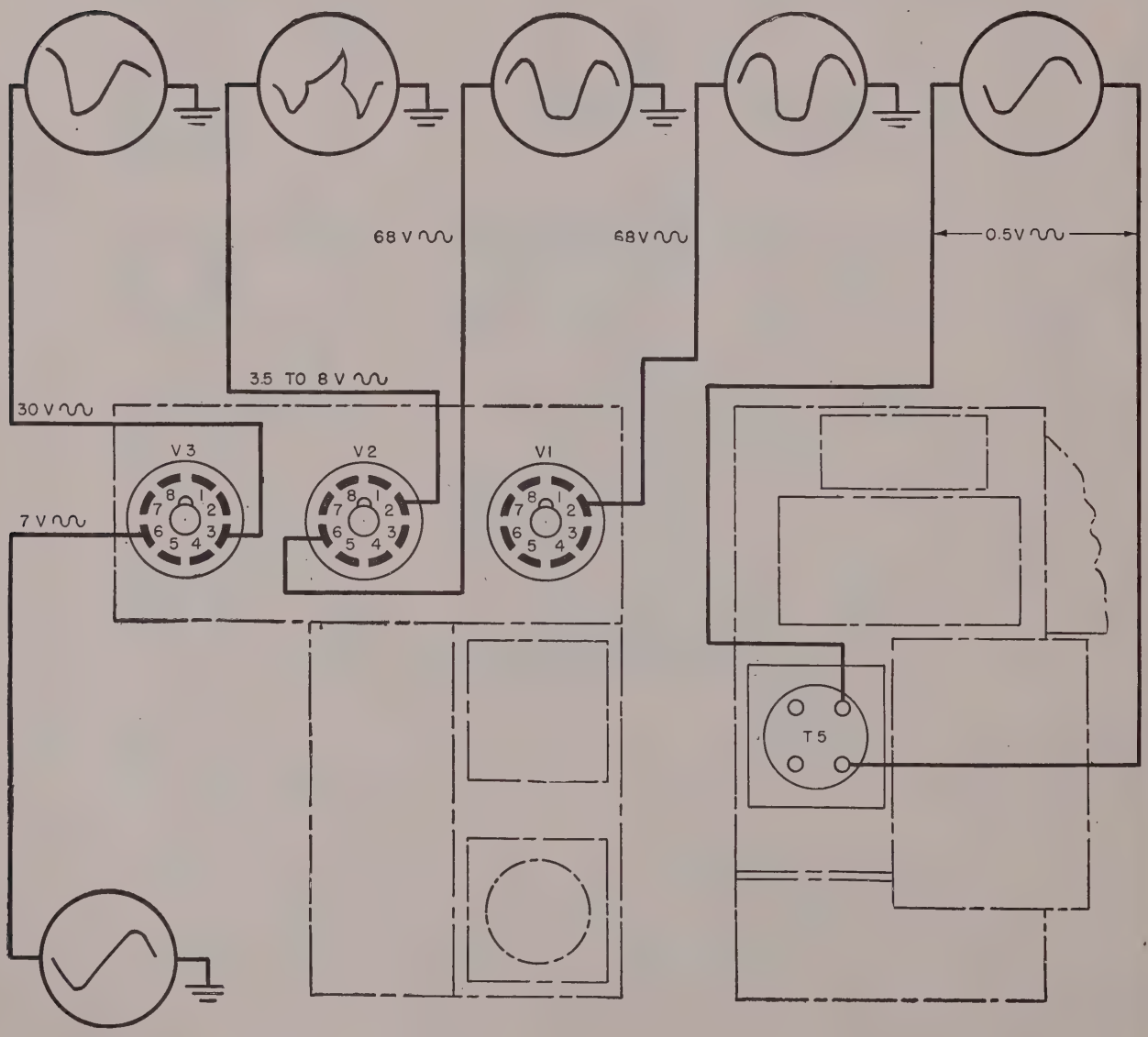


Figure 95. Signal tracing chart, unsealed fork oscillator unit.

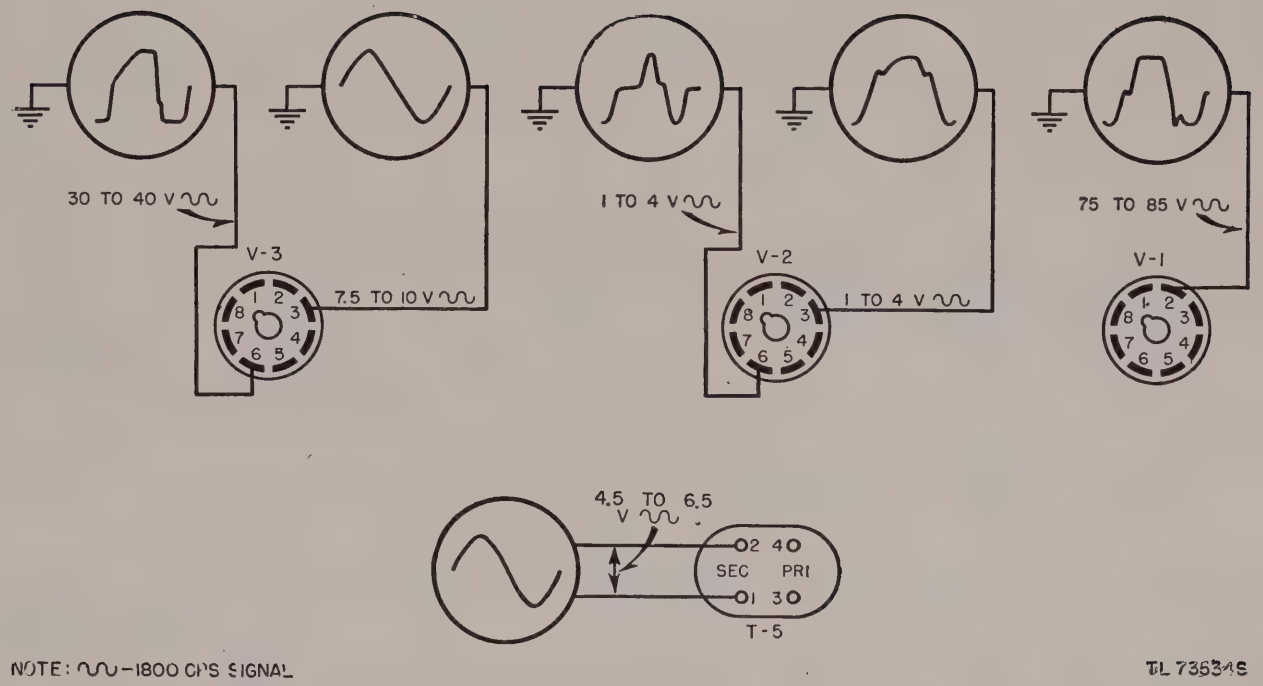


Figure 96. Signal tracing chart, sealed fork oscillator unit.

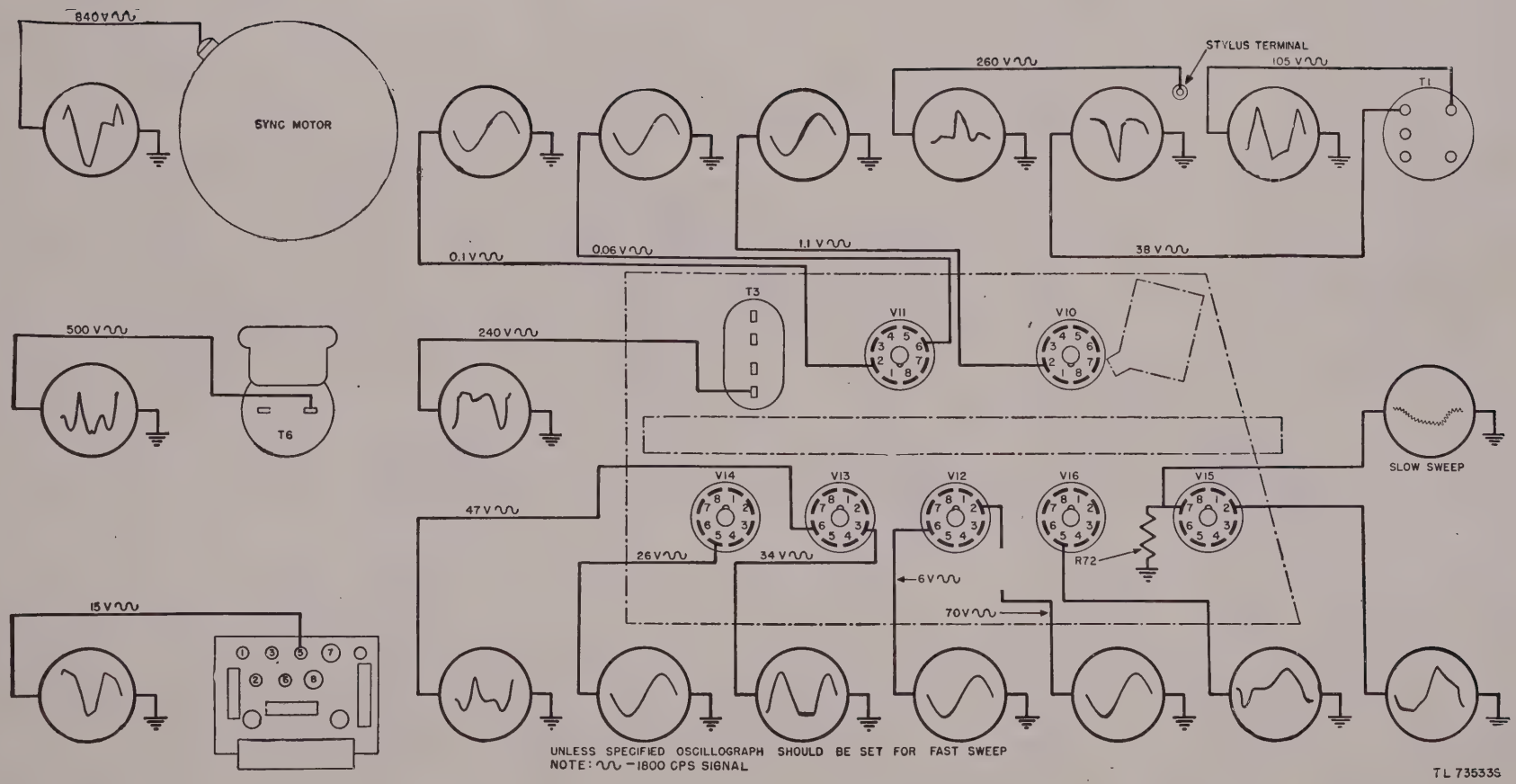


Figure 97. Signal tracing chart, Facsimile Transceiver TT-1/TXC-1.

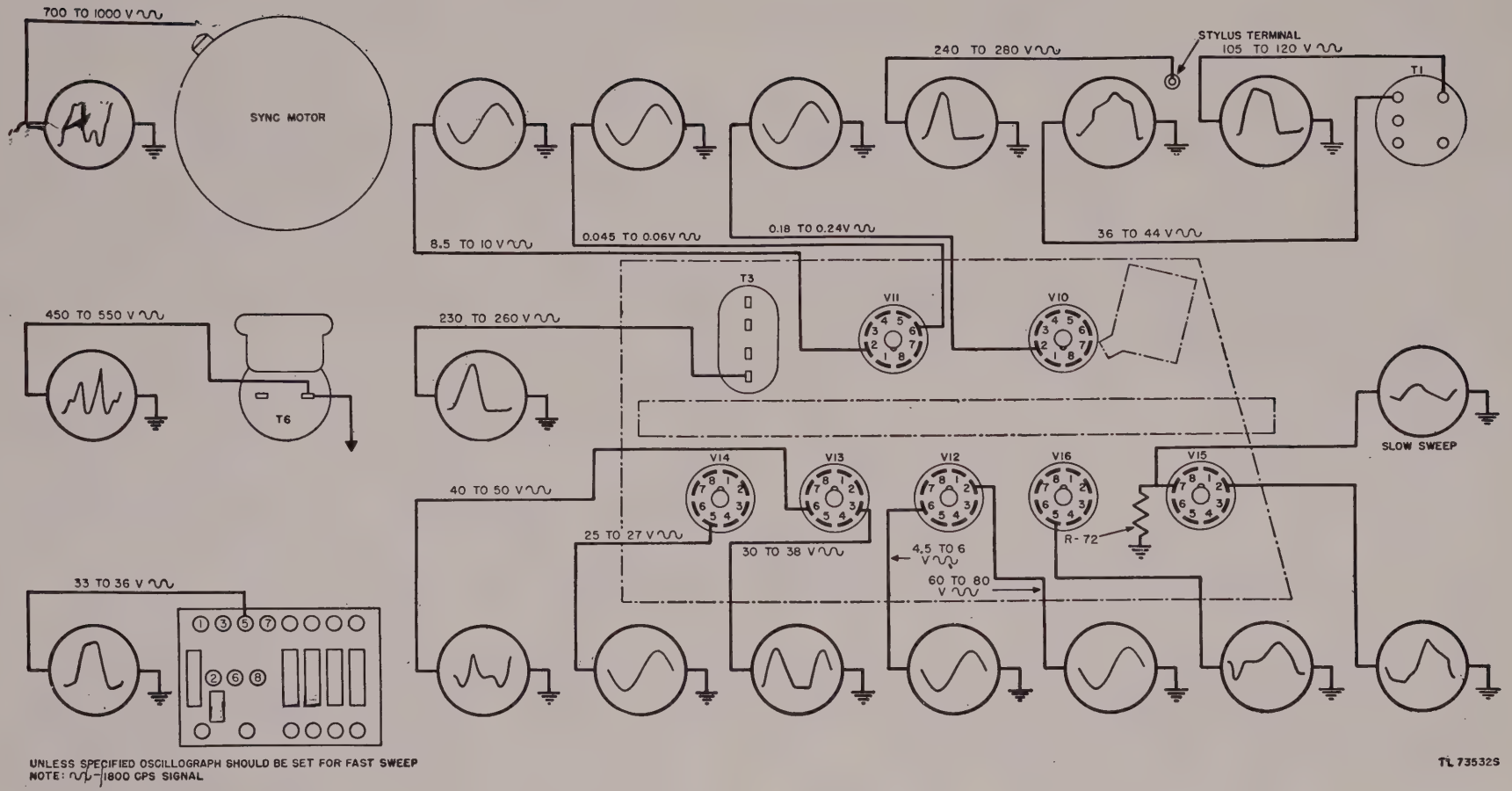


Figure 98. Signal tracing chart, Facsimile Transceiver TT–1A/TXC–1.

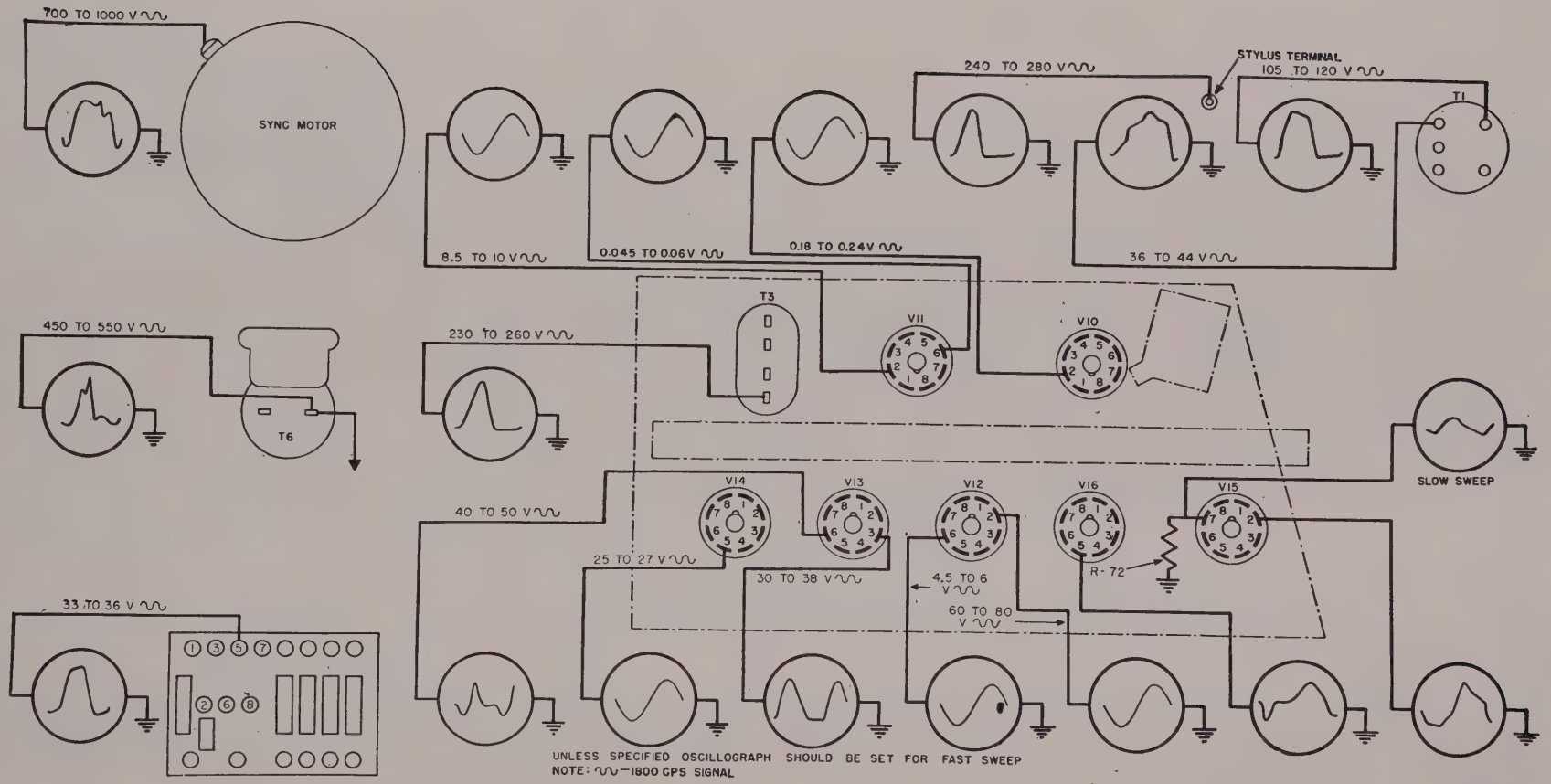


Figure 99. Signal tracing chart, Facsimile Transceiver TT–1B/TXC–1.

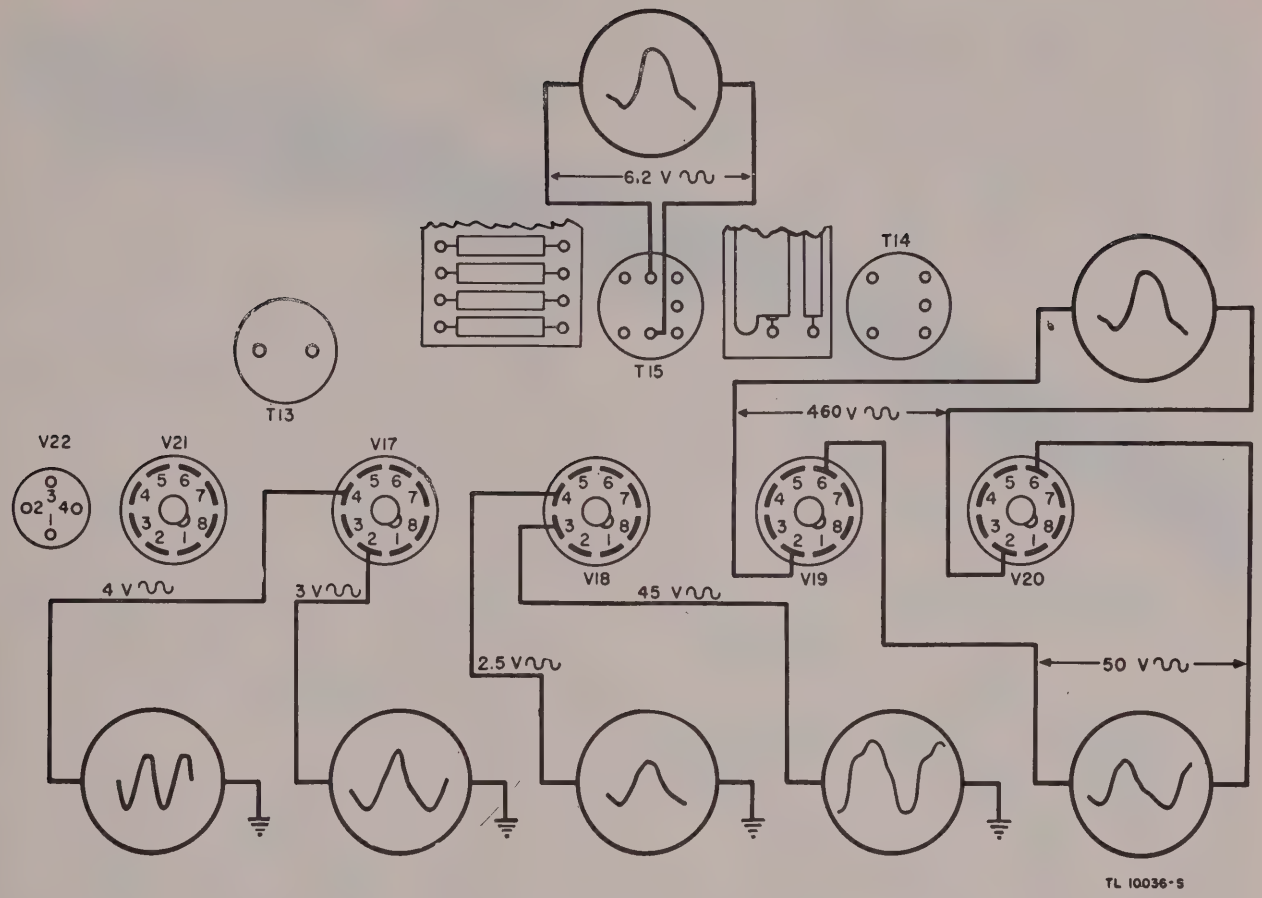


Figure 100. Signal tracing chart, Rectifier Power Unit PP-86(*)/TXC-1.

104. Synchronous Motor Unit

a. Lack of Power. When the clutch is properly adjusted and the motor does not hold synchronism when phasing, the trouble is caused by lack of motor power. This may be due to the following:

(1) Lack of lubrication on the worm and gear or the top and bottom motor bearings.

(2) Synchronous motor current too low.

(3) Synchronous rotor hitting the pole pieces.

(4) Binds in the bearings caused by dirt or by improper assembly of the upper and lower sections of the motor.

b. Failure to Lock in Synchronism. The synchronous motor should fall into synchronism at least three out of every four times it is started. When starting, the engaging knob must be in the released position. Synchronizing failures may be due to the following:

(1) Synchronous motor current too low.

(2) Clutch locked.

(3) Synchronous rotor floating too freely or too tightly on its shaft.

(4) Binds in the bearings caused by dirt or by improper assembly of the upper and lower sections of the motor.

c. Start Motor. Under normal temperature conditions, the start motor when operating properly accelerates the drum past synchronous speed in 1 or 2 seconds. Additional time must be allowed during cold weather. Failures are caused by—

(1) Lack of input voltage.

(2) Defective START switch.

*(3) Broken connections in brush leads.

*(4) Improper operation of start magnet.

*(5) Worn brushes.

*(6) Dirty commutator.

(7) Clutch locked.

(8) Tight motor bearings.

**d.* Start Magnet. Failure of the start magnet (figs. 107 and 108) to operate may be caused by—

*Facsimile Sets AN/TXC-1 and 1A only.

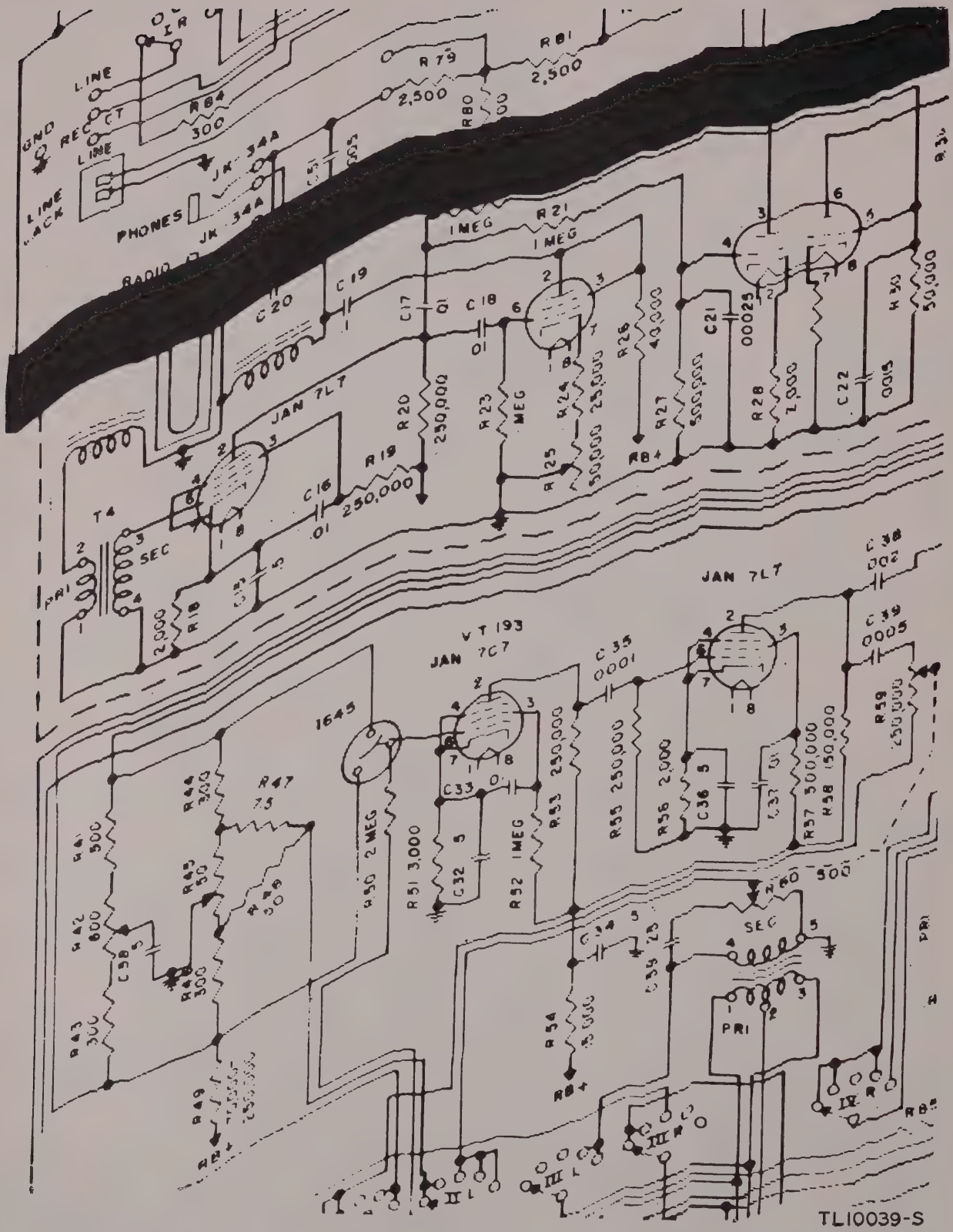


Figure 101. Example of irregular skew.

(1) Low voltage or no voltage across coil when START button is pressed.

(2) Armature rubbing against motor casting.

(3) Open winding.

*(4) Brush holder binding in motor casting.

e. Clutch and Phase Magnet. When the PHASE button is not pressed, the armature of the phase magnet must lock, permitting the stop arm of the clutch to pass it freely. When the button is pressed, the armature should release to intercept the stop arm and lock the clutch. Upon receipt of a phasing pulse, the phase magnet should pull away from the stop arm.

(1) Failure of the armature to release the stop arm may result from improper adjustment of the armature back stop screw, too much clutch pressure, insufficient electrical power applied to phase magnet when phasing pulse is received, armature spring being too tight, or electrical contacts not being closed.

(2) Failure of the armature to remain locked when the PHASE button is released may be traced to lack of voltage across cathode resistors of tubes V4 and V13.

(3) Failure of the armature to release when the PHASE button is pressed may be caused by a weak armature return spring, improper adjustment of the PHASE switch contacts, or a bind in the pivots.

(4) Failure of the armature to pull in when the PHASE button is released may be traced to an open coil winding.

(5) A slow, irregular skew in the received copy (fig. 101) is generally caused by a slipping clutch; the slip may be traced to low clutch pressure or excessive uncontrolled friction between the clutch ring and the clutch bearing.

f. Motor Thrust Bearing. Improper action of the motor thrust bearing may cause patterns or jagged lines in received pictures (fig. 102).

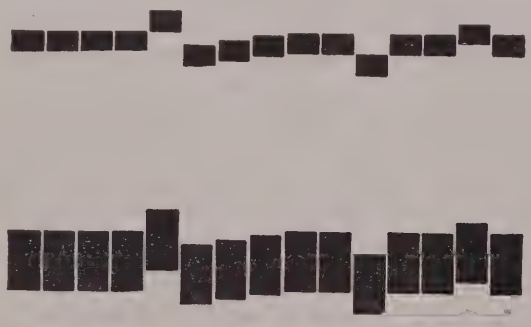
(1) The thrust ball (R in fig. 104) must show no signs of wear.

(2) Trouble may be expected if the end of the motor shaft is worn where it comes into contact with the thrust ball.

(3) The shaft must be able to move up and down freely without riding on the top shoulder of the bearing.

105. Lead Screw and Drum

a. Line Feed Pattern. Line feed pattern (fig. 103) may develop as a result of irregular longitudinal travel of the drum. If the drum does not advance uniformly at the rate of 1/96 inch per revolution, some of the photographically recorded scanning lines will overlap and others will underlap, thereby creating a blank space between the two lines. If the effect is sufficiently great to cause a noticeable degradation in the received copy, corrective measures must be taken. The most common cause of trouble is the drum and lead-screw system. First check the arm of the drum feed engaging mechanism to make certain it is riding on the guide rail. Try installing new half-nuts. Make certain that the snubber (N in fig. 114) is set firmly against the lens barrel. If this does not cure the trouble, make a test recording by substituting the drum of another machine. Be sure that the test recording is of the same type and is made by the same method as the one on which line feed pattern proved troublesome. A final test should be made by using both the drum and lead screw of another machine. If the line feed trouble remains, it can be assumed that trouble is in the motor or optical system.



TL 10038-S

Figure 102. Enlarged example of jitters.



Figure 103. Enlarged example of line feed overlap and underlap.

*Facsimile Sets AN/TXC–1, and 1A only.

b. Jag or Jitters. These are the terms used to describe irregular or saw-tooth recording of lines that should be straight (fig. 102). The trouble is generally in the motor or clutch. It can, however, originate in the drum or lead screw. To determine if it is in the drum and lead screw, first replace the motor with one from another machine which is operating satisfactorily and make a test run. Use a transmission test copy having straight lines running parallel to the axis of the drum. The recording of the straight line should not deviate from its correct position by more than the width of one recording dot or elemental area. This is approximately 1/100 inch. A bind in the drum and lead-screw system causes jitters which will be aggravated considerably if the synthetic rubber plate (P in fig. 104) is too soft.

c. Drum Wobble. There may be an eccentric rotation of the drum sufficiently great to throw the optical system out of focus during a portion of the revolution. The eccentricity may be caused by a bent lead screw or a worn bearing in the drum. Ordinarily, eccentricity of 0.008 inch does not cause trouble. A simple and practical way to test the effect of eccentricity is to place a white sheet of paper on the drum, adjust for a negative transmission having a 15-db contrast range, and scan the white sheet on the drum, noting the variation in output level as measured by the db meter. The level over the entire circumference should not differ by more than ½ db; if it does, take corrective measures as described in paragraph 122. Partial compensation for the wobble effect may be made by centering the exciter lamp (par. 123).

d. Irregular Skew. If the received copy shows an irregular skew, as illustrated in figure 101, it is probable that the clutch of the transmitter or receiver motor is slipping. The clutch slippage can often be traced to a bind in the drum system. To determine whether the defect is in the transmitter or receiver, examine the photographically recorded copy with a magnifying glass. If the individually recorded elemental areas are in approximate straight alinement (fig. 115) the defect is in the transmitter system. If the individual recorded elemental areas follow the contour of the skew, the trouble is in the recorder system. When receiving on direct recording paper, observe the direction of skew before removing the paper from the drum. If the right-hand side of the copy is skewed to the rear of the machine, the clutch is slipping in the transmitting machine. Check the clutch tension in accordance with paragraph 120. If the tension is correct, take necessary measures to eliminate the bind in the defective drum or lead screw (pars. 121 and 122).

e. Failure to Feed. If the drum fails to feed or remains in one spot more than 1 revolution, it is probable that the half-nuts (G in fig. 111) are damaged. The trouble may have started with a bind between the drum and lead screw. If the trouble persists after the bind has been cleared, examine the lead screw with a magnifying glass for defects before replacing the half-nuts.

106. Motor Amplifier

a. General. The output circuit of the motor amplifier includes choke T6, capacitors C28, C29, and C30, as well as the synchronous motor winding.

Caution: The high voltage at the terminals of the synchronous motor, choke T6, capacitors C28, C29, and C30 may be dangerous to life. Shut off power when connecting meter or oscilloscope to these components. Do not touch meter or oscilloscope when power is on. In Facsimile Transceiver TT–1A/TXC–1, do not replace the motor fuse without discharging capacitor C31 or the fuse may blow. In Facsimile Transceiver TT–1B/TXC–1, wait for capacitors C31 to discharge through resistor R95 before attempting to replace the motor fuse.

b. Low Output. In Facsimile Transceiver TT–1B/TXC–1, motor current is read directly on meter M2. Tubes JAN–1635, V5 and V6, of this equipment should draw a total current of approximately 90 ma. In Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1, which use Tubes JAN–6AC5G-T/G, current should be 80 ma, plus or minus 5 ma, but may drop to 70 ma without seriously impairing operation. A convenient way of measuring motor current in Facsimile Transceiver TT–1A/TXC–1 is to connect a milliammeter between the two terminals on the motor fuse post and remove the fuse. Shut off power when making this connection or when replacing a fuse. There is serious danger of shock. A fuse replaced with power on will frequently blow. Motor current in Facsimile Transceiver TT–1/TXC–1 can be measured by connecting the milliammeter between the hot side of the C55 and the B+ side of the synchronous motor. By pressing the START button slightly, the normal circuit will be broken and current will flow through the meter.

(1) If the input to the motor amplifier is low, the exciter lamp does not light up to its full brilliancy.

(2) If the motor current is between 40 and 70 ma any one or more of the three tubes V4, V5, and V6 may be weak.

(3) If the current is less than 40 ma, the trouble is probably a defective component.

(4) If motor current is excessively high, the motor may be shorted.

(5) If the troubles are not located by the above checks, follow the signal tracing charts.

107. Fork Oscillator Unit

a. Off Frequency. If the received copy shows a straight uniform skew or a drift, the frequency of either the transmitter or receiver fork is off standard.

(1) The set under question can be tested by using it to record radio signals from station WWV, Washington, D. C. The signals include a pulse each second. If the fork is properly adjusted, a straight line pattern parallel to the drum clamp will be recorded.

(2) If a signal is available from a facsimile transceiver having a fork known to be in perfect adjustment, a comparison can be made with the set under test and adjustments made. Feed the signal known to be accurate into the transceiver under test through the 6-volt connection of the UC feed coil. Set the selector switch at RECORD PHOTO. Adjust the GAIN control for a meter reading of —2 db. Move the feed coil close to the synchronous motor. The db meter will rise and fall. The amount of rise and fall will depend upon the position of the feed coil with respect to the motor. The rate of rise and fall will indicate the off-frequency condition of the fork. Adjust potentiometer R25 in unsealed unit or R304 in sealed unit until the rate drops to less than one full swing in 2 minutes.

(3) Condensation or moisture on the unsealed tuning fork will cause a frequency drift until the moisture evaporates.

(4) Rusting of the unsealed tuning fork will affect the frequency.

(5) Slight changes in component values will affect the frequency.

(6) Deviations from the values shown in the signal tracing chart may point to the cause of off-frequency operation.

(7) Low or high RB+ voltage may affect frequency.

b. Low Output. Low brilliancy of the exciter lamp and low power in the synchronous motor indicate a low fork amplifier output.

Caution: Do not change tubes in the fork amplifier unit unless absolutely necessary. If a tube is removed and found to be good, place it back in its original position. New tubes in the unsealed fork oscillator unit require about 30 hours of aging to stabilize; new tubes in the sealed unit require about 3 hours. Readjustment of R25 in the unsealed fork unit or R304 in the sealed unit may be necessary when tubes are replaced. If there is no signal output, measure the voltage across the fork output to determine if the fork is delivering the proper signal. If it is not, test for continuity of fork coils. If the voltage is correct, trace the signal in accordance with figure 95 or 96. If mechanical trouble exists in the fork or its mount, replace the entire fork oscillator unit with a new sealed unit from depot stock. The fork and mount are not field replaceable parts.

108. Signal Amplifier (RECORD PHOTO)

a. Signal Tracing. Apply an input signal of 0.0015 volt at 1,800 cps to the LINE JACK connector. Connect a voltmeter between the grid and ground of V14 with the selector switch at RECORD PHOTO and the GAIN control set at 100. It may be difficult to obtain a voltmeter that indicates 0.0015 volt. In this case, set the signal generator to produce an output of 1 volt. Place across this 1-volt output a 100,000-ohm resistor in series with a 200-ohm resistor. The output across the 200-ohm resistor will be about 0.002 volt. This is sufficiently accurate to assure an input voltage that will give a test of the amplifier gain. The voltage on the grid of V14 should be approximately 26 volts in Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1, 16 volts in Facsimile Transceiver TT–1B/TXC–1. In some sets, it may be necessary to raise the input voltage to obtain the proper reading on the grid of V14. The oscilloscope should show the waveform as indicated in the signal tracing chart. If the voltage and waveform are not up to requirements, trace the signal in accordance with the signal tracing chart to localize the trouble. The performance of stage V14 can be checked by measuring the current in the recorder lamp. The current should be approximately 35 ma with proper voltage on the grid. This current will vary somewhat with different recording lamps and different tubes.

b. Level Changes. Occasionally, recordings will show undesirable changes in density. To localize the trouble, apply to the input of the facsimile trans-

ceiver a steady tone, free of level changes. If necessary, connect the meter across the input and watch it for several minutes, making sure that there is no change in level corresponding to more than 0.2 db; watch the db meter in the facsimile transceiver for 5 to 10 minutes. Bounce or jar the set in an effort to aggravate the troubles caused by poor contacts. If the db meter stands steady, it is possible the level changes are the result of a defective recorder lamp. Replace the lamp with a new one. Line it up and adjust it in accordance with paragraph 124. Take a photographic test on a steady input signal. As a final check, a test should be taken at several levels, for example —4 db, —1 db, +4 db and +2 db. Plus 4 db is not an operating level, but it is possible defects will show up quicker when using this overload signal.

109. Db Meter Circuit

a. General. The db meter circuit is of the vacuum-tube voltmeter type which measures the output of the second signal amplifier, V11. The circuit of the meter includes one of the two resistors, R71 or R70, depending on whether the selector switch is in the sending or receiving position.

b. Correct Meter Reading. The exact value of R70 or R71 is within the 10-percent range. If the meter does not read correctly, select resistors within the tolerance range to obtain a reasonably exact reading. To determine whether the reading is correct with the selector switch in TRANSMIT position, measure the output signal across the LINE binding posts after connecting a 600-ohm resistor to these terminals. A reading of 0 dbm across the LINE binding posts should cause the db meter in the transceiver to read +2 db. If the reading is correct in the TRANSMIT position, it will also be correct in the RECEIVE position, unless the value of R71 has changed. This may be checked by making a simple resistance measurement.

110. Signal Amplifier (RECORD DIRECT)

a. General. When the selector switch is set to RECORD DIRECT, the signal amplifier circuit is changed in the following manner:

(1) Tube JAN–7C5, V12, is cut out by opening the plate circuit. One section of Tube JAN–7N7, V13, is switched in and takes the place of V12. This is done for the purpose of increasing the direct recording contrast. The cut-off bias of V13 is supplied in part by bias from the cathode circuit of tube V4.

(2) The output of V14 is switched to transformer T3. The output of T3 delivers the power to the recording stylus. The switching connections include two sets of contacts to reduce the danger of a high-voltage flash-over. When operating through transformer T3 the plate voltage of tube V14 is B+ 450 volts.

b. Low Output. Recordings which are not up to full density may be traced to—

(1) Excessive bias on the cathode, pin 7, of V13.

(2) Defective transformer T2.

(3) Low cathode emission in V14.

(4) Flat-faced stylus or accumulation of carbon on stylus. For correction, clean stylus and rotate it 90°.

c. Blurred Recording. When the tungsten wire point which is set in the brass body of the stylus becomes so worn that a reproduction is blurred during the RECORD DIRECT process, change the stylus needle. Loosen the screw holding the needle, remove the old needle, and replace it with a new one. Locate the needle so that the point is in contact with the surface of the direct recording paper mounted on the drum when the selector switch is in the RECORD DIRECT position.

d. Poor Contrast. If the recorded copy lacks contrast, and if the transmitted signal has a range of 15 db, the trouble may be traced to low bias voltage on cathode pin 7 of stage V13. This voltage may be increased by raising the value of R67 in Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1, or by readjusting potentiometer R97 in Facsimile Transceiver TT–1B/TXC–1. A defective tube V4 may also be the cause of low bias voltage. When tubes are changed, the bias on the cathode of V13 should be checked.

111. Phasing Amplifier

a. No Output. To determine whether V16, thyratron Tube JAN–884, delivers power to the phase magnet, watch the tube when receiving phasing pulses. There should be a flash within the tube at each pulse if the PHASE button is pressed and a good phasing signal is being received. A quick test with no received signal can be made by pressing the PHASE button and giving the START button a short, quick push. A flash within the thyratron should occur each time the START button is pressed.

b. Signal Tracing. Connect the transceiver under test to a second transceiver for the purpose of obtaining a phasing signal. Set the CONTRAST control of the sending transceiver to produce a 6- to 8-db phasing pulse with the CONTRAST control in the range for negative transmissions.

(1) Connect the oscilloscope between ground and the cathode of V15. With the PHASE button pressed, the signal should appear as indicated on the signal tracing chart. If it does not, trace trouble in stage V14.

(2) Check the signal at the other points indicated in the signal tracing chart.

c. Phase Magnet. The phase magnet is part of the cathode circuit of stage V4 when the PHASE button is not pressed. Failure of the phase magnet to lock when the PHASE button is not pressed may be traced to stage V4. R40 is in the cathode circuit of V4 only when the button is pressed.

112. Photocell Circuit

a. Signal Tracing. Because of the sensitiveness of the output of the photocell circuit, it is not practical to make direct measurements with a meter or oscilloscope. It is convenient to use the signal amplifier to feed the oscilloscope which can be connected across the line terminals. The signal amplifier and meter circuit must first be checked for satisfactory operation. If the required measurements at the db meter and oscilloscope are not obtained, the circuit should be traced on a stage-to-stage basis as indicated in the signal tracing chart. If the photocell has been subjected to high humidity, it may require replacement. Its d-c resistance, measured on an ohmmeter when no light is shining on the cell, should exceed 10 megohms. Be sure to readjust R42 after replacing the photocell with a new one.

b. Output Requirements. Set the GAIN control at 100 and adjust the CONTRAST control for minimum meter reading when the scanning beam is on the phasing spot. This is the condition for positive transmission. The db meter should read +2 or +3 db when the scanning beam is on the raised portion of the phasing ring. The equipment will operate satisfactorily even though the reading is not above 0 db. It is desirable but not necessary to have the 2- or 3-db margin. If the output level is not up to requirement, check alinement of the optical system; check amplifier stages V10, V11, and V12; and then check the voltage across resistors R41, R42, and R43. This should be between 0.4 and 0.6 volt.

c. Low Contrast. Insufficient contrast when balanced on black or white can generally be correct by the adjustment of R42. Excessive voltage from the fork unit reduces the contrast range. The voltage can be reduced by shunting the output of the fork unit with a resistor of the order of 2,000 ohms. Sometimes the correction can be made by increasing the value of R49. The exact amount of this increase can be determined by experiment. Low contrast may also be due to lack of light from the exciter lamp (par. 101).

113. Signal Amplifier (TRANSMIT)

a. Low Output. The signal amplifier with the selector switch in the TRANSMIT position is a modification of the signal amplifier with the selector switch in the RECORD PHOTO position. In practice, it is generally found that if the signal amplifier is lined up properly in the RECORD PHOTO position, it performs properly with the selector switch in the TRANSMIT position. A quick check to determine whether the input circuit has been properly switched to the photocell circuit is to place a screw driver under the extension of the photocell shield pan. Do not let the blade touch the grid connection or the pan. If the amplifier is performing properly, it breaks into oscillation. In most cases, if the input circuit is open, the amplifier motorboats.

b. Signal Compression. Connect the oscilloscope and db meter across the LINE terminals. The waveform should be sinusoidal between the balance point and +2 db. If the waveform tends to compress before reaching +2 db, trace through the circuit to localize the trouble. The flattening or compression of the signal may be caused by low plate voltage, low cathode bias voltage, low screen voltage, or defective tubes.

114. Signal Amplifier (STAND BY)

With the selector switch of Facsimile Transceiver TT–1/TXC–1 in the STAND BY position, the fork signal to the motor amplifier is effectively shorted to ground. (In Facsimile Transceivers TT–1A/TXC–1 and TT–1B/TXC–1 the STANDBY-MON-TALK switch must also be at STAND BY. This short is made by connecting pin 9 of the Jones plug to ground through the exciter lamp and its circuit. By shortening the 1,800-cycle signal to the motor amplifier, the power to the synchronous motor is practically cut off. There is only a small residual

dc flowing through the synchronous motor coils. Failure of the signal amplifier circuit to operate properly may be caused by a burned-out exciter lamp or a poor switch contact. The disappearance of the characteristic 1,800-cycle tone in the synchronous motor indicates proper operation of the grounding circuit.

115. Voltage Regulator

a. Requirements. The B+ voltage regulator must deliver voltage that does not vary more than 2 volts under normal variation of operating conditions. The nominal voltage may be anywhere between 240 and 255 volts dc. The measurements may be made at the bottom end of R88 or R89 on the regulator panel terminal strip, or on pins 3 and 6 of stage V16 in Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1. This voltage is measured by meter M3 in Facsimile Transceiver TT–1B/TXC–1.

b. Effects of Poor Operation. If the regulated voltage is too high, the fork frequency deviates from 1,800 cycles and causes a noticeable drift in the recorded copy. A low voltage also results in a drift. A low voltage permits the amplifiers to overload on a high signal level. The overloading shows up as flattened highlights when transmitting for negative reception or flattened shadows when transmitting for positive reception. A flickering voltage regulator may produce level changes, and may oscillate when the line voltage is low. The oscillations will show up in the recorded copy.

c. Tracing Trouble. When trouble is suspected in the regulator unit, check the output voltage with the line voltage varying between 100 and 130 volts. The power frequency may be between 50 and 65 cycles. Watch the voltmeter for several minutes when level-change trouble is being traced. If the voltage takes a jump when the line voltage is within a few volts of 100, there is danger of the regulator breaking into oscillation at low line voltages. If operation at 100 volts is a critical consideration, the accuracy of the voltmeter measuring the line voltage is an important consideration. Most rectifier type voltmeters cannot be depended upon for an accuracy of better than 5 percent at temperatures between 65° F and 100° F. Above and below these temperatures, the accuracy is generally poor. If it is found that the regulator B+ voltage is not within the correct range, check the voltage across regulator lamp V25. This can be done by measuring the voltage between cathode pin 7 of tube V9 and ground. Use the 250-volt scale of a voltmeter having a resistance of 1,000 ohms per volt or higher. The voltage across the regulator lamp should be between 79 and 86 volts in Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1, between 74 and 82 volts in Facsimile Transceiver TT–1B/TXC–1. If the voltage is found to be correct, test V9 or try a new tube. Weak tubes in stages V7 and V8 may be responsible for a low RB+ voltage. There is a possibility that an excessive load is responsible for the low output voltage. If there is reason to suspect this, disconnect the load from the regulator panel and measure the open-circuit voltage. If it is necessary to trace further, test the components for the correct value. Capacitors, especially C57, must be tested for leaks.

116. Rectifier Power Supply

a. General. The term rectifier power unit is used to describe the complete unit which includes the conventional rectifier power supply and the exciter lamp power supply system. In this paragraph, the term rectifier power supply does not include the exciter lamp supply system. The rectifier power supply is conventional.

b. Tube Replacement. Rectifier Tube JAN–5Z3, V22, may require replacement after a few hundred hours of operation, especially if the equipment is to operate on low line voltages, that is, 100 to 110 volts. A tube selected for high emission permits operation on voltages between 90 and 100. If the unregulated B+ voltage falls below 400 when the line voltage is 100, the tube emission is too low for satisfactory operation. In general, tube V22 should be replaced after each 500 transmissions.

117. Exciter Lamp Supply

a. Signal Tracing. For a quick check of satisfactory operation, measure the voltage across the exciter lamp. It should be between 6.1 and 6.3 at any line voltage between 100 and 130. The 6-volt measurement is made at the terminal strip in the power pack. The voltage drop to the lamp socket is approximately 0.2 volt. If the voltage is not correct, measure the voltage on grid 4 of stage V17. This should be about 4 volts ac as measured on a

vacuum-tube voltmeter. If further signal tracing is necessary, follow through the steps shown in the signal tracing chart. The exciter lamp should be replaced after each 500 transmissions.

b. Output Transformer T15. When the exciter lamp burns out, the load on transformer T15 becomes practically zero, which results in a very high voltage across secondary No. 1. There have been transformer failures as a result of the high voltage. In tracing trouble, consideration must be given to the probability of failure of this transformer.

Section XIII. REPAIRS AND ALINEMENT

118. General

Only after a particular trouble is located should replacements or repair work be made. The few exceptions to this rule are explained elsewhere in this manual. Except in cases of simple trouble, do not attempt to repair mechanical parts such as motor, lead screw, drum, and tuning fork unless new parts are not available. Put replacements and lead wires in the same physical location as the original. When replacing components in the amplifier system, take into account protection necessary because of high voltages. For location of parts see figures 104 through 133.

119. Synchronous Motor Unit (figs. 104 and 105)

Caution: Work on the synchronous motor should be done in a clean, dry place, free from dust. Disassemble and assemble motor parts with care, avoiding risks of scratching and damaging any of the machined surfaces. Take care not to lose the lower thrust bearing ball (R in fig. 104) when disassembling the motor.

a. Top Bearing (B in fig. 104). It is not practical to replace this bearing in the field. Use solvent (SD) in removing gummed-up oil and grease. After bearing has been thoroughly cleaned, dry out all traces of the solvent before re-oiling with oil (PL–SPECIAL).

b. Lower Bearing (fig. 104). In motors having serial numbers below 1157, do not attempt to replace the side-wall bearing in the field. Clean and re-oil. In motors above serial No. 1157 side-wall bearings C are of the ball-bearing type and are not expected to develop trouble because of wear. These bearings may be replaced if defective. If tests indicate synthetic rubber pad P is too soft, replace it. A satisfactory material to use for this purpose is Hycar. If the pad is too hard, a portion of the center can be cut away. If ball R is replaced, select one that will not bind on the side wall of the bearing.

c. Synchronous Rotor Bearing (D in fig. 104). This bearing cannot be replaced in the field. If the rotor turns too freely on the shaft and does not fall into synchronism as it should, the free oscillating action must be reduced by adding some end thrust. Insert a thin washer U between the felt washer V and collar S. Remove the collar after driving out the taper pin T with a pin punch having a tip approximately 0.05 inch in diameter. Cut a washer from a thin piece of celluloid or fiber. For celluloid, use a piece of photographic film after removing the emulsion with hot water.

d. Commutator (E in fig. 104). Clean the commutator with a rubber eraser, preferably one containing grit, such as an ink eraser. Do not use emery or sandpaper.

e. Synchronous Motor Field Coils (F in fig. 104). In emergencies, a defective coil can be disconnected and the motor operated on three of its four coils. The power will be reduced, making it difficult to phase. Motors above serial No. 1000 have six poles rather than four. The removal of one coil does not materially reduce the motor power. When ordering replacement parts take care to select the proper replacement coil. Refer to appendix II.

f. Lead-in Bushings. Defective lead-in bushings are the most common causes of motor oils burning out. Keep them clean at all times, and when possible replace them with nylon bushings. Nylon bushings are supplied on Facsimile Transceiver TT–1B/TXC–1.

g. Brushes (C in fig. 107). To replace the brushes in motors supplied with Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1, remove armature extension A of the start magnet and disconnect brush leads from terminal H. If Bakelite sleeve B is in good condition, it is necessary only to replace carbon brush D and its flexible lead. The brush can be pulled loose from the Bakelite sleeve. In some cases it may be necessary to warm the brush with a soldering iron or soak the brush and tip of the Bakelite sleeve in glyptal solvent.

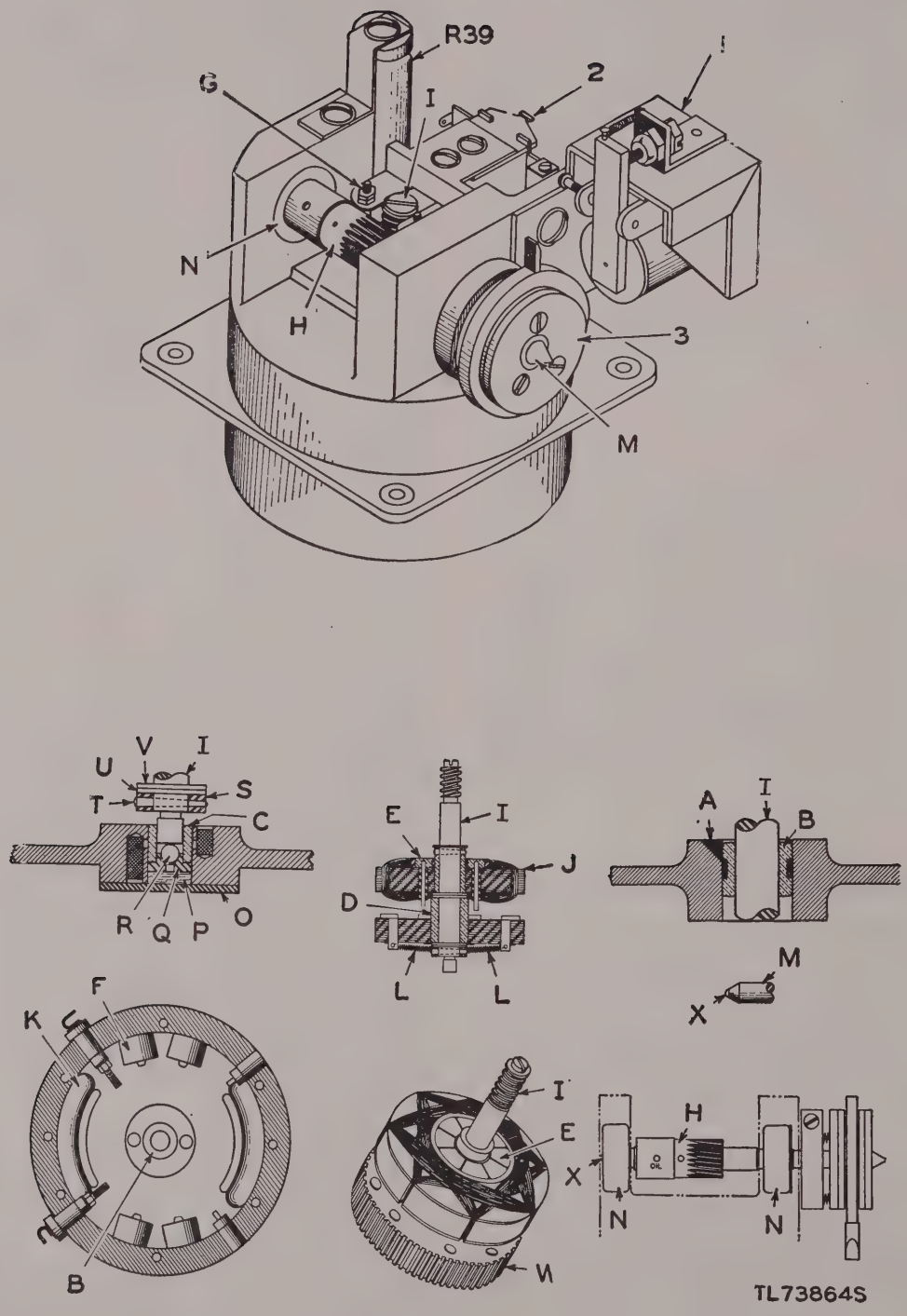


Figure 104. Synchronous motor, early models.

Ref Symbol	Signal Corps stock No.	Name of part and description	Function
	3H3000–74	MOTOR, AC: 1,800-cycle synchronous; TTE No. 96-06..	Driver for drum.
A	*	WICK: felt	Oil reservoir.
B	*	BEARING: composition, 5/16"; TTE No. 90–06–01–12....	Top bearing.
C	*	BEARING: composition, 3/16"; TTE No. 90–06–01–22....	Lower bearing on motors below serial No. 1157.
C	*	BEARING: ball, 1/2" OD by 3/16" ID by 5/32" w; TTE No. 12–06–01–22, Norma-Hoffman No. 4666–R.	Lower bearing on motors above serial No. 1157.
D	*	BEARING: composition, 5/16"; TTE No. 90–06–01–42 ...	Synchronous rotor bearing.
E	*	COMMUTATOR	Reverses current.
F	*	COILS: field, 125 ohms each; TTE No. 90–06–01–25....	Synchronous motor field coils.
G	3H526	BRUSH ASSEMBLY: electrical contact; TTE No. 90–06–01–04.	Supports motor brushes.
H	*	GEAR: 30 teeth, 40 pitch; TTE No. 90–06–03–2.....	Reduction gear.
I	*	SHAFT: synchronous motor; start motor, worm; TTE No. 90–06–01–31.	Motor shaft and worm.
J	*	ARMATURE: series type; TTE No. 90–06–01–5	Start armature.
K	*	COILS: series field, 2 ohms each; TTE No. 90–06–01–15.	Start motor field coil.
L	*	SPRINGS: synchronous rotor coupling; TTE No. 90–06–01–45.	Couple rotor to shaft.
M	*	SHAFT: drive; TTE No. 90–06–03–1	Drives clutch assembly.
N	*	BEARINGS: ball; Norma-Hoffman No. 7007–P; TTE No. 90–06–03–10.	Drive shaft bearings.
O	*	PLATE: bottom; TTE No. 90–06–01–63	Thrust bearing retainer.
P	*	RUBBER: synthetic Hycar; TTE No. 90–06–01–61	End-thrust decoupling.
Q	*	PLATE: thrust; TTE No. 90–06–01–62	Thrust ball retainer.
R	3H230.130	BALL BEARING: steel; 1/8" diam; TTE No. 90–04–00–32	Thrust bearing.
R39	3ZK157–20	RESISTOR: fixed; wire-wound; 7,500-ohm ±10%; 20–w; Ward Leonard No. A7500W–L.	Voltage-dropping resistor.
S	*	COLLAR: thrust; and SPRING ANCHOR; TTE No. 90–06–01–44.	Thrust collar and spring anchor.
T	*	PIN: taper; 7/0	Secures spring anchor to shaft.
U	*	WASHER: bakelite thrust; TTE No. 90–06–01–64.....	Thrust bearing for synchronous rotor.
V	*	WASHER: felt thrust; TTE No. 90–06–01–65.....	Thrust bearing for synchronous rotor.
W	*	ROTOR: synchronous; TTE No. 90–06–01–4	Synchronous rotor.
X	3H230.130	BALL BEARING: steel, 1/8" diam; TTE No. 90–04–00–32	Thrust bearing for shaft assembly.

* Not stocked in depots.

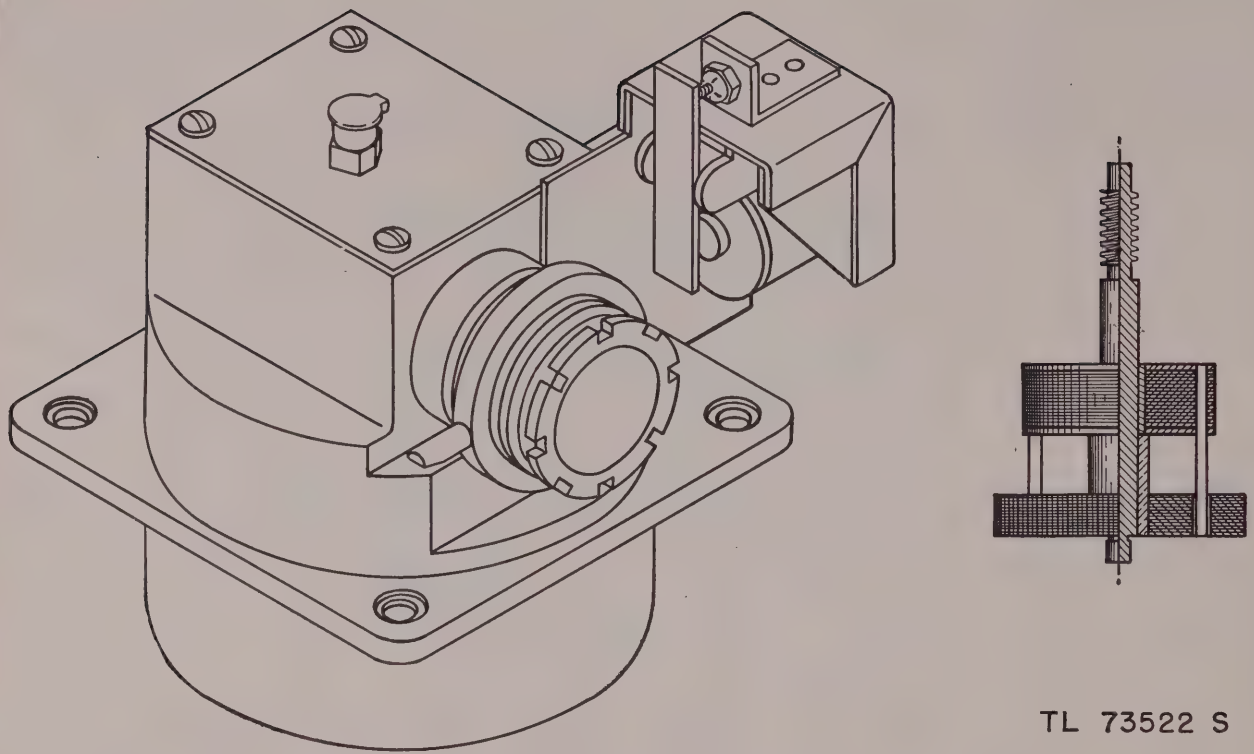


Figure 105. Synchronous motor, later models.

h. Gear H. The gear on the drive shaft can be replaced if suitable shop facilities are available. Pin the new gear to the shaft with a 7/0 taper pin. In Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1 only, improvised pinning arrangements may be used in emergencies. Sometimes a damaged gear can be moved along the shaft and pinned in a new place so that a good portion of the gear will mesh with the worm.

i. Phase Magnet (fig. 106). Armature return spring H must produce a strong, snappy action. Replace the spring if the tension is too weak. Pivots F and G must not cause binds or side play. To adjust armature back stop B, set up the transceiver for a receiving test on a phasing signal. Proceed as follows: With the PHASE button pressed, back off the adjusting screw until the armature fails to operate. Screw in the armature back screw until the armature fails to catch the top arm. Return the screw to a position halfway between the two points. The head of the screw is made hexagonal so that fractions of turns can be counted. The armature should operate satisfactorily over a range of approximately one turn. If the range is less than one turn, the armature return spring may be too tight or the armature may be binding at the pivots. If the range is greater than one turn, the spring may be too loose.

j. Start Magnet (figs. 107 and 108). Poor operation of the start magnet in motors below serial No. 1193 may be caused by the magnet armature's rubbing against the motor casting. This can be cleared by loosening the magnet mounting screws and shifting the frame slightly. Check the action of the armature and brushes for freedom from binds. A lug which straddles the armature spring serves as a backstop to limit the upward movement of the armature. Adjust this backstop by bending the lug so that brushes lift approximately 1/16 inch off the armature. Test by pushing the armature downward with a pencil and noting the free armature travel before brush springs begin to compress. Motors having serial numbers above 1193 are provided with a different type backstop which eliminates this trouble. Motors in Facsimile Transceiver TT–1B/TXC–1 have no start magnet.

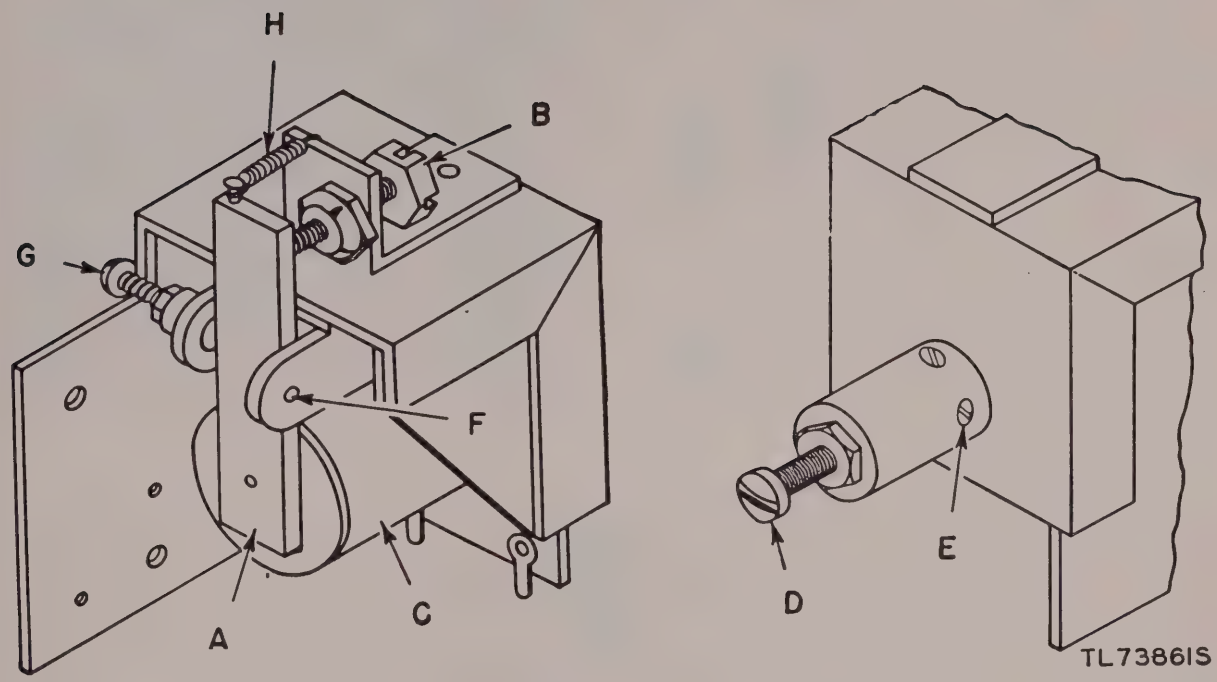


Figure 106. Phase magnet.

Ref Symbol	Signal Corps stock No.	Name of part and description	Function
	*	PHASE MAGNET ASSEMBLY: TTE No. 90–06–04..	Phase drum.
A	*	ARMATURE: TTE No. 90–06–04–3	Armature and stop latch.
B	*	SCREW: back stop; TTE No. 90–06–04–10	Armature back stop adjustment.
C	*	COIL, SOLENOID: 3,000 ohms; TTE No. 90–06–04–07..	Electromagnet.
D	*	SCREW: core locating; 6–32	Core position adjustment.
E	*	SCREWS: set; 8–32	Setscrews for locking core in place.
F	*	PIVOT: TTE No. 90–03–02–3	Fixed armature fulcrum pivot.
G	*	PIVOT: TTE No. 90–06–04–9	Adjustable armature fulcrum pivot.
H	*	SPRING: TTE No. 90–06–04–4	Armature return spring.

* Not stocked in depots.

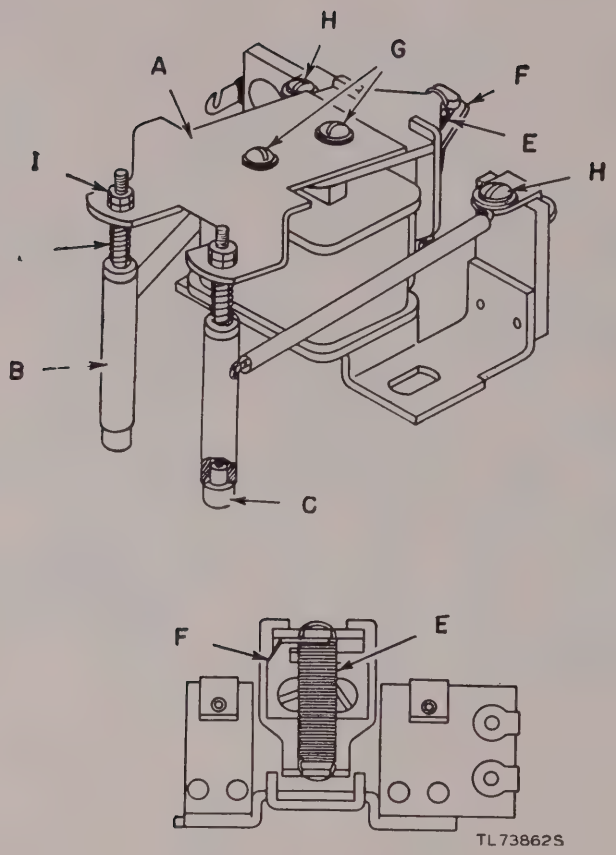


Figure 107. Start magnet.

Ref symbol	Signal Corps stock No.	Name of part and description	Function
	*	START MAGNET ASSEMBLY TTE No. 90–06–02...	Moves brushes in contact with commutator.
A	*	ARMATURE EXTENSION: TTE No. 90–06–02–3	Brush actuator.
B	3H526	BRUSH ASSEMBLY, ELECTRICAL CONTACT: motor; includes brushes; sleeves, springs, brush arms, and nuts; TTE No. 90–06–02–04.	Brush and brush holder.
C	3H3115/B3	BRUSH, ELECTRICAL CONTACT: TTE No. 90–06–02–44.	Commutator brush.
D	*	SPRING: brush; TTE No. 90–06–02–43	Brush pressure control.
E	*	SPRING: armature	Armature return spring.
F	*	BACK STOP: armature	Armature back stop.
G	*	SCREWS: armature extension	Remove brush assembly for replacement.
H	*	SCREWS: binding head	Brush pig-tail connector.
I	*	NUTS: 2–56	Hold brush assembly in place.

* Not stocked in depots.

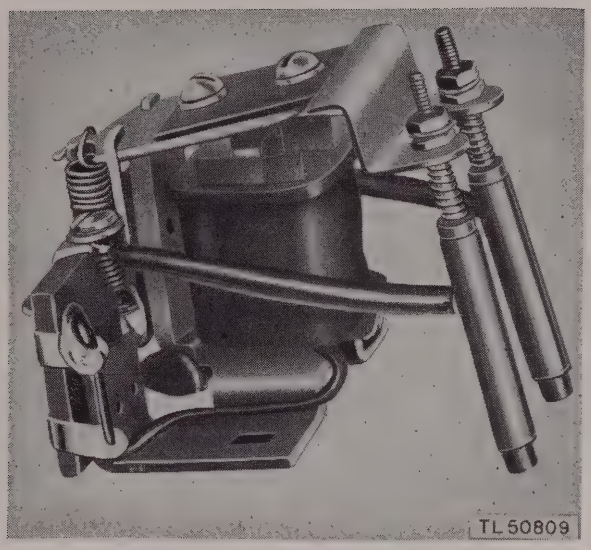


Figure 108. Start magnet.

120. Clutch (fig. 110)

a. Primary Clutch. The primary clutch tension, as measured by a scale with a string wrapped around the drum (fig. 109), should be 12 to 14 ounces. A scale is supplied with Facsimile Set AN/TXC–1B; with other models of equipment use scale, 32-ounce, stock No. 4T138–58 or equal. Make a dynamic measurement, with the motor running and the drum held stationary by means of the string wrapped around the drum and attached to the scale. To adjust primary clutch tension, stop the motor and loosen the clamp screw (fig. 110). The spring retainer F can be pushed forward or backward in Facsimile Transceiver TT–1/TXC–1, serial numbers 1 through 90; in all later models tension is adjusted by turning the retainer on its screw thread.

Warning: Never run the motor with the clamp screw G loose, or gears may be stripped.

b. Secondary Clutch. The secondary clutch tension should be approximately half that of the primary clutch (6 to 7 ounces). If the secondary clutch is too loose, the stop arm and dog strip will come together too rapidly and possibly throw the motor out of synchronism or slip the primary clutch. Slipping of the primary clutch during the phasing operation will result in out-of-phase recording. If the secondary clutch tension is too heavy, the secondary clutch load added to the primary clutch load may cause the motor to stall during the phasing operation. Make a static measurement of the secondary clutch tension. With the motor stopped, and the string wrapped around the drum, pull the string

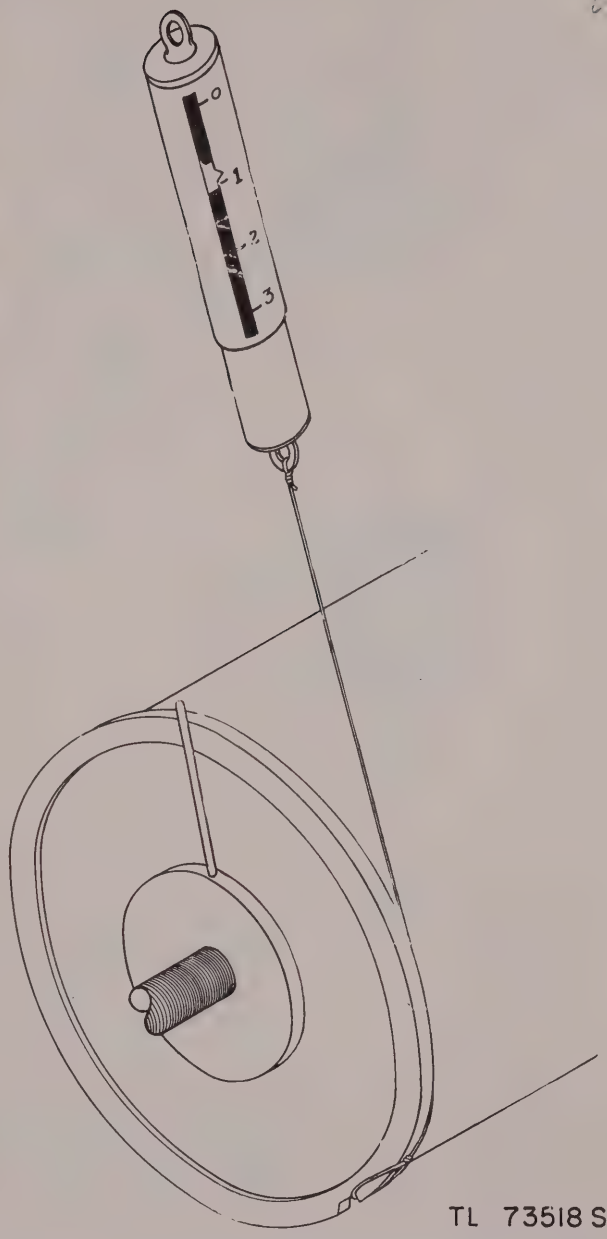


Figure 109. Method of measuring primary clutch tension.

to rotate the drum while reading the scale. Be sure the measurement is taken when the dog latch is engaged with the secondary clutch ring to obtain a correct measurement. The secondary clutch tension is adjustable by means of screws (P in fig. 110). If screws work loose, lock the heads in place with glyptal after making correct adjustments. Before using glyptal, remove all grease with solvent (SD). If the screws are of the slotted type, spread the sides slightly by inserting a small screw driver or knife into the slot.

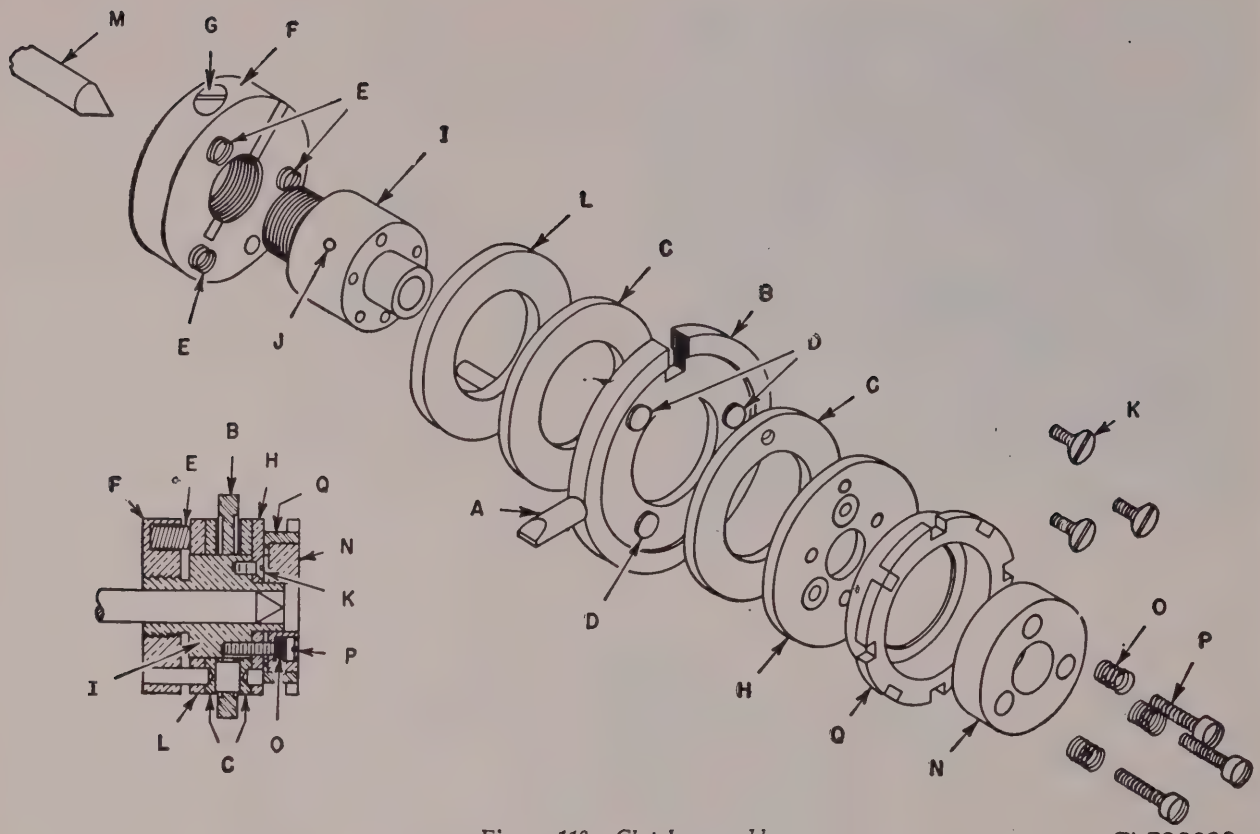


Figure 110. Clutch assembly.

Ref symbol	Signal Corps stock No.	Name of part and description	Function
	*	CLUTCH ASSEMBLY: part of countershaft drive assembly; TTE No. 90–06–03.	Holds back drum while phasing.
A	*	ARM: stop; TTE No. 90–60–03–82	Stop arm and driver.
B	*	CLUTCH: ring; TTE No. 90–06–03–81	Retainer for friction driver plugs.
C	*	RINGS: composition, clutch plates; TTE No. 90–06–03–9.	Driving part of clutch.
D	*	PLUGS: composition, clutch plugs; TTE No. 90–06–01–72.	Driven part of clutch.
E	*	SPRINGS: TTE No. 90–06–03–5	Clutch pressure springs.
F	*	RETAINER: spring; TTE No. 96–06–03–4	Clutch pressure spring.
G	*	SCREW: clamp; 6–32	Clamps spring retainer to shaft.
H	*	RETAINER: clutch assembly; TTE No. 96–06–03–7	Clutch assembly retainer and clutch plate driver.
I	*	BEARING: clutch; TTE No. 96–06–03–3	Hub for clutch assembly.
J	*	PIN: taper 7/0	Secures clutch bearing to drive shaft.
K	*	SCREW: 4–40 flathead	Holds clutch retainer to clutch bearing.
L	*	PLATE: pressure; TTE No. 90–06–03–6	Transfers spring pressure to clutch.
M	*	SHAFT: drive	Drives clutch assembly.
N	*	CLUTCH: secondary, bearing; TTE No. 96–06–03–18	Secondary clutch bearing.
O	*	SPRING: secondary clutch; TTE No. 96–06–03–19.	Secondary clutch pressure.
P	*	SCREWS: 4–40	Adjust pressure on secondary clutch.
Q	*	CLUTCH: secondary ring; TTE No. 96–06–03–17.	Secondary clutch ring.

* Not stocked in depots.

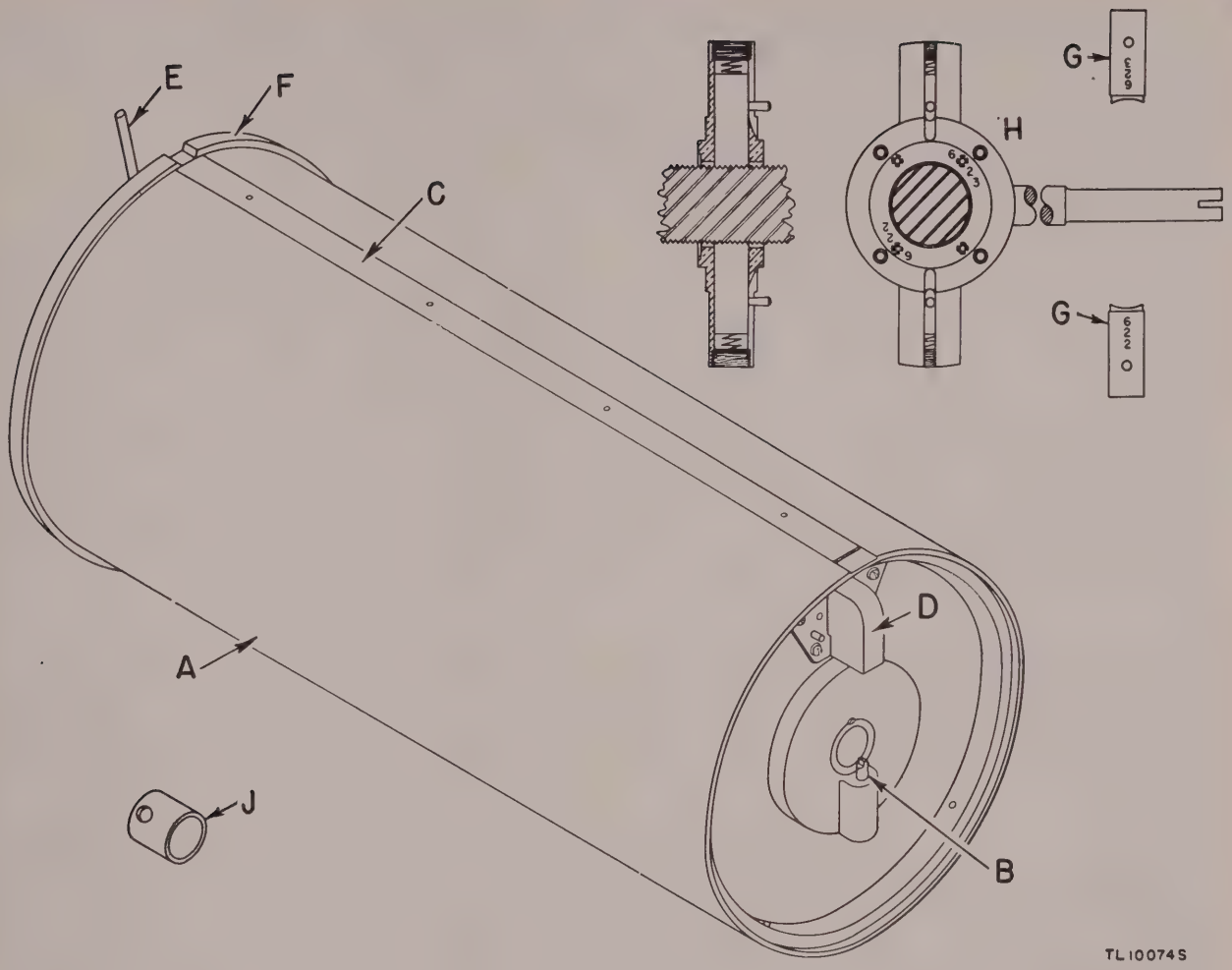


Figure 111. Drum assembly.

Ref symbol	Signal Corps stock No.	Name of part and description	Function
	6C310–I/D5	DRUM, FACSIMILE TRANSCEIVER: TTE No. 96–08.	Holds, rotates and spirals copy.
A	.....	DRUM SLEEVE	Outside of drum.
B	.....	KEY: TTE No. 96–08–01–51	Drives drum through contact with keyway in lead screw.
C	.....	PAPER and FILM CLAMP: TTE No. 96–08–01–7	Secures copy to drum.
D	.....	PAPER and FILM CLAMP CONTROL LEVER: TTE No. 96–08–01–84.	Opens and closes paper and film clamp.
E	.....	CAM PLATE LEVER: TTE No. 96–07–04–2	Operates cam controlling half-nuts.
F	.....	PHASING RING: TTE No. 96–08–01–9	Reflects light during phasing.
G	6L3090–4	HALF-NUTS: TTE No. 96–08–03–2	Feed drum along lead screw.
H	.....	HALF-NUT RETAINER: TTE No. 96–08–03	Mounting for half-nuts and left-hand end drum support.
J	.....	DRUM STOP: TTE No. 96–08–06	Bumper between drum and bearing block.

c. LUBRICATION. Erratic clutch tension usually indicates the need for lubrication. Refer to section VII.

d. ALINEMENT OF SHAFT. For proper operation of the clutch and drive assembly, shaft M must be in alinement with the lead screw. The up and down alinement can be controlled in Facsimile Transceiver TT–1/TXC–1 by the mounting screws of the motor, provided the motor has rubber grommets in the mounting holes. Motors without grommets are machined in a jig and should give no trouble in this respect.

e. DOG LATCH CAM PLATE. Excessive wear and damage are caused to the dog latch cam plate by setting it improperly. The cam plate should be adjusted so that it first begins to trip the dog latch after the dog latch has traveled approximately ¼ inch past the end of the plate. The plate must engage the dog latch near the tip in order to insure sufficient leverage. Adjustment can be made by sliding the entire dog trip arm assembly along the lead screw or by changing shims under the cam plate. The dog latch and trip arm must operate freely under a light tension from the springs.

121. Drum (fig. 111)

a. GENERAL. The drum of Facsimile Transceiver TT–1(*)/TXC–1 is constructed as illustrated in figure 111.

b. HALF-NUTS. If the half-nuts (split nuts) have become damaged, replacement may be made with the spares provided with the equipment. In older equipments, each half-nut holder is numbered. Later equipments will accept stock half-nuts, and their retainers are lettered A and B. The half-nuts must be matched with the corresponding markings on the retainer.

c. BINDING. If the drum tends to bind on the lead screw when it is turned or moved along the lead screw by hand, it is possible that the lead screw is bent or nicked. A nick in the guide rail may cause binding. Do not blame the drum unless other repairs fail to solve the trouble. Binds can sometimes be cleared by flushing the drum bearings with solvent (SD) and relubricating with oil (PL–SPECIAL).

d. JITTERS (fig. 102). If the key (B in fig. 111) is too loose and is free to move sidewise, there may be jitters in the recorded copy. If replacement parts are not available, a temporary repair may be made by squeezing the walls of the key retainer.

e. TENSION ADJUSTMENT. If phasing troubles occur in Facsimile Transceiver TT–1B/TXC–1, tighten the drum tension adjusting screw a half turn. This is the upper screw on the left-hand lead screw bearing block.

122. Lead Screw (fig. 112)

a. CLEANING. Clean the lead screw thoroughly with solvent (SD). Take care not to scratch the threaded portion. After cleaning, inspect for scratches and nicks, using a magnifying glass. If nicks appear in the threaded portion, the threads may sometimes be chased by a skilled machinist working with a hand tool. Any nicks or dents in the other portion of the lead screw should be smoothed out with fine oil stone. Examination of the lead screw should include an inspection of the bearing (K in fig. 112). Replace bearings which cause the lead screw to bind.

b. STRAIGHTENING. If the lead screw runs eccentric by more than 0.008 inch, straighten it. Move the drum to the extreme left and place a light about a foot or two directly over the center of the screw. Rotate the screw and note deflection of its shadow on the chassis. A piece of white paper placed on the chassis may aid in observing the deflection. Find the high spot by rotating to the point of maximum deflection and mark the spot with chalk or ink. Rotate the lead screw until the high spot is at the top. Grasp the screw firmly at the center and push down on it with a force of about 100 pounds. Check deflection again and repeat, increasing force in steps up to 175 pounds. This force should cause the lead screw to bend approximately 1/32 inch. If the screw bends too far, apply a lesser force in the opposite direction.

c. KEYWAY. Nicks in the keyway will cause jitters in the recorded copy. A nick can sometimes be smoothed out with a very fine three-cornered file; the file mark may be smoothed out with a fine stone.

d. LUBRICATION. After a lead screw has been cleaned, inspected, and repaired, lubricate it as directed in section VII.

123. Transmitter Optical System

a. GENERAL. The cause of insufficient light on the photocell will in most cases be dirt on lenses or poor adjustment of the optical system. Before tracing for trouble, clean and adjust the system in accordance with *e* and *f* below. Aline the exciter lamp after each 100 transmissions.

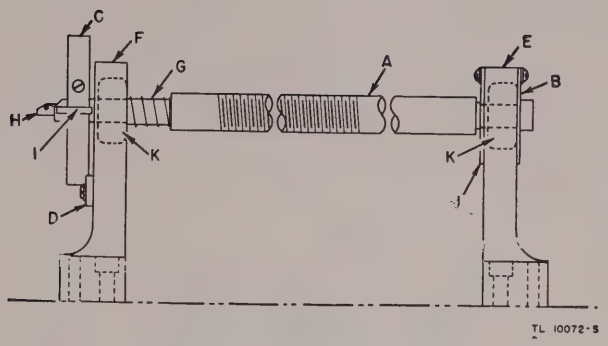


Figure 112. Lead screw, dog, and bearings.

Ref symbol	Signal Corps stock No.	Name of part and description	Function
A	6C310–1/L5	LEAD SCREW ASSEMBLY: lead screw; TTE No. 96–04–00–1 with drive dog, TTE No. 96–04–00–5.	Rotates and feeds drum assembly.
B	.....	LEAD SCREW PRESSURE PLATE: TTE No. 90–07–00–5.	End-thrust bearing.
C	.....	DRIVE DOG ASSEMBLY: TTE No. 96–04–00–5.....	Couples lead screw to motor clutch.
D	.....	DOG LATCH CAM: TTE No. 96–07–01–2	Causes dog latch to disengage from clutch.
E	6C310–1/B1	BLOCK, BEARING: RH; TTE No. 96–07–00	Supports right-hand end of lead screw.
F	6C310–1/B2	BLOCK, BEARING: LH; TTE No. 96–07–01.....	Supports left-hand end of lead screw.
G	.....	SPRING: TTE No. 96–04–00–2	Preloads thrust bearing.
H	.....	DOG TRIP ARM: TTE No. 96–04–00–54	Drives lead screw from primary clutch.
I	6C310–1/P2	DOG LATCH: TTE No. 96–04–00–57	Drives lead screw from secondary clutch.
J	.....	DRUM STOP PLATE: TTE No. 96–07–00–3	Dust shield for bearing.
K	.....	BALL BEARING: TTE No. 96–07–00–2; Norma-Hoffman No. 7010–P.	Lead-screw bearings.

b. Inspection. The following points in the transmitter optical system must be examined for defects before starting any repair work:

(1) *Exciter lamp.* The exciter lamp may have a poor internal contact which causes it to flicker. Try a second lamp known to be good to determine whether the first lamp is at fault. Be sure the lamp is in its right position and not rotated 180° in the socket. Check each time the lamp is removed.

(2) *Socket.* Examine the socket for good contact. Be sure there is no corrosion. This can be done by forcing the lamp up and down and sideways with the current on. If the lamp flickers, repair or replace the socket. Side play may cause the lamp to go out of focus. Examine the connections to the socket, especially the connection to the shell of the socket. Test the spring in the socket to make sure that it operates freely to give a strong contact pressure to the lamp.

(3) *Socket mounting plate.* Examine the screws holding the socket mount in place to make sure they are set up tightly on the Bakelite holder. There is a possibility that the Bakelite may have shrunk away from the screws, causing them to become loose.

(4) *Lamp holder bracket assembly.* The bracket assembly must not move when a pressure of 10

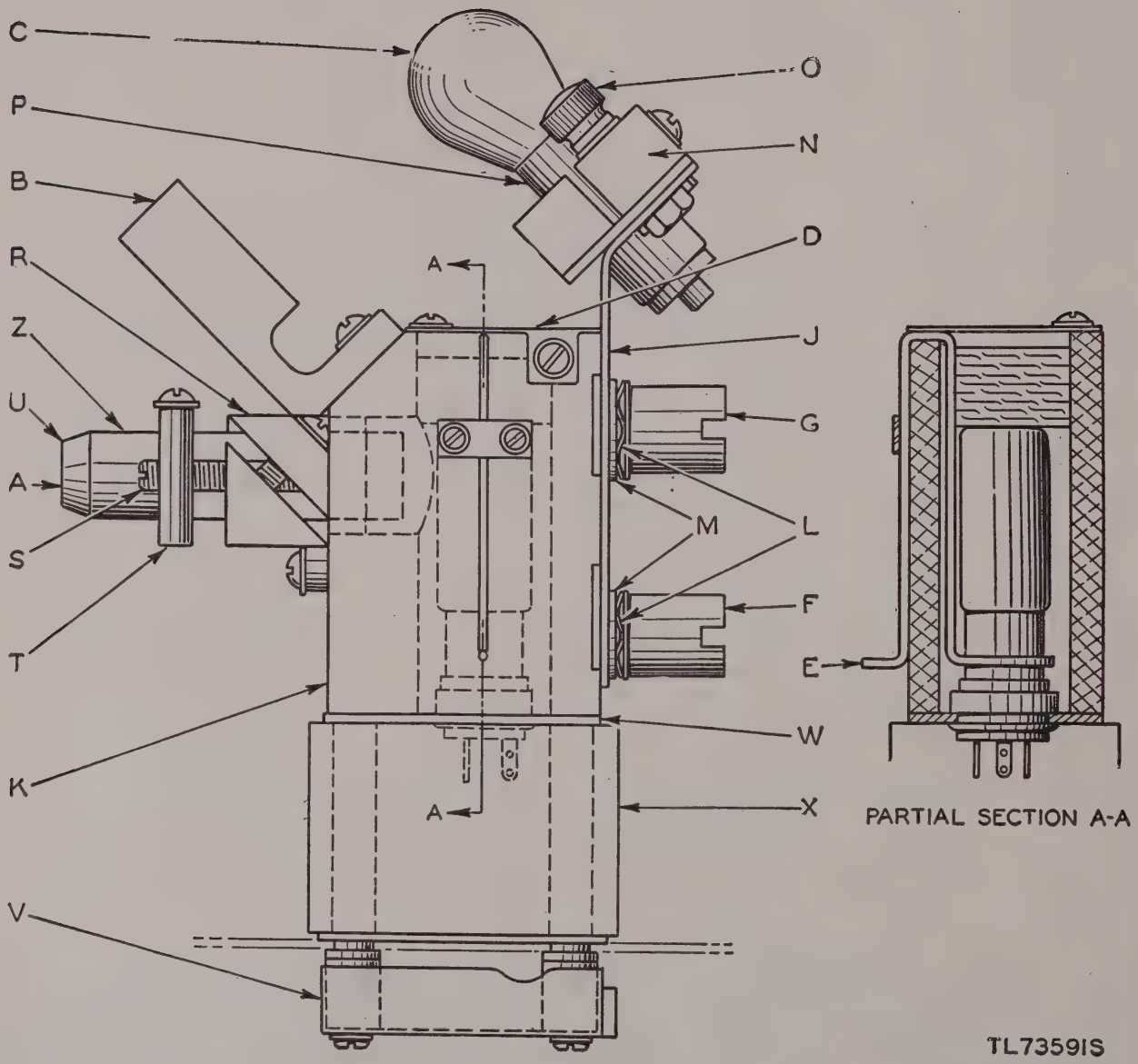


Figure 113. Transmitter optical system.

Ref symbol	Signal Corps stock No.	Name of part and description	Function
	6C25–1B/L1	TRANSMITTER OPTICAL SYSTEM: TTE No. 90–01–00.	Scans subject matter for transmission.
A	6C25–1/L7	OBJECTIVE LENS: TTE No. 90–01–10	Focuses image of scanned spot on aperture.
B	6C25–1( )/M5	CONDENSER LENS ASSEMBLY: TTE No. 90–01–02.	Focuses light from exciter lamp onto spot to be scanned.
C	6Z6806.8	LAMP, INCANDESCENT: Mazda 6-volt, 21 cp auto lamp; TTE No. 90–01–13; GE No. 1129.	Illuminates spot to be scanned; exciter lamp.
D		BLOCK COVER: TTE No. 90–01–01–3	Cover for photocell chamber.
E		CELL EJECTOR: TTE No. 90–01–01–4	Removes photocell.
F		ADJUSTING SCREW (eccentric): TTE No. 90–01–04–3	Adjusts vertical position of exciter lamp.
G		ADJUSTING SCREW (eccentric): TTE No. 90–01–04–3	Adjusts horizontal position of exciter lamp.
J		EXCITER LAMP ADJUSTING PLATE: TTE No. 90–01–04–1.	Mounts exciter lamp to cell block.
K		CELL BLOCK: TTE No. 90–01–01–1	Mounts optical system and supports photocell.
L		LEAF COMPRESSION SPRINGS: TTE No. 90–01–04–9.	Presses exciter lamp adjusting plate against cell block.
M		ADJUSTING PLATE WASHER: TTE No. 90–01–04–4	Washer between leaf compression springs and cell block.
N		SOCKET HOLDER: TTE No. 90–01–04–5	Mounts exciter lamp socket to permit vertical adjustment of socket and adjustment of distance between exciter lamp and capacitor lens.
O		LOCKING SCREW: TTE No. 90–01–04–7	Locks socket holder in correct focusing position.
P		SOCKET: TTE No. 90–01–04–6; Culver-Stearns No. AG–135.	Lamp socket.
R	6C310–1/C5	CLAMP: TTE No. 90–01–01–6	Clamps lens barrel.
S	6L7032–19.3S	SCREW, SET: lens barrel focus adjust; TTE No. 90–01–01–8.	Adjusts focus.
T	6C310–1/C4	CLAMP: TTE No. 90–01–01–7	Transmits motion from adjustment screw S to lens barrel.
U		INDICATOR SPOT	Indicates UP position of lens barrel.
V		PHOTOCELL and GRID CONNECTION SHIELD: TTE No. 90–01–90–11.	Shield.
W		SOCKET PLATE ASSEMBLY: TTE No. 90–01–01–2 including socket TTE No. 90–01–01–23	Photocell socket and mounting plate.
X		RAISING BLOCK: TTE No. 96–01–14	Raises optical system.
Z		LENS BARREL ASSEMBLY: TTE No. 90–01–03	Scans area of predetermined size (elemental area) passing light through aperture to photocell.

pounds is applied by hand. If it does move, the spring tension under cam screws G and F is too light. The tension may be increased by taking one full turn on the screw. It is possible that the spring leaves may be broken. If so, replace them.

(5) *Condenser lens.* Examine the condenser lens for dirt and fitting in the mount.

(6) *Objective lens barrel.* Inspect the objective lens for dirt and fitting in the mount. The barrel must not be loose in the block. Inspect the lens for defects. It may be necessary to remove the lens barrel. If the cementing between the elements of the lens appears to be fern-like when examined under a magnifying glass, replace the lens. If any other defects appear under examination with a magnifying glass, replace the lens unless the defects occur only at the outer rim of the lens.

(7) *Photocell socket.* Remove the pan under the photocell and examine the socket connections.

c. Exciter Lamp Socket. Do not replace the exciter lamp socket with any ordinary type automobile socket. The socket must be constructed with strong springs behind the contact, and insulated with Bakelite, not hard rubber.

d. Lamp Bracket. If it is necessary to tighten the lamp bracket, keep in mind that the eccentric action of the top screw moves the bracket sideways and the eccentric action of the bottom screw raises and lowers the bracket. The center operating position of the screw heads is marked with a red dot. Do not attempt to obtain alinement with the red dot a quarter- or half-turn off center. The dot should not move more than 45° either side of center. If it is necessary to take up a turn on either the lower or upper cam screw, it may be necessary to make a partial turn of the second cam in order to obtain a complete revolution of the first one. This holds true if one cam is removed to replace a spring. Under emergency conditions, a spring may be replaced with a heavy piece of rubber that has a thin washer on each side.

e. Condenser Lens. In most cases, the condenser lens may be cleaned sufficiently for operation by dusting off the top surface and wiping with a soft cloth. It is this top surface that collects most of the dirt. If the lens is fogged on the inside surface, it must be removed for cleaning. The nut is cemented in place with glyptal, which must first be loosened with a solvent such as glyptal thinner or paint remover. Use a form tool as shown in figure 116 for unscrewing the nut. Take care not to damage the paper washers.

f. Objective Lens. The objective lens must not be removed unless it is necessary to make a replacement because of cracked element or because of cementing. Cleaning of the front surfaces of the lens may be done without removing the barrel. To remove the objective lens, first remove the entire barrel. In removing the barrel, first unloosen the locking screws of the clamp R as shown in figure 113. From sheet metal, form a screw driver or spanner wrench tool as shown in figure 116. Do not use a single pointed screw driver, as it is apt to slip and scratch the lens. Try to loosen the nut without using solvent (SD) as the solvent will damage the cement between the lens elements. If it is necessary to use the solvent, use it very sparingly, keeping the lens barrel in a vertical position with the lens down.

g. Photocell. Do not remove the photocell unless there is good reason to suspect that replacement is necessary. To remove the photocell, take off the cover D, and eject the cell by lifting the ejector rod E. In replacing the cell, have the single-wire anode in the cell pointing to the back. If subjected to high humidity, the base may absorb moisture, making replacement of the photocell necessary. After replacing the photocell be sure to readjust R42.

h. Exciter Lamp and Condenser Optical System. (1) Center cam screws so the red dot is up. Set photocell lens barrel with the dot or line marker in the top position (U in fig. 113). If the lens barrel has been removed and the focal point is not known, set the barrel back so that the face of the lens is about one-half inch from the surface of the drum. Tighten the screw in clamp R. Wrap a piece of white paper around the drum, turn on the power, set the selector switch for TRANSMIT, set the CONTRAST control about five points higher than the balance point for negative transmission, and set the GAIN control at 100.

(2) Loosen the clamps on the socket and adjust the alinement of the filament; move the socket up and down in the clamp until the maximum meter reading is obtained. If there is no meter reading, adjust the top adjusting cam until there is a meter reading.

(3) If the alinement of the condenser lens system is uncertain, loosen the mounting screws and move the system laterally for maximum reading. Return the top adjusting cam screw to center position and readjust the system for maximum reading.

(4) Loosen the clamp screws which hold the bakelite block to the mounting plate. Swing the block to and from the condenser lens and lock it in

position at the point of maximum reading. If the adjustment is not critical, clamp the block in the center position. With the drum rotating, readjust the eccentric screws for steadiest signal. If at any time during the procedure the meter reads above +2, adjust the GAIN control to bring the reading into the range between −4 and +2.

i. PHOTOCELL LENS BARREL. Remove the white paper from the drum and replace with a sheet of 65-line half-tone or very fine print. The 65-line half-tone copy may be obtained from large newspaper photographs having light gray or white background. Connect a headset across the line terminals. If the tone is not loud enough, use the LINE JACK. Listen to the signal as the drum rotates; move the lens barrel in and out until the sharpest and loudest modulation tones are heard. To make the modulation tones distinct, the 1,800-cycle carrier can be cut off by shorting terminals 1 and 2 of T5. Keep the line or indicator (U in fig. 113) in the top position. At the point of loudest or sharpest tone, lock the lens barrel in position. Again refine the adjustments of the exciter lamp position with the cam screws. Replace the white sheet on the drum for a final check. An alternate method of alining the photocell lens barrel is to connect an oscilloscope across the line terminals and move the drum by hand, alternately scanning black and white copy. Adjust the lens barrel for maximum contrast between black and white, as indicated on the oscilloscope. By using a synchronized horizontal sweep on the oscilloscope and letting the motor turn the drum, the wave envelope can be studied.

124. Recorder Optical System (fig. 114)

a. GENERAL. Failure to obtain recordings of sufficient density in most cases can be traced to a weak recorder lamp. Check the current going through the recorder lamp and make a test with a replacement lamp before suspecting faults in the optical system.

b. CLEANING LENSES. The lens surfaces, with the exception of the front face of the objective lens E, are protected. Dust can usually be removed with a camel's-hair brush without tampering with the adjustments of the optical system.

c. RECORDER LAMP REPLACEMENT. The recorder lamp can be replaced without removing the recorder lamp optical system from its bracket, in the following manner:

(1) Remove connectors or sockets from recorder lamp A.

(2) Remove four screws B at the rear of recorder optical system.

(3) Remove pressure plate C and retainer cup D.

(4) Pull lamp A carefully out of optical system. If the lamp comes out without a rubber ring F around the bulb, remove rubber ring from the inside of the optical system.

(5) Place rubber ring F on the bulb of the new recorder tube and reassemble the system, leaving the four pressure plate screws loose.

(6) Connect the recorder tube leads to the prongs, the red lead (+) going to the No. 7 prong which is nearest the alining projection. (Most sets have a socket, not individual connectors.)

(7) Connect the UC coupling coil to the transceiver and place the coil near the motor.

(8) Turn the selector switch to RECORD PHOTO.

(9) Adjust the GAIN control and the position of the UC coupling coil until the meter reads about +2 db.

(10) Move the drum to the extreme right and shade the transceiver from direct light; slip a piece of tissue paper or a piece of undeveloped film in front of the recorder optical system, close to the objective lens. A ring of light should be visible on the tissue or film. This ring must be within the field of the lens, preferably in the center. If the light is off to one edge so that some of the light is being shut off by the lens barrel or the light is not visible at all, orient the recorder tube by pressing on the retainer cup in different directions to center the ring of light well within the confines of the objective lens. Once the ring of light is centered, tighten the plate screws progressively and recheck the ring of light. If there is a clamp under one of the pressure plate screws, the recorder tube wires should be placed under the clamp so that they are captive but free enough to slip and prevent cutting of the insulation.

Caution: There are 250 volts direct current on recorder tube terminals.

d. TESTING ALINEMENT OF RECORDER OPTICAL SYSTEM. Set up for photographic reception and make a test run on photographic paper or film. Recording for 1 minute is required at the following levels: −4, −2, 0, and +2 db. Develop the exposed paper, examine it under a magnifying glass, and note how the rectangular images stack up on one another in sharpness and size (fig. 115). When in proper adjustment, the rectangles just touch one another on all four sides. If the rectangular images

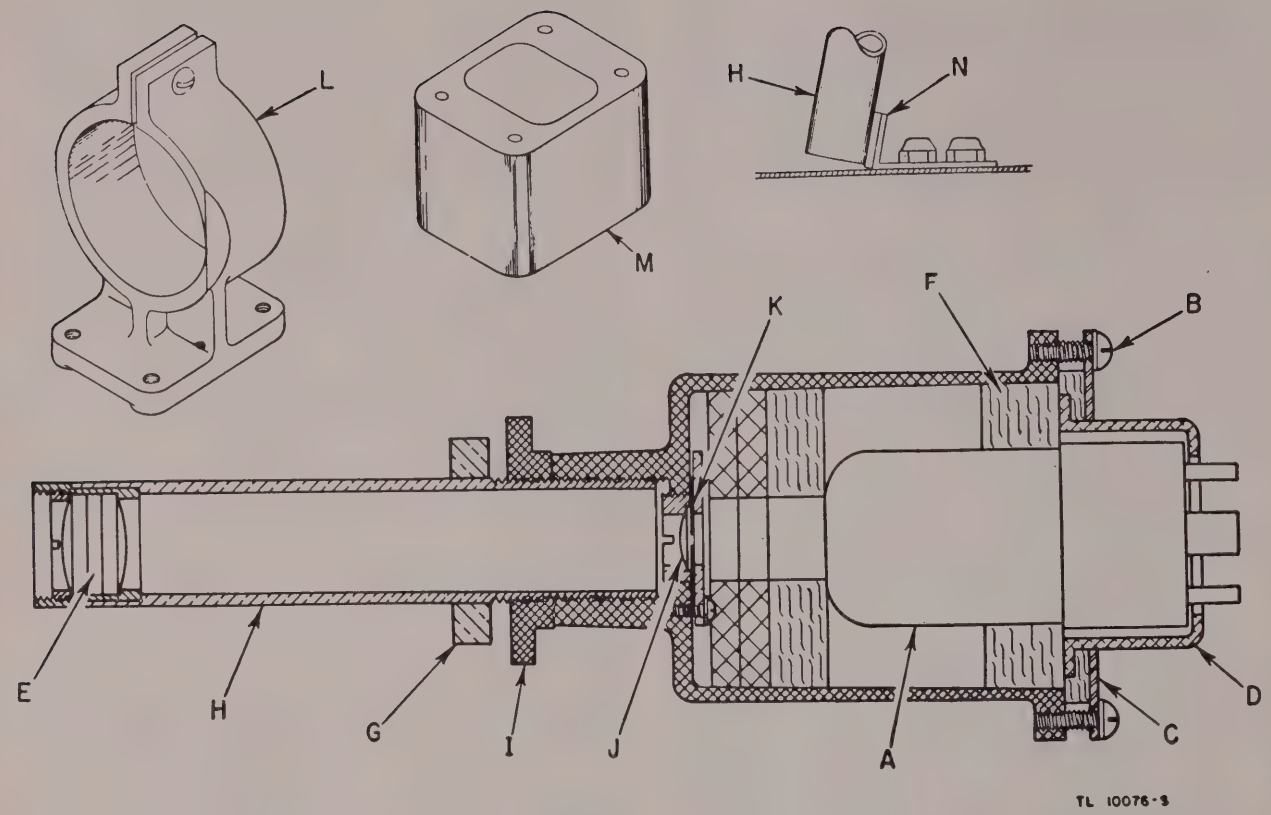


Figure 114. Recorder optical system.

Ref Symbol	Signal Corps stock No.	Name of part and description	Function
	6C310–1/L2	RECORDER LAMP ASSEMBLY: TTE No. 96–02–00..	Recorder optical system.
A	2Z58 90–11	LAMP, RECORDER: Sylvania No. R1130A or No. R1130B; TTE No. 90–02–06.	Converts signal to light.
B	.....	SCREW: ⅜" x 6–32	Fastens pressure plate.
C	.....	PLATE: pressure; TTE No. 90–02–02–2	Clamps lamp base sleeve.
D	.....	SLEEVE: lamp base; TTE No. 90–02–02–9	Clamps recorder lamp in place.
E	6C310–1/L7	LENS: objective; plano convex, Hasting Triplet 10x; TTE No. 90–02–05.	Focuses light passing through aperture onto drum.
F	6C310–1/H1	HOUSING, LAMP: TTE No. 90–02–02	Main assembly barrel.
G	.....	KNURLED RING: TTE No. 90–02–03–12	Adjusts lens barrel.
H	6C310–1/B4	BARREL SUBASSEMBLY: lens; TTE No. 90–02–03–1.	Mounts and shields objective lens.
I	6C310–1/N1	NUT, LOCK: TTE No. 90–02–03–3	Locknut.
J	6C310–1/L3	LENS: condensing; plano convex, 18-mm focal length; TTE No. 90–02–04.	Field lens.
K	.....	APERTURE PLATE: for AN/TXC–1; TTE No. 96–02–02–7.	Light aperture.
L	2Z2650.8	CLAMP: lamp recorder; zinc die-cast; TTE No. 90–02–01.	Supports lamp housing.
M	.....	RAISING BLOCK: TTE No. 96–02–07	Raises optical system.
N	.....	SNUBBER	Prevents vibration of lens barrel.



Figure 115. Enlarged section of photo recording.

are not obvious to the naked eye at 8 to 10 inches distance the images can be considered satisfactory. If the rectangles are obviously undersize or oversize, readjust the lens barrel.

e. Alinement of Recorder Optical System. Loosen locking ring (I in fig. 114) and turn adjusting ring G and lens barrel H two turns in the proper direction. If the rectangles are too small, turn the lens barrel into the housing. If they are too large, turn the lens barrel out of the housing and tighten the locking ring. Move the drum to the extreme left and place a thin negative on the drum so that the negative is perfectly tight and extends one-quarter inch over the right-hand edge of the drum, keeping the emulsion side out. Adjust the transceiver so the meter reads +2. The image of the rectangle should be visible on the film beyond the edge of the drum. If it is not visible, remove the motor and clutch cover and push the drum farther to the left. If the readjustment has caused the image to go out of focus, loosen the screw in clamp L which supports the optical system. Carefully slide the optical system back and forth until the image is sharp. A magnifying glass is necessary to see the image clearly. It may be necessary to repeat this image size adjustment several times to get satisfactory results. Tighten screws and locking rings securely after each adjustment. The square image should have two sides parallel to the axis of the drum. When focus adjustment is made the optical system tends to turn, since it is being moved in and out of the clamp. The direction of the image must therefore be restored to its original position.

125. Motor Amplifier

a. Motor Amplifier Driver V4. Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1 differ from Facsimile Transceiver TT–1B/TXC–1 in the grid and cathode circuits of V4.

(1) *Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1.* In these two transceivers, the cathode bias for V4 is developed across resistors R66 and R67 and the phase magnet coil. The resistors are associated with V13. The value of R67 may be altered to improve the direct recording. If this is done, it may be necessary to increase or decrease the value of R34 to obtain the normal operating current

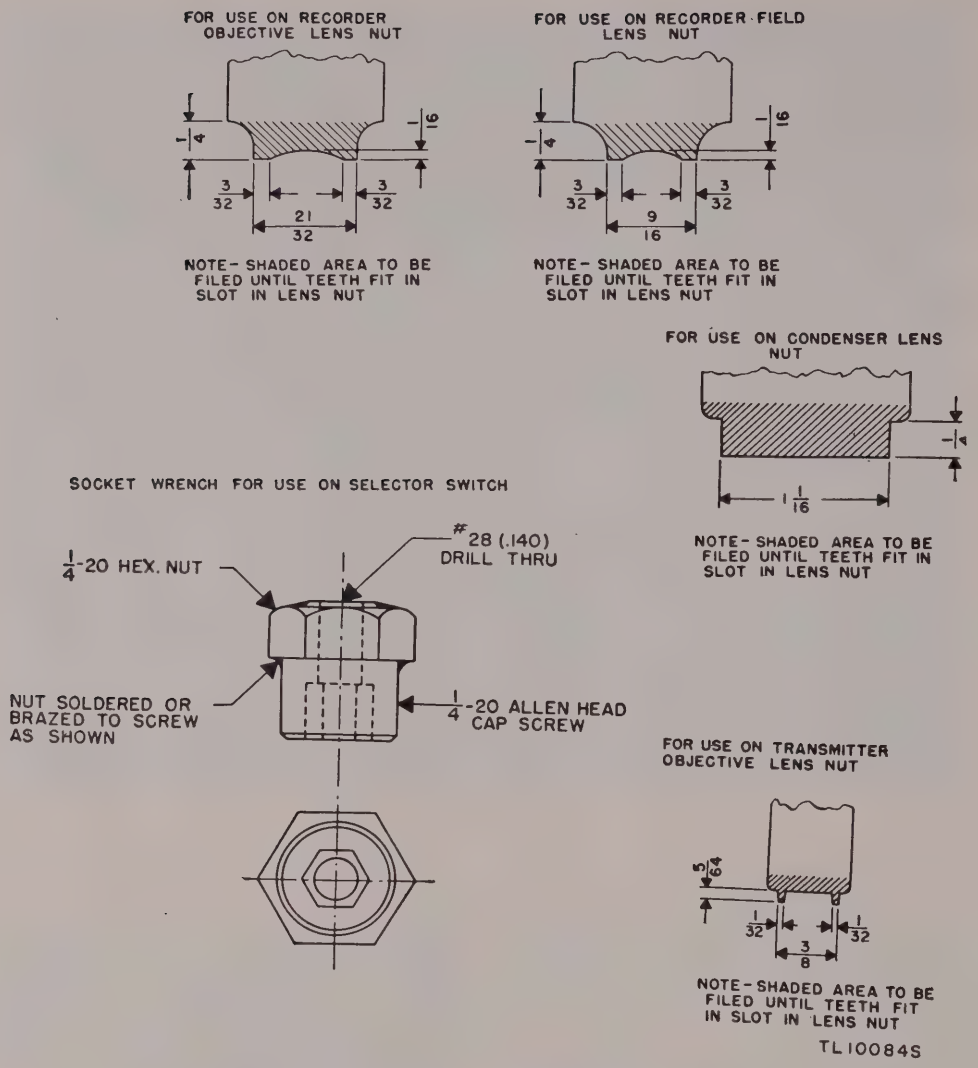


Figure 116. Special tools.

of 75 to 85 ma in the synchronous motor. Before changing any resistor, make sure that the tubes involved are not defective and that the resistance of other resistors in the circuit is correct. T1 is a class B driver transformer and may be replaced with any similar transformer which will fit in place. In making a replacement, try reversing the direction of current through the primary winding to obtain the maximum current in the motor circuit.

(2) *Facsimile Transceiver TT–1B/TXC–1.* This transceiver includes potentiometer R93, in the input circuit of V4, which is used to adjust the motor current as read on meter M2 to 90 ma. Another potentiometer, R97, is located in the cathode circuit of V13 so that bias may be adjusted for best direct recording results without changing the value of R67.

b. Output Stage, V5 and V6. Flash-overs may occur in the sockets of V5 and V6. Do not scrape away the carbonized portion of the sockets. Replace them with new ones. If the plate circuit becomes shorted to ground either through the socket, wiring, or tubes, the motor of Facsimile Transceiver TT–1/TXC–1 will burn out if the power is left on for more than a few seconds. Motors of Facsimile Transceivers TT–1A/TXC–1 and TT–1B/TXC–1 are protected by fuses.

Caution: Under normal operating conditions, the a-c voltage across choke T6 is approximately 800 volts. Take care when testing the circuit with the power on.

c. Filter. A high-voltage leak in choke T6 or in capacitor C28 or C29 may not interfere with the

operation of the synchronous motor but will cause disturbances in nearby radio-receiving equipment. In such cases, replace the choke or capacitor. A short to ground in this circuit will cause the synchronous motor or fuse to burn out.

d. MOTOR JACK. The input circuit includes the MOTOR JACK which may give contact trouble. The contact pressure is increased by bending the springs with long-nose pliers.

e. ALINEMENT. With proper voltage on grid 6 of tube V4, the direct current in the synchronous motor should be between 75 and 85 ma in Facsimile Sets AN/TXC–1 and –1A; approximately 90 ma in Facsimile Set AN/TXC–1B. If the input voltage is not correct, adjust it by changing R34 in Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1 to a higher or lower value, or adjusting R93 in Facsimile Transceiver TT–1B/TXC–1. If the voltage is not correct as indicated by the signal tracing chart, try changing the tubes. Make current measurements with the motor running.

126. Fork Oscillator Unit

The fork oscillator unit is designed to supply a 1,800-cycle signal of extreme accuracy. The regulated B+ voltage must not vary more than ±5 volts. The oscillator unit is calibrated at the factory; however, small adjustments in frequency may be made in the field by varying cathode resistor R25 of the unsealed unit or R304 of the sealed unit. Enough adjustment is available to compensate for minor changes due to aging of tubes, new tubes, and small differences in the RB+ voltage. Since the frequency of the fork oscillator unit is easily upset, it is not practical in most cases to make repairs in the field.

127. Phasing Circuit

a. GENERAL. The phasing circuit is inoperative except during the phasing operation. When the PHASE button is pressed, the input signal is picked up across cathode resistor R72 of V14. The signal is rectified by the recorder lamp in the plate circuit.

b. PULSE FILTER. The phasing pulse, which is represented by a dip in the steady 1,800-cycle signal or an increase in the steady 1,800-cycle signal, is smoothed out into a d-c pulse by the action of smoothing capacitor C45 which has a capacity of 50 microfarads (mf). In case of failure, and if an exact equivalent is not available, replacement may be made with a capacitor having a value between 10 and 50 mf. The voltage rating must be between 25 and 50 volts.

c. STAGE V15. The pulse amplifier stage V15 is similar to any voltage amplifier. The signal is applied to the cathode. The grid is at ground potential. This must be taken into account in tracing trouble since it is frequently a cause of confusion. Capacitor C47, connected from plate to ground, helps to eliminate the 1,800-cycle ripple in the amplifier pulse.

d. STAGE V16. As the strength of the pulse increases, a positive potential is applied to the grid of the thyratron Tube JAN–884, causing current to flow in the plate circuit. The positive voltage develops at the beginning of the phasing pulse when transmitting for negative reception. At this time, the signal level increases, scanning from black to white. A positive pulse is generated immediately after scanning the phasing pulse when transmitting for positive reception. At this point, the signal increases when scanning from white to black. Thus, the exact phasing point for negative recording is displaced from the exact phasing point for a positive recording by the length of the phasing pulse. The dog trip arm (fig. 71) must be so positioned that it will split the two pulses (positive and negative) evenly on each side of center. The plate of V16 is connected directly to RB+. When current flows through the plate, it must pass through the cathode circuit. The low impedance path to the cathode is through the phase magnet and capacitor C50. Before phasing, one side of C50 was at cathode potential and the other side at ground potential. After the capacitor is charged, the impedance of the cathode circuit is very high and the plate current ceases to flow. If C50 fails, current flows in the plate circuit at all times. The failure can be detected by watching for the glow in the tube. The normal bias voltage is controlled by voltage bias resistors R78 and R17. If the phase magnet fails to operate and no discharge glow is noted in V16, try another tube before tracing trouble in the phase magnet.

128. Photocell Circuit

a. RESISTANCE AND VOLTAGE MEASUREMENTS. The balancing anode of the photocell should have between 0.3 and 0.6 volts dc, depending upon the value of R49, which in most cases is 100,000 ohms. With the power turned off, measure all resistances. Check potentiometer R45 for good contact between the contact arm and resistor. A poor contact in equip-

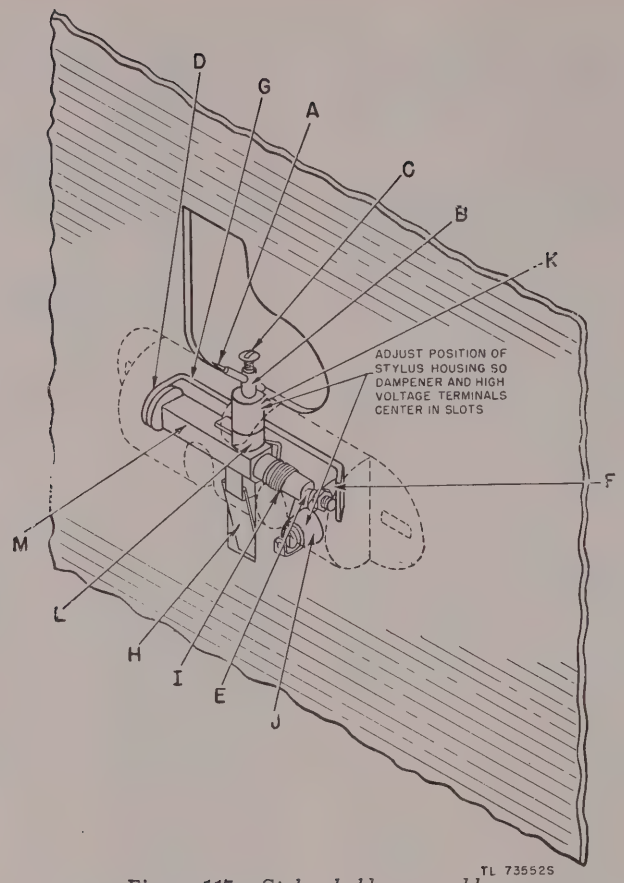


Figure 117. Stylus holder assembly.

Ref symbol	Signal Corps stock No.	Name of part and description	Function
	6C297	STYLUS ASSEMBLY	Supports stylus needle.
A	6C25–1/S20	STYLUS	Conducts high voltage to recording paper.
B		STYLUS HOLDER: TTE No. 90–03–01–3	Holder for stylus A.
C		SCREW	Clamps stylus in holder.
D		FIXED PIVOT: TTE No. 90–03–02–3	Left-hand pivot for stylus shaft.
E		ADJUSTABLE PIVOT: TTE No. 90–03–02–4	Right-hand pivot for stylus shaft.
F		BRACKET SPRING: TTE No. 09–03–02–2	Spring support for adjustable pivot.
G		BRACKET ASSEMBLY: TTE No. 90–03–02 including fixed pivot TTE No. 90–02–03–3.	Supports pivots.
H		STYLUS SHAFT LEVER: TTE No. 90–03–01–1	Rotates stylus shaft to remove needle from drum.
I		SPRING: TTE No. 90–03–01–7	Rotates stylus shaft to bring stylus in contact with drum; electrical connection between stylus holder and connecting terminal.
J		FEED-THROUGH INSULATOR	Insulates connection to terminal lug.
K		DAMPENER: TTE No. 96–03–02–6	Dampens vibration of needle holder when riding over paper clamp of AN/TXC–1 drum.
L		INSULATOR: TTE No. 90–05–04–3 .	
M		STYLUS SHAFT: TTE No. 90–03–01–1	Supports needle holder.

ment that has been standing idle for some time can be cleared by rapidly rotating the CONTRAST control back and forth 15 or 20 times. Also check for a good contact between resistor R42 and the sliding contact. This can be done by connecting the meter on one side of R42 to the contact and applying a light pressure to the contact ring. Capacitor C58 usually does not develop trouble, inasmuch as the voltage across it is very low.

b. Switching Circuit. Any unbalance in the bridge circuit develops a voltage across R50 which is applied to the grid of V10. In tracing circuit continuity, switch IIL must be taken into account.

c. Adjustment and Alinement. With the power turned on and the selector switch set at TRANSMIT, adjust the CONTRAST control and R42 for the best possible balance with the beam scanning the black portion of the phasing strip. If it is not possible to obtain a minimum signal of at least 20 db below the maximum signal (1/10 maximum value on the oscilloscope), it is necessary to improve the balance. This may require changing the photocell or checking the transmitting optical system. After proper contrast is obtained between black and white, as adjusted for negative transmission, set the CONTRAST control for positive transmission and obtain as good a balance on white as possible. Readjust the balance by adjusting the sliding contact on R42. If further improvement is necessary, adjust the value of R49 by changing the resistor to a higher or lower value.

129. Signal Amplifier

a. General. The alinement of the signal amplifier involves nothing more than step-by-step checks of signal voltage and waveform. If there is any deviation from the voltages in the signal tracing chart, or if there is any tendency for the signal to flatten as shown by the oscilloscope, locate the faulty stage and take corrective measures. All parts may be replaced with approximate equivalents, with the exception of transformer T2. In emergencies this transformer can be replaced with a driver transformer designed to operate into a Tube JAN–6N7 or a pair of Tubes JAN–6V6. Such a transformer should have a ratio of 1 to 1½ for full secondary. Connect one half of the low impedance secondary of the driver transformer to the No. 1 and 2 terminal positions. Leave the other half of the secondary open. If such an emergency replacement is made, low-voltage line terminal connections may be obtained by using the UC feed coil.

b. Stylus Transformer. Stylus transformer T3 should be replaced with an exact equivalent. In an emergency a driver transformer, such as one de-

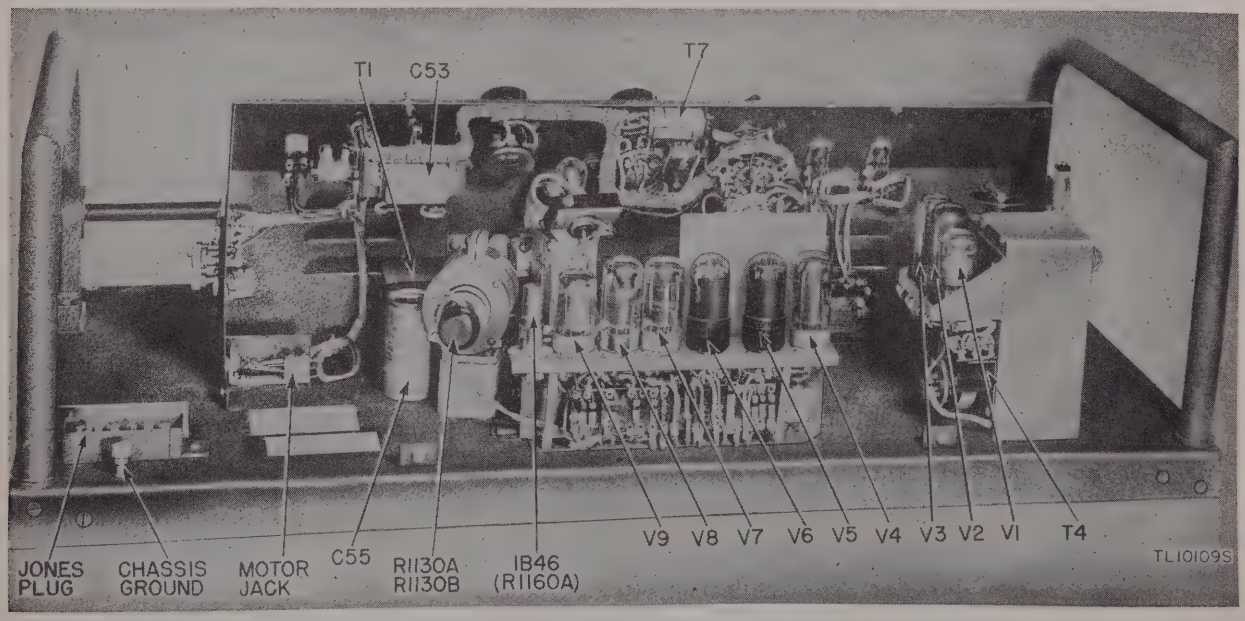


Figure 118. Facsimile Transceiver TT–1/TXC–1 with unsealed fork oscillator unit, top view, parts identification.

signed to operate into a pair of Tubes JAN-6V6 or a Tube JAN–6N7, will serve the purpose. The voltage break-down rating should be above 2,000 volts. The line side should be connected to terminals No. 1 and 2. A line-to-line transformer may be used, but the recording will not be at full density.

130. Selector Switch

a. Wafer Replacements. If a wafer is defective, it is easier to replace the wafer than to replace the entire switch and cable assembly. At the factory a special socket wrench, as shown in figure 116, is used for removing the nuts of the entire switch assembly. Similar socket wrenches can easily be made in the field. If materials are not available, long-nose pliers will serve the purpose.

b. Grounding Switch. A leaf switch is actuated by the selector switch when in the transmitting position. This switch grounds the tip of the RADIO XMTR. jack for the purpose of controlling the power relays in the radio transmitter. Proper operation is obtained by bending the springs.

c. Stylus Actuating System. After working the switch, make certain that the adjustments of the stylus actuating system are not upset. If the stroke is too short or too long, make correction by bending the actuating arm attached to the selector switch. The stylus holder assembly is shown in figure 117.

131. Db Meter Circuit

If the db meter readings are not correct, first try a new Tube JAN–7N7 in stage V13. If the results are the same, replace the original Tube JAN–7N7. Check the resistance of R61, R62, R68, and R69. If the value of these resistors is found to be correct —that is, within 10 percent—select the value for R70 to get the required reading. The value of R71 should be as specified.

132. B+ Voltage Regulator

a. Regulator lamp V25 is designated as type R1160A or Tube JAN–1B46 in Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1, and as

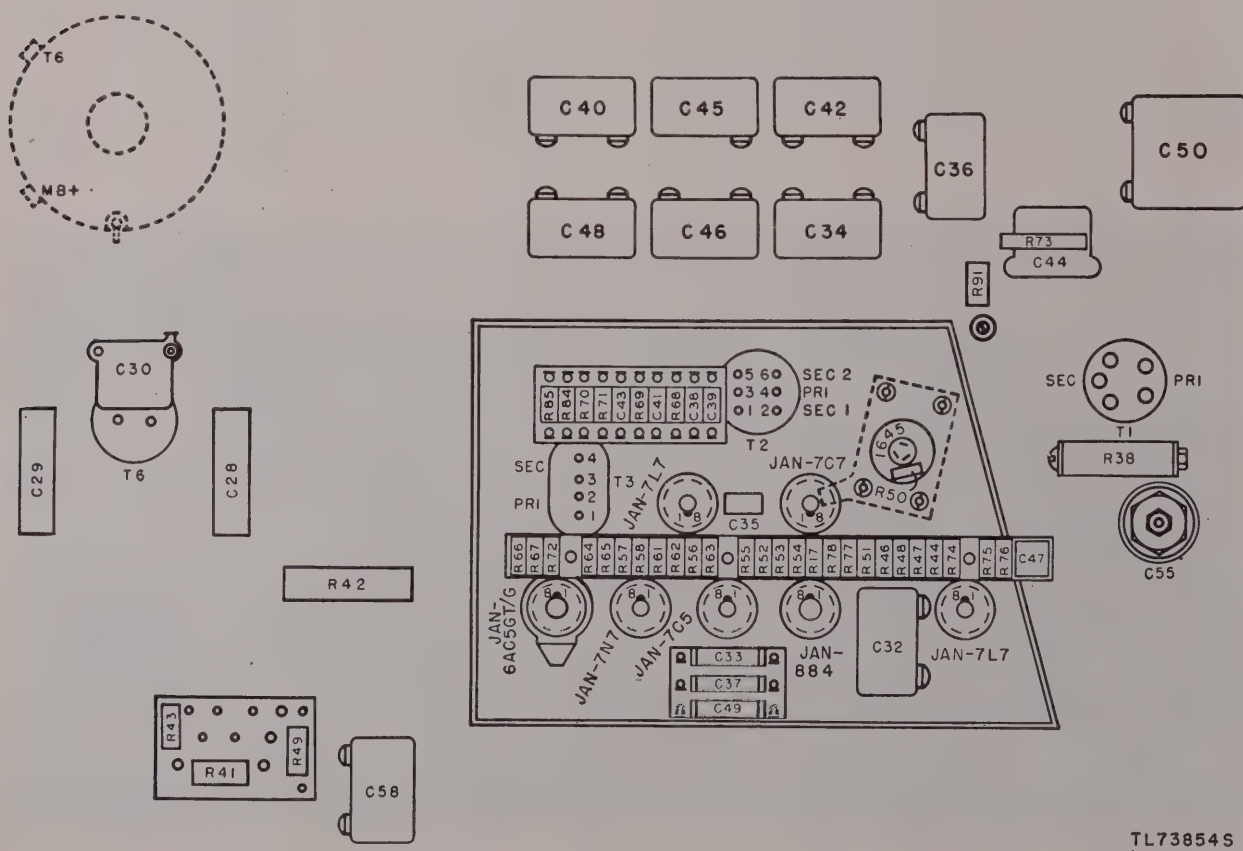


Figure 119. Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1, bottom view, parts identification.

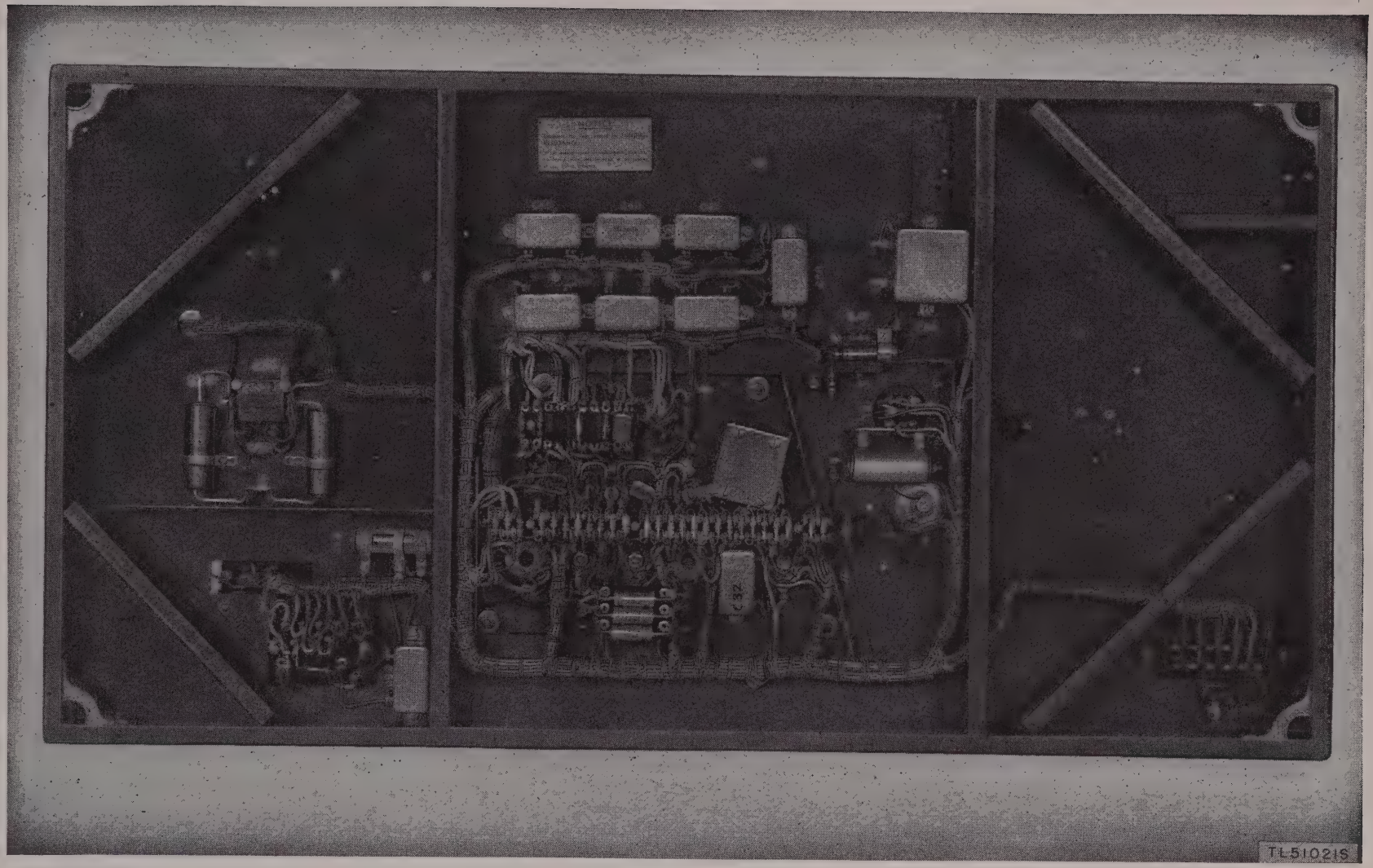


Figure 120. Fcsaimile Transceivers TT-1/TXC-1, bottom view, parts identification.

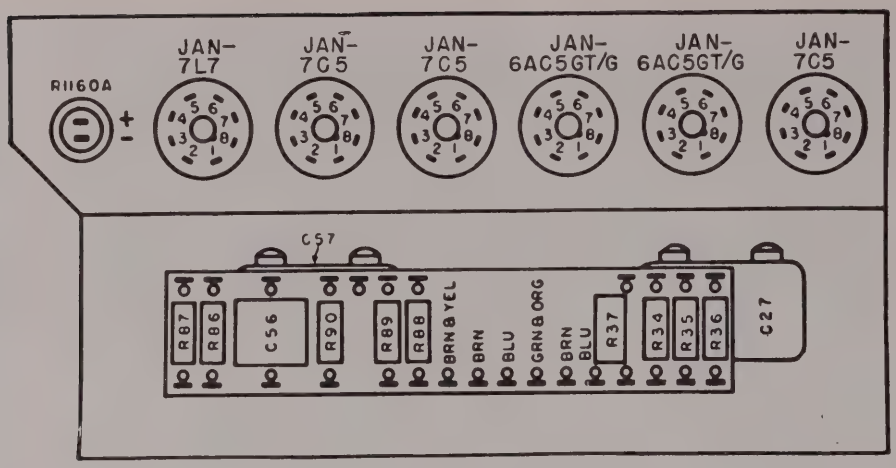


Figure 121. Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1, regulator panel, bottom view, parts identification.

type 5651 in Facsimile Transceiver TT–1B/TXC–1. The voltage range of Tube JAN–1B46 or the R1160A is 79 to 85 volts, that of the 5651 approximately 73 volts. Both must be measured with a high-impedance voltmeter. When making a replacement, measure the voltage across the lamp. If the voltage is not within the proper range, try another lamp.

Caution: Do not remove the regulator lamp V25 or tube V7 with the power turned on. If this is done, the RB+ voltage will rise to approximately 350 volts and possibly cause damage to some of the components.

b. V7 is a critical factor in the voltage control. There are times when it may be easier to select a tube V7 than to select a voltage regulator lamp to produce desired output voltage.

c. Oscillations develop in the regulator circuit at low line voltages, that is, at the point where the voltage regulator lamp drops out of control. Oscillations are sometimes aggravated by a feedback condition. Feedback can be remedied sometimes by separating the green grid wires of tube V7 from the plate and the grid wires of the other tubes in the regulator circuit. Replacement of V25 may be necessary in some cases.

133. Rectifier Power Supply

a. Power Transformer T11. The original transformer used in earlier equipment was the Kenyon type T246. This transformer may be used as a replacement, but the filament winding feeding the

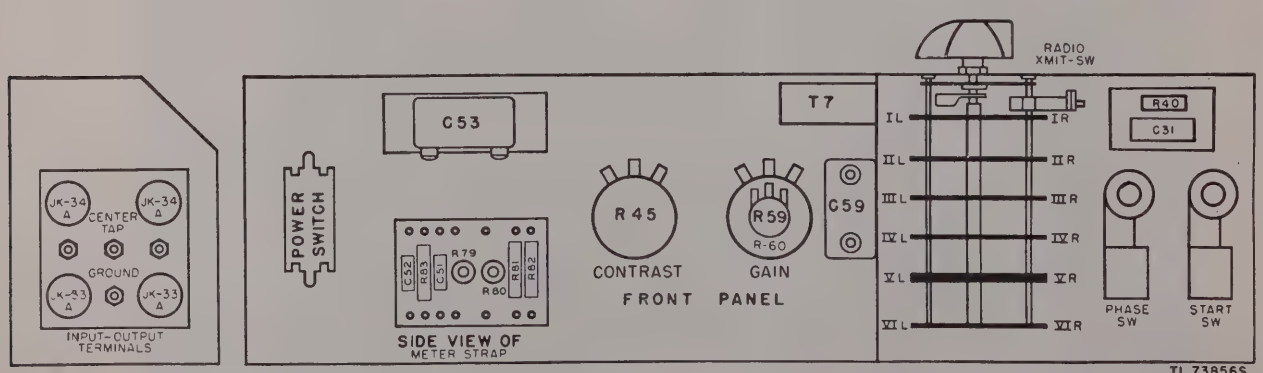


Figure 122. Facsimile Transceiver TT–1/TXC–1, rear of front panel, parts identification.

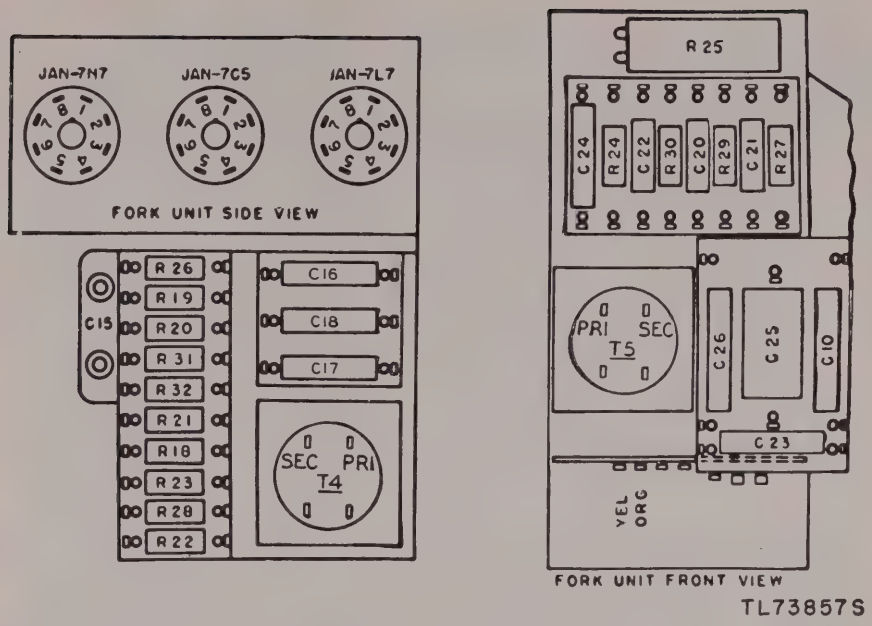


Figure 123. Unsealed fork oscillator unit, parts identification.

transceiver unit will be overloaded. The original T246 has two 6.3-volt, 3-ampere filament windings. The modified transformers have one 6.5-volt, 1.75-ampere filament winding, and one 6.5-volt, 6.25-ampere filament winding. The filament windings of a replacement transformer may not be phased the same as the original. If the phasing is not correct, the motor start voltage across terminals 5 and 8 of the Jones plug will be about 3 volts instead of the required 10. To phase the windings, remove the jumper wire from the 1.75-ampere winding. Connect it to the other end of the same winding. For example, if the jumper is on the terminal with the green wire, move it to the terminal with the brown and yellow wire.

b. Chokes T12 and T13. These chokes may be replaced with close equivalents that fit in the space available.

c. Capacitors C12, C13, and C14. These capacitors have a rating of 1,000 volts. In an emergency, capacitors having a rating of 600 volts may be used.

d. Power Cable. If the power cable or Jones plug is damaged, a replacement may be made with a complete cable and plug assembly, available at signal depots.

134. Exciter Lamp Supply

a. Condition. Set the selector switch in SET RANGE or TRANSMIT position. Turn the power on. Measure the exciter lamp voltage at secondary No. 2 on transformer T15. A regular a-c voltmeter will not give an accurate reading of this voltage, which is not a sign wave. First calibrate an oscilloscope to serve as a voltmeter, by applying 6.3 volts from one of the filament windings of the facsimile set to the vertical input terminals of the oscilloscope. Note the deflection. Then, without changing the setting of the horizontal gain control on the oscilloscope, disconnect it from the filament supply and connect it across the exciter lamp supply. The exciter lamp voltage should cause approximately the same peak deflection on the oscilloscope (90 percent is sufficient). With the exciter lamp voltage properly set in this manner, it may be measured on a conventional a-c voltmeter and the voltmeter reading recorded as a standard against which future checks can be made. If the exciter lamp is lit and the voltage across it is slightly low, check output tubes V19 and V20. If the tubes are in good condition, readjust potentiometer R15. If correct voltage cannot be obtained, check the regulator lamp with a vacuum-tube voltmeter. Set the meter on the 250-volt scale and connect across the regulator lamp (V23) terminals. The voltage should be between 75 and 90 volts dc. If the reading is out of range, replace the tube. If the regulator lamp is in good condition, check tube V21. If the output voltage is below 5 volts ac, check tubes V19 and V20. If tubes are in good condition, check the signal voltage on grids (6) of

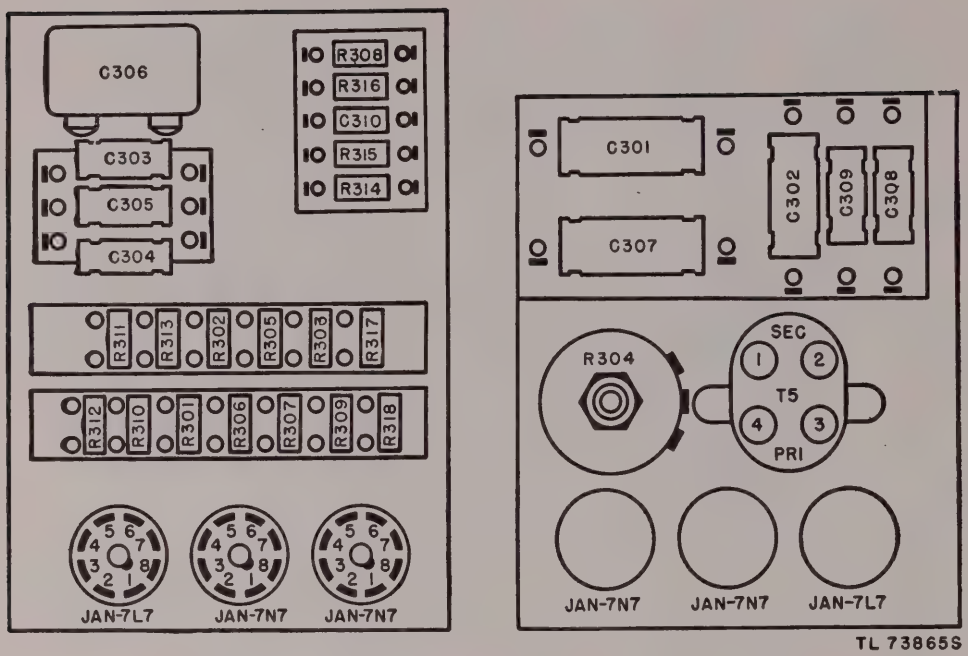


Figure 124. Sealed fork oscillator unit, parts identification.

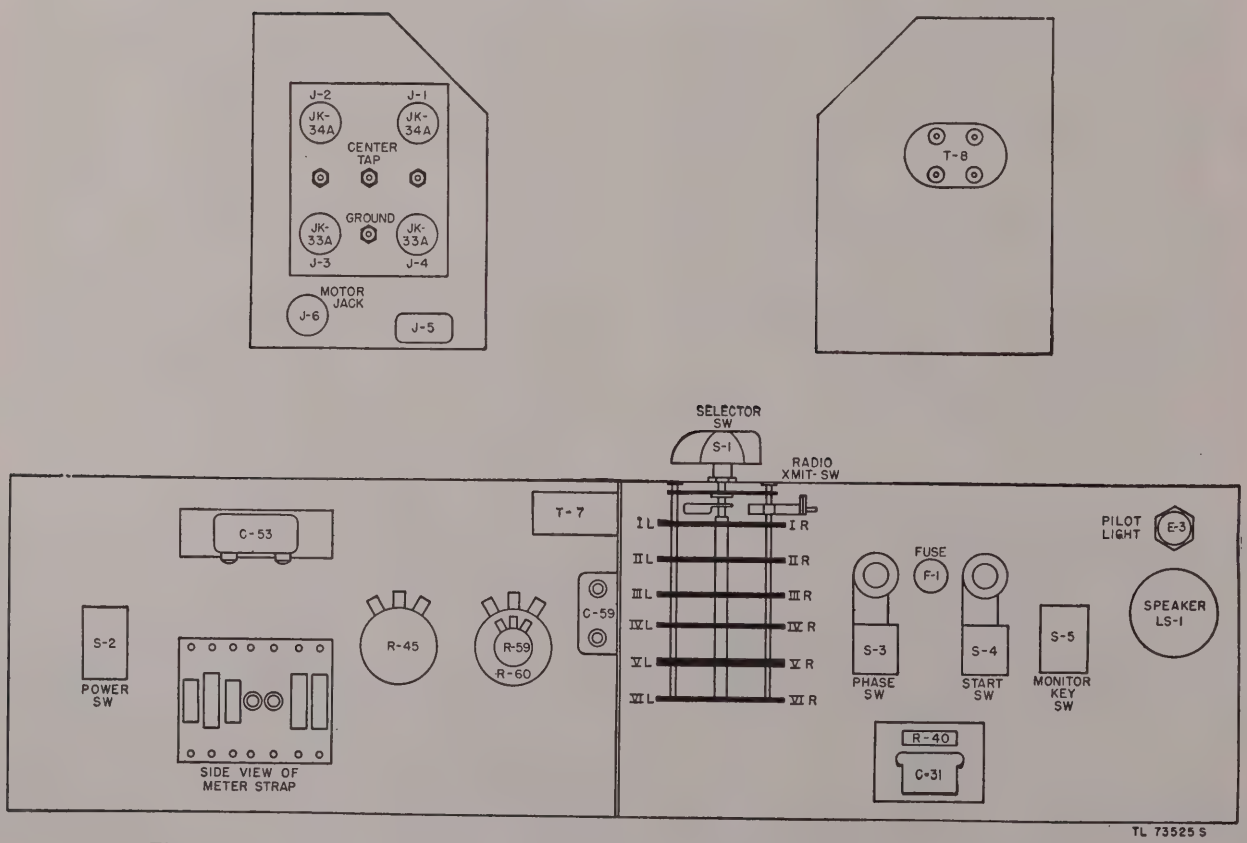


Figure 125. Facsimile Transceiver TT-1A/TXC-1, rear of front panel, parts identification.

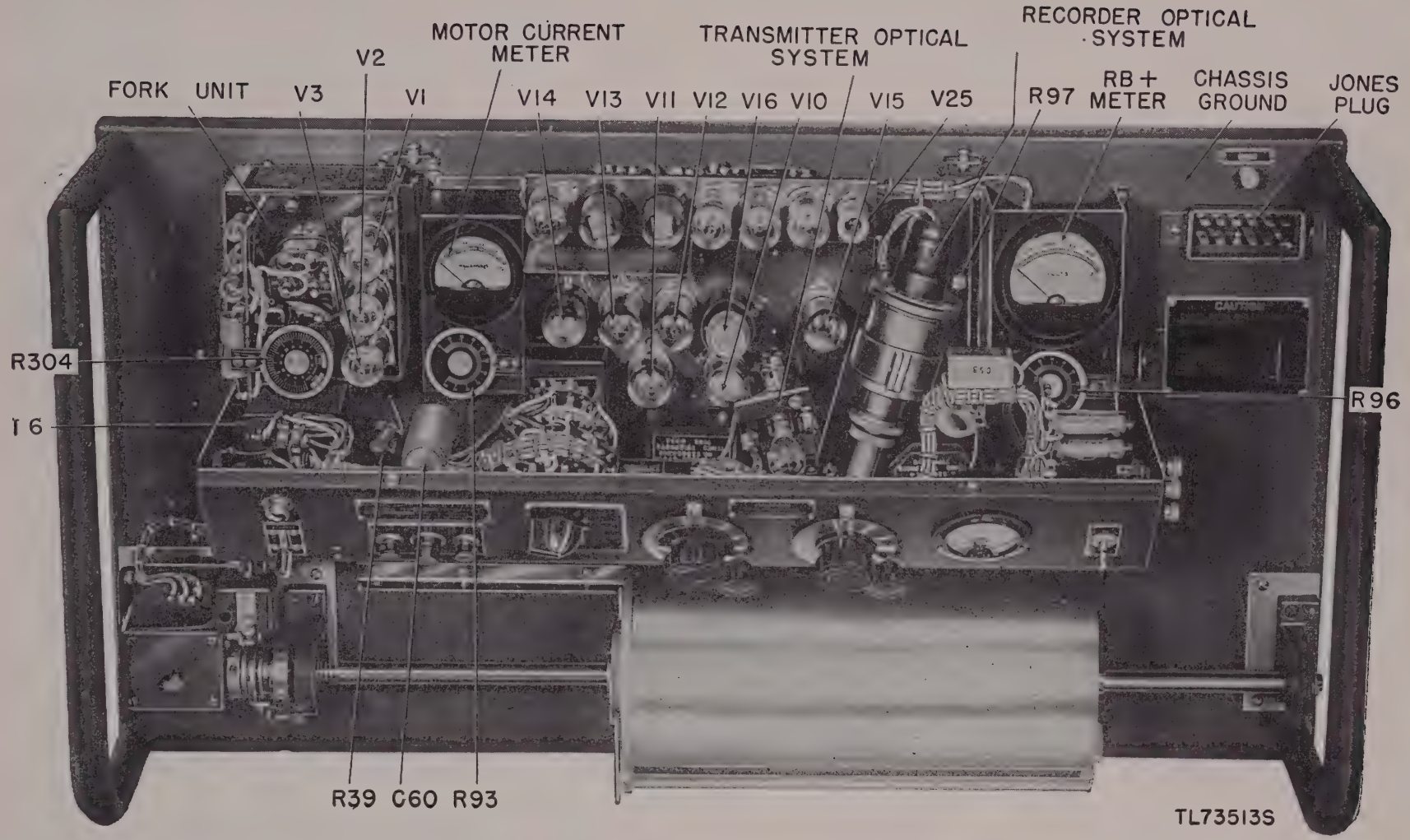


Figure 126. Facsimile Transceiver TT–1B/TXC–1, top view, parts identification.

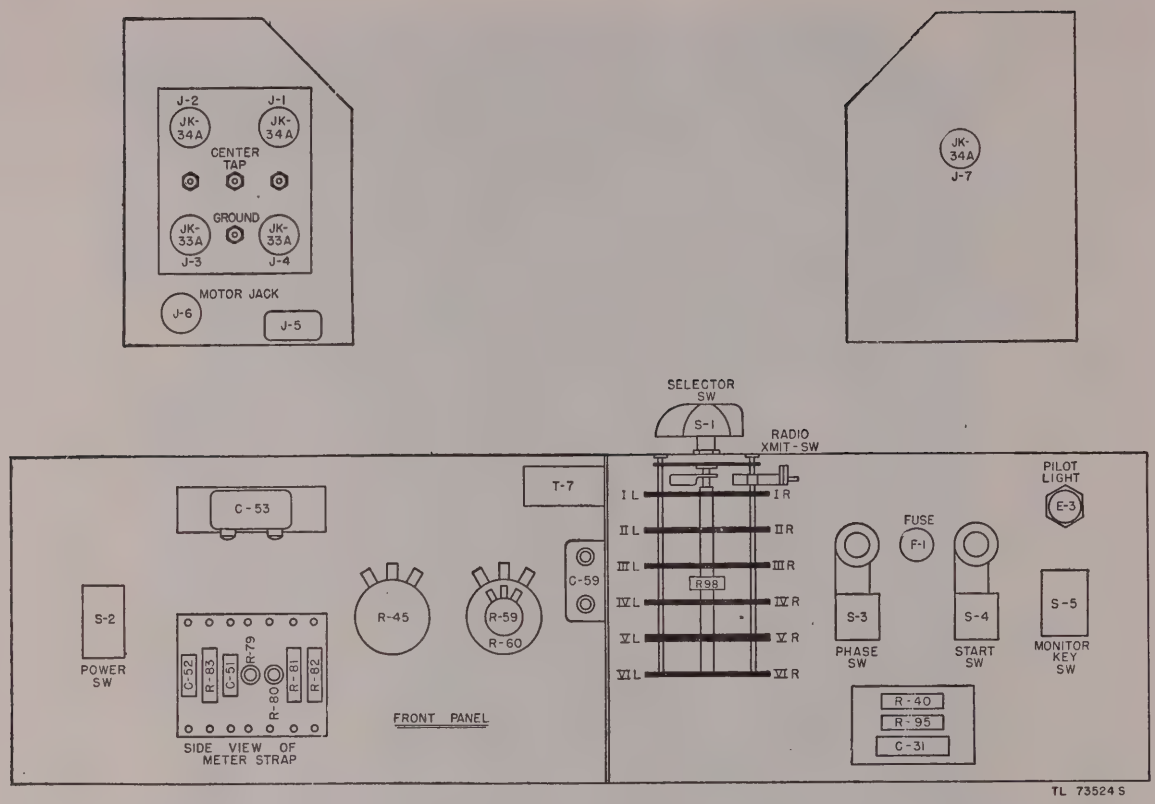


Figure 127. Facsimile Transceiver TT–1B/TXC–1, rear of front panel, parts identification.

V19 and V20. If grid voltage is normal or above normal, transformer T15 is defective. See the signal tracing chart (fig. 100). This transformer must be replaced with an exact equivalent. The exciter lamp may be checked by connecting it to a 6-volt battery.

Caution: If the exciter lamp is removed, a replacement must be made before the power is turned on. Operation without an exciter lamp may cause damage to transformer T15.

b. Replacement Parts. Potentiometer R15 may be replaced with any close equivalent which fits into the available space. Transformer T14 may be replaced with a conventional driver transformer having a ratio ranging from 1:1 to 1:½ between primary and one half of the secondary.

135. Rustproofing and Painting

When the finish on the case has been badly scarred or damaged, rust and corrosion can be prevented by touching up the bared surface as follows:

a. Use #00 or #000 sandpaper to clean the surface down to the bare metal. Obtain a bright, smooth finish.

Caution: The use of steel wool is not recommended. Minute particles of steel wool may cause internal shorting of circuits.

b. When a touch-up job is necessary, apply approved paint with a small brush. Remove rust by cleaning with solvent (SD). Paint used must be authorized and consistent with existing regulations.

136. Unsatisfactory Equipment Report

a. WD AGO Form 468 (War Department Unsatisfactory Equipment Report) for Equipment Used by Army Ground Forces and Technical Services. WD AGO Form 468 will be filled out and forwarded through channels to the Office of the Chief Signal Officer, Washington 25, D. C., when trouble occurs more often than is normal, as determined by qualified repair personnel.

b. AAF Form 54 (Unsatisfactory Report) for Equipment Used by Army Air Forces. AAF Form 54 will be filled out and forwarded to Commanding General, Air Matériel Command, Wright Field, Dayton, Ohio, in accordance with AAF Regulation 15–54.

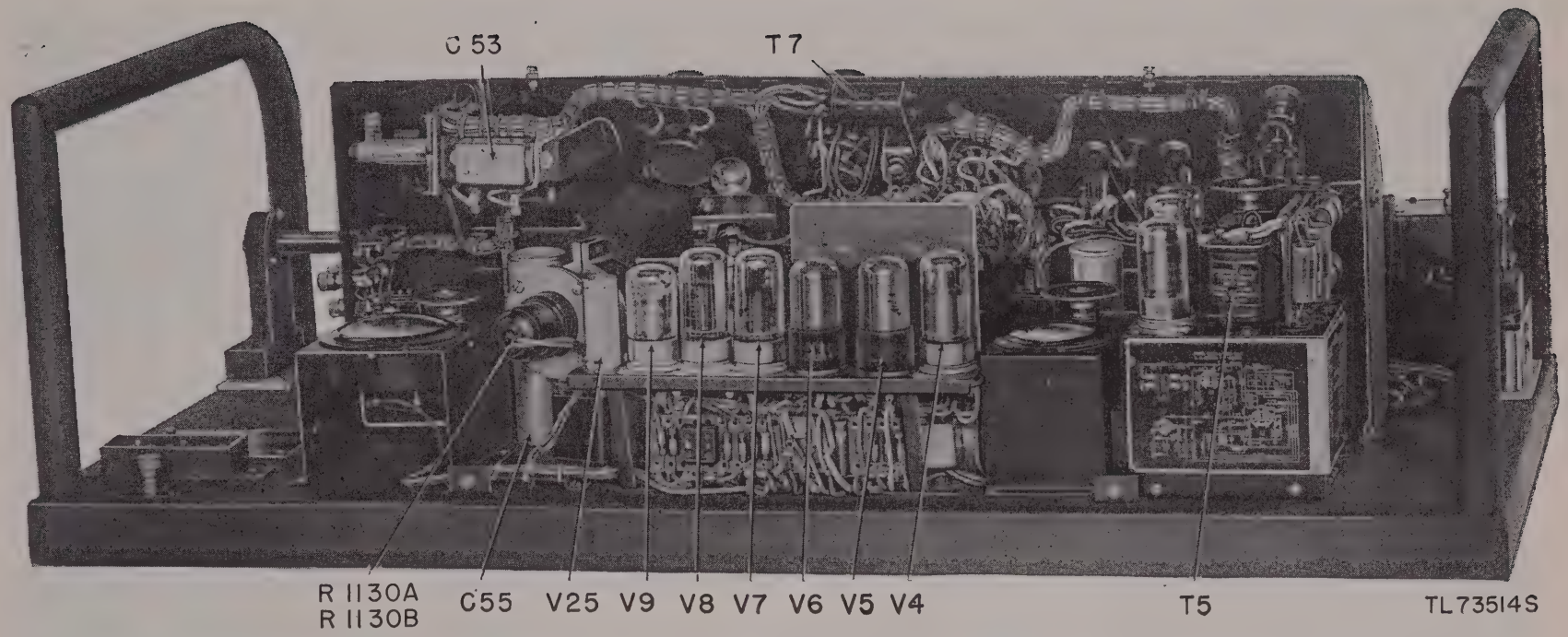


Figure 128. Facsimile Transceiver TT–1B/TXC–1, rear view, parts identification.

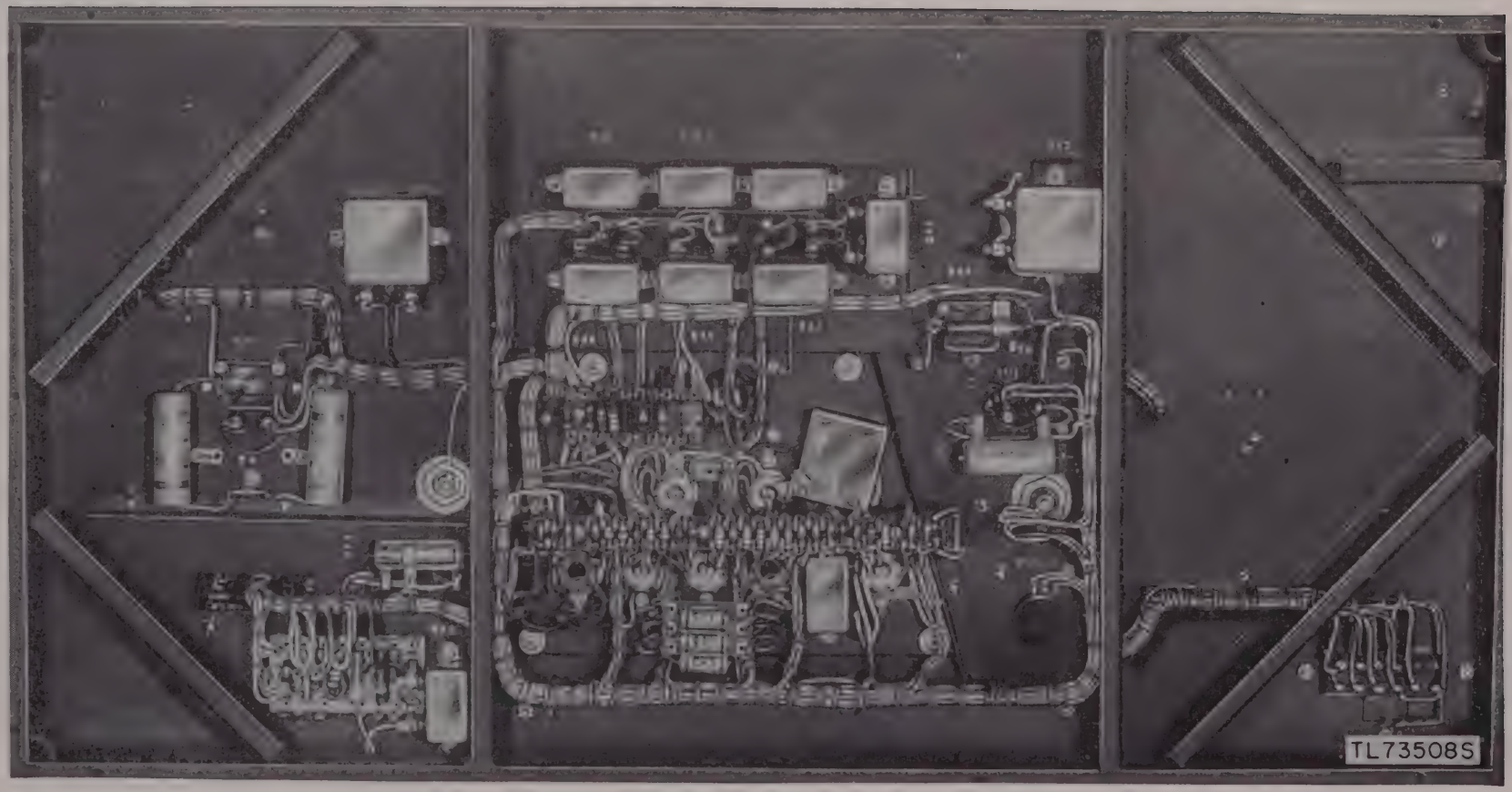


Figure 129. Facsimile Transceiver TT-1B/TXC-1, bottom view, parts identification.

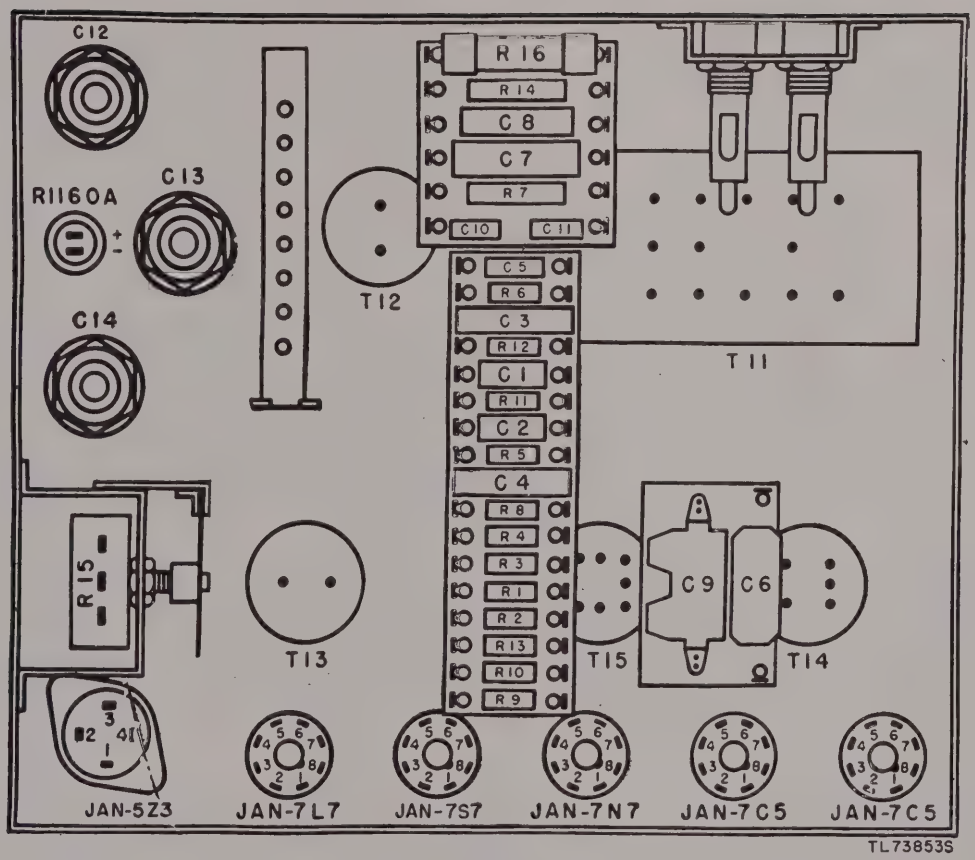


Figure 130. Rectifier Power Unit PP-86/TXC-1, bottom view, parts identification.

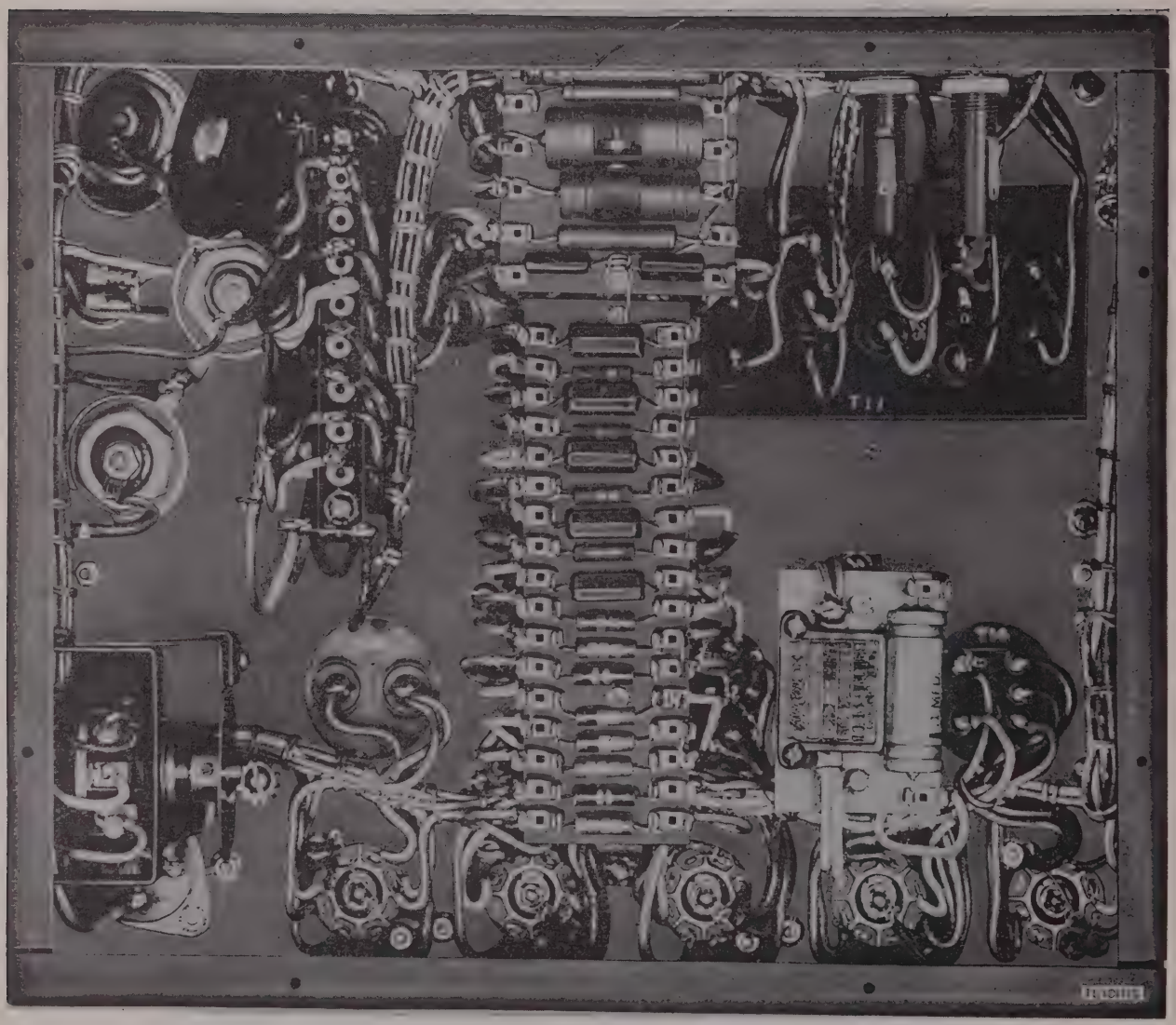


Figure 131. Rectifier Power Unit PP–86/TXC–1, bottom view, parts identification.

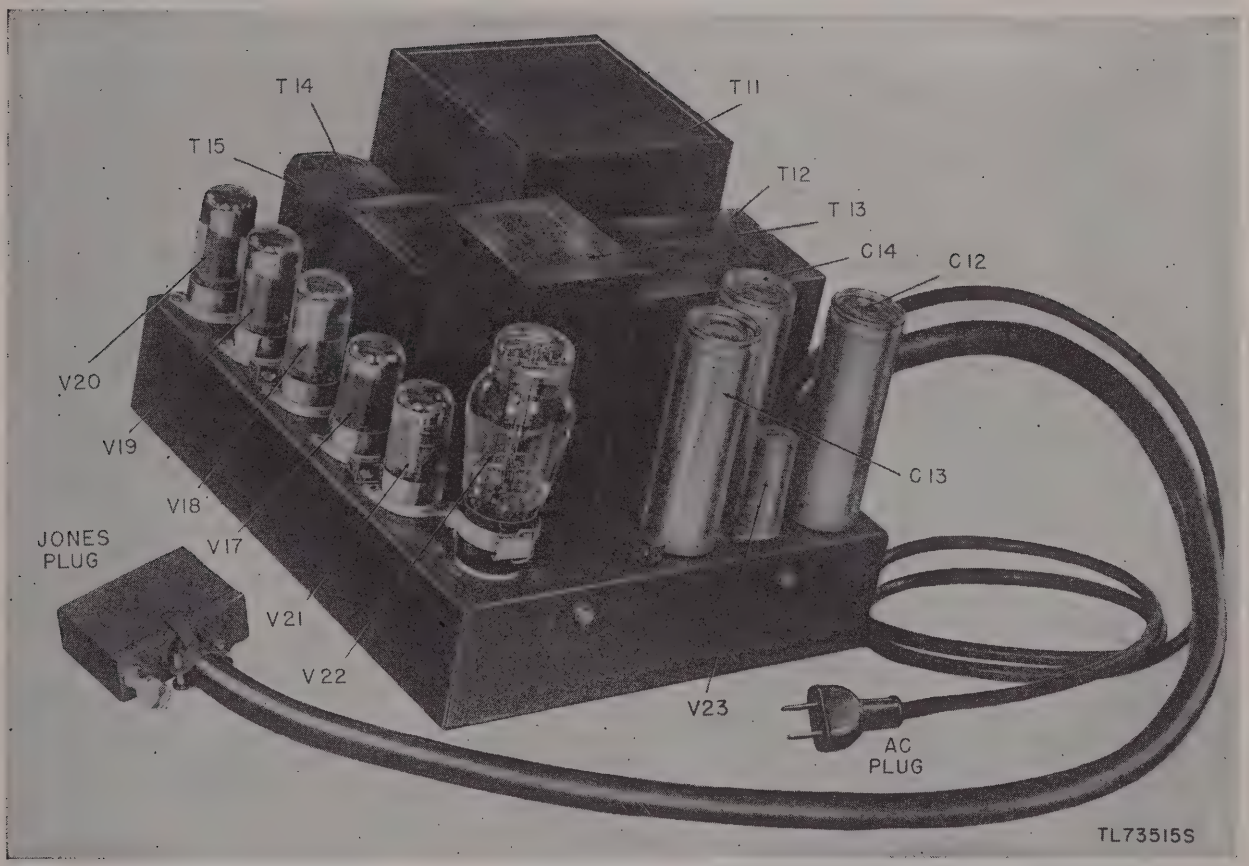


Figure 132. Rectifier Power Unit PP-86A/TXC-1, top view, parts identification.

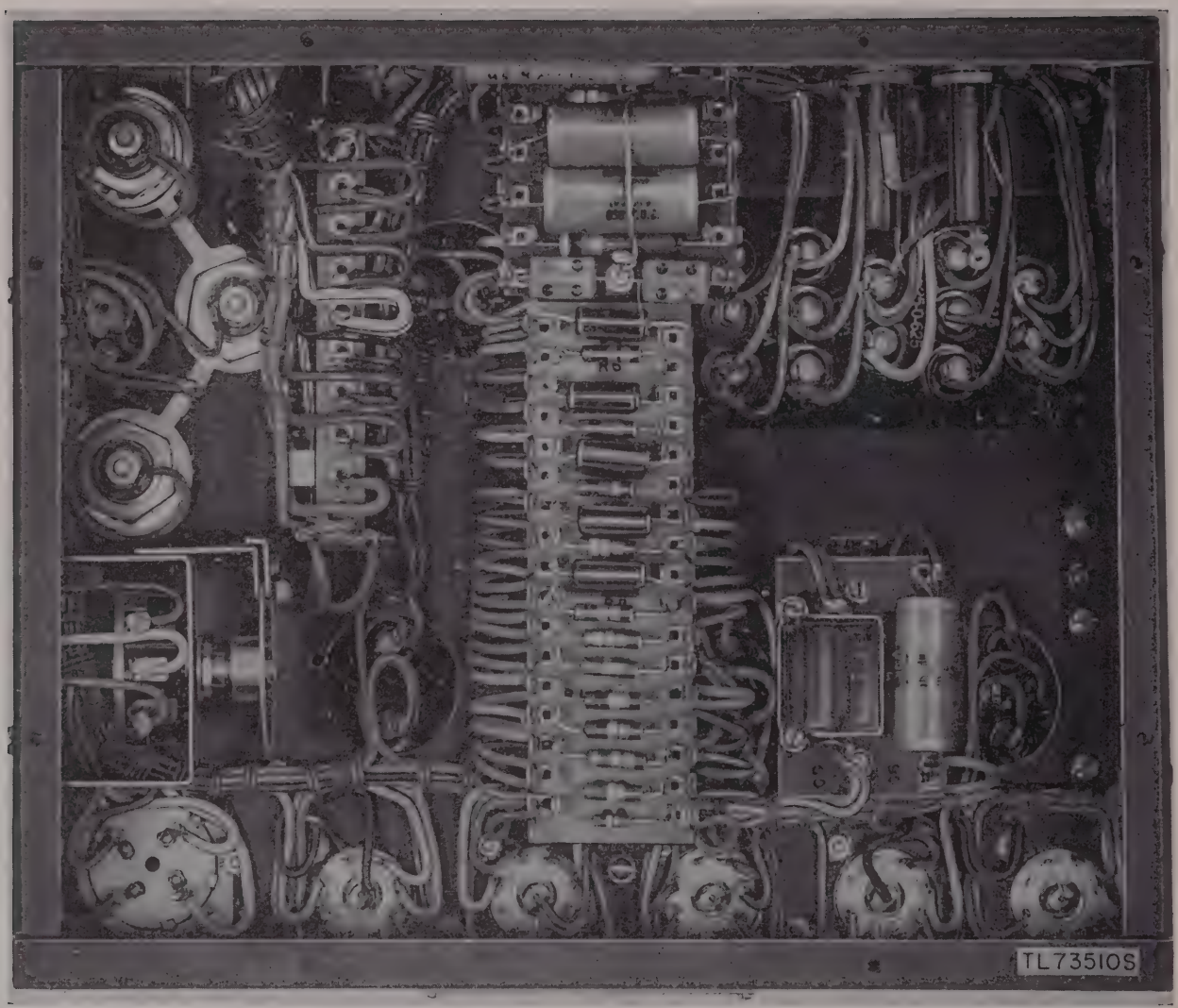


Figure 133. Rectifier Power Unit PP-86A/TXC-1, bottom view, parts identification.

Section XIV. FINAL TESTING

137. Individual Unit Performance

a. GENERAL. After the set has been repaired and is ready for operation, check all units to see that they meet the minimum performance requirements outlined in this section.

b. TRANSMITTING. Make the following tests with the transceiver operating as a transmitter:

Test	*Requirement*
(1) Fork frequency: TRANSMIT position. Db meter at 0.	1 cycle in 2 minutes maximum deviation from standard.
(2) Contrast: TRANSMIT position.	20-db minimum wedge for both positive and negative settings.
(3) Voltage regulation: TRANSMIT position. Balance on black and shine light on white. Db meter at 0 with light shining on white.	1-db maximum deviation on meter while varying power line voltage between 100 volts and 130 volts ac at the rate of about 1 cycle per second.
(4) LINE JACK output into 600-ohm load: TRANSMIT position. Db meter at +2 db.	Voltage measured across 600-ohm load resistor: maximum, 17 volts ac; minimum, 14 volts ac.
(5) LINE binding post output into 600-ohm load: TRANSMIT position. DB meter at +2 db.	Voltage measured across 600-ohm load resistor: maximum, 0.85 volt ac; minimum, 0.7 volt ac.
(6) LINE binding post balance: TRANSMIT position. Db meter at +2 db. 600-ohm load resistor across binding posts.	Voltages measured from each binding post to ground differ by no more than 1 db.
(7) RADIO XMTR. jack output into 100-ohm load: TRANSMIT position. Db meter at +2 db.	Voltage measured across 100-ohm load resistor: maximum, 0.44 volt ac; minimum, 0.36 volt ac.

c. RECEIVING. Make the following tests with the transceiver operating as a receiver:

Test	*Requirement*
(1) Fork beat: RECORD PHOTO position. GAIN at 100. No connections to input circuits.	Db meter gives no indication of signal.
(2) LINE JACK input 0.0035 volt ac, 1,800 cycles: RECORD PHOTO position. GAIN at 100.	Db meter reading: maximum, +4 db; minimum +1 db. Recorder lamp current measured on d-c milliammeter in series with lamp: maximum, 33 ma; minimum, 28 ma.
(3) LINE binding post input 0.0035 volt ac, 1,800 cycles: RECORD PHOTO position. GAIN at 100.	Db meter reading: maximim, +1 db; minimum, −1 db.
(4) LINE binding post input balance to C.T., 0.0035 volt ac, 1,800 cycles: RECORD PHOTO position. GAIN at 100.	Connect ground lead of signal generator to C.T. post and hot side alternately to each LINE binding post. Difference in two readings on db meter should not exceed 1 db.
(5) RADIO RCVR. jack input 0.14 volt ac, 1,800 cycles: RECORD PHOTO position. GAIN at 100.	Db meter reading: maximum, +5 db; minimum, +2 db.
(6) Motor action: RECORD PHOTO position. Drum engaging lever disengaged from lead screw.	Set power line voltage at 100 volts ac. Press START button until motor speed is slightly above synchronous speed, then release button. Motor should lock into synchronous speed an average of 4 times out of 5. After several trials, press PHASE button while motor is running. Primary clutch should stop without stopping motor. If primary clutch does not rotate when PHASE button is released and motor is running, rotate top of drum manually toward front panel about ½ inch and release. If clutch tension is too tight or motor current is too low, motor will stall. Repeat above tests with power line voltage at 115 to 130 volts ac.
(7) RECORD DIRECT: RECORD PHOTO position. Db meter at +2 db. LINE JACK input approximately 0.005 volt ac, 1,800 cycles. Fasten sheet of Teledeltos paper to drum. Start motor. Engage drum to lead screw. Turn selector switch to RECORD DIRECT.	Stylus should contact drum and continuously record at least a dark gray.

Section XV. EMERGENCY REPAIRS AND OPERATION

138. General

Emergency conditions of operation and repair may require deviation from normal procedures and standards. This section covers information required for operation under emergency conditions and for making emergency repairs which will keep equipment in operation until full repairs can be made.

139. Emergency Parts Replacements

a. Resistors. All ½-watt resistors may be replaced with ¼- or 1-watt resistors. When making a replacement, select a resistor having a value as near as possible to the value specified.

b. Capacitors. Except for capacitors C28 and C29 in the motor circuit and capacitors in the unsealed fork oscillator unit, the capacitance ratings are not critical. Replacements may be made with approximate equivalents.

c. Transformers and Chokes. Most replacement transformers are of the hermetically sealed type. These fit into the space provided for the original units.

(1) T1 and T14 are not critical and may be replaced by any one of several types and makes of driver transformers stocked by depots. The first choice is a transformer designed as a driver transformer for a pair of Tubes JAN–6V6 or a Tube JAN–6N7.

(2) T5 may be replaced by a plate-to-line transformer of the ouncer type.

(3) T12 and T13 may be replaced by similar chokes having a current rating of about 250 ma. In an emergency, T12 may be dispensed with if the line voltage does not exceed 115 volts.

140. Emergency Transmitting Allowances

a. The specified requirements for contrast call for a 20-db difference between black and white. In an emergency, a range as low as 4 db will still permit the receiving station to record intelligible photographic copy. For direct recording, a range of 10 db is considered minimum. The transmitted copy must have extreme range between black and white so that the transmitted signal will have the maximum possible range. If the recording is to be made on film, the receiving operator can assist by setting his equipment for reception of minimum signal 1 or 2 db above the normal setting. Film should be developed in a D–72 developer instead of a DK–60A. A high contrast printing paper such as Azo No. 5 should be used.

b. Under most operating conditions the facsimile transceiver will deliver a signal strong enough to feed a wire line or radio set, even though the signal level at the transceiver output is considerably less than the rated minimum. For example, if the line is connected to the LINE binding posts and it is found that the output level is only a half or a fourth of the specified level, the receiving operator will in most cases be able to make up for the difference by adjusting the GAIN control of the receiving transceiver. If he is unable to do so, the UC coupling coil may be plugged into the LINE JACK and the line connected to the 6-volt output of the feed coil.

Caution: If there is danger of causing crosstalk into another circuit, do not put more signal onto the line than necessary. The LINE binding post output, RADIO XMTR. jack output, or the 1-volt output of the UC coupling coil will not give excessive signal. Never put more than a 0-dbm signal into a line feeding a carrier system unless there is loss in the line between the facsimile transceiver and the carrier equipment. For example, if there is a 10-dbm loss in the line between the transceiver and the carrier equipment, a +10-dbm output at the transceiver will not overload the carrier equipment.

Note. In transmitting to a nearby receiving station over a line having very little loss, the transmitting operator can reduce the signal by readjusting the GAIN control to give a low meter reading (for example −10 db for maximum signal) *after* the CONTRAST adjustments have been made.

141. Emergency RECORD PHOTO Allowances

a. Normally the transceiver must be capable of producing a +2 db meter reading with a line signal input of 0.0035 volt. Under fixed conditions where it is known that the available signal is considerably more than 0.0035 volt, the equipment may be put into service if it does not meet this sensitivity requirement.

b. If the phasing system does not operate over the normal GAIN control range, the receiving operator can sometimes obtain satisfactory operation by readjusting the GAIN control during the phasing operation. For recording, the GAIN control is reset to its normal position. If it is essential

that equipment be used when the phasing system is inoperative, it is usually possible to obtain intelligible copy by recording on direct recording paper, cutting the paper at the proper point, and fitting the picture together. If the recording must be made on film, fasten the film onto the drum with transparent Scotch tape. Remove the tape before developing the film. With skill and practice the drum can be hand-phased. To do this, hold the drum by hand (with motor running) with the paper overlap or film clamp directly in front of the lens system. Watch or listen for the phasing pulse and release the drum at the instant the pulse is received.

c. If the recorder lamp becomes weak and a replacement lamp is not available, satisfactory results may be obtained by using a faster recording film or paper. A satisfactory film is superspeed ortho or portrait pan. Care will have to be taken to avoid fogging the film. A paper which will give the effect of 2 or 3 db more signal is Eastman kind 797. This paper will not give the contrast of the Royal Bromide F1, but the lack of contrast can be compensated for by having the transmitting operator transmit a signal of greater range between black and white. If the low density of a recording is the result of fogging of the recording lamp, the fog or sputter can sometimes be partially removed by heating the end of the tube in a flame. The heating must be done by bringing the temperature up gradually, and the cooling must also be gradual. The heat evaporates the deposited coating.

142. Emergency RECORD DIRECT Allowances

a. If there is no supply of stylus needles, ordinary steel phonograph needles may be used, but they must be replaced often. Steel spring wire having a diameter of approximately 0.010 inch may be used in emergency. If the stylus holder has become damaged beyond repair, a light steel spring may be mounted in a fixed position to serve as a stylus.

b. If Teledeltos or Timefax paper is not available, readable copy can be made on the black interleaving paper used in the packing of transmission film.

143. Radio Interference (TRANSMIT)

Under some conditions a radio transmitter will feed back into a facsimile transceiver when the transceiver is set for TRANSMIT. This feedback condition may occur when the facsimile set is close to the radio transmitter. The cause of the feedback condition may be circulating currents through the ground system or in the signal line connections. The feedback is indicated by a short contrast range when the radio set is turned on. Do not attempt to operate when there is an indication of radio feedback. It must be eliminated. There is no fixed rule for doing this. In most cases, proper isolation may be secured after trying different coupling circuits and grounding systems between the facsimile transceiver and the radio modulator input circuit.

144. Radio Interference (RECORD DIRECT)

The sparking at the recorder stylus sometimes causes radio interference. Interference in radio reception may be reduced by the use of proper grounding systems. It is sometimes necessary to use a common ground for the radio receiver and the facsimile transceiver.

145. Field Wire Operational Troubles

The signal attenuation over field wire such as Wire W–110B is very high as compared with commercial telephone circuits. If there is only one circuit involved, make the line connection to the LINE JACK through the test cord provided with alligator clips. This permits the satisfactory transmission of signals over approximately 25 miles of field line. If there are adjacent circuits, it may not be possible to operate directly from the line jack because the facsimile signal will produce crosstalk. The next best method of feeding the line is to use the UC feed coil and connect the line to the 6-volt receptacle.

Caution: Never connect a commercial telephone circuit to the LINE JACK.

146. Loaded Cable Circuit Operational Troubles

Telephone circuits carried in cables usually have loading coils inserted in the cable at regular intervals to improve the voice transmission characteristic. The insertion of the loading coils produces a distortion effect which is quite noticeable in some of the older type commercial circuits. If the received copy shows an out-of-focus or stutter effect, this degradation in many cases can be traced to delay distortion on the telephone transmission line. Under normal operating conditions, nothing can be done to correct this trouble. The only remedy is to obtain a better circuit or to transmit copy having no fine lines.

147. Timefax Recording

a. When multiple copies of direct recording are required, Timefax recording paper is used. This paper contains a dye in the undercoating which transfers to the gelatin pad in the hectograph method of duplicating. The Timefax paper is used in the same manner as the Teledeltos. It is important, however, not to attempt to make dense recordings. A strong current at the stylus will burn away the dye in the undercoating. To judge whether the recording signal has been too strong, hold the received copy up to the light with the back side of the copy to the observer. If the copy appears to be perforated, the recording density is excessive.

b. In making multiple copies from the Timefax recording, the gelatin pad must be carefully prepared. If the moisture content is too low, the dye will not transfer. If the pad is too moist, the gelatin may peel off when the Timefax copy is stripped from the pad. There is no way of conveniently measuring the condition of the pad. It must be determined by experience. By touching the pad with the fingertips, an operator soon becomes acquainted with the requirements. The Timefax copy must be left in contact with the pad 1 or 2 minutes before stripping it off. If it is not left on long enough, there will be insufficient transfer of the dye. If it is left on too long, there may be a tendency of the background (unrecorded portions) to bleed through. Normally, 10 to 15 satisfactory copies can be made from one impression of the original copy. If additional copies are required, one or more additional impressions can be made from the recorded Timefax copy.

148. Recording Paper Substitutes

If Royal Bromide F1 paper is not available, the recordings should be made on film and contact prints made from the film. If the time required for this process is excessive, bromide enlarging papers may be used. Fairly good results may be obtained from photostat paper. Experiments will have to be made to determine the correct db meter reading for the proper exposure. Most papers require a higher signal level than Royal Bromide F1. If it is necessary to go up to +4 or +5 db for recording, do not attempt to handle half-tone copy, since the shadows will be badly flattened because of the overloading of the amplifier.

149. Use of Old Rectifier Power Unit with New Transceiver

Rectifier Power Unit PP–86/TXC–1, which is a component of Facsimile Sets AN/TXC–1 and –1A, will not operate Facsimile Transceiver TT–1B/TXC–1, for no provision is made to connect 115 volts, 60-cycle ac from the power unit to the transceiver to start the new motor on the new transceiver. In an emergency, however, the old power unit may be changed so that it will operate the new transceiver. Proceed as follows:

a. Remove four black wires and shield from the No. 11 lug on the Jones plug cable strip (fig. 140). Replace the No. 11 lug with a double tie lug. Connect the three black wires from the power unit cable and the shield from the Jones plug cable to one side of the double tie lug. To the other side connect the remaining black wire (from the Jones plug cable) and a blue jumper wire to C10 or C11, whichever one traces out to the *fuse* side of the primary of transformer T11.

b. Remove the cover from the Jones plug and unsolder the black wire from the No. 11 contact. (DO NOT disconnect the shield.) Connect this wire to contact No. 4.

c. Remove the end of the jumper wire on C14, coming from C13, and connect it to C12.

APPENDIX I

REFERENCES

Note. For availability of items listed, check FM 21–6 and WD Supply Catalog SIG 1 & 2. Also see latest issue of FM 21–6 for applicable technical bulletins, supply bulletins, modification work orders, and changes.

1. Army Regulations

AR 380–5	Safeguarding Military Information.

2. Supply Publications

SIG 1 & 2	Introduction and Index
SIG 10	Fixed Plant Maintenance Lists.
SB 11–76	Signal Corps Kit and Materials for Moisture- and Fungi-Resistant Treatment.
SB 11–17	Electron Tube Supply and Reference Data.

3. Technical Manuals on Auxiliary Equipment and Test Equipment

TM 11–303	Test Sets I–56–C, –D, –H, and –J.
TM 11–307	Signal Generators I–72–G, –H, –J, and –K.
TM 11–321	Test Set I–56–E.
TM 11–472	Repair and Calibration of Electrical Measuring Instruments.
TM 11–2205	Exciter Unit 0–5/FR.
TM 11–2252	Converter CV–2/TX.
TM 11–2524	Oscillator I–151–A.
TM 11–2526	Oscilloscope BC–1060–A.
TM 11–2613	Voltohmmeter I–166.
TM 11–2626	Test Unit I–176.
TM 11–2627	Tube Tester I–177.
TM 11–2653	Vacuum Tube Voltmeter Precision Model EV–10–MCP.
TM 11–2673	Multimeter TS–389/U.
TM 11–4021	Converter CV–2/TX, Repair Instructions.

4. Painting, Preserving, and Lubrication

TB SIG 13	Moistureproofing and Fungiproofing Signal Corps Equipment.
TB SIG 69	Lubrication of Ground Signal Equipment.

5. Camouflage

FM 5–20	Camouflage, Basic Principles.

6. Packaging and Packing Instructions

a. Joint Army-Navy Packaging Specifications.

JAN–D–169	Desiccants, Activated.
JAN–P–100	General Specifications.
JAN–P–106	Boxes, Wood, Nailed.
JAN–P–116	Preservation, Methods of.
JAN–P–125	Barrier Material, Waterproof.
JAN–P–131	Barrier Material, Moisture-Vaporproof, Flexible.

b. U.S. Army Specification.

100–2E	Marking Shipments by Contractors (and Signal Corps Supplement thereto).

c. Signal Corps Instructions.

720–7	Standard Pack.
726–15	Interior Marking.

7. Decontamination

TM 3–220	Decontamination.

8. Demolition

FM 5–25	Explosives and Demolitions.

9. Other Publications

FM 24–18	Radio Communication.
FM 72–20	Jungle Warfare.
MWO SIG 11–375B–1	Modification of Facsimile Set AN/TXC–1A to Provide an External Loudspeaker.
TB SIG 25	Preventive Maintenance of Power Cords.
TB SIG 66	Winter Maintenance of Signal Equipment.
TB SIG 72	Tropical Maintenance of Ground Signal Equipment.
TB SIG 75	Desert Maintenance of Ground Signal Equipment.
TB SIG 123	Preventive Maintenance Practices for Ground Signal Equipment.
TB SIG 178	Preventive Maintenance Guide for Radio Communication Equipment.
TM 1–455	Electrical Fundamentals.
TM 11–453	Shop Work.
TM 11–466	Radar Electronic Fundamentals.
TM 11–483	Suppression of Radio Noises.
TM 11–486	Electrical Communication Systems Engineering.
TM 38–650	Basic Maintenance Manual.

10. Forms

WD AGO Form 468	Unsatisfactory Equipment Report.
AAF Form 54	Unsatisfactory Report.

APPENDIX II

IDENTIFICATION TABLE OF REPLACEABLE PARTS

1. Department of the Army Pamphlet References

The following information was compiled on 14 October 1947. The appropriate pamphlets of the Department of the Army Supply Catalog for Facsimile Sets AN/TXC–1, AN/TXC–1A and AN/TXC–1B are—

Organizational Maintenance Allowances, and Field and Base Maintenance Stockage Guide (Including Fixed Plant Maintenance Lists).

SIG 7–8–10 TT–1/TXC–1, TT–1A/TXC–1, TT–1B/TXC–1 (when published).

SIG 7–8–10 PP–86/TXC–1 and PP–86A/TXC–1 (when published).

For an index of available catalog pamphlets, see the latest issue of SIG 1 & 2.

a. FACSIMILE TRANSCEIVER TT–1/TXC–1, TT–1A/TXC–1, AND TT–1B/TXC–1.

Ref symbol	Models			Name of part and description	Function of part	Signal Corps stock No.
	TT–1/TXC–1	TT–1A/TXC–1	TT–1B/TXC–1			
				FACSIMILE TRANSCEIVER TT–1/TXC–1: fixed station; transmitting and receiving; wire and radio transmission; transmits and receives positive or negative photographs, maps, line drawings, messages, etc., up to 12" x 18¾"; receives photographically on paper or film or by stylus on "Teledeltos" or "Timefax" paper; 100-130 v, 50-70 cyc, 300 w, single phase.	Transmits and receives facsimile signals.	6C310–1
				FACSIMILE TRANSCEIVER TT–1A/TXC–1: fixed station; transmitting and receiving; wire and radio transmission; transmits and receives positive or negative photographs, maps, line drawings, messages, etc., up to 12" x 18¾"; receives photographically on paper or film or by stylus on "Teledeltos" or "Timefax" paper; 100-130 v, 50-70 cyc, 300 w, single phase; includes talk-back circuit.	Transmits and receives facsimile signals.	6C310-1
				FACSIMILE TRANSCEIVER TT–1B/TXC–1: fixed station; transmitting and receiving; wire and radio transmission; transmits and receives positive or negative photographs, maps, line drawings, messages, etc., up to 12" x 18¾"; receives photographically on paper or film or by stylus on "Teledeltos" or "Timefax" paper; 100-130 v, 50-70 cyc, 300 w, single phase; includes talk-back circuit.	Transmits and receives facsimile signals.	6C310-1
				TECHNICAL MANUAL: TM 11–2285	Describes facsimile equipment.	(Order through AGO channels.)

Ref symbol	Models TT-1/TXC-1	Models TT-1A/TXC-1	Models TT-1B/TXC-1	Name of part and description	Function of part	Signal Corps stock No.
				Transceiver Parts		
O3	*	*		BALL, bearing: chromium steel; spherical; ⅛" diam; Times Facsimile part/dwg No. 90–04–00–32.	O3—Motor thrust bearing.	3H230.130
A1	*	*	*	BARREL; lens: brass; 27/16" lg x ⅝" diam; clamp mtg; includes lens barrel, lens holder, lens holder nut, aperture plate, spacers, and objective lens; Times Facsimile part/dwg No. 90–01–03	A1—Part of transmitter optical system.	6C310–1/B3
A2	*	*	*	BARREL, lens: brass; 3¾" lg x 1¼" diam; clamp mtg; includes lens tube, adjusting collar, lens holder; Times Facsimile part/dwg No. 90–02–03–1.	A2—Part of recorder optical system.	6C310–1/B4
			*	BEARING, ball: single row radial; double shield; light duty; bore 0.1875", 0.5000" OD, 0.1969" wd; 7 balls; packed w/high temp grease; standard fit; Barden No. R3SS.	Bottom motor bearing	3H320–90
		*		BEARING, ball: single row radial; double shield; light duty; bore 0.1875" diam; 0.5000" OD, 0.156" thk; 7 balls; packed w/high temp grease; standard fit; Norma-Hoff No. 4666–R.	Bottom motor bearing	3H230–7.1
			*	BEARING, ball: single row radial; double shield; light duty; bore 0.3149" diam; 0.8661" OD, 0.2756" thk; 7 balls; packed w/high temp grease; standard fit; Barden No. R-38SS.	Top motor bearing	3H320–89
	*	*	*	BEARING, ball: single row radial; single metal shield one side, felt seal other side; light duty; bore 0.2756" diam, 0.9449" OD, 0.406"thk; 7 balls; packed w/standard grease; standard fit; Norma-Hoff No. 7007–P.	Drive shaft bearing	3H320–91
	*	*	*	BEARING, ball: single row radial; single metal shield one side, felt seal other side; light duty; 10-mm bore, 1.1811" OD, 0.500" wd; 7 balls; packed w/standard grease; standard fit; Norma-Hoff No. 7010–P.	Lead screw bearing	3H304–35
O2	*	*	*	BLOCK, bearing: shaft support, RH; consists of bearing block, single row ball bearing, stop plate, and pressure plate; cast aluminum block, steel bearing; 3" lg x 1⅛" wd x 4" h over-all; Times Facsimile part/dwg No. 96–07–00.	O2—Supports right-hand end of lead screw.	6C310–1/B1
O1	*	*	*	BLOCK, bearing: shaft support, LH; consists of bearing block, single row ball bearing, and cam plate; cast aluminum block, steel bearing; 3" lg x 1⅛" wd x 4" h over-all; Times Facsimile part/dwg No. 96–07–01.	O1—Supports left-hand end of lead screw.	6C310–1/B2
E13	*	*	*	BOARD, terminal: input-output connector term board; 4 holes ⅜" diam on 1¼" x 1½" centers to mount jacks, 4 holes No. 18 drill w/4 holes No. 50 drill 9/64" from ctr for mtg binding posts; phenolic; 2 15/16" lg x 2½" wd x ⅛" thk; Times Facsimile part/dwg No. 96–00–13.	E13—Input and output connector.	3G1838-45.3

Ref symbol	Models			Name of part and description	Function of part	Signal Corps stock No.
	TT-1/TXC-1	TT-1A/TXC-1	TT-1B/TXC-1			
E6	*	*	*	BOARD, terminal: switch term; 4 Zierick No. 195 solder lug term; phenolic; 2 9/16" lg x 1 5/8" wd x 7/16" thk over-all; Times Facsimile part/dwg No. 90-00-40.	E6—Mounts components ...	2Z9404.146
E14	*	*		BOARD, terminal: mts capacitors; 6 Radio Essentials No. 2822 term lugs; Bakelite; 2" lg x 1¼ wd x ¾" thk over-all; Times Facsimile part/dwg No. 90-00-15.	E14—Mounts capacitors ...	2Z9406.126
E15		*	*	BOARD, terminal: chassis fork term; 7 Zierick No. 195 and 4 Radio Essentials No. 2822 term; phenolic; 2¾" lg x 1¾" wd x 5/8" thk over-all; Times Facsimile part/dwg No. 90-00-16.	E15—Mounts components ,	2Z9411.28
E4	*	*	*	BOARD, terminal: input-output term; 14 Zierick No. 195 solder lug term; phenolic; 2 13/16" lg x 1¾" wd x 7/16" thk over-all; Times Facsimile part/dwg No. 90-00-14.	E4—Mounts components...	2Z914.53
E5	*	*	*	BOARD, terminal: meter ckt term; 20 Zierick No. 195 solder lug term; phenolic; 3⅛" lg x 1¼" wd x 7/16" thk over-all; Times Facsimile part/dwg No. 90-00-19.	E5—Mounts components ...	2Z9420.33
E7	*	*	*	BOARD, terminal: regulator panel term; 28 Zierick No. 195 solder lug term; phenolic; 5 15/16" lg x 1¼" wd x 7/16" thk over-all; Times Facsimile part/dwg No. 90-00-17.	E7—Mounts components ...	2Z9428-19
E8	*	*	*	BOARD, terminal: mts resistors and capacitors; 54 Zierick No. 194 solder lug term; phenolic; 9⅞" lg x ¾" wd x 7/16" thk over-all; Times Facsimile part/dwg No. 90-00-18.	E8—Mounts components ...	2Z9440-172
E9	*	*		BRUSH ASSEMBLY, electrical contact: for start motor; includes brushes, brush arms, compression springs, nuts, and washers; 1 13/16" lg x 3/16" diam over-all; Times Facsimile part/dwg No. 90-06-02-04.	E9—Start motor brush assembly.	3H526
E10	*	*		BRUSH, electrical contact: LV commutator brush; carbon; 0.156" diam x ¼" lg w/3" lg stranded copper pigtail; flat cont; Times Facsimile part/dwg No. 90-06-02-41, 44.	E10—Start motor brushes ..	3H3115/B3
H	*	*		BUTTON, thrust: for Times Facsimile motor; rod, hardened; round; no dimen greater than 1"; Times Facsimile part/dwg No. 90-06-01-62.	H—Motor thrust button ...	3H643
W1	*	*	*	CABLE ASSEMBLY, special purpose: single #18 AWG stranded cond, 16 #30 AWG strands, RI, shielded, 300 v working, SB, RC, 3/8" diam over-all; 5½" ft lg; GE No. 1346 plug one end, 2 Mueller No. 60-S alligator clips other end; GE plug marked w/red dot on side connected to wire, white dot on side connected to shield; Times Facsimile part/dwg No. 90-37-02.	W1—Line connector	3E4039-2

Ref symbol	Models			Name of part and description	Function of part	Signal Corps stock No.
	TT-1/TXC-1	TT-1A/TXC-1	TT-1B/TXC-1			
W2	*	*	*	CABLE ASSEMBLY, special purpose: Sig C Cord CD-1018; 2 #20 AWG stranded copper cond; RI, shielded, cotton wrap, RC, 0.280" diam; 10 ft lg less term; Sig C Plug PL-55 ea end; Sig S dwg No. SC-D-4821.	W2—Connects to radio receiver.	3E1999-18
W3	*	*	*	CABLE ASSEMBLY, special purpose: Sig C Cord CD-1019; 2 #20 AWG stranded copper cond, RI, shielded, cotton wrap, RC, 0.280" diam; 10 ft lg less term; Sig C Plug PL-68 ea end; Sig C dwg No. SC-D-4822.	W3—Connects to radio transmitter.	3E1999-19
C35	*	*	*	CAPACITOR, fixed: mica; 100 mmf ±10%; 500 vdcw; max body dimen 51/64" lg x 15/32" wd x 7/32" thk; molded low-loss bakelite case; 2-wire lead term; JAN type CM20B101K.	C35—V10 plate output coupling.	3K2010121
C39, C51, C52	*	*	*	CAPACITOR, fixed: mica; 510 mmf ±5%; 500 vdcw; max body dimen 51/64" lg x 15/32" wd x 7/32" thk; molded low-loss bakelite case; 2-wire lead term; JAN type CM20B511J.	C39—V11 plate output coupling to GAIN control. C51—RADIO RCVR. jack r-f bypass. C52—RADIO XMTR. jack r-f bypass.	3K2051122
C44	*	*	*	CAPACITOR, fixed: mica; 510 mmf ±5%; 2,500 vdcw; max body dimen 15/8" lg x 1 1/8" wd x 23/64" thk; molded low-loss bakelite case; 2 solder lug term; JAN type CM45B511J.	C44—Stylus spark suppressor.	3K4551122
C30	*	*	*	CAPACITOR, fixed: mica; 1,000 mmf ±10%; 2,500 vdcw; max body dimen 15/8" lg x 1 1/8" wd x 23/64" thk; molded low-loss bakelite case; 2 solder lug term; JAN type CM45B102K.	C30—Synchronous motor coil transient suppressor.	3K4510221
C38	*	*	*	CAPACITOR, fixed: mica; 2,000 mmf ±5%; 500 vdcw; max body dimen 53/64" lg x 53/64" wd x 9/32" thk; molded low-loss bakelite case; 2-wire lead term; JAN type CM30B202J.	C38—V11 plate output coupling to V13.	3K3020222
C56	*	*	*	CAPACITOR, fixed: mica; 5,100 mmf ±5%; 500 vdcw; max body dimen 53/64" lg x 53/64" wd x 11/32" thk; molded low-loss Bakelite case; 2-wire lead term; JAN type CM35B512J.	C56—V9 screen, oscillation suppressor.	3K3551222
C31	*	*		CAPACITOR, fixed: mica; 5,100 mmf ±5%; 2,500 vdcw; max body dimen 15/8" lg x 1 1/8" wd x 29/64" thk; molded low-loss Bakelite case; 2 solder lug term; JAN type CM50B512J.	C31—START switch bypass.	3K5051222
C33, C37, C49	*	*	*	CAPACITOR, fixed: paper; 10,000 mmf +20% −10%; 600 vdcw; herm sealed metal case; max body dimen 1 1/4" lg x 7/16" diam; 2-wire lead term; JAN type CP26A1EF103V.	C33—V10 screen bypass. C37—V11 screen bypass. C49—V15 plate output coupling.	3DA10-334

Ref symbol	Models			Name of part and description	Function of part	Signal Corps stock No.
	TT-1/TXC-1	TT-1A/TXC-1	TT-1B/TXC-1			
C47, C41, C43	*	*	*	CAPACITOR, fixed: paper; 10,000 mmf +6% −20%; 400 vdcw; molded Bakelite case; max body dimen 53/64" lg x 53/64" wd x 11/32" thk; 2-wire lead term; JAN type CN35A103.	C47—V15 plate pulse filter. C41—V13 grid (pin 4) input coupling. C43—V13 plate (pin 3) output coupling to db meter	3DA10–330
C28, C29	*	*	*	CAPACITOR, fixed: paper; 20,000 mmf ±20%; 2,000 vdcw; herm sealed metal case; 2½" lg x 13/16" diam; oil impregnated; 2-wire lead term; Aerovox No. 2089M.	C28—Synchronous motor resonating. C29—Synchronous motor resonating.	3DA20–65
C31			*	CAPACITOR, fixed: paper; 100,000 mmf +40% −15%; 600 vdcw; herm sealed metal case; max body dimen 1¾" lg x 11/16" diam; 2-wire lead term; JAN type CP26A1EF104X.	C31—Motor fuse bypass ...	3DA100–601
C46	*	*	*	CAPACITOR, fixed: paper; 100,000 mmf +20% −10%; 600 vdcw; herm sealed metal case; max body dimen 1 13/16" lg x 1" wd x ¾" thk; 2 solder lug term; JAN type CP53B1EF104V.	C46—V15 grid, pulse filter..	3DA100–634
C59	*	*	*	CAPACITOR, fixed: paper; 250,000 mmf +20% −10%; 600 vdcw; herm sealed metal case; max body dimen 1 13/16" lg x 1" wd x ¾" thk; 2 solder lug term; JAN type CP53B1EF254V.	C59—Receiving GAIN control (R60) coupling.	3DA250–380
C27, C32, C34, C36, C40, C42, C48, C53, C57, C58	*	*	*	CAPACITOR, fixed: paper; 500,000 mmf +20% −10%; 600 vdcw; herm sealed metal case; max body dimen 1 13/16" lg x 1" wd x 1" thk; 2 solder lub term; JAN type CP53B1EF504V.	C27—V4 cathode bypass. C32—V10 cathode bypass. C34—V10 plate decoupling. C36—V11 cathode bypass. C40—V12 cathode bypass. C42—V13 cathode (pin 7) bypass. C48—V15 screen bypass. C53—RADIO XMTR. jack, blocking. C57—V9 grid filter. C58—Bridge modulator reactance.	3DA500–451
C55	*	*	*	CAPACITOR, fixed: paper; 1 mf +20% −10%; 1,000 vdcw; herm sealed metal case; max body dimen 3⅜" lg x 1½" diam; single screw term and single solder lug ground term; JAN type CP40C2EG105V.	C55—V7, V8 plate filter ...	3DB1–151
C50	*	*	*	CAPACITOR, fixed: paper; 2 mf +20% −10%; 600 vdcw; herm sealed metal case; max body dimen 2" lg x 2" wd x 1⅛" thk; 2 solder lug term; JAN type CP53B1EF205V.	C50—V16 cathode, phase magnet coupling.	3DB2–142
C54			*		C54—Start motor capacitor.	
C60			*	CAPACITOR, fixed: paper; 2 mf +40% −15%; 1,000 vdcw; herm sealed metal case; max body dimen 2⅞" lg x 1½" wd; single No. 10–32 stud term; JAN type CP40C2FG205X.	C60—Synchronous motor circuit decoupling.	3DB2–149

Ref symbol	Models TT-1/TXC-1	Models TT-1A/TXC-1	Models TT-1B/TXC-1	Name of part and description	Function of part	Signal Corps stock No.
C45	*	*	*	CAPACITOR, fixed: electrolytic; 50 mf; 25 vdcw; max body dimen 1 13/16" lg x 1" wd x 15/16" thk; herm sealed metal case; 2 solder lug term; JAN type CE63D500F.	C45-V15 cathode, pulse filter.	3DB50-71
H3	*	*	*	CLAMP: recorder lamp housing; zinc die cast; nickel pl; 2 1/8" lg x 2 3/8" wd x 3 1/2" h over-all; 2" diam clamping hole; Times Facsimile part/dwg No. 90-02-01.	H3—Supports lamp housing in recorder optical system.	2Z2650.8
	*	*	*	COIL, solenoid: for Times Facsimile synchronous motors type KB-1 and KBA-1; 2,700-3,300 ohms resistance, 500 v RMS, 60 cyc; 1 1/16" OD x 1 3/4" lg over-all; Times Facsimile part/dwg No. 90-06-04-07.	Phase magnet	3C1999-25A
J5	*	*	*	CONNECTOR, plug: female; 2 flat parallel cont; straight; 1 1/2" lg x 7/8" wd x 9/16" thk; 10 amp, 125 v; Bakelite; 5/16" diam cable opening; GE No. 1347.	J5—LINE JACK	2Z7255-11
P1	*	*	*	CONNECTOR, receptacle: male; 12 flat parallel cont, polarized; straight; 2 3/4" lg x 1" wd x 1 9/16" thk over-all; 10 amp, 110 v; Bakelite; Jones HB No. P-412LAB.	P1—Connects to rectifier power unit.	2Z7228.12
	*	*	*	COUPLER, facsimile set: electrically couples Facsimile Transceiver to telephone hand set; includes clamp and cord w/male connector plug; phosphor-bronze clamp; pri 600 ohms impedance, secd 10 ohms impedance, tapped at 2 ohms for 1 v use, 10 ohms for 6 v use, secd term in two GE No. 1348 female plugs; 6" lg x 2" wd x 4 1/2" h; Times Facsimile part/dwg No. 90-09-00.	Induction coupler to telephone receiver.	6C25-120/C8
	*	*	*	COVER: dust; canvas; 34 1/2" lg x 18 1/2" wd x 10 1/2" h; Times Facsimile part/dwg No. 96-00-22.	Protects equipment	6C310-1/C1
H7	*	*	*	CUSHION, electron tube: sponge rubber; 1/2" ID, 2" OD x 3/8" thk; Times Facsimile part/dwg No. 90-00-02-5.	H7—Protects recorder lamp in recorder optical system.	2Z3600-7
H6	*	*	*	CUSHION, electron tube: sponge rubber; 7/8" ID, 2" OD x 1/2" thk; Times Facsimile part/dwg No. 90-02-02-4.	H6—Protects recorder lamp in recorder optical system.	2Z3600-8
H5	*	*	*	CUSHION, electron tube: sponge rubber; 1 1/4" ID, 2" OD x 1/2" thk; Times Facsimile part/dwg No. 90-02-02-3.	H5—Protects recorder lamp in recorder optical system.	2Z3600-9
O	*	*	*	DISK, driving: consists of disk No. 96-04-00-51, pawl yoke No. 96-04-00-52, spring anchor No. 96-04-00-53, pawl trip arm No. 96-04-00-54, trip arm shaft No. 96-04-00-55, trip arm spring No. 96-04-00-56, driving pawl No. 96-04-00-57, pawl spring No. 96-04-00-58, pawl cushion No. 96-04-00-6 and No. 8-32 x 3/4" Fil H mtg screw; 2 1/2" diam 3/4" wd; clamps on lead screw; Times Facsimile part/dwg No. 96-04-00-5.	O—Drives dog assembly; couples lead screw to clutch.	6C310-1/D1

Ref symbol	Models TT-1/TXC-1	Models TT-1A/TXC-1	Models TT-1B/TXC-1	Name of part and description	Function of part	Signal Corps stock No.
	*	*	*	DRUM, facsimile transceiver: includes drum, clamping bar, phasing ring, springs, and half-nuts; aluminum and bronze casting; 6″ diam x 14″ lg; Times Facsimile part/dwg No. 96–08.	Holds and moves Facsimile copy.	63310–1/D5
F1	*	*	*	FUSE, cartridge: 1/8″ amp; 250 v; glass body; ferrule term; 1¼″ lg x 9/32″ diam over-all; Buss No. 3AG.	F1—Motor fuse	3Z2585
	*	*	*	GASKET: condenser lens; 2-ply bristol board; single hole; 0.953″ ID, 1.070″ OD x 0.011″ thk; Times Facsimile part/dwg No. 90–01–02–3.	Holds condenser lens in transmitter optical system.	6C310–1/G1
H8	*	*	*	HOLDER, fuse: extractor post; for single type 4AG fuse; Bakelite; 5 amp, 500 v; 2½″ lg x 5/8″ diam; 2 solder lug term; Buss No. HCM.	H8—Holds motor fuse	3Z1939.1
E	*	*	*	INSULATOR, feed-through: round post shape; FM–1 nylon; 1⅓″ lg x 15/16″ OD; includes ¼″–20 mtg nut and lockwasher, solder lug term; Times Facsimile part/dwg No. 26–03–05–00.	Insulates wiring from metal.	3G1350–133
J3, J4	*	*	*	JACK JK–33–A: telephone; for 3 cond 0.205″ diam plug; 1¼″ lg x 7/8″ diam over-all; Sig C dwg No. SC–D–2332.	J3—RADIO XMTR. jack. J4—CARBON MIKE jack.	2Z5533A
J1, J2, J7	*	*	*	JACK JK–34: telephone; for 2 cond 0.250″ diam plug; 1¼″ lg x 1″ wd x ¾″ h; cont arrangement J–1; Sig C dwg No. SC–D–2339.	J1—PHONES jack. J2—RADIO RCVR. jack. J7—Speaker jack.	2Z5534
J6	*	*	*	JACK, telephone: for 3 cond 0.205″ diam plug; 3″ lg x ½″ wd x 1⅛″ h over-all; cont arrangement J–10; Times Facsimile part/dwg No. 90–00–81.	J6—MOTOR JACK	2Z5531.51
	*	*	*	KNOB: bar; Bakelite; for ¼″ diam shaft; 2 No. 10–32 setscrews; white line marker on pointer; 1½″ lg x 7/8″ wd x 7/8″ h; brass insert; shaft hole ¾″ d; Kurz Kasch No. S–246–3L.	For selector switch	2Z5840–11
E1	*	*	*	LAMP, incandescent; 6–8 v, 21 cp; cylindrical, 1″ diam, clear; 1⅞″ lg; miniature bayonet base; tungsten filament; Mazda No. 1129.	E1—Exciter lamp	6Z6806.8
E3		*	*	LAMP LM–52: incandescent; 6-8 v, 0.15 amp; bulb T–3–¼ clear; 1⅛″ lg over-all; miniature bayonet base; Mazda No. 47.	E3—Pilot lamp	2Z5952
	*	*		LAMPHOLDER: miniature bayonet; brass shell; 1 amp, 250 v; 1 7/16″ lg x 1¼″ diam; two 5/32″ mtg holes on 1″ centers; polarized; Culver-Stearns No. 414B.	Lamp socket	2Z5883–156
J9	*	*	*	LAMPHOLDER: single cont standard bayonet; brass, NP shell; 3 1/32″ lg x 3″ wd x ¾″ d over-all; includes 1 adj plate No. 90–01–04–1, 1 plate No. 90–01–04–2, 2 screws No. 90–01–04–3, 2 washers No. 90–01–04–4, 1 socket holder No. 90–01–04–5, 2 pressure springs No. 90–01–04–9, 2 screws No. 90–01–04–7 and 1 nut No. 90–01–04–8; Times Facsimile part/dwg No. 90–01–04.	J9—Socket for exciter lamp.	6C310–1/L6

Ref symbol	Models TT-1/TXC-1	Models TT-1A/TXC-1	Models TT-1B/TXC-1	Name of part and description	Function of part	Signal Corps stock No.
	*	*	*	LEAD, test: 2 cond #20 AWG stranded, 10 #30 AWG strands, 300 v working, RC; 6″ lg; Sig C Plug PL–55 one end, 2 Mueller Pee Wee No. 45 clips w/No. 47 red and black ins sleeves other end; Times Facsimile part/dwg No. 90–37–03.	Line connector to RADIO RCVR. jack.	3E4039–4
				LEAD SCREW. (*See* SHAFT.)		
I2	*	*	*	LENS, condensing; 9-mm diam, 18-mm f/lg; unmounted; 9-mm diam x 1/16″ thk; Times Facsimile part/dwg No. 90–02–04.	I2—Field lens, recorder optical system.	6C310–1/L3
I1	*	*	*	LENS, condensing; matched pair; 27-mm diam, 59-mm f/lg; unmounted; 1 1/16″ diam x 5/32″ thk; Times Facsimile part/dwg No. 90–01–06.	I1—Condensing lens, transmitter optical system.	6C310–1/L4
I3	*	*	*	LENS, magnifying: magnifying power 10X; 5/8″ diam x 1/2″ thk over-all; Times Facsimile part/dwg No. 90–02–05.	I3—Objective lens, recorder optical system.	6C310–1/L7
			*	LENS, magnifying: magnifying power 10X; 1 1/8″ diam x 11/16″ lg over-all; metal holder; Times Facsimile part/dwg No. 26–45–00.	For inspecting shaft and copy.	6C33B
I4	*	*	*	LENS, magnifying: magnifying power 20X; 5/16″ diam x 1/4″ thk over-all; Times Facsimile part/dwg No. 90–01–10.	I4—Objective lens, transmitter optical system.	6C25–1/L7
M1			*	METER, audio level: AC rectifier; −10 to +6 db; round phenolic case; flange 2.695″ OD, body 2.220″ diam x 1.50″ d behind flange less term; calibrated for use on 0.09″ thk steel panel; logarithmic scale divisions; self-contained; 2 stud term; JAN type MR24W124SPEC.	M1—Db meter	3F3307.12–3
M2			*	METER, ammeter: DC; 0–100 ma; round plastic flush mtg case; max body dimen 2.220″ diam x 1.60″ d behind flange less term, 2 1/2″ diam flange; calibrated for 0.09″ thk steel panel; self-contained; two 1/4″ –28 stud term; JAN type MR24W100DCMA.	M2—Motor current meter.	3F1100–23
M3			*	METER, voltmeter: DC; 0–500 v; round plastic flush mtg case; max body dimen 2.820″ diam x 1.66″ d behind flange less term, 3 1/2″ diam flange; calibrated for nonmagnetic panel; self-contained; two 1/4″ –28 stud term; JAN type MR35W500DCVV.	M3—RB + voltmeter.....	3F8500–5
B1	*	*	*	MOTOR, AC: synchronous; 1/100 hp at 60 rpm; inclosed frame; dustproof; power take-off and equipped w/phasing clutch; 5 1/2″ lg x 4 9/16″ wd x 4 7/8″ h over-all; operates in plate ckt of amplifier requiring 450 v plate supply, draws 90 ma, 1,800 cyc single phase; fixed base mtg; includes 110 v 60 cyc start winding; Times Facsimile type KBA–1, part/dwg No. 26–06.	B1—Drives drum	3H3000–74–1

Ref symbol	Models TT-1/TXC-1	Models TT-1A/TXC-1	Models TT-1B/TXC-1	Name of part and description	Function of part	Signal Corps stock No.
	*	*	*	MOTOR COIL KIT: for 6 pole 1,800 cyc Times Facsimile type KB–1 and KBA–1 synchronous motors serial No. 1000 and above; consists of 6 rectangular coils Times Facsimile part/dwg No. 12–06–01–25, 2 ins plates Times Facsimile part/dwg No. 12–06–01–67, 2 feed-through ins Times Facsimile part/dwg No. 20–06–01–28, one 1-oz bottle Dolph ins varnish No. PG–131M; 1 set of wooden coil wedges and 2 synchronous interconnecting term Times Facsimile part/dwg No. 20–06–01–28; no dimen greater than 1"; Times Facsimile.	For motor repair.....	3H3000–74–3
	*	*	*	MOTOR COIL KIT: for 4 pole 1,800 cyc Times Facsimile type KB–1 synchronous motor serial numbered below 1000; consists of 4 rectangular coils, Times Facsimile part/dwg No. 90–06–01–25, 2 ins plates, Times Facsimile part/dwg No. 12–06–01–67, 2 feed-through insulators, Times Facsimile part/dwg No. 20–06–01–29, one 1-oz bottle Dolph ins varnish No. PG–131M; 1 set of wooden coil wedges and 2 synchronous interconnecting term, Times Facsimile part/dwg No. 20–06–01–28; no dimen greater than 1"; Times Facsimile (used in early models of KB–1 type motors on Order No. 2173–MPD–45).	For motor repair.....	3H3000–74–2
H9	*	*	*	NUT, half: brass; 47/64" thk x 0.277" diam, end face profiled concave on 0.313" radius to match shaft, 96 "V" thd per inch cut and threaded in this face in working assembly; assembly together w/5/0 steel taper pin, replaceable and furnished only in pr; Times Facsimile part/dwg No. 96–08–03–2.	Feeds drum along lead screw.	6L3090–4
	*	*	*	NUT, round: brass; 9/16" ID, 1 1/16" OD x 1/8" lg, 1 1/16" –36 thd on outside; 1/32" wd x 1/16" d screw driver slot; Times Facsimile part/dwg No. 90–02–03–5 (objective lens).	For objective lens in recorder optical system.	6C310–1/N2
	*	*	*	NUT, round: brass; 1" ID, 1 1/8" OD x 1/4" thk, 1/16" x 1/16" screw-driver slot; Times Facsimile part/dwg No. 90–01–02–4 (1 1/8" –32 thd on outside).	For condenser lens in transmitter optical system.	6C25–1/N6
O	*	*	*	PAWL: drum drive; phospor-bronze; cylindrical w/hole in one end, driving tooth profiled in other end; 1 5/32" lg x 3/16" diam; drive tooth profile to match shaft keyway; Times Facsimile part/dwg No. 12–08–01–51.	O—Drives drum through contact with keyway in drive shaft.	6C176A
				PAWL: phasing connection for shaft; stainless steel; L-shaped; 23/32" lg x 19/32" wd x 0.120" thk over-all; Times Facsimile part/dwg No. 96–04–00–57.	Drives lead screw from secondary clutch.	6C310–1/P2

Ref symbol	Models TT-1/TXC-1	Models TT-1A/TXC-1	Models TT-1B/TXC-1	Name of part and description	Function of part	Signal Corps stock No.
			*	PLATE, friction: bronze; 1″ diam x 5/64″ thk over-all; 0.395″ diam hole in center for mtg on lead screw; Times Facsimile part/dwg No. 26–04–00–07.	Slows drum during phasing operation.	6C177–2
O	*	*	*	PLATE, thrust: for facsimile leadscrew; steel, wrinkle finish w/compo 63–H–2 bearing surface; 1⅝″ diam x 13/32″ thk over-all; Times Facsimile part/dwg No. 96–07–00–5.	O—End thrust bearing plate for lead screw.	3H4350
O	*	*	*	PLATE, thrust: for facsimile motor; steel, wrinkle finish w/compo 63–H–2 bearing plug; ¼″ lg x 1¼″ wd x 13/32″ thk over-all; Times Facsimile part/dwg No. 90–06–01–69.	O—Motor thrust plate.....	3H4350–1
O	*	*	*	PLUNGER: for drum paper clamp; stainless steel; ⅜″ lg x 3/16″ diam, both ends rounded; Times Facsimile part/dwg No. 96–08–01–83.	O—Part of clamp mechanism.	6C177A
E12	*	*	*	POST binding: Sig C Binding Post TM–149; screw type; 1 13/16″ lg open x ½″ diam over-all; No. 8–32 x ⅞″ lg mtg stud; brass; Sig C dwg No. SC–D–530.	E12—For line connections...	3Z249
T6	*	*	*	REACTOR: audio reactor; 2 hy, 100 ma; 175 ohms max DC resistance; 3,000 RMS test; herm sealed metal case; 2¾″ lg x 2 7/32″ wd x 3 5/16″ h; 2 solder lug term; Times Facsimile part/dwg No. 90–11–05–00.	T6—V5 and V6 plate circuit, motor choke.	3C323–81A
R42	*	*	*	RESISTOR, adjustable: wire wound; 600 ohms +10%; 20 w; single slide; body dimen 2″ lg x ⅝″ diam; ceramic coated; 3 solder lug term; WL No. 2A.	R42—Modulator bridge balancing.	3Z5360–3
R48	*	*	*	RESISTOR, fixed: wire wound; 51 ohms ±5%; ½ w; max body dimen 21/32″ lg x 15/64″ diam; 2-wire lead term; JAN type RU3A510J.	R48—Bridge modulator circuit, part of voltage divider across CONTRAST control (R45).	3RU22804
R47	*	*		RESISTOR, fixed: composition; 75 ohms ±5%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF750J.	R47—Bridge modulator circuit, part of voltage divider across CONTRAST control (R45).	3RC21BF750J
R47			*	RESISTOR, fixed: wire wound; 100 ohms ±10%; ½ w; max body dimen 21/32″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF151K.	R47—Bridge modulator circuit, part of voltage divider across CONTRAST control (R45).	3RU25604
R72	*	*	*	RESISTOR, fixed: composition; 150 ohms ±5%; ½ w; max body dimen 0.655″ x 0.249″ diam; 2-wire lead term; JAN type RC21BF151K.	R72—V15 cathode coupling resistor.	3RC21BF151K

Ref symbol	Models TT-1/TXC-1	Models TT-1A/TXC-1	Models TT-1B/TXC-1	Name of part and description	Function of part	Signal Corps stock No.
R43, R84, R85	*	*	*	RESISTOR, fixed: composition; 300 ohms ±5%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF301J.	R43—Modulator circuit, voltage divider. R84—LINE JACK output voltage dropping. R85—LINE JACK output voltage dropping.	3RC21BF301J
R44, R46	*	*	*	RESISTOR, fixed: wire wound; 300 ohms ±5%; ½ w; max body dimen 21/32″ lg x 15/64″ diam; 2-wire lead term; JAN type RU3A301J.	R44—Modulator circuit, voltage divider. R46—Modulator circuit, voltage divider.	3RU30003
R80	*	*	*	RESISTOR, fixed: wire wound; 310 ohms ±10%; 5w; max body dimen 2″ lg x 19/32″ diam; moisture-resistant; 2 solder lug term; JAN type RW32E311K.	R80—RADIO RCVR. jack input attenuator.	3RW21318
R41	*	*	*	RESISTOR, fixed: composition; 510 ohms ±5%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF511J.	R41—Modulator circuit, voltage divider.	3RC21BF511J
R63	*	*	*	RESISTOR, fixed: composition; 620 ohms ±5%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF621J.	R63—V12 cathode.	3RC21BF621J
R92		*	*		R92—Speaker circuit loading.	
R98			*		R98—Attenuates signal in talk-back circuit.	
R66, R67			*	RESISTOR, fixed: composition; 750 ohms ±5%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF751J.	R66—V4 cathode. R67—V4, V13 cathode.	3RC21BF751J
R91	*	*	*	RESISTOR, fixed: composition; 1,000 ohms ±10%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF102K.	R91—Stylus spark suppressor.	3RC21BF102K
R39			*	RESISTOR, fixed: wire wound; 1,200 ohms; 16 w; max body dimen 2″ lg x 19/32″ diam; 2 solder lug term; JAN type RW32F122.	R39—V5, V6 plate voltage dropping.	3RW24915
R66	*	*		RESISTOR, fixed: composition; 1,500 ohms ±10%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF152K.	R66—V4 cathode	3RC21BF152K
R56	*	*	*	RESISTOR, fixed: composition; 2,000 ohms ±5%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF202J.	R56—V11 cathode.	3RC21BF202J
R67		*	*		R67—V4, V13 cathode.	
R73	*	*	*	RESISTOR, fixed: composition; 2,000 ohms ±5%; 2 w; max body dimen 1.78″ lg x 0.405″ diam; 2-wire lead term; JAN type RC21BF202J.	R73—Stylus spark suppressor.	3RC41BF202J
R81	*	*	*	RESISTOR, fixed: composition; 2,400 ohms ±5%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF242J.	R81—RADIO RCVR. jack, input attenuator.	3RC21BF242J

Ref symbol	Models TT-1/TXC-1	Models TT-1A/TXC-1	Models TT-1B/TXC-1	Name of part and description	Function of part	Signal Corps stock No.
R79	*	*	*	RESISTOR, fixed: wire wound; 2,500 ohms; ±10%; 5 w; max body dimen 2″ lg x 19/32″ diam; moisture-resistant; 2 solder lug term; JAN type RW32E252.	R79—RADIO RCVR. jack, input attenuator.	3RW26722
R36, R40, R51	*	*	*	RESISTOR, fixed: composition; 3,000 ohms ±5%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF302J.	R36—V4 grid voltage divider. R40—V4 cathode. R51—V10 cathode.	3RC21BF302J
R39	*	*		RESISTOR, fixed: wire wound; 7,500 ohms ±10%; 20 w; body dimen 2″ lg x 23/32″ diam; glass inclosed, resistant to salt water immersion; 2 solder lug term; WL No. B7500W–L.	R39—Start magnet current limiting.	3Z5475–15
R34, R35, R82	*	*	*	RESISTOR, fixed: composition; 10,000 ohms ±10%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF103K.	R34—V4 grid voltage divider. R35—V4 grid voltage divider. R82—RADIO RCVR. jack, input attenuator.	3RC21BF103K
R54	*	*	*	RESISTOR, fixed: composition; 15,000 ohms ±10%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF153K.	R54—V10 plate decoupling.	3RC21BF153K
R38	*	*	*	RESISTOR, fixed: wire wound; 15,000 ohms ±10%; 20 w; max body dimen 2″ lg x 13/16″ diam; glass inclosed, resistant to salt water immersion; 2 solder lug term; WL No. B15000W–L.	R38—V4 plate dropping.	3Z5550.18
R74	*	*	*	RESISTOR, fixed: composition; 24,000 ohms ±5%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF243J.	R74—V15 grid.	3RC21BF243J
R71, R94			*		R71—Db meter multiplier. R94—Recorder lamp shunt.	
R71	*	*		RESISTOR, fixed: composition; 47,000 ohms ±10%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF473K.	R71—Db meter multiplier.	3RC21BF473K
R71, R90	*	*	*	RESISTOR, fixed: composition; 51,000 ohms ±5%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF513J.	R70—Db meter multiplier. R90—V9 grid.	3RC21BF513J
R37	*	*	*	RESISTOR, fixed: composition; 51,000 ohms ±5%; 1 w; max body dimen 1.28″ lg x 0.310″ diam; 2-wire lead term; JAN type RC31BF513J.	R37—V4 screen	3RC31BF513J
R49	*	*	*	RESISTOR, fixed: composition; 68,000 ohms ±10%; 1 w; max body dimen 1.28″ lg x 0.310″ diam; 2-wire lead term; JAN type RC31BF683K.	R49—V24 bias voltage divider.	3RC31BF683K

Ref symbol	Models TT-1/TXC-1	Models TT-1A/TXC-1	Models TT-1B/TXC-1	Name of part and description	Function of part	Signal Corps stock No.
R78 R88	*	*	* *	RESISTOR, fixed: composition; 75,000 ohms ±5%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF753J.	R78—V16 cathode. R88—V25 cathode.	3RC21BF753J
R69 R89	* *	* *	*	RESISTOR, fixed: composition; 100,000 ohms ±10%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF104K.	R69—V13 plate (pin 3). R89—V9 grid voltage divider.	3RC21BF104K
R49A		*	*	RESISTOR, fixed: composition; 100,000 ohms ±10%; 1 w; max body dimen 1.28″ lg x 0.310″ diam; 2-wire lead term; JAN type RC31BF104K.	R49A—V24 bias voltage divider.	3RC31BF104K
R58 R89	*	*	* *	RESISTOR, fixed: composition; 150,000 ohms ±10%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF154K.	R58—V11 plate. R89—V9 grid voltage divider.	3RC21BF154K
R49B		*	*	RESISTOR, fixed: composition; 150,000 ohms ±10%; 1 w; max body dimen 1.28″ lg x 0.310″ diam; 2-wire lead term; JAN type RC31BF154K.	R49B—V24 bias voltage divider.	3RC31BF154K
R17, R53, R55 R88, R90A	* *	* *	*	RESISTOR, fixed: composition; 240,000 ohms ±5%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF244J.	R17—V16 cathode bias voltage divider. R53—V10 plate load. R55—V11 grid. R88—V25 bleeder. R90A—V9 grid.	3RC21BF244J
R49C		*	*	RESISTOR, fixed: composition; 240,000 ohms ±5%; 1 w; max body dimen 1.28″ lg x 0.310″ diam; 2-wire lead term; JAN type RC31BF244J.	R49C—V24 bias voltage divider.	3RC31BF244J
R57, R61, R62, R65, R68 R95	*	*	* *	RESISTOR, fixed: composition; 510,000 ohms ±5%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF514J.	R57—V11 screen. R61—V12 grid, signal voltage divider for V13 grid (pin 4). R62—V12 grid, signal voltage divider for V13 grid (pin 4). R65—V13 grid (pin 5) current limiting. R68—V13 grid (pin 4). R95—Bleeder across C31 and motor fuse.	3RC21BF514J
R52, R64, R76, R77, R83, R87	*	*	*	RESISTOR, fixed: composition; 1 meg ±10%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF105K.	R52—V10 screen. R64—V13 grid (pin 5). R76—V15 plate. R77—V16 grid. R83—RADIO RCVR. input jack ground. R87—V9 plate.	3RC21BF105K

Ref symbol	Models TT-1/TXC-1	TT-1A/TXC-1	TT-1B/TXC-1	Name of part and description	Function of part	Signal Corps stock No.
R50, R75, R86	*	*	*	RESISTOR, fixed: composition; 2 meg ±5%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF205J.	R50—V10 grid. R75—V15 screen. R86—V9 screen.	3RC21BF205J
R45	*	*	*	RESISTOR, variable: wire wound, noninductive; 50 ohms ±10%; 3 w; 3 solder lug term; inclosed phenolic case 1⅝″ diam x ¾″ d; round metal shaft ¼″ diam x ⅞″ lg; linear taper; normal torque; mts w/ ⅜″ –32 x ⅜″ bushing; Clarostat No. G3912–B.	R45—CONTRAST control.	3Z7050–22
R97			*	RESISTOR, variable: wire wound; 2,000 ohms ±10%; 3 w; 3 solder lug term; inclosed metal case 1.64″ diam x 0.84″ thk; round metal shaft ¼″ diam x ½″ lg; A taper; normal torque; mts w/ ⅜″ –32 x ⅜″ lg bushing; JAN type RA25A1FK202K.	R97—V13 cathode bias control.	3RA6312
R93			*	RESISTOR, variable: wire wound; 5,000 ohms ±10%; 3 w; 3 solder lug term; inclosed metal case 1.64″ diam x 0.84″ thk max; round metal shaft ¼″ diam x ½″ lg; A taper; normal torque; mts w/ ⅜″ –32 x ⅜″ lg bushing; JAN type RA25A1FK502AK.	R93—V4 grid voltage control.	3RA6910
R96			*	RESISTOR, variable: wire wound; 50,000 ohms ±10%; 3 w; 3 solder lug term; inclosed phenolic case 1⅝″ diam x ¾″ thk; round metal shaft ¼″ diam x ⅞″ lg; linear taper; normal torque; mts w/ ⅜″ –32 x ⅜″ lg bushing; non-turn device located on 17/32″ radius at 9 o'clock; Clarostat No. 1–1708–B.	R96—V9 grid, RB + voltage control.	3Z7450–69
R59, R60	*	*	*	RESISTOR, variable: sect No. 1 wire wound, sect No. 2 composition; sect No. 1 500 ohms ±10%, sect No. 2 250,000 ohms ±10%; sect No. 1 2.5 w, sect No. 2 1 w; 3 solder lug term ea sect; inclosed phenolic case 1 21/32″ diam x 1 5/16″ d; metal shaft ¼″ diam x 1″ lg from mtg surface; sect No. 1 linear taper, sect No. 2 Z taper; ins cont arm; mts w/ ⅜″ –32 x ⅜″ lg bushing; non-turn device located on 17/32″ radius at 9 o'clock; Clarostat No. H1851.	R59—Transmitting half of dual GAIN control. R60—Receiving half of dual GAIN control.	2Z7286.1
			*	SCALES, weighing: avoirdupois; spring principle hanging type; 8-24 oz in 4-oz divisions; 5″ lg x 1″ wd x ¾″ thk over-all; aluminum case; movable pointer in groove in front of case; Times Facsimile part/dwg No. 26–44–00.	Measure clutch tension.....	6Z8080
H10	*	*	*	SCREW, set: slot drive; headless; steel; No. 10–32; 1⅜″ lg; flat point; Times Facsimile part/dwg No. 90–01–01–08.	H10—Lens focusing screw for transmitter optical system.	6L7032–19.3S
	*	*	*	SHAFT: lead screw type; stainless steel; 28 9/16″ x 0.6250″ diam over-all; 96 thd per inch; 0.140″ diam steel ball spun in one end; Times Facsimile part/dwg No. 96–04–00–1.	Lead screw, rotates and feeds drum assembly of facsimile transceiver.	6C310–1/L5

Ref symbol	Models TT-1/TXC-1	Models TT-1A/TXC-1	Models TT-1B/TXC-1	Name of part and description	Function of part	Signal Corps stock No.
X24	*	*	*	SOCKET, tube: 3 cont; retainer ring mtg; round mica filled bakelite body ¾" diam x ½" lg excluding term; phosphor-bronze silver pl cont; Times Facsimile part/dwg No. 90–01–01–2.	X24—Socket for V24.....	2Z8673.55
X5, X6, X14, X16	*	*	*	SOCKET, tube: octal; one piece saddle mtg; round plastic body, 1 9/16" lg x 1 7/8" wd x ½" thk over-all excluding term; phosphor-bronze silver pl cont; Cinch No. 9919.	X5—Socket for V5. X6—Socket for V6. X14—Socket for V14. X16—Socket for V16.	2Z8650.1
X4, X7, X8, X9, X10, X11, X12, X13, X15	*	*	*	SOCKET, tube: 1 octal; 2 piece saddle mtg; round ceramic body, 1 13/16" lg x 1¼" wd x ⅜" thk over-all excluding term; phosphor-bronze silver pl cont; Eby No. 7790.	X—Socket for V4. X7—Socket for V7. X8—Socket for V8. X9—Socket for V9. X10—Socket for V10. X11—Socket for V11. X12—Socket for V12. X13—Socket for V13. X15—Socket for V15.	2Z8678.294
X25			*	SOCKET, tube: 7 cont, miniature; 1 piece saddle mtg; round ceramic body 0.805" diam max x ¾" h less cont; beryllium copper cont; silver pl; marked S011C; metal shock shield; JAN type S011C.	X25—Socket for V25.....	2Z8677.100
		*	*	SPEAKER, magnetic: Sig C Loudspeaker LS–11; 4" diam cone; PM; 4⅝" lg x 4⅝" wd x 2⅝" thk; 250 ohms input impedance transf; Sig C spec No. 71–1514.	External speaker for talk-back system.	6C51
			*	SPRING: flat type; 0.020" beryllium copper; 9/16" lg x ¼" wd x ⅛" h bent on 9/32" radius; Times Facsimile part/dwg No. 26–07–00–05.	Stiffens friction plate spring.	6C310–1/S9
			*	SPRING: flat type; 0.020" beryllium copper; 1⅜" lg x ¼" wd x 3/32" h, 3/32" radius cupped depression on cont end; Times Facsimile part/dwg No. 26–07–00–04.	Exerts braking pressure on friction plate.	6C310–1/S8
			*	SPRING: flat type; 0.015" thk beryllium copper; 1 11/16" lg x 5/32" wd; Times Facsimile part/dwg No. 26–06–01–55.	Flexible coupling in motor.	6C293B–6
		*		SPRING: flat type; 0.012" beryllium copper; 1⅞" lg x 5/32" wd x 13/16" d; Times Facsimile part/dwg No. 20–06–01–08.	Flexible coupling in motor.	6C293B–8
	*	*	*	SPRING: torsion type; 0.011" diam phosphor-bronze wire; 3/32" lg x 0.187" diam less radial term; approx 7 turns; wound clockwise; 2 straight radial term ½" lg; Times Facsimile part/dwg No. 96–04–00–56.	For pawl trip arm.....	6C310–1/S7
	*	*	*	SPRING: helical extension type; 0.011" diam phosphor-bronze wire; ¼" lg x 0.125" diam less axial term; approx 14 turns; 2 straight axial term ⅜" lg; Times Facsimile part/dwg No. 96–04–00–58.	For secondary clutch pawl.	6C310–1/S6

Ref symbol	Models TT-1/TXC-1	Models TT-1A/TXC-1	Models TT-1B/TXC-1	Name of part and description	Function of part	Signal Corps stock No.
	*	*	*	SPRING: helical compression type; 0.029″ diam stainless steel spring wire; ⅜″ lg x 0.180″ OD; 10 turns per inch; close wound ends; Times Facsimile part/dwg No. 90–06–03–5.	For clutch and drum clamp detent.	6C293B–4
	*			SPRING: helical extension type; 0.014″ diam stainless steel wire; ½″ lg x 0.100″ OD; approx 25 RH turns; straight axial ends; Times Facsimile part/dwg No. 90–06–01–45.	Flexible coupling in motor.	6C293B–7
	*	*	*	SPRING: helical compression type; 0.020″ diam stainless steel spring wire; 9/16″ lg x 0.144″ OD; 14 turns per inch; close wound ends; Times Facsimile part/dwg No. 12–08–01–54.	Presses drum drive pawl in lead screw keyway.	6C293B–5
	*	*	*	SPRING: helical compression type; 0.044″ diam stainless steel spring wire; 1″ lg x 0.406″ OD; approx 5 RH turns; close wound ends; Times Facsimile part/dwg No. 96–04–00–2.	For lead screw.....	6C293B–2
	*	*	*	SPRING: helical compression type; 0.029″ diam stainless steel spring wire; 1⅛″ lg x 0.385″ ID for 1″ lg and 0.302″ ID for ⅛″ lg; 8 turns per inch; close wound ends; Times Facsimile part/dwg No. 96–06–03–12.	For facsimile motor drive shaft.	6C293B–3
O4	*	*	*	SPRING: helical compression type; 0.018″ stainless steel wire; 0.160″ OD x 11/16″ lg; 11 turns; close wound ends; Times Facsimile part/dwg No. 90–08–03–3.	O4—For drum feed half-nut.	6C310–1/S5
H11	*	*	*	STYLUS: tungsten point; straight round shank; Times Facsimile part/dwg No. 90–03–04.	H11—Electrode used in direct recording.	6C25–1/S20
O5	*	*	*	STYLUS ASSEMBLY: includes 1 mtg bracket, 1 spring, 1 adj screw and 2 adj screw nuts; approx 1¾″ lg x 1½″ wd x ⅜″ d over-all; Times Facsimile part/dwg No. 96–03–01.	O5—Assembly holding stylus in correct position.	6C297
S5	*	*	*	SWITCH, lever: 2 position, No. 1 non-locking; No. 2 locking; cont arrangement position No. 1 6C, position No. 2 2A; metal body; 4½″ lg x ¾″ wd x 1⅜″ h over-all; bat type handle; solder lug term; moistureproofed; Times Facsimile part/dwg No. 12–13–00–00.	S5—STANDBY-MON-TALK switch.	3Z9580–33
S3	*	*	*	SWITCH, push: cont arrangement 2B1C; 2 sect; metal body; 1¾″ lg x 15/16″ wd x ¾″ d; momentary cont, normally open; solder lug term; Times Facsimile part/dwg No. 90–00–83.	S3—PHASE button.....	3Z9824–26
S4	*	*	*	SWITCH, push: cont arrangement 1A1B; 2 sect; metal body; 1¾″ lg x 15/16″ wd x ¾″ d; momentary cont, normally open; solder lug term; Times Facsimile part/dwg No. 90–00–82.	S4—START button.....	3Z9824–27
	*	*	*	SWITCH SECTION, rotary: 2 pole, 5 position; Bakelite ins phosphor-bronze silver pl; shorting type cont; solder lug term; 2″ OD x 7/16″ thk; Centralab No. C.	Part of selector switch.....	3Z9903E–7.1

Ref symbol	Models			Name of part and description	Function of part	Signal Corps stock No.
	TT-1/TXC-1	TT-1A/TXC-1	TT-1B/TXC-1			
	*	*	*	SWITCH SECTION, rotary: 2 pole, 5 position; ceramic ins, phosphor-bronze silver pl; nonshorting type cont; solder lug term; 2″ OD x 7/16″ thk; Centralab No. RR.	Part of selector switch.....	3Z9903E-7.2
S1	*	*		SWITCH, rotary: 6 pole, 5 position; 6 sect; phosphor-bronze silver pl cont; 5 sect Bakelite ins, 1 sect ceramic ins; 3″ diam x 5″ lg; 5 sect w/shorting cont; 1 sect w/nonshorting cont; solder lug term; includes Centralab index assem K-123 modified to include stylus actuating arm and one pr form B leaf cont; Times Facsimile part/dwg No. 96-04-50.	S1—Selector switch	3Z9903A/36.1
S1			*	SWITCH, rotary: 6 pole, 5 position; 6 sect; phosphor-bronze silver pl cont; 4 sect Bakelite ins, 2 sect ceramic ins; 3″ diam x 5″ lg; 4 sect w/shorting cont, 2 sect w/nonshorting cont; solder lug term; includes Centralab index assem K-123 modified to include stylus actuating arm and one pr form B leaf cont; Times Facsimile part/dwg No. 26-40-50.	S1—Selector switch	6C301A
S2	*	*	*	SWITCH, toggle: DPST; 25 amp, 125 v AC; 9 amp, 250 v AC noninductive load; Bakelite body; 1 21/64″ lg x 49/64″ wd x 1 1/16″ h; bat type handle 5/8″ lg x 3/16″ diam; solder lug term; JAN type ST52K.	S2—Power ON-OFF switch.	3Z9863-52K
T3	*	*	*	TRANSFORMER, AF: plate coupling type; herm sealed metal case; 2 15/16″ lg x 2 7/32″ wd x 2 5/16″ h over-all; turns ratio pri to secd 8:15; freq response 1,800 cps; 4 solder lug term on top; Times Facsimile No. 601 dwg No. 90-11-02.	T3—V14 output to stylus...	2Z9632.13
T2	*	*	*	TRANSFORMER, AF: plate coupling type; herm sealed metal case; 2 5/8″ lg x 2 9/32″ wd x 2 9/16″ h over-all; turns ratio pri to secd No. 1 5:2; pri to 1/2 secd No. 2 100:1; freq response 1,200-3,000 cps; 6 solder lug term on top; CT secd No. 2 connected to inside lead secd No. 1; Times Facsimile No. 633A dwg No. 90-11-01.	T2—V12 or V13 output.....	2Z9632.222
T1	*	*	*	TRANSFORMER, AF: plate coupling type; herm sealed metal case; 2 9/16″ lg x 2 1/8″ wd x 3 5/16″ h over-all; turns ratio pri to 1/2 secd 5:3; freq 1,800 cps; 5 solder lug term on top; Times Facsimile part/dwg No. 90-11-00.	T1—V4 output to V5 and V6.	2Z96833.4
T8		*		TRANSFORMER, AF: plate coupling type; pri 550 ohms, secd 11 ohms impedance; herm sealed metal case; 2 5/32″ lg x 1 7/8″ wd x 2 1/8″ h over-all; turns ratio pri to secd 7.45:1; freq response 100-5,000 cps ±1.5 db; 4 solder lug term on top; Times Facsimile part/dwg No. 12-11-00-00.	T8—Output to speaker.....	2Z9632.443

Ref symbol	Models TT-1/TXC-1	Models TT-1A/TXC-1	Models TT-1B/TXC-1	Name of part and description	Function of part	Signal Corps stock No.
T7	*	*	*	TRANSFORMER, AF: line type; pri 600 ohms CT, secd 600 ohms; herm sealed metal case; 2⅜" lg x 15/16" diam over-all; turns ratio ½ pri to secd 1:2; freq response 1,200-3,000 cps; electrostatic shield between pri and secd connected to one side of secd; 5 solder lug term on top; secd balanced to within +½ db; Times Facsimile part/dwg No. 96-11-06.	T7—Line input to V10 grid.	2Z9631.153
V4, V7 V8, V12	*	*	*	TUBE, electron: JAN-7C5	V4—Motor amplifier driver. V7—Voltage regulator output. V8—Voltage regulator output. V12—Third signal amplifier.	2J7C5
V10	*	*	*	TUBE, electron: JAN-7C7	V10—First signal amplifier.	2J7C7
V9, V11, V15	*	*	*	TUBE, electron: JAN-7L7	V9—Control voltage amplifier. V11—Second signal amplifier. V15—Pulse amplifier.	2J7L7
V13	*	*	*	TUBE, electron: JAN-7N7	V13—Signal meter amplifier.	2J7N7
V16	*	*	*	TUBE, electron: JAN-884	V16—Trigger tube	2J884
V24	*	*	*	TUBE, electron: JAN-1645	V24—Photocell	2J1645
V5, V6, V14	*	*		TUBE, electron: JAN-6AC5GT/G	V5—Motor amplifier output. V6—Motor amplifier output. V14—RECORD output amplifier.	2J6AC5GT/G
V5, V6, V14			*	TUBE, electron: JAN-1635	V5—Motor amplifier output. V6—Motor amplifier output. V14—RECORD output amplifier.	2J1635
V25	*	*		TUBE, electron: JAN-1B46	V25—Reference voltage regulator.	2J1B46
V25			*	TUBE, electron: voltage regulator RMA No. 5651.	V25—Reference voltage regulator.	2Z5890-16
E2	*	*	*	TUBE, electron: Sylvania R1130B	E2—Recorder lamp	2JR1130B
	*	*	*	WASHER, flat: Bakelite; round, 5/16" ID, ½" OD x 1/32" thk; Times Facsimile part/dwg No. 90-06-01-65.	Hardware	6L40235-3
	*	*	*	WASHER, flat: Bakelite; round, 0.313" ID, 0.438" OD x 0.010" thk; Times Facsimile part/dwg No. 90-06-01-64.	Hardware	6L40235-2
				Fork Oscillator Unit		
				Note. Oscillator 6C25-1/F8 was used in all Sets TT-1/TXC-1 and TT-1A/TXC-1 up to serial No. 105. This Oscillator is now obsolete, hav-		

Ref symbol	Models TT-1/TXC-1	Models TT-1A/TXC-1	Models TT-1B/TXC-1	Name of part and description	Function of part	Signal Corps stock No.
				ing been superseded by Oscillator 6C140 which is electrically and mechanically interchangeable with it. Parts for Oscillator 6C25-1/F8 have been purposely omitted from this list and upon failure this Oscillator will be replaced by Oscillator 6C140.		
	*	*	*	OSCILLATOR, AF: fixed freq 1,800 cyc; 5" lg x 4⅝" wd x 6½" h over-all; 50 mw output at 25,000 ohms impedance, 0.5 mw sinusoidal output at 500 ohms impedance; 5-7 v AC and 250 v DC ±5% input; 8 solder lug term; metal frame; one term of 25,000 ohms output and metal frame grounded; high stability at freq, pressure, and temp compensated, tuning fork sealed in vacuum; Times Facsimile part/ dwg No. 12-05-00-00.	Generates 1,800-cycle signal.	6C140
E303	*	*	*	BOARD, terminal: 6 Zierick No. 195 solder lug term; Bakelite; 2" lg x 1¼" wd x 7/16" thk over-all; Times Facsimile part/ dwg No. 12-05-04-2.	E303—Mounts components..	3Z12531-39.2
E304	*	*	*	BOARD, terminal: 10 Zierick No. 195 solder lug term; Bakelite; 2⅛" lg x 1½" wd x 7/16" thk over-all; Times Facsimile part/dwg No. 12-05-04-03.	E304—Mounts components..	3Z12531-39.1
E305	*	*	*	BOARD, terminal: 10 Zierick No. 195 solder lug term; Bakelite; 4½" lg x 2¼" wd x 7/16" thk over-all; Times Facsimile part/dwg No. 12-05-04-01.	E305—Mounts components..	3Z12531-39.3
E302	*	*	*	BOARD, terminal; 12 Zierick No. 195 solder lug term; Bakelite; 4½" lg x ¾" wd x 7/16" thk overall; Times Facsimile part/dwg No. 12-05-04-04.	E302—Mounts components..	3Z12531-39.4
E301	*	*	*	BOARD, terminal; 14 Zierick No. 195 solder lug term; Bakelite; 4½" lg x ¾" wd x 7/16" thk over-all; Times Facsimile part/dwg No. 12-05-04-05.	E301—Mounts components..	3Z12531-39.5
C310	*	*	*	CAPACITOR, fixed: mica; 510 mmf ±5%; 500 vdcw; max body dimen 51/64" lg x 15/32" wd x 7/32" thk; molded low-loss Bakelite case; 2-wire lead term; JAN type CM20B511J.	C310—V3 grid (pin 5) high-frequency bypass.	3K2051122
C303, C304, C305, C308, C309	*	*	*	CAPACITOR, fixed: paper; 10,000 mmf +20%, −10%; 600 vdcw; herm sealed metal case; max body dimen 1¼" lg x 7/16" diam; 2-wire lead term; JAN type CP26A1EF103V.	C303—V1 plate output coupling. C304—V2 plate (pin 3) output coupling. C305—V1 screen, bypass. C308—T5 input, high-frequency bypass. C309—V3 plate (pin 3) output coupling.	3DA10-334

Ref symbol	Models			Name of part and description	Function of part	Signal Corps stock No.
	TT-1/TXC-1	TT-1A/TXC-1	TT-1B/TXC-1			
C302	*	*	*	CAPACITOR, fixed: paper; 50,000 mmf ±10%; 600 vdcw; herm sealed metal case; max body dimen 1 13/16" lg x 1 1/16" diam; 2-wire lead term; JAN type CP26A1EF503K.	C302—V3 plate (pin 6) output coupling.	3DA50–224
C301, C307	*	*	*	CAPACITOR, fixed: paper; 100,000 mmf +40%, −15%; 600 vdcw; herm sealed metal case; max body dimen 1¾" lg x 1 1/16" diam; 2-wire lead term; JAN type CP26A1EF104X.	C301—V2 plate (pin 6) output coupling. C307—T5 output, high-frequency bypass.	3DA100–601
C306	*	*	*	CAPACITOR, fixed: paper; 500,000 mmf +20%, −10%; 600 vdcw; herm sealed metal case; max body dimen 1 13/16" lg x 1" wd x 1" thk; 2 solder lug term; JAN type CP53B1EF504V.	C306—V1 cathode bypass...	3DA500–451
I301	*	*	*	FORK, tuning: 1,800 cps fixed freq; 4¾" lg x 2¾" wd x 2⅜" h over-all; 3 solder lug term; herm sealed metal case; input and output grounded to case; high stability of freq, pressure, and temp compensation, fork sealed in vacuum; Times Facsimile part/dwg No. 12–05–01–71.	I301—Stabilizes frequency..	3F5876.5
R316	*	*	*	RESISTOR, fixed; composition; 1,000 ohms ±%; ½ w; max body dimen 0.655" lg x 0.249" diam; 2-wire lead term; JAN type RC21BF102K.	R316—V3 cathode (pin 7)..	3RC21BF102K
R302, R310, R317	*	*	*	RESISTOR, fixed: composition; 2,000 ohms ±5%; ½ w; max body dimen 0.655" lg x 0.249" diam; 2-wire lead term; JAN type RC21BF202J.	R302—V2 cathode (pin 2). R310—V1 cathode. R317—V3 cathode (pin 2).	3RC21BF202J
R303	*	*	*	RESISTOR, fixed: composition; 10,000 ohms ±10%; ½ w; max body dimen 0.655" lg x 0.249" diam; 2-wire lead term; JAN type RC21BF103K.	R303—V2 cathode (pin 7).	3RC21BF103K
R308, R309	*	*	*	RESISTOR, fixed: composition; 24,000 ohms ±5%; ½ w; max body dimen 0.655" lg x 0.249" diam; 2-wire lead term; JAN type RC21BF243J.	R308—V3 plate (pin 6) load. R309—V3 plate (pin 3) load.	3RC21BF243J
R306, R307	*	*	*	RESISTOR, fixed: composition; 51,000 ohms ±5%; ½ w; max body dimen 0.655" lg x 0.249" diam; 2-wire lead term; JAN type RC21BF513J.	R306—V2 grid (pin 5). R307—V2 plate (pin 6) load.	3RC21BF513J
R301, R305, R312, R313	*	*	*	RESISTOR, fixed: composition; 100,000 ohms ±10%; ½ w; max body dimen 0.655" lg x 0.249" diam; 2-wire lead term; JAN type RC21BF104K.	R301—V2 plate (pin 3) load. R305—V2 grid (pin 5) voltage divider. R312—V1 plate load. R313—V1 grid.	3RC21BF104K
R318	*	*	*	RESISTOR, fixed: composition; 150,000 ohms ±10%; ½ w; max body dimen 0.655" lg x 0.249" diam; 2-wire lead term; JAN type RC21BF154K.	R318—V3 grid (pin 4).....	3RC21BF154K

Ref symbol	Models			Name of part and description	Function of part	Signal Corps stock No.
	TT-1/TXC-1	TT-1A/TXC-1	TT-1B/TXC-1			
R311	*	*	*	RESISTOR, fixed: composition; 240,000 ohms ±5%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF244J.	R311—V1 screen	3RC21BF244J
R315	*	*	*	RESISTOR, fixed: composition; 390,000 ohms ±10%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF394K.	R315—V3 grid voltage divider.	3RC21BF394K
R314	*	*	*	RESISTOR, fixed: composition; 1 meg ±10%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; 2-wire lead term; JAN type RC21BF105K.	R314—V3 grid voltage divider.	3RC21BF105K
R304	*	*	*	RESISTOR, variable: wire wound; 50,000 ohms ±10%; 3 w; 3 solder lug term; inclosed phenolic case 1⅝″ diam x ¾″ d; metal shaft ¼″ diam x ⅞″ lg from mtg surface; linear taper; ins cont arm; mts w/ ⅜″ –32 x ⅜″ thk bushing; non-turn device located on 17/32″ radius at 9 o'clock; Clarostat No. 1–1708–B.	R304—V2 cathode (pin 7), frequency control.	3Z7450–69
X1, X3, X2	*	*	*	SOCKET, tube: loctal; 2 piece saddle mtg; round ceramic body, 1 13/16″ lg x 1¼″ wd x ⅜″ thk over-all excluding term; phosphor-bronze silver pl cont; Eby No. 7790.	X1—Socket for V1. X3—Socket for V3. X2—Socket for V2.	2Z8678.294
T5	*	*	*	TRANSFORMER, AF: plate coupling type; herm sealed metal case; 2 5/32″ lg x 1⅞″ wd x 2⅛″ h over-all; turns ratio pri to secd 100:9; built-in band pass filter to limit output freq to 1,800 cyc; 4 solder lug term on top; Times Facsimile No. 679 dwg No. 90–11–04.	T5—V3 output filter and coupling unit.	2Z9632.438
V1	*	*	*	TUBE, electron: JAN–7L7.....	V1—Second fork amplifier.	2J7L7
V2, V3	*	*	*	TUBE, electron: JAN–7N7.....	V2—Fork input amplifier and driver. V3—Motor amplifier buffer and modulator buffer.	2J7N7

b. Rectifier Power Unit PP–86/TXC–1 and PP–86A/TXC–1.

Ref symbol	Models		Name of part and description	Function of part	Signal Corps stock No.
	PP–86/TXC–1	PP–86A/TXC–1			
			RECTIFIER POWER UNIT PP–86/TXC–1: electronic type; output 500 v DC, 270 ma, 245 v DC ±5 v 70 ma, 6.3 v, 6.25 amp, 6.3 v ±0.1 v 3 amp, 1,800 cyc AC, 10 v 1.5 amp AC; input 100–130 v, 50–70 cyc, 300 w; 12″ lg x 10″ wd x 9½″ h over-all; 5Z3 rectifier tube; full wave; built in filter; herm sealed components; Sig C spec No. 71–3107.	Supplies operating power to transceiver.	3H4698–86

Ref symbol	Models PP-86/TXC-1	Models PP-86A/TXC-1	Name of part and description	Function of part	Signal Corps stock No.
			TECHNICAL MANUAL TM 11–2258.....	Describes rectifier power unit.	(Order through AGO channels.)
	*	*	BOARD, terminal: 2 Zierick No. 195 solder lug term and 2 holes No. 33 drill on 2⅛" mtg/c; Bakelite; 2½" lg x 1¾" wd x 7/16" thk over-all; Times Facsimile part/dwg No. 90–15–18.	Mounts components.....	2Z9402.200
	*	*	BOARD, terminal: general purpose; 8 solder lug term; Bakelite; 4 9/16" lg x ½" wd x 7/16" thk over-all; Times Facsimile part/dwg No. 90–15–10.	Mounts components.....	2Z9408.104
	*	*	BOARD, terminal: 12 Zierick No. 195 solder lug term; Bakelite; 2 9/16" lg x 2½" wd x 7/16" thk over-all; Times Facsimile part/dwg No. 90–15–17.	Mounts components.....	2Z9412.97
	*	*	BOARD, terminal: 34 Zierick No. 195 solder lug term; Bakelite; 5⅝" lg x 1½" wd x 7/16" thk over-all; Times Facsimile part/dwg No. 90–15–16.	Mounts components.....	2Z9434–6
W1	*	*	CABLE ASSEMBLY, special purpose: 12 No. 18 AWG stranded copper cond, vinylite ins, color coded, 600 vdcw, shielded, cotton braid, vinylite jacket, 11/16" diam; 50" lg excluding term; modified Jones HB plug No. S–412CCT one end, other end fanned for connection to term strip Times Facsimile part/dwg No. 26–15–08.	W1—Connects rectifier power unit to transceiver.	3E4039–3
	*	*	CABLE, power: Sig C Cordage CO–130; Underwriters type "SJ"; for portable installation; 2 No. 18 AWG stranded copper cond; RI; cotton filler, RC; 600 vdcw; Sig C spec No. 71–700.	Connects rectifier power unit to power line.	3E2130
C5, C10, C11	*	*	CAPACITOR, fixed: mica; 1,000 mmf ±10%; 500 vdcw; max body dimen 53/64" lg x 53/64" wd x 9/32" thk; molded low-loss Bakelite case; 2-wire lead term; JAN type CM30B102K.	C5—V18 grid (pin 4) h-f bypass. C10—Line h-f bypass. C11—Line h-f bypass.	3K3010221
C9	*	*	CAPACITOR, fixed: mica; 1,000 mmf ±10%; 2,500 vdcw; max body dimen 1⅝" lg x 1⅛" wd x 23/64" thk; molded low-loss Bakelite case; 2 solder lug term; JAN type CM45B102K.	C9—T15 secondary peak voltage suppressor.	3K4510221
C1, C2, C3, C4,	*	*	CAPACITOR, fixed: mica; 5,100 mmf ±5%; 500 vdcw; max body dimen 53/64" lg x 53/64" wd x 11/32" thk; molded low-loss Bakelite case; 2-wire lead term; JAN type CM35B512J.	C1—V17 injection grid (pin 4) h-f bypass. C2—V17 input coupling. C3—V17 screen bypass. C4—17 plate output coupling.	3K3551222
C7	*	*	CAPACITOR, fixed: paper; 50,000 mmf ±10%; 600 vdcw; herm sealed metal case; max body dimen 1 13/16" lg x 11/16" diam; 2-wire lead term; JAN type CP26A1EF503K.	C7—V1 grid (pin 6) control voltage filter.	3DA50–224

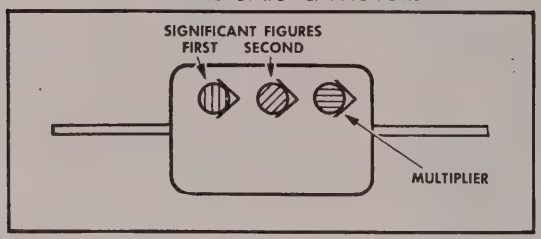
Ref symbol	Models		Name of part and description	Function of part	Signal Corps stock No.
	PP-86/TXC-1	PP-86A/TXC-1			
C6, C8	*	*	CAPACITOR, fixed: paper; 100,000 mmf +40% −15%; 600 vdcw; herm sealed metal case; max body dimen 1¾" lg x 11/16" diam; 2-wire lead term; JAN type CP26A1EF104X.	C6—V18 cathode bypass. C8—V21 operating voltage filter.	3DA100-601
C12, C13, C14	*	*	CAPACITOR, fixed: paper; 2 mf +40% −15%; 1,000 vdcw; herm sealed metal case; max body dimen 2⅞" lg x 1½" wd; single No. 10-32 stud term; JAN type CP40C2FG205X.	C12—B+ filter. C13—B+ filter. C14—B+ filter.	3DB2-149
	*	*	CONNECTOR, plug: 2 flat parallel male blades; straight; 10 amp, 250 v, 15 amp, 125 v; round rubber body; cable opening 0.296"-0.562"; includes cable grip; Hubbell No. 9754.	Power line plug.....	6Z1735
	*	*	CONNECTOR, plug: 12 flat parallel female cont, polarized; straight; 2 13/16" lg x 1 3/16" wd x 1 3/16" thk over-all less cable clamp; 10 amp, 110 v; rectangular Bakelite body; Jones HB No. S-412CCT.	Transceiver plug	2Z8682.3
	*	*	COVER: dust; canvas; 12½" lg x 10½" wd x 10" h; Times Facsimile part/dwg No. 96-15-22.	Protects equipment	3H4497-86
F1	*	*	FUSE, cartridge: 5 amp; 250 v; glass body; ferrule term; 1¼" lg x ¼" diam; Buss type MTH.	Power line fuse.....	3Z2605.2
E1	*	*	HOLDER, fuse: extractor post; for single 3 AG fuse; phenolic; 250 v, 10 amp max; 2⅛" lg x 11/16" diam; 2 solder lug term; Littelfuse No. 341001.	Holds fuse	3Z3275
	*		LAMPHOLDER: miniature bayonet; brass shell; 1 amp, 250 v; 1 7/16" lg x 1¼" diam; two 5/32" mtg holes on 1" ctr; polarized; Culver-Stearns No. 414B.	Socket for V23.....	2Z5883-156
T13	*	*	REACTOR: filter choke; 10 hy, 200 ma max; 100 ohms DC resistance; 1,000 v RMS test; herm sealed metal case; 3 1/16" lg x 2 9/16" wd x 3 5/8" h over-all; 2 Wheaton No. 301 term on top; Kenyon No. T-152.	T13—B+ output filter.....	3C369-1
T12	*	*	REACTOR: swinging choke; 3-10 hy, 250-30 ma; 100 ohms DC resistance; 1,000 v RMS test; herm sealed metal case; 4½" lg x 3" wd x 3⅞" h over-all; 2 Wheaton No. 301 term on top; Kenyon No. T-501.	T12—B+ input filter.....	3C369
R16	*	*	RESISTOR, fixed: wire wound; 310 ohms ±5%; 5 w; max body dimen 2" lg x 19/32" diam; JAN type RW32E311.	R16—V19 and V20 cathode.	3RW21311
R6	*	*	RESISTOR, fixed: composition; 1,000 ohms ±10%; ½ w; max body dimen 0.655" lg x 0.249" diam; JAN type RC21BF102K.	R6—V17 cathode	3RC21BF102K
R7	*	*	RESISTOR, fixed: composition; 3,000 ohms ±5%; ½ w; max body dimen 0.655" lg x 0.249" diam; JAN type RC21BF302J.	R7—V18 cathode (pin 2)...	3RC21BF302J

Ref symbol	Models		Name of part and description	Function of part	Signal Corps stock No.
	PP-86/TXC-1	PP-86A/TXC-1			
R8	*	*	RESISTOR, fixed: composition; 51,000 ohms ±5%; 1 w; max body dimen 0.655″ lg x 0.249″ diam; JAN type RC31BF513J.	R8—V21 operating voltage filter.	3RC31BF513J
R9	*	*	RESISTOR, fixed: composition; 75,000 ohms ±5%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; JAN type RC21BF753J.	R9—V21 grid voltage divider.	3RC21BF753J
R1, R2	*	*	RESISTOR, fixed: composition; 10,000 ohms ±10%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; JAN type RC21BF104K.	R1—V17 grid voltage divider. R2—V17 injection grid (pin 4).	3RC21BF104K
R9		*	RESISTOR, fixed: composition; 200,000 ohms ±5%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; JAN type RC21BF204J.	R9—V21 grid voltage divider.	3RC21BF204J
R4, R5, R13	*	*	RESISTOR, fixed: composition; 240,000 ohms ±5%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; JAN type RC21BF244J.	R4—V17 plate load. R5—V18 grid. R13—V23 bleeder.	3RC21BF244J
R14	*	*	RESISTOR, fixed: composition; 240,000 ohms ±5%; 1 w; max body dimen 1.28″ lg x 0.310″ diam; JAN type RC31BF244J.	R14—V21 grid voltage divider.	3RC31BF244J
R3, R10	*	*	RESISTOR, fixed: composition; 510,000 ohms ±5%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; JAN type RC21BF514J.	R3—V17 screen. R10—V17 control grid (pin 6) filter.	3RC21BF514J
R11, R12	*	*	RESISTOR, fixed: composition; 1 meg ±10%; ½ w; max body dimen 0.655″ lg x 0.249″ diam; JAN type RC21BF105K.	R11—V21 plate load. R12—V21 screen.	3RC21BF105K
R15	*	*	RESISTOR, variable: wire wound; 50,000 ohms ±10%; 3 w; 3 solder lug term; inclosed phenolic case 1⅝″ diam x ¾″ d; metal shaft ¼″ diam x ⅞″ lg from mtg surface; linear taper; ins cont arm; mts w/ ⅜″–32 x ⅜″ thk bushing; non-turn device located on $^{17}/_{32}$″ radius at 9 o'clock; Clarostat No. 1–1708–B.	R15—V21 grid voltage control (controls output to exciter lamp).	3Z7450–69
X2	*	*	SOCKET, tube: 4 cont medium; under chassis one piece saddle mtg; body 1⅜″ OD x ⅜″ h; phosphor-bronze silver pl cont; Natl Co No. CIR–4.	X2—Socket for V22.....	2Z8757.3
X23		*	SOCKET, tube: 7 cont miniature; one piece saddle mtg; round ceramic body 0.805″ diam max x ¾″ h less cont; beryllium copper cont, silver pl; marked SO11C; metal shock shield; JAN type SO11C.	X23—Socket for V23.....	2Z8677.100
X1	*	*	SOCKET, tube: loctal; 2 piece saddle mtg; round ceramic body, $1^{13}/_{16}$″ lg x 1¼″ wd x ⅜″ thk over-all excluding term; phosphor-bronze silver pl cont; Eby No. 7790.	X1—Socket for loctal tubes.	2Z8678.294

Ref symbol	Models PP-86/TXC-1	Models PP-86A/TXC-1	Name of part and description	Function of part	Signal Corps stock No.
T14	*	*	TRANSFORMER, AF: plate coupling type; herm sealed metal case; 2 9/16" lg x 2 1/8" wd x 3 5/16" h over-all; turns ratio pri to 1/2 secd 5:3; freq response 1,800 cps; 5 solder lug term on top; Times Facsimile No. 252 dwg No. 90-11-00.	T14—V18 output	2Z9633.4
T15	*	*	TRANSFORMER, AF: plate coupling type; herm sealed metal case; 2 7/8" lg x 2 1/2" wd x 3 23/32" h over-all; turns ratio 1/2 pri to secd No. 1-1:2, 1/2 pri to secd No. 2-33:1; freq response 1,800 cps; 7 solder lug term on top; Times Facsimile No. 655 dwg No. 90-11-10.	T15—V19 and V20 output.	2Z9635.3
T11	*	*	TRANSFORMER, power: filament and plate type; input 115 v, 60 cyc, single phase; 4 output windings; secd No. 1 625 v ea side of CT, 250 ma, secd No. 2 5 v, 3 amp, secd No. 3 6.5 v 1.75 amp CT, secd No. 4 6.5 v at 6.25 amp CT; 2,250 v ins; air coolant; herm sealed metal case; 5" lg x 5 1/8" wd x 5" h; 13 solder lug term on top; Kenyon S-2O156.	T11—Power transformer	2Z9613.448
V22	*	*	TUBE, electron: JAN-5Z3	V22—Power supply rectifier.	2J5Z3
V19, V20	*	*	TUBE, electron: JAN-7C5	V19—Lamp output amplifier. V20—Lamp output amplifier.	2J7C5
V21	*	*	TUBE, electron: JAN-7L7	V21—Control voltage amplifier.	2J7L7
V18	*	*	TUBE, electron: JAN-7N7	V18—Driver-rectifier	2J7N7
V17	*	*	TUBE, electron: JAN-7S7	V17—First lamp amplifier.	2J7S7
V23	*		TUBE, electron: JAN-1B47	V23—Reference voltage regulator.	2J1B47
V23		*	TUBE, electron: RMA No. 5651	V23—Reference voltage regulator.	2Z5890-16

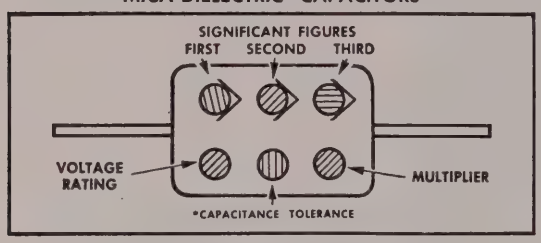
CAPACITOR COLOR CODES

RMA 3-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS

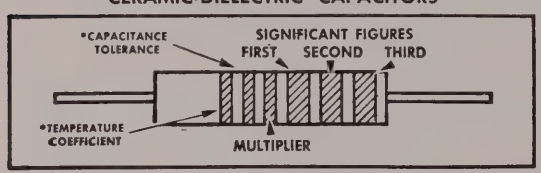


Capacitors marked with this code have a voltage rating of 500 volts.

RMA 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



RMA COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS



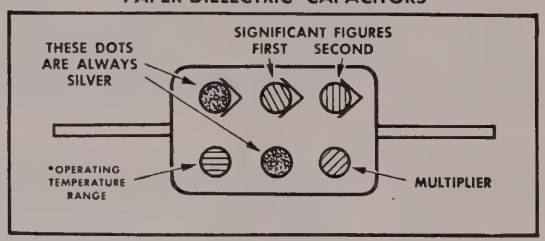
Capacitors marked with this code have a voltage rating of 500 volts.

RMA Radio Manufacturers Association JAN Joint Army Navy

Note These color codes give all capacitances in micromicrofarads.

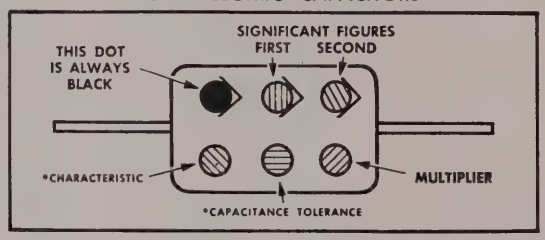
*Items marked with an asterisk are of interest primarily to depot and higher echelon repair personnel

JAN 6-DOT COLOR CODE FOR PAPER-DIELECTRIC CAPACITORS



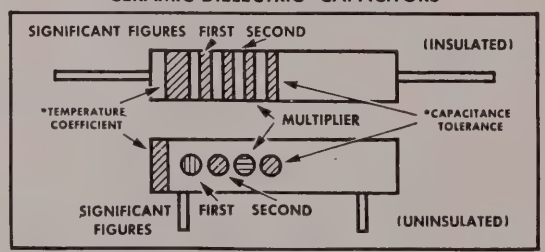
The silver dots serve to identify this marking. For working voltages see JAN type designation code.

JAN 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



The black dot serves to identify this code. For working voltages see JAN type designation code.

JAN COLOR CODE FOR FIXED CERAMIC-DIELECTRIC CAPACITORS



Capacitors marked with this code have a voltage rating of 500 volts. Either the band or dot code may be used.

COLOR	SIGNIFICANT FIGURE	MULTIPLIER			RMA VOLTAGE RATING
		RMA MICA-AND CERAMIC-DIELECTRIC	JAN MICA-AND PAPER-DIELECTRIC	JAN CERAMIC-DIELECTRIC	
BLACK	0	1	1	1	
BROWN	1	10	10	10	100
RED	2	100	100	100	200
ORANGE	3	1,000	1,000	1,000	300
YELLOW	4	10,000			400
GREEN	5	100,000			500
BLUE	6	1,000,000			600
VIOLET	7	10,000,000			700
GRAY	8	100,000,000		0.01	800
WHITE	9	1,000,000,000		0.1	900
GOLD		0.1	0.1		1,000
SILVER		0.01	0.01		2,000
NO COLOR					500

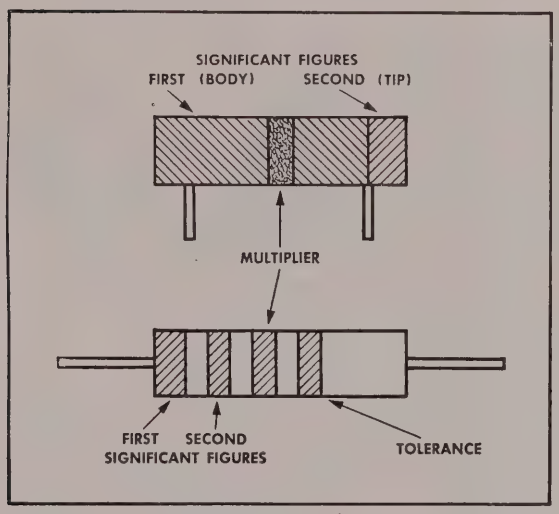
TL 13417 A

858–Ft. Mon.–6-6-45–500

Figure 134. Color codes.

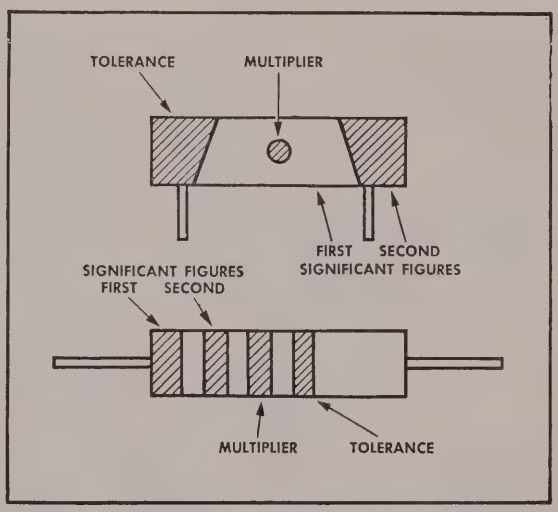
RESISTOR COLOR CODES

RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS



Insulated fixed composition resistors with axial leads are designated by a natural tan background color. Non-insulated fixed composition resistors with axial leads are designated by a black background color.

JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS



Resistors with axial leads are insulated. Resistors with radial leads are uninsulated.

COLOR	SIGNIFICANT FIGURE	MULTIPLIER	TOLERANCE (PERCENT)
BLACK	0	1	
BROWN	1	10	
RED	2	100	
ORANGE	3	1,000	
YELLOW	4	10,000	
GREEN	5	100,000	
BLUE	6	1,000,000	
VIOLET	7	10,000,000*	
GRAY	8	100,000,000*	
WHITE	9	1,000,000,000*	
GOLD		0.1*	5
SILVER		0.01*	10
NO COLOR			20

*JAN ONLY

Example: A 50,000-ohm resistor with a standard tolerance of 20 percent (no color) would be indicated by a green ring (5), a black ring (0), and an orange ring (000)

RMA: Radio Manufacturers Association
JAN: Joint Army-Navy

FL 13418 A

Figure 135. Color codes.

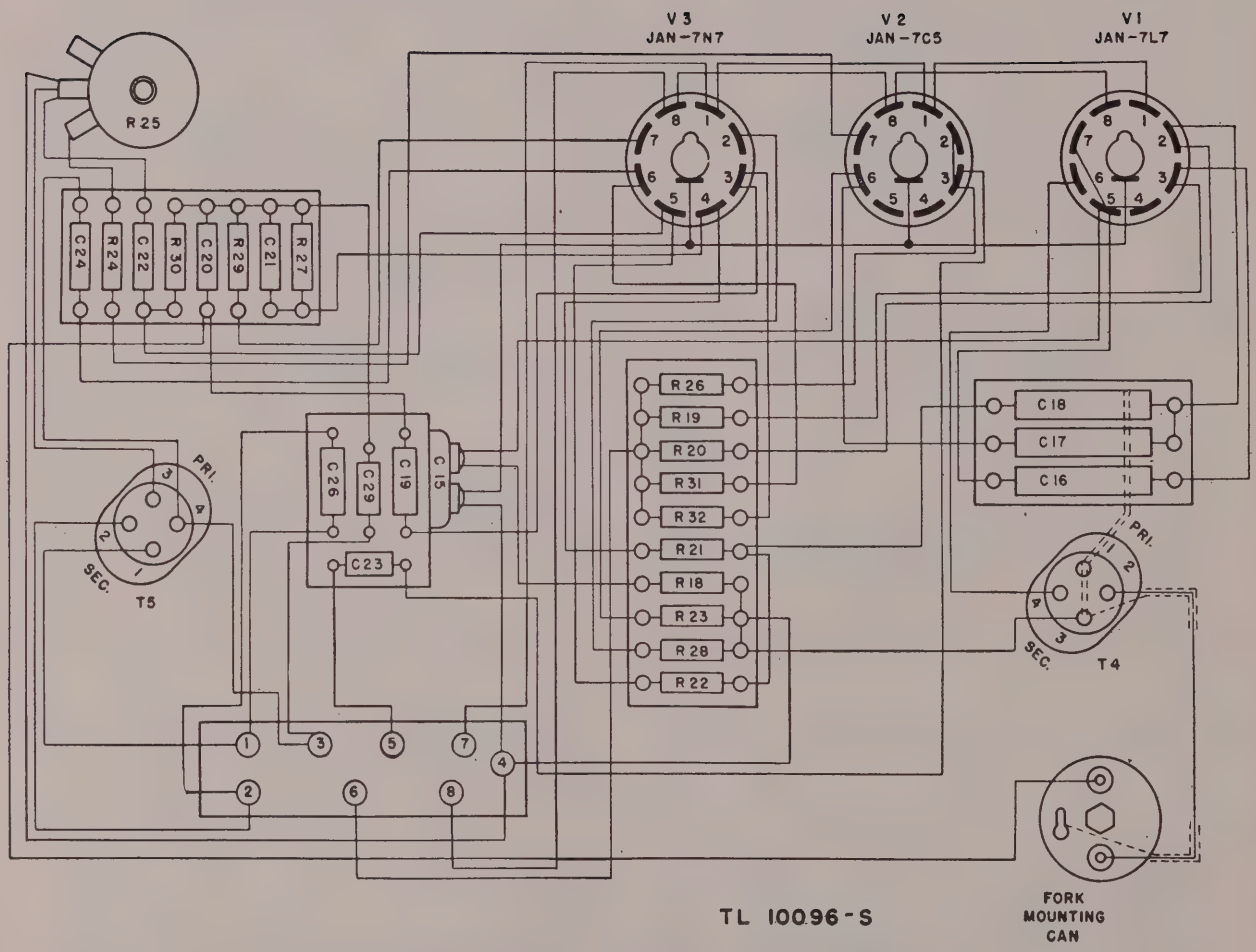


Figure 136. Unsealed fork oscillator unit, wiring diagram.

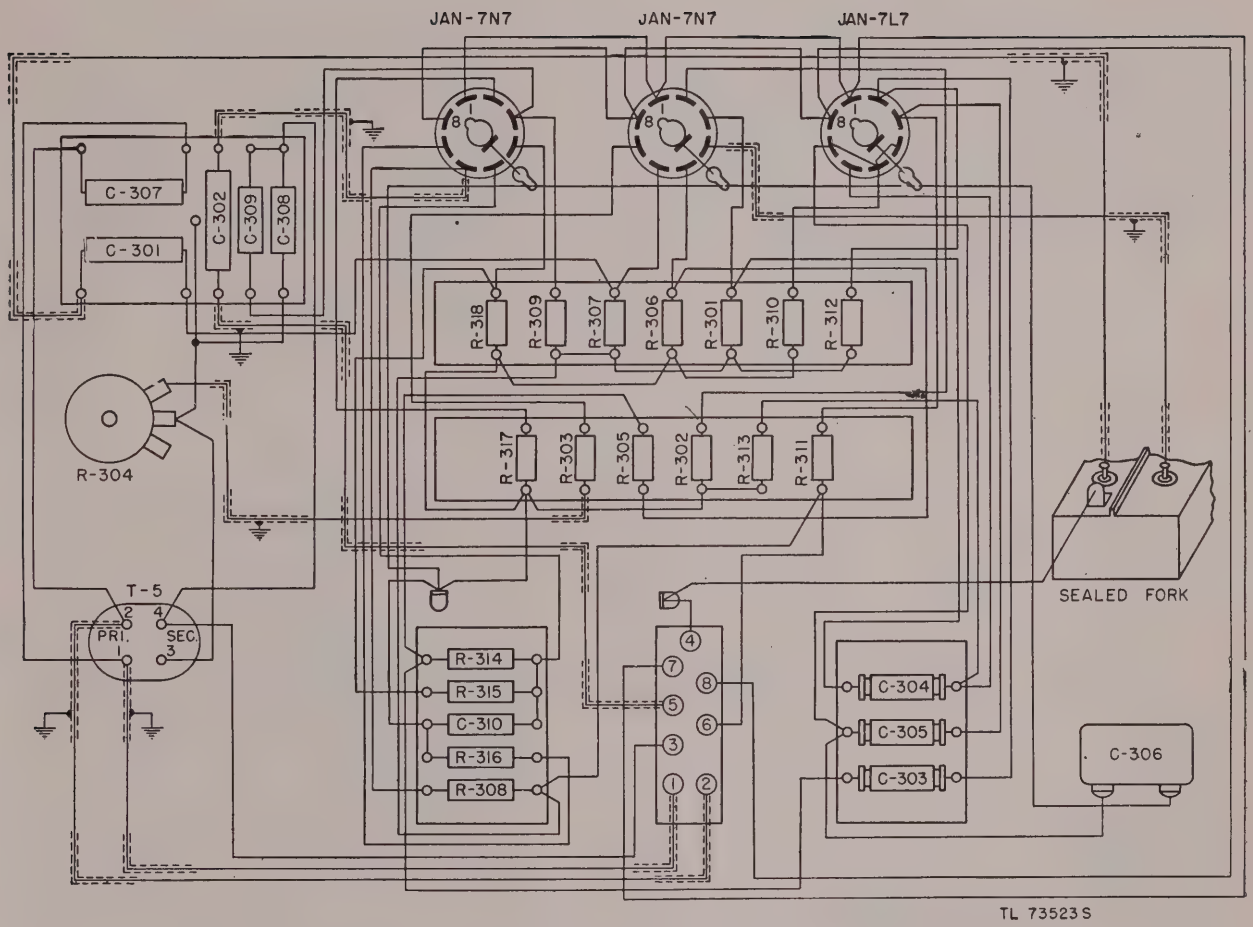


Figure 137. Sealed fork oscillator unit, wiring diagram.

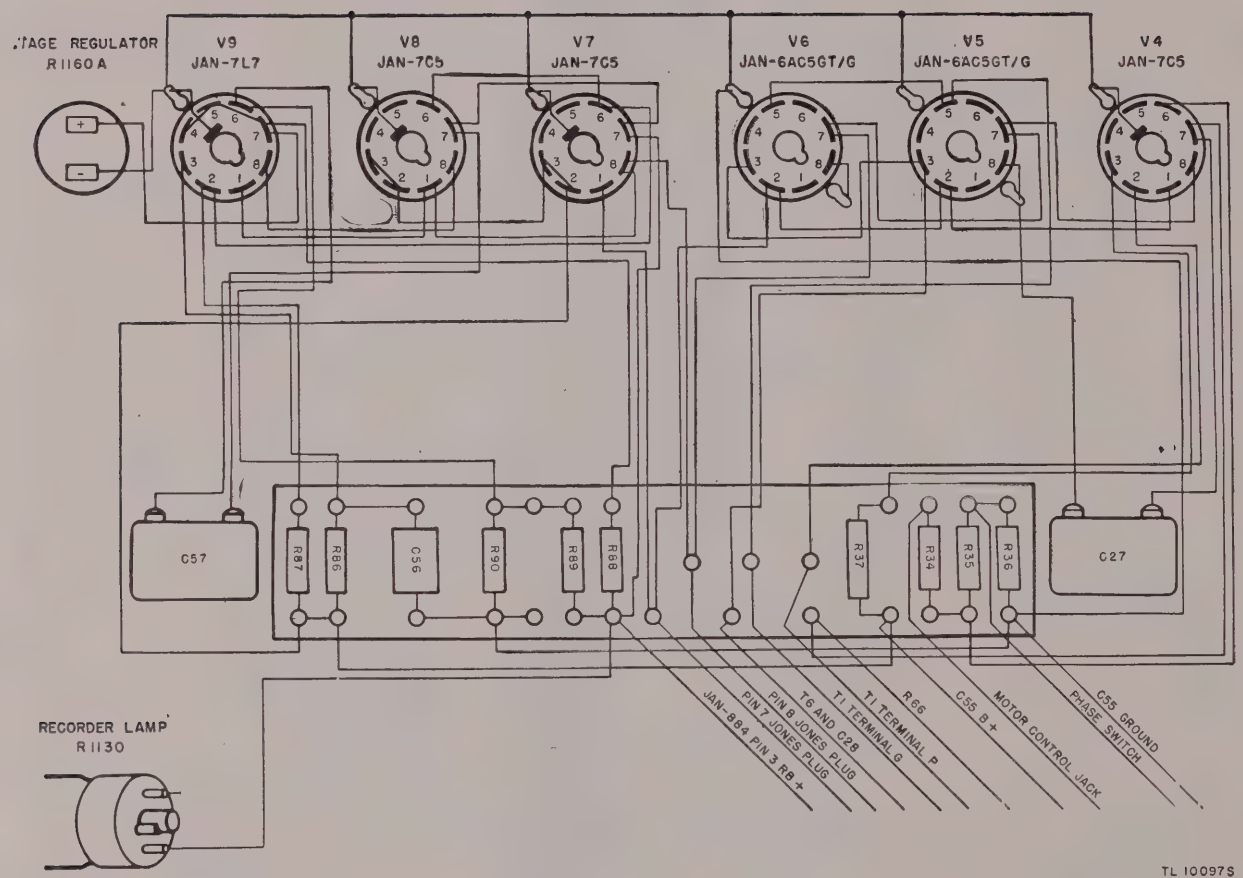


Figure 138. Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1, regulator panel wiring diagram.

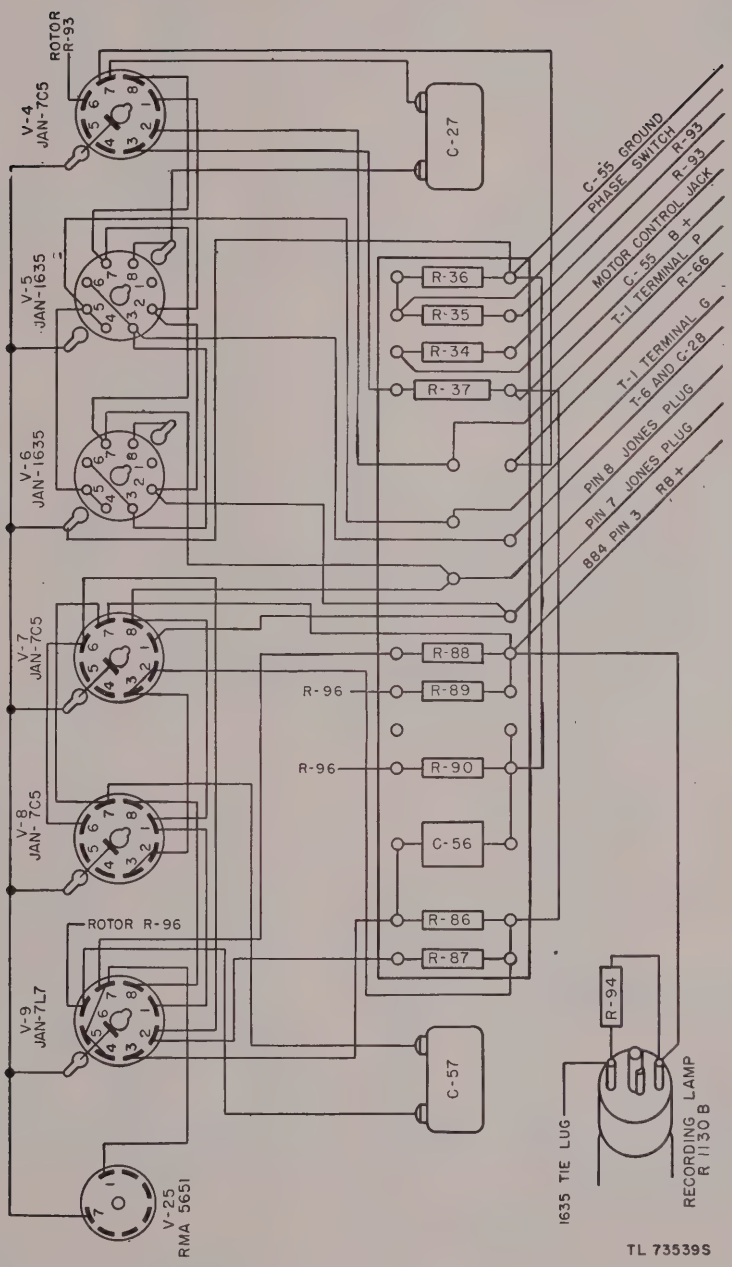


Figure 139. Facsimile Transceiver TT–1B/TXC–1, regulator panel wiring diagram.

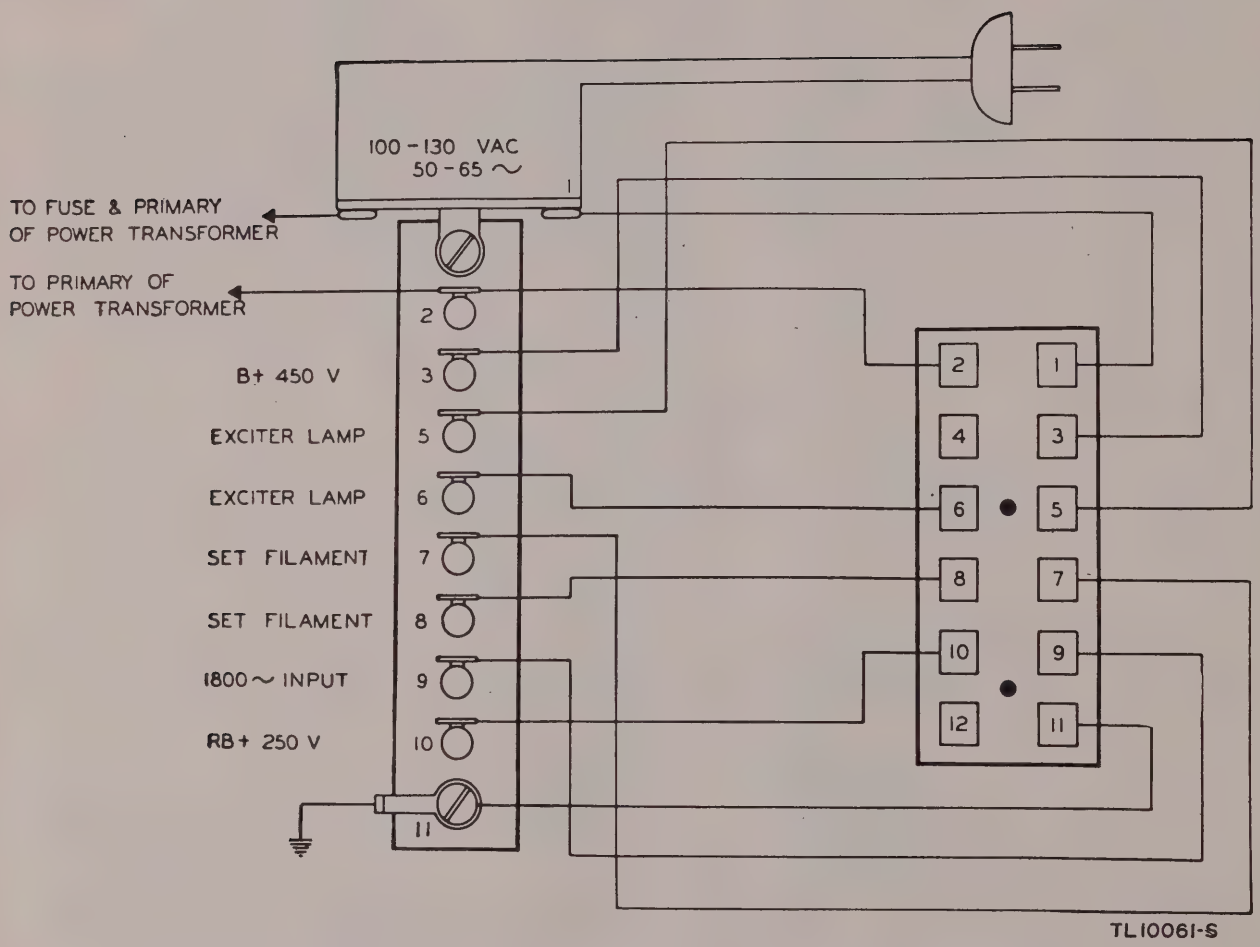


Figure 140. Rectifier Power Unit PP-86/TXC-1, wiring between terminal strip and Jones plug.

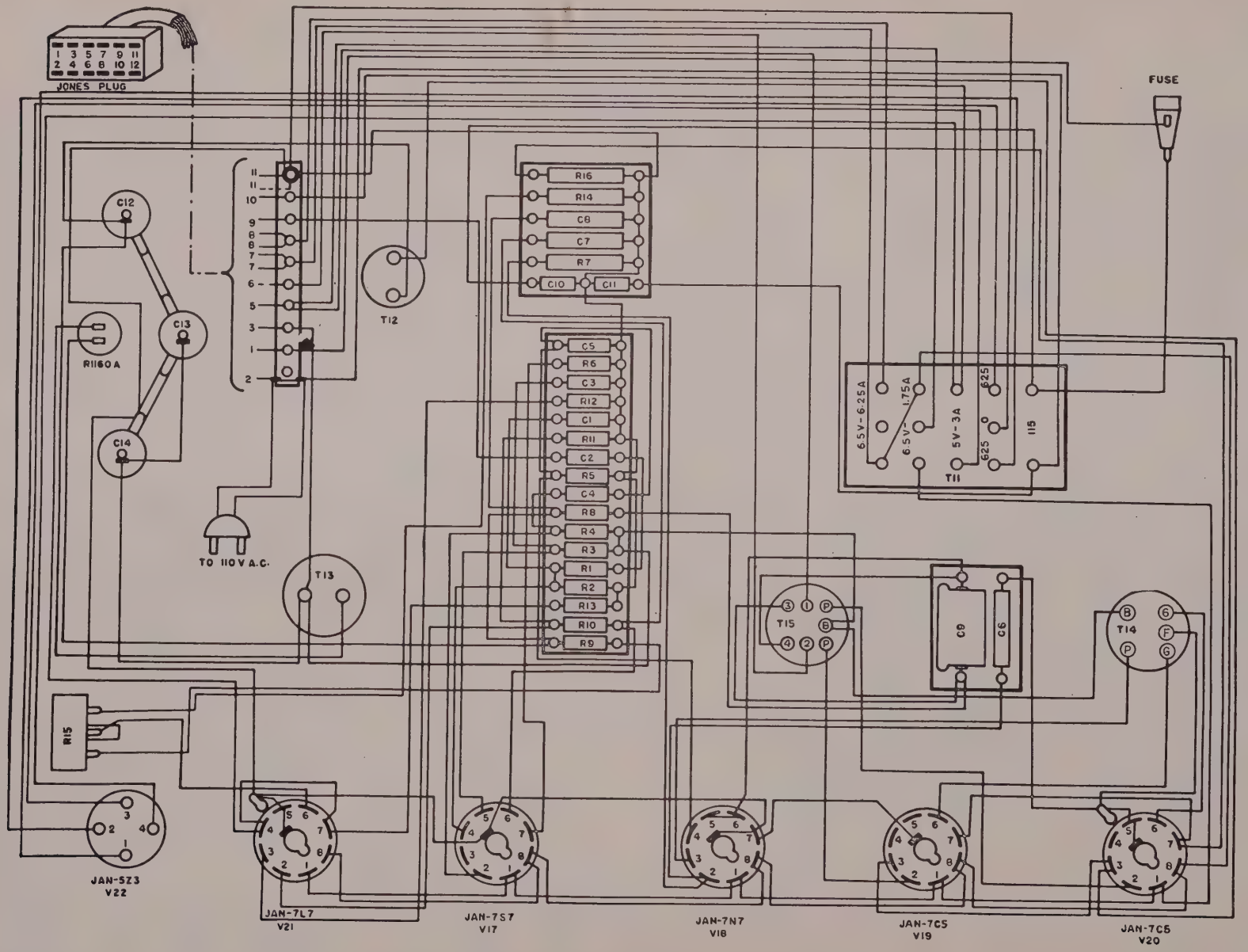


Figure 141. Rectifier Power Unit PP–86/TXC–1, wiring diagram.

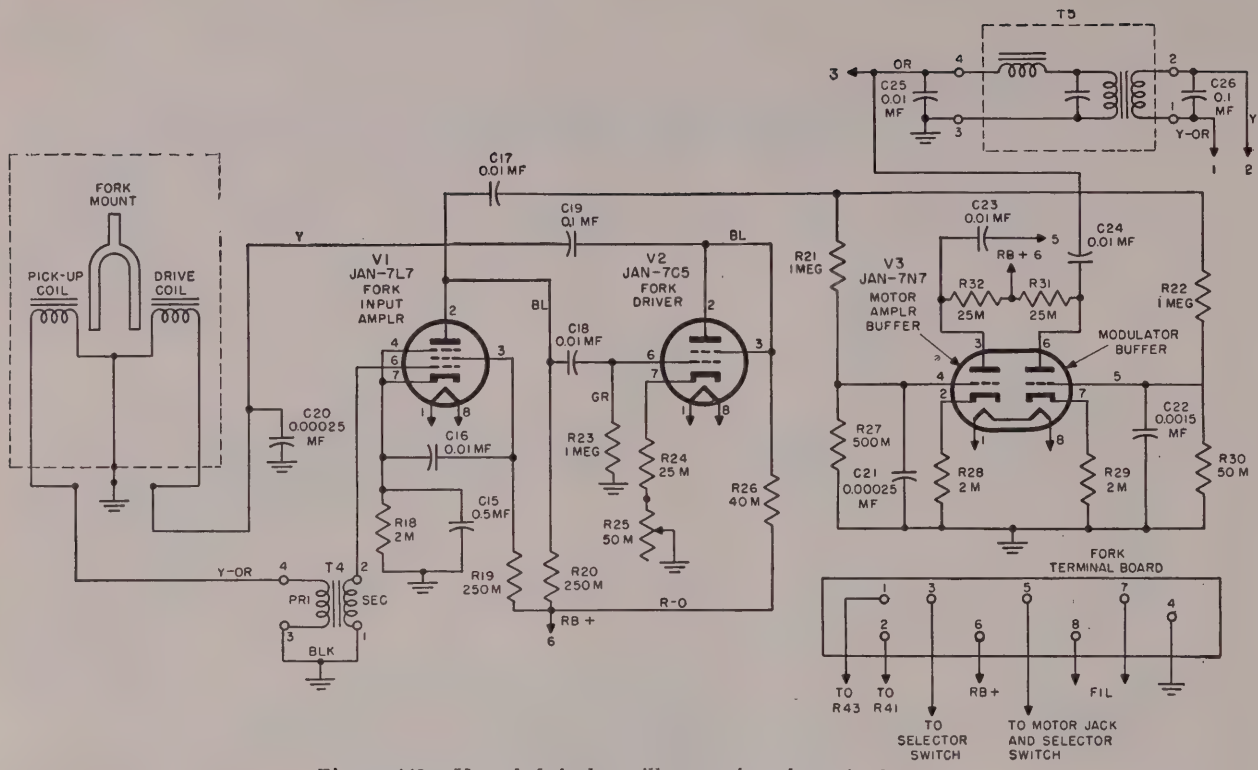
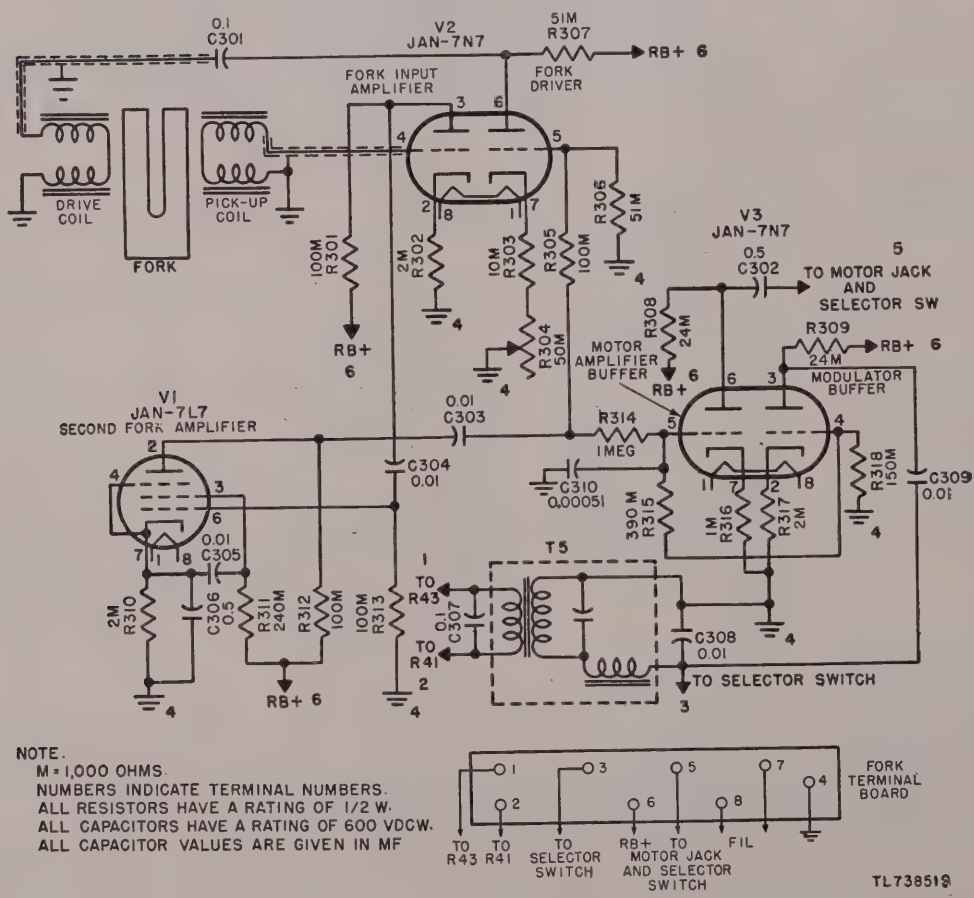


Figure 142. Unsealed fork oscillator unit, schematic diagram.

TL 73852S



TL738519

Figure 143. Sealed fork oscillator unit, schematic diagram.

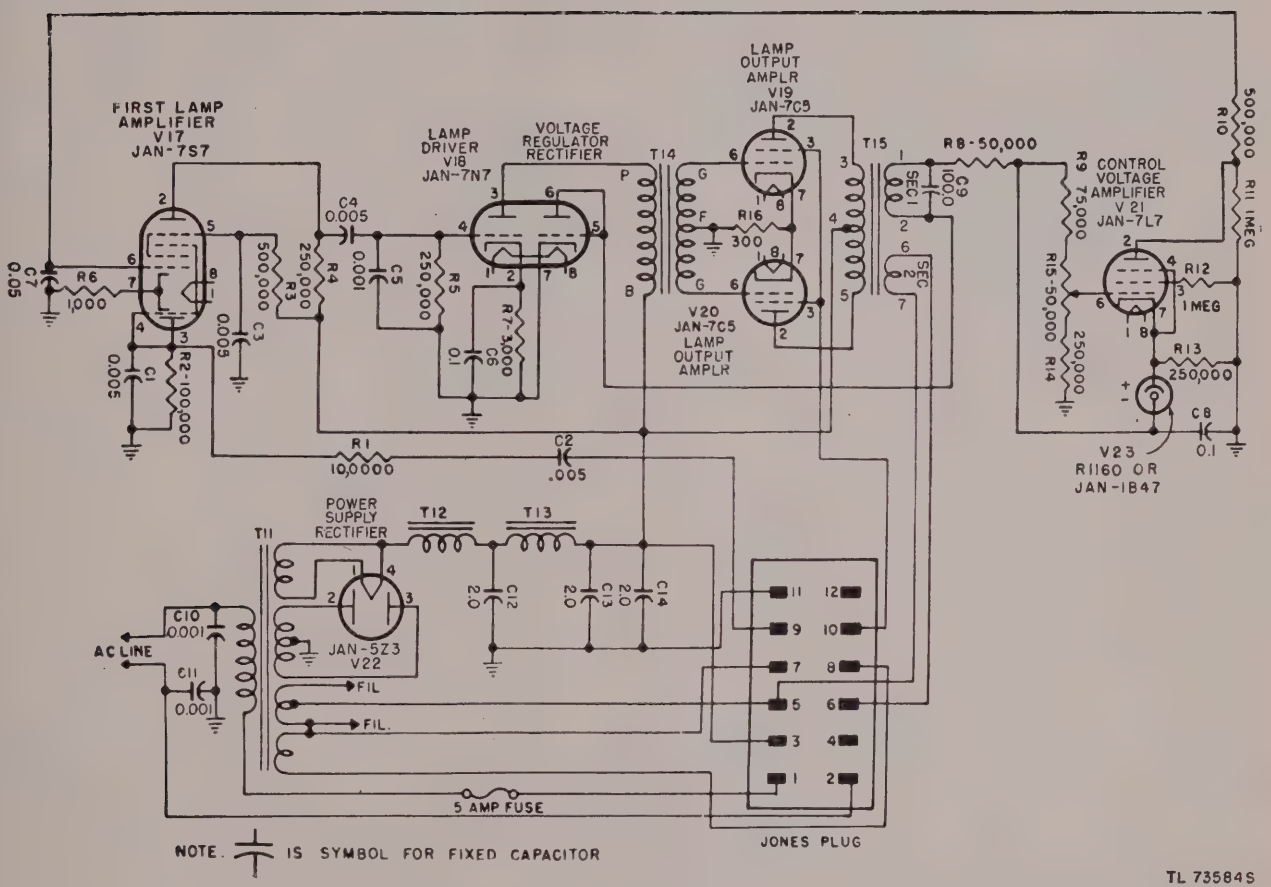


Figure 144. Rectifier Power Unit PP-86/TXC-1, schematic diagram.

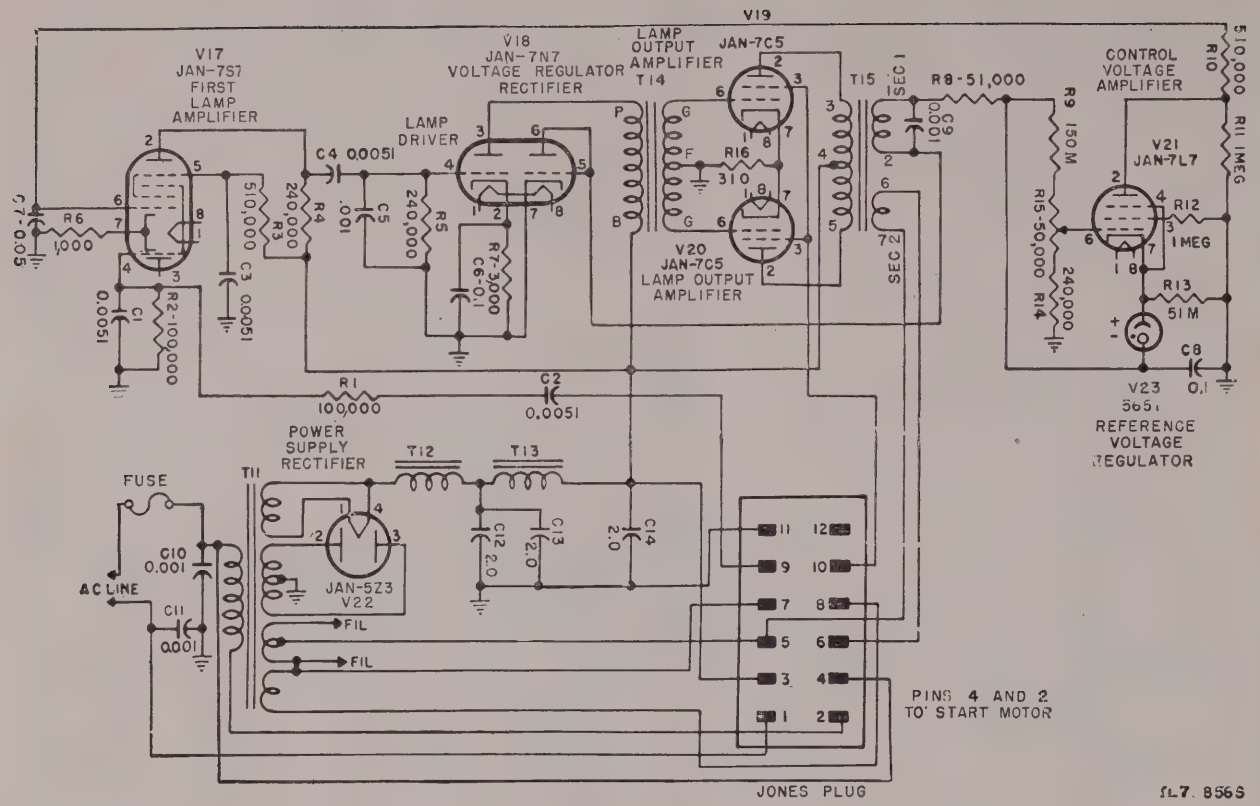


Figure 145. Rectifier Power Unit PP-86A/TXC-1, schematic diagram.

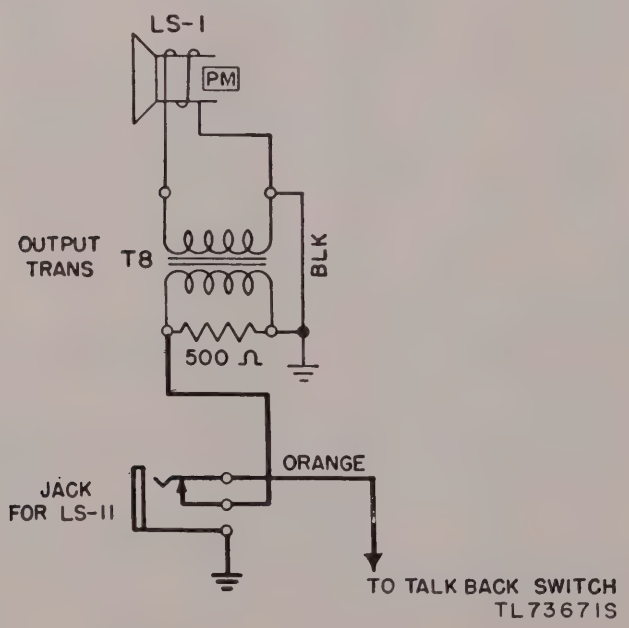
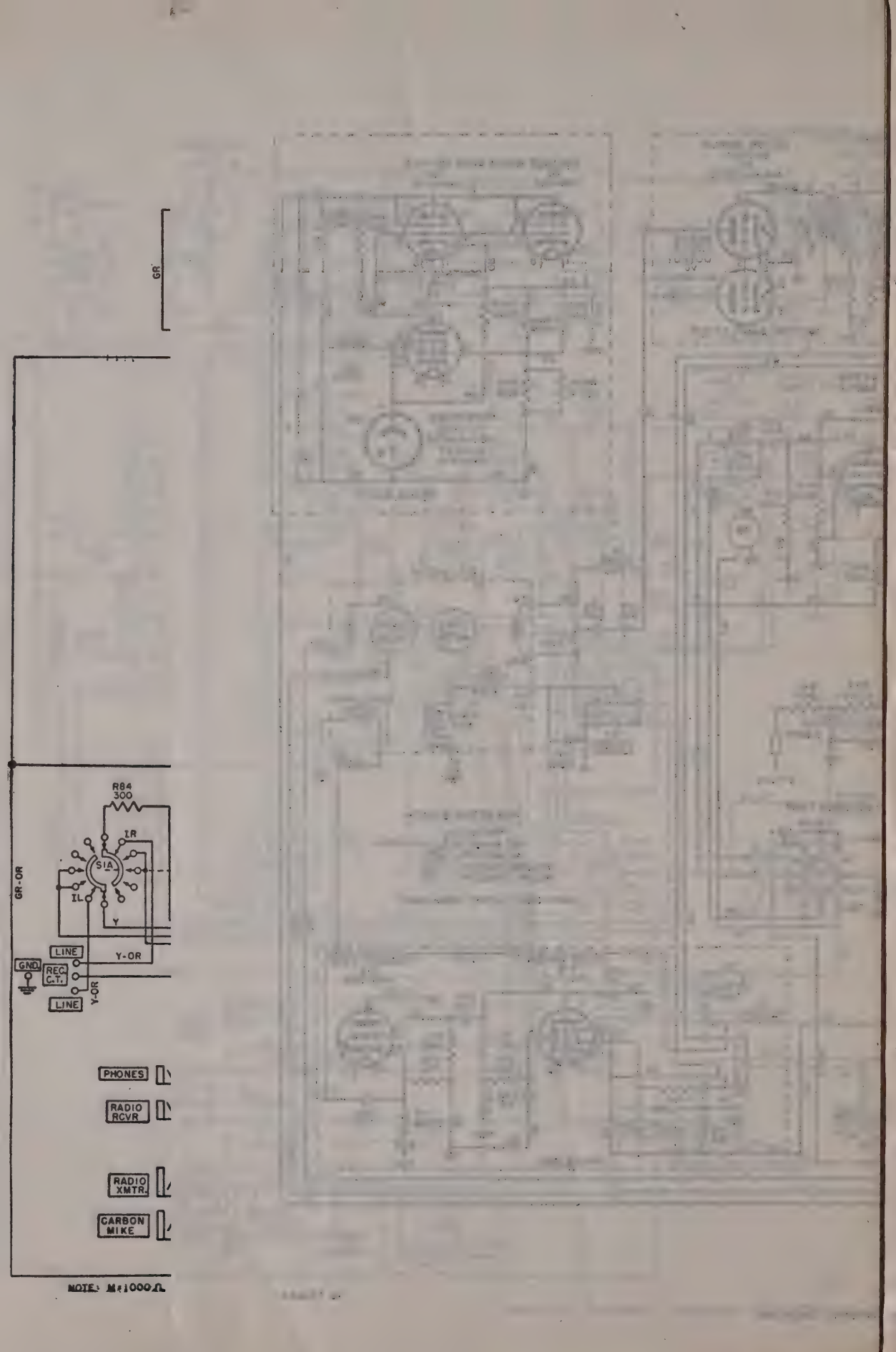


Figure 146. Facsimile Transceiver TT-1A/TXC-1, speaker circuit after application of MWO SIG 11-375B-(1)

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GR
R84
300
IR
S1A
IL
Y
GR-OR
LINE
Y-OR
GND
REC.
C.T.
LINE
Y-OR
PHONES
RADIO
RCVR
RADIO
XMTR.
CARBON
MIKE
NOTE: M=1000Ω

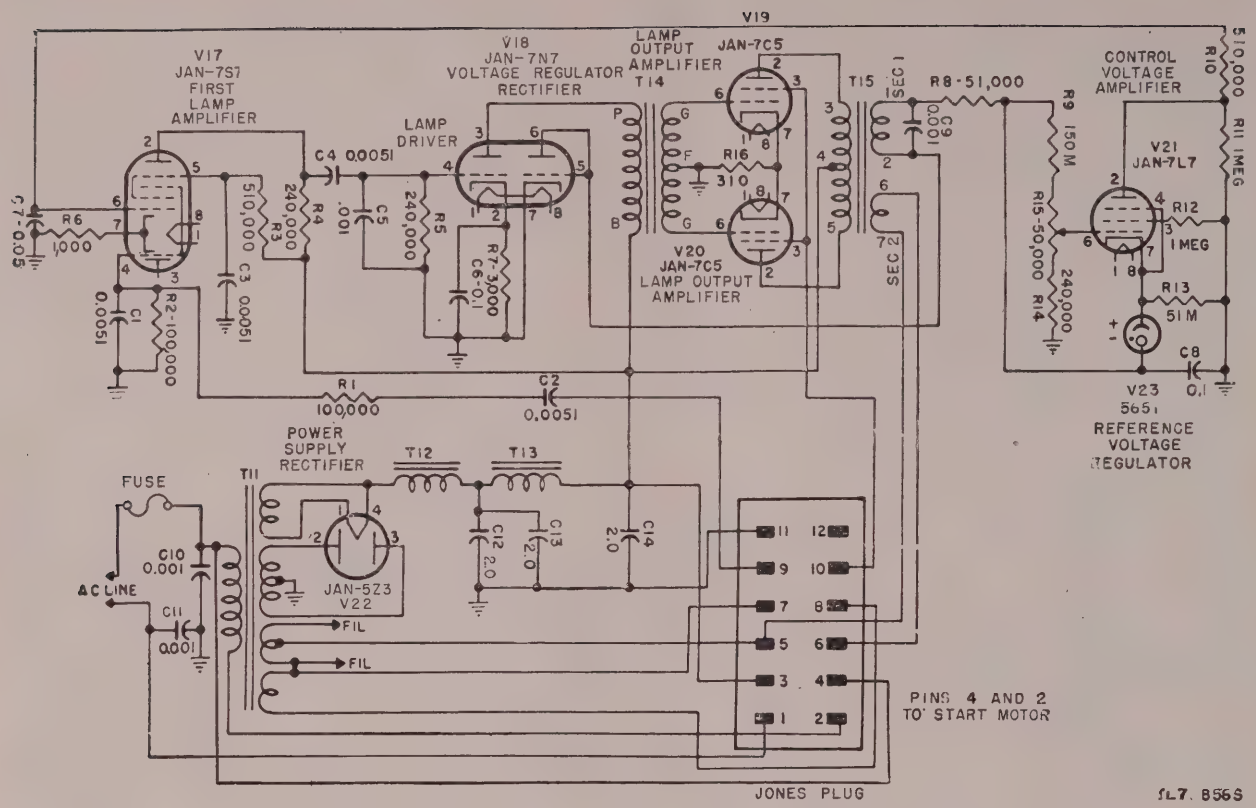


Figure 145. Rectifier Power Unit PP-86A/TXC-1, schematic diagram.

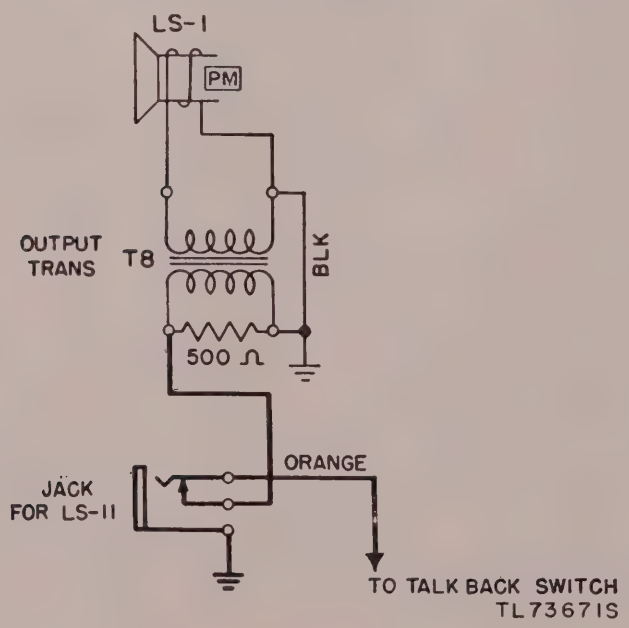
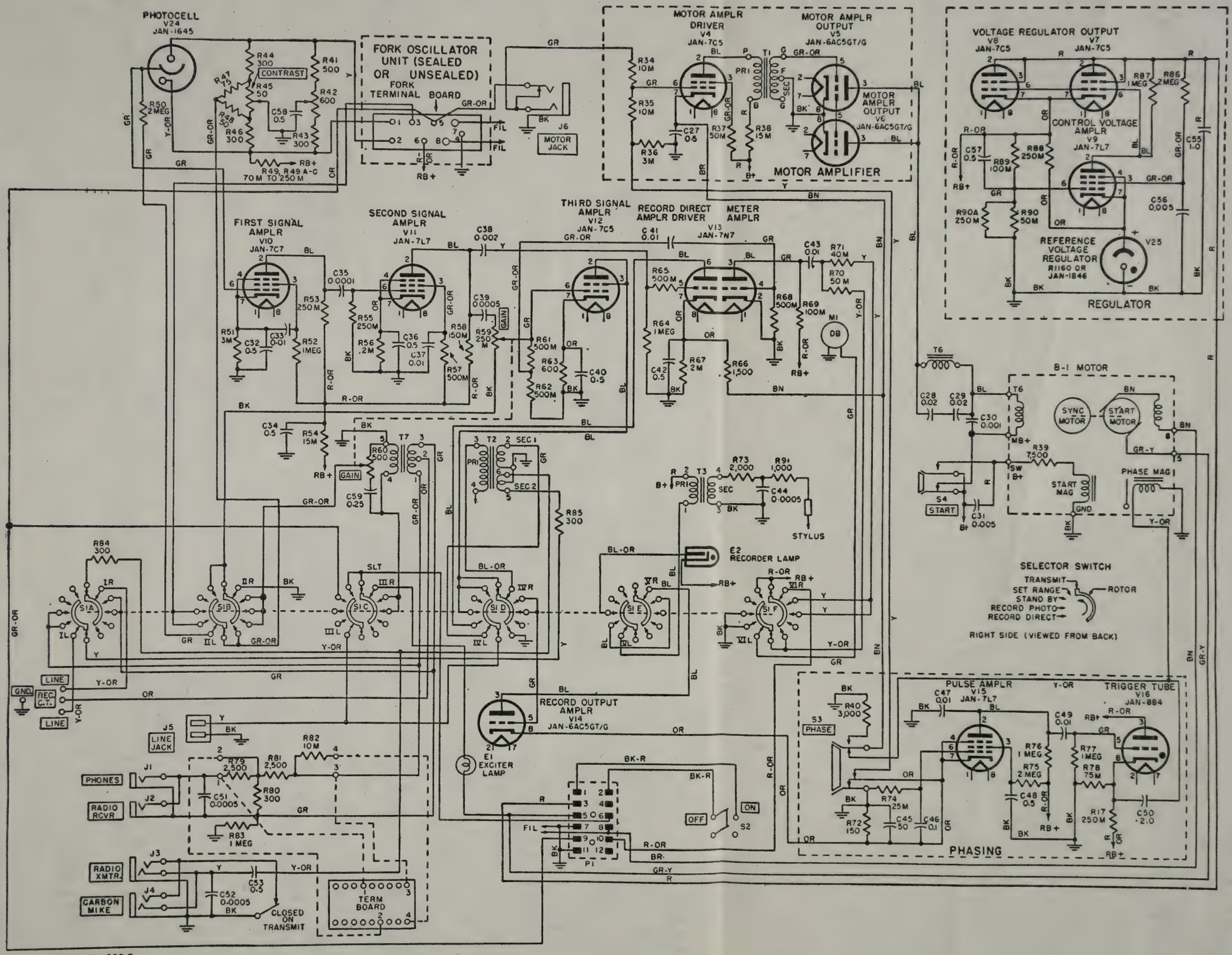


Figure 146. Facsimile Transceiver TT-1A/TXC-1, speaker circuit after application of MWO SIG 11-375B-(1)

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NOTE: M=1000Ω.

Figure 147. Facsimile Transceiver TT-1/TXC-1, schematic diagram.

TL 738668

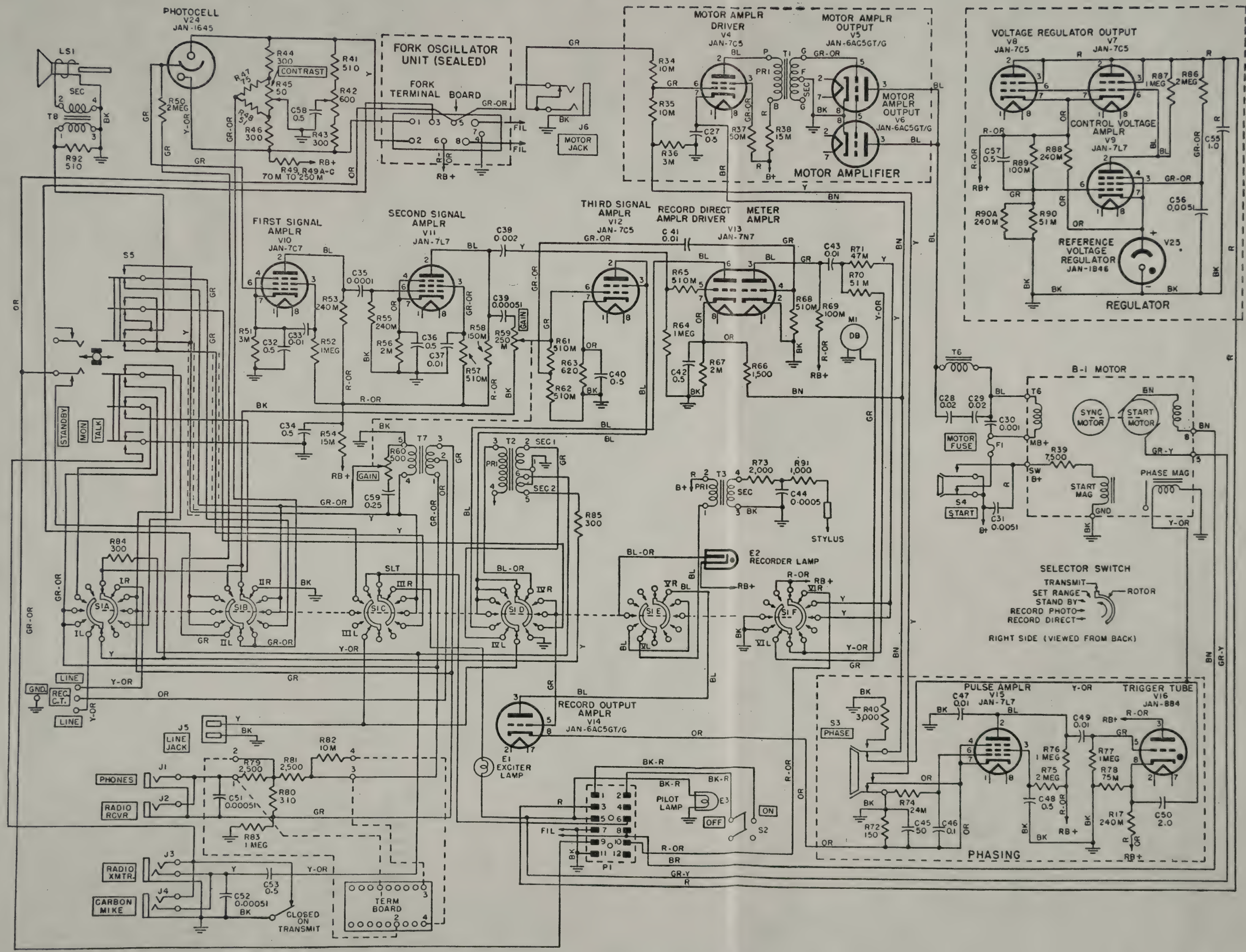


Figure 148. Facsimile Transceiver TT-1A/TXC-1, schematic diagram.

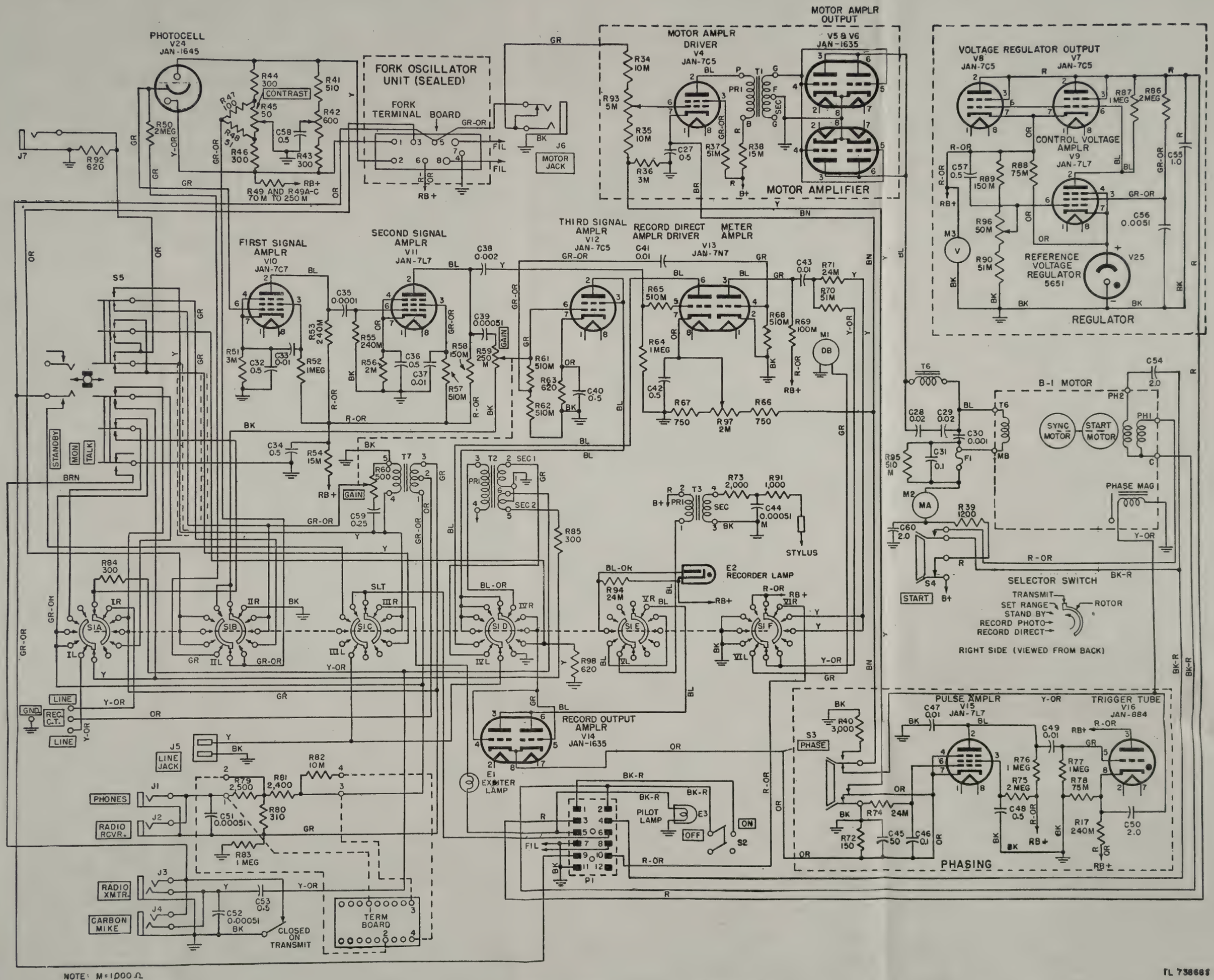


Figure 149. Facsimile Transceiver TT-1B/TXC-1, schematic diagram.

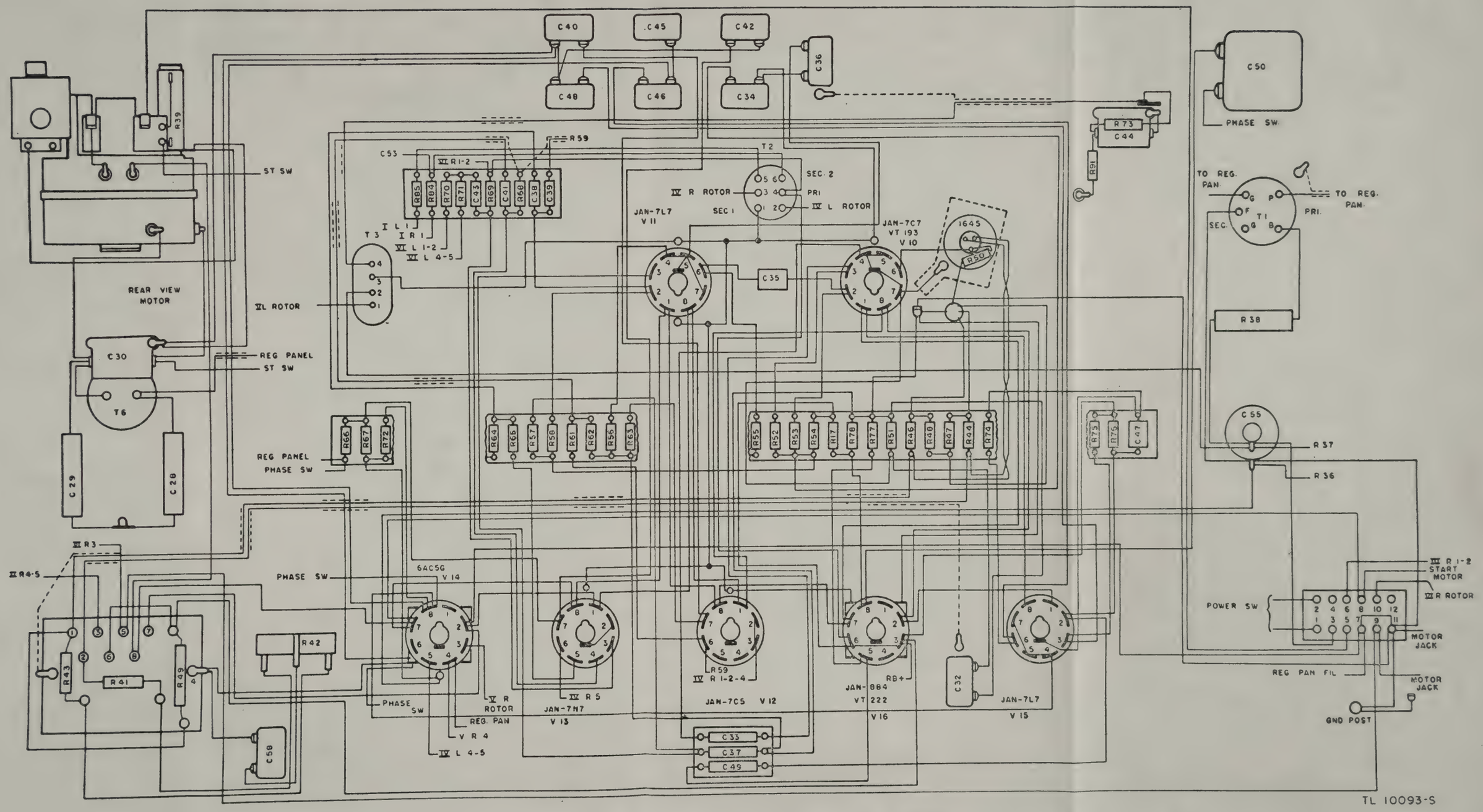


Figure 150. Facsimile Transceiver TT-1/TXC-1, chassis wiring diagram.

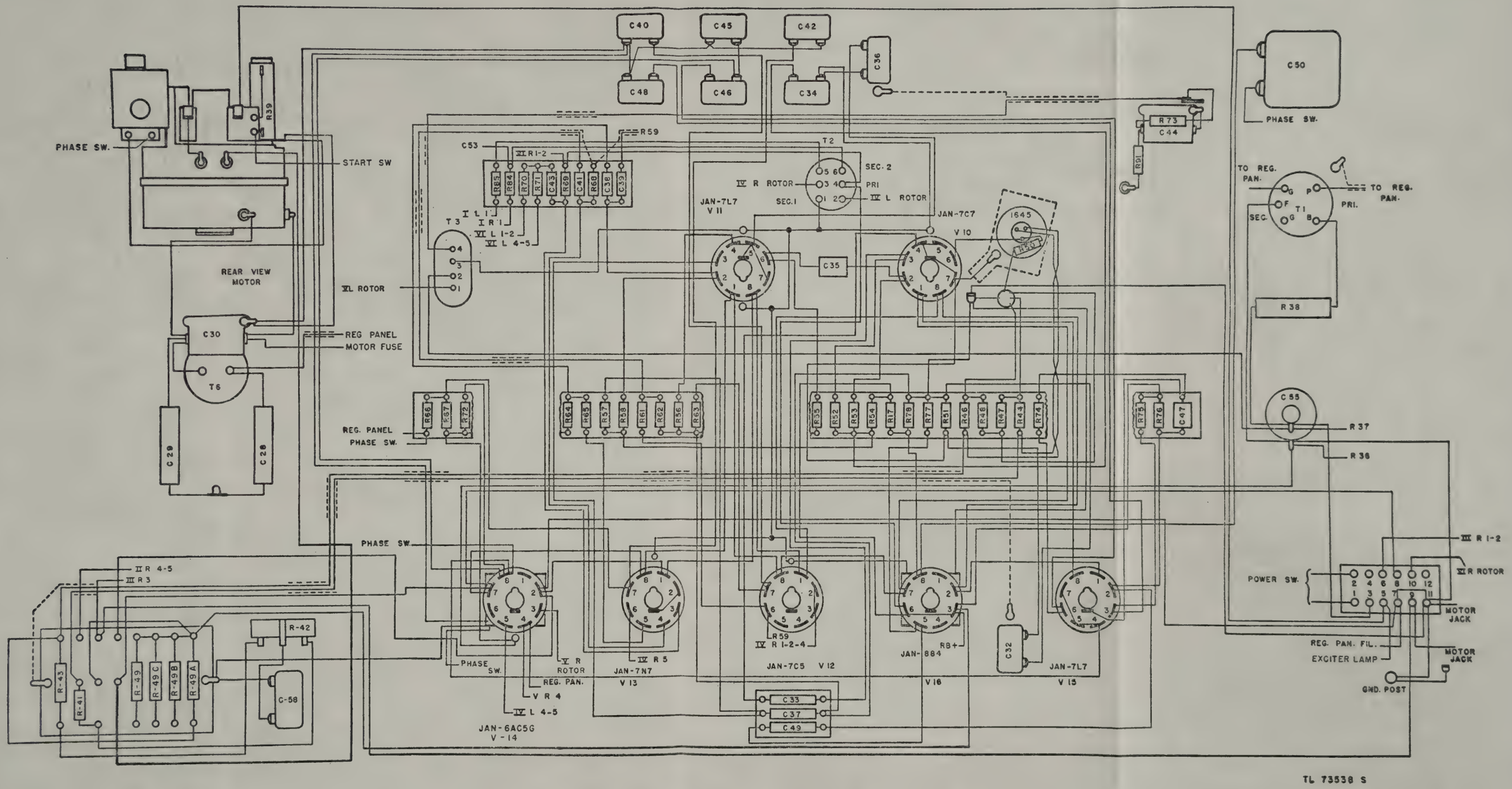


Figure 151. Facsimile Transceiver TT-1A/TXC-1, chassis wiring diagram.

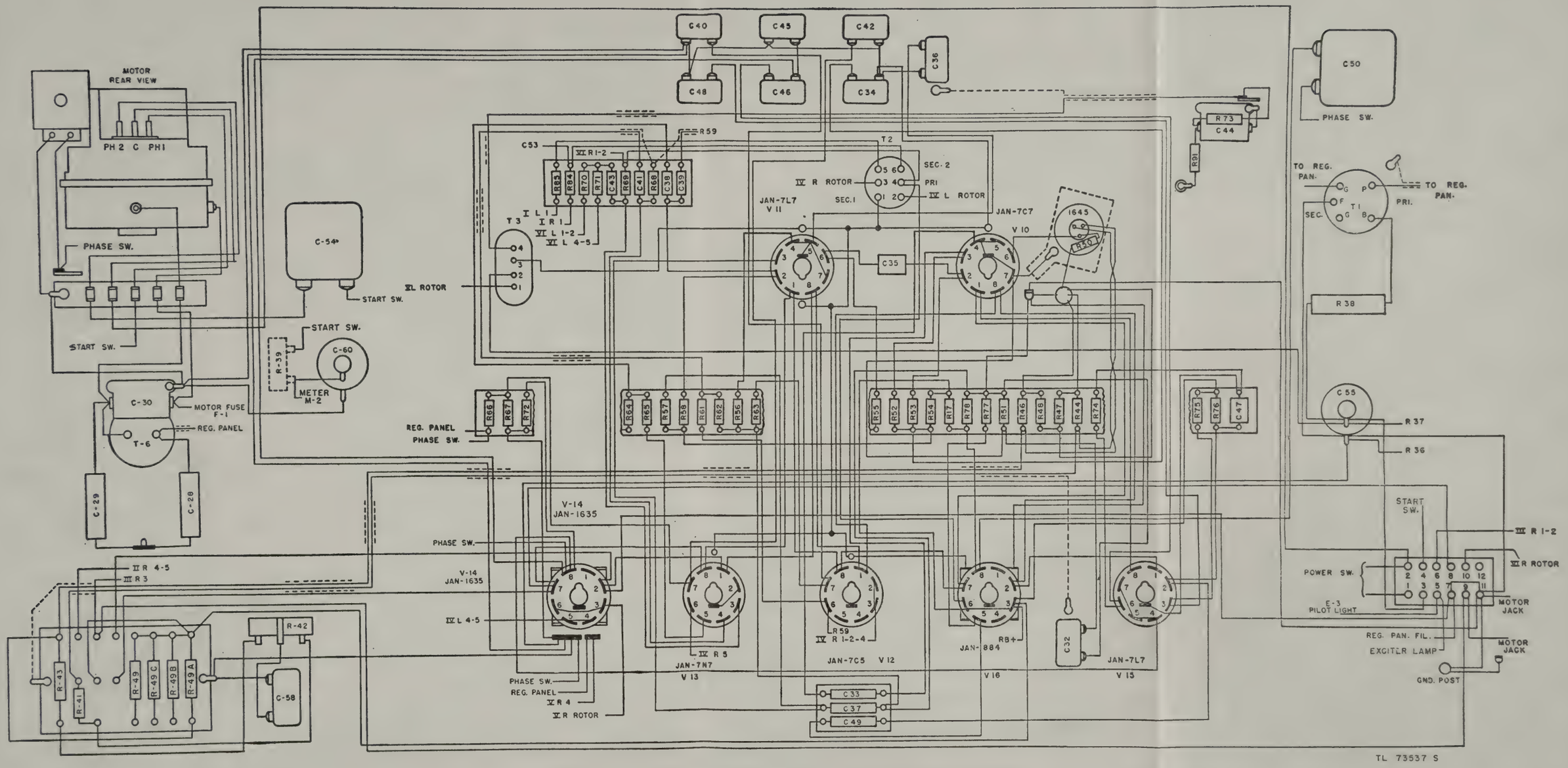


Figure 152. Facsimile Transceiver TT-1B/TXC-1, chassis wiring diagram.

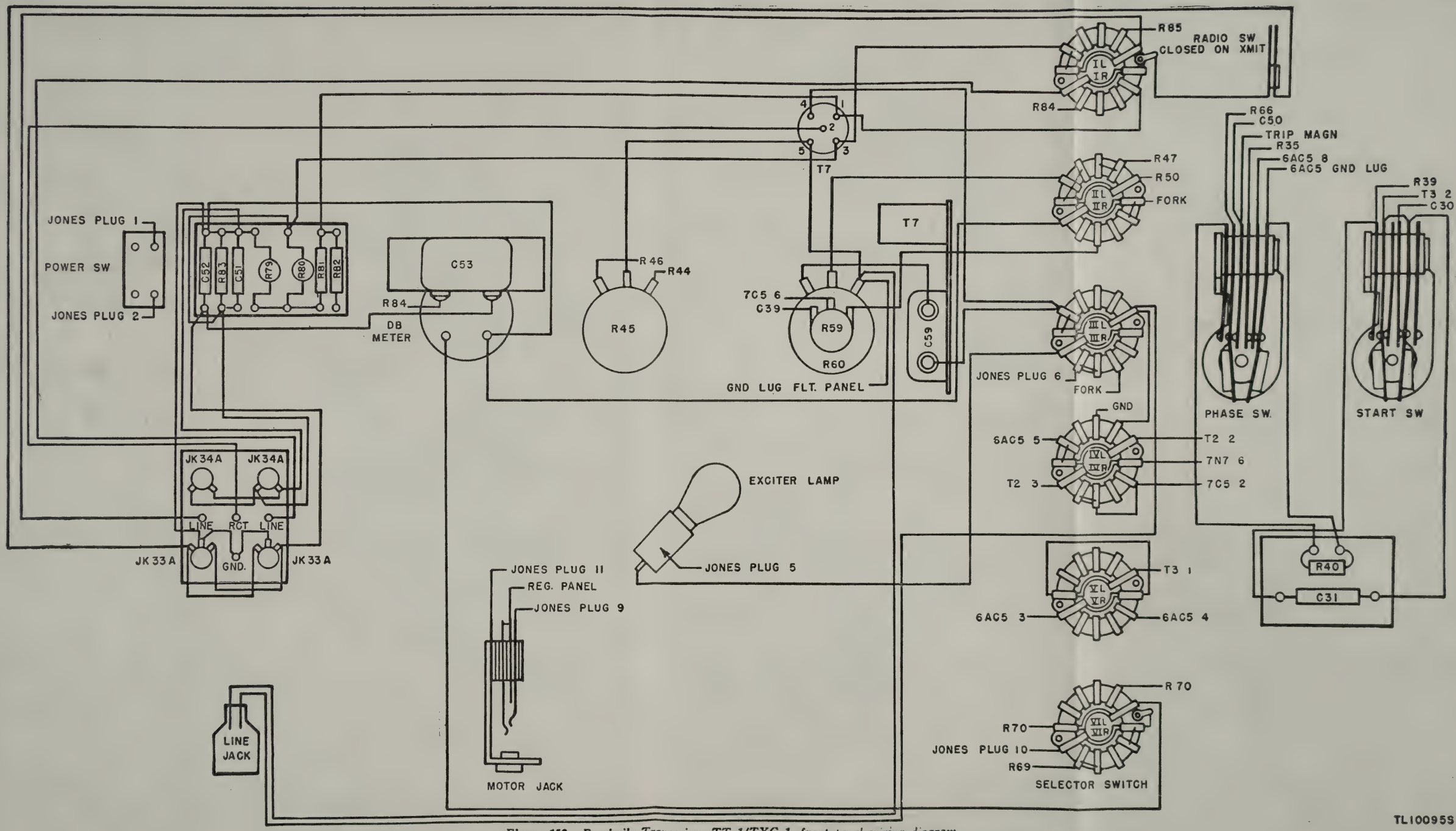


Figure 153. Facsimile Transceiver TT-1/TXC-1, front panel wiring diagram.

TL100955

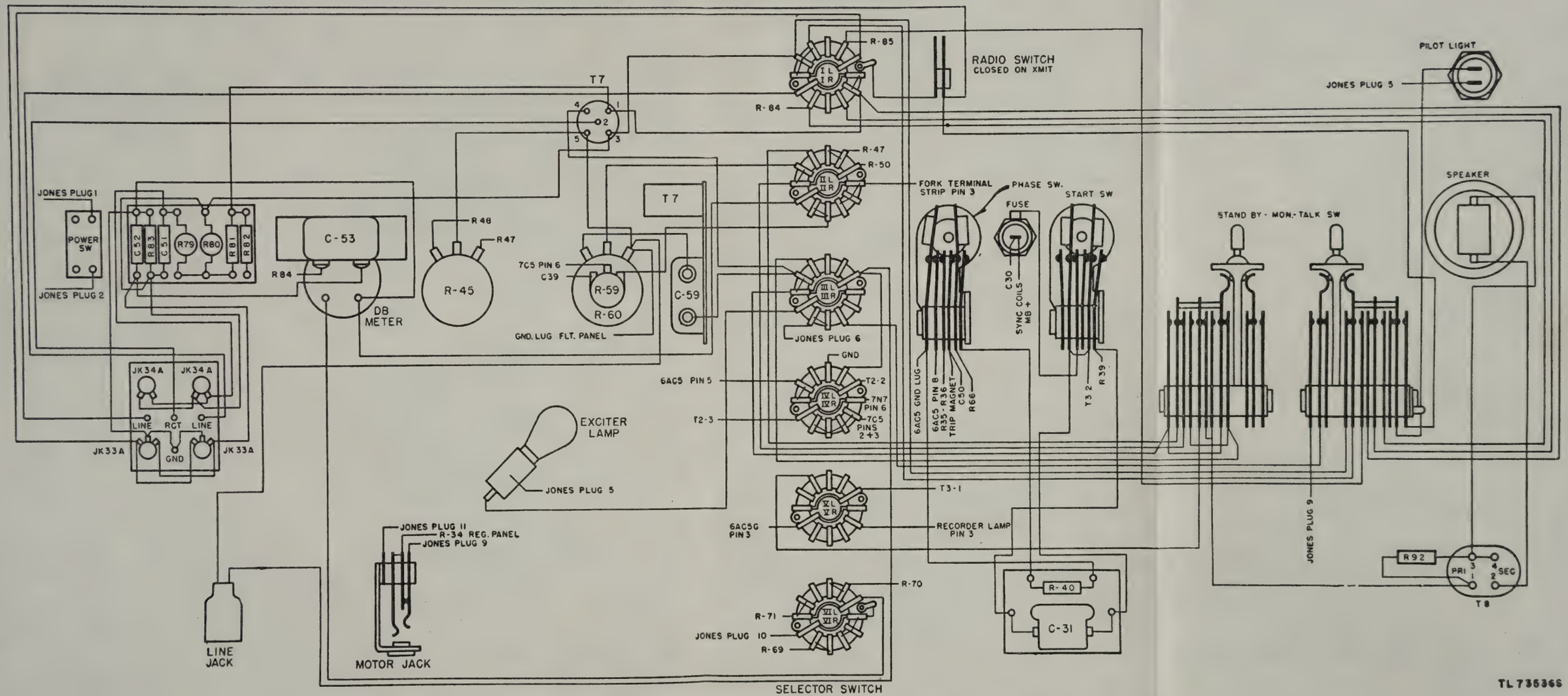


Figure 154. Facsimile Transceiver TT-1A/TXC-1, front panel wiring diagram.

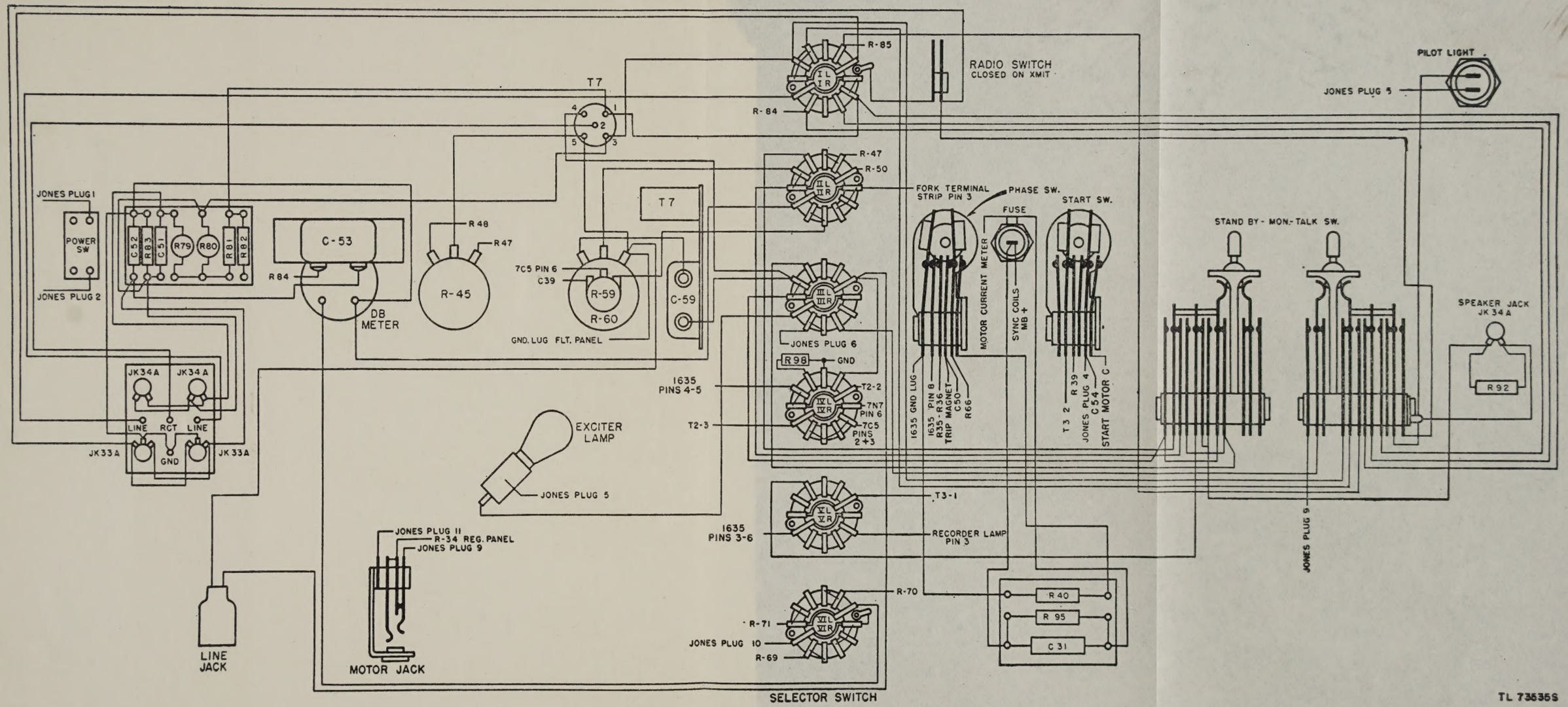


Figure 155. Facsimile Transceiver TT-1B/TXC-1, front panel wiring diagram.