NAVSHIPS 91688

INSTRUCTION BOOK

for

TEST-TOOL SET AN/USM-3A

RADIO FREQUENCY LABORATORIES, INC.

BOONTON, NEW JERSEY

BUREAU OF SHIPS NAVY D[illegible]

Contract: NObsr-52269 *Apl e B a 1 1952*

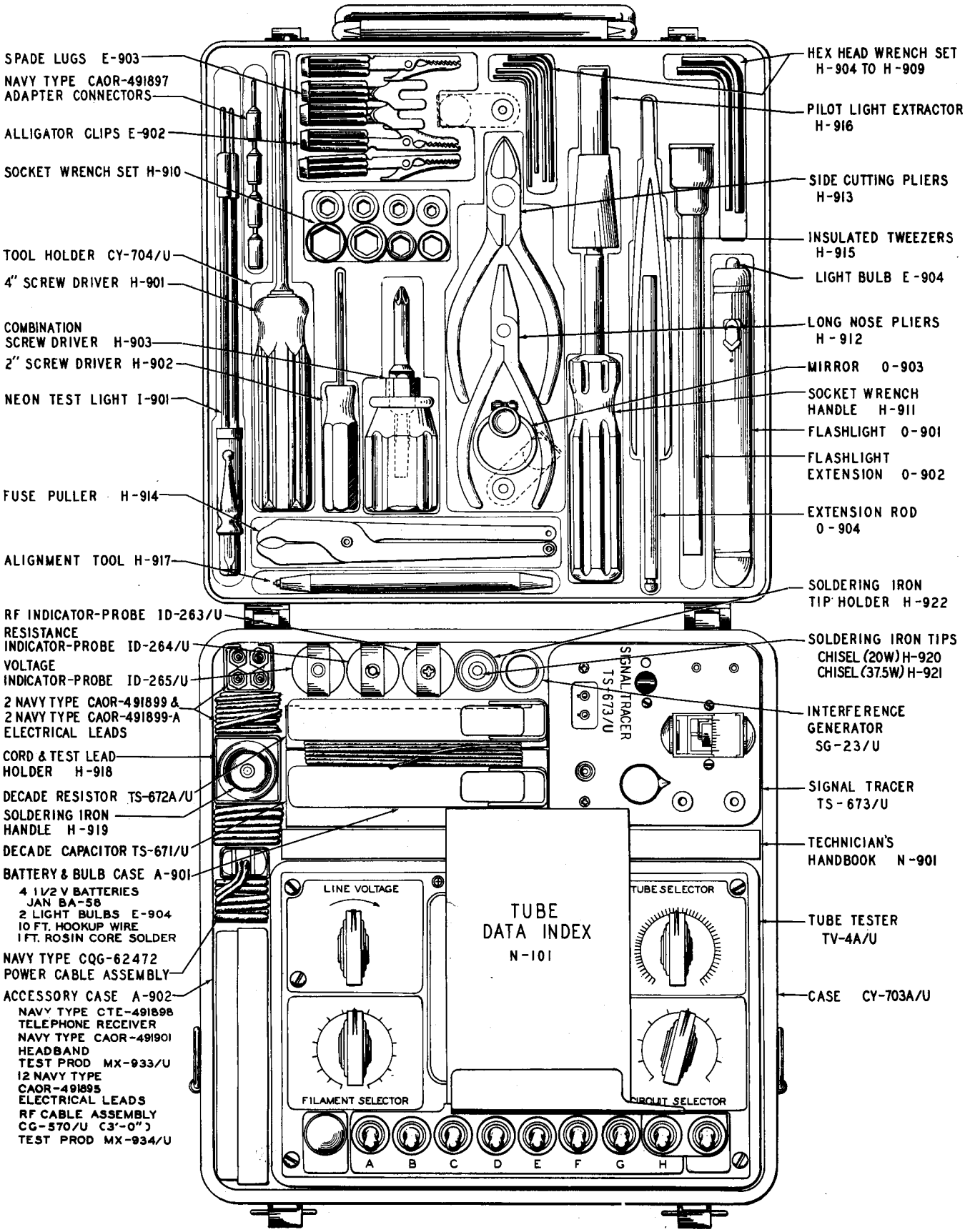

Figure 1-1. Test-Tool Set AN/USM-3A, Identification of Units

SECTION 1
GENERAL DESCRIPTION

1. INSTRUCTION BOOK COVERAGE.

This instruction book covers Test-Tool Set AN/USM-3A as shown in figure 1-1. The units are shown in place in the carrying case.

2. PURPOSE AND BASIC PRINCIPLES.

The Test-Tool Set AN/USM-3A is designed for use as a test and repair set for emergency repair on electronic and electrical equipment. It is intended only for getting equipment back into operation in a situation where more accurate test equipment is either unavailable or where all necessary precision test equipment is damaged or cannot be carried. To accomplish this end, a compact, lightweight case is supplied with the items as shown in figure 1-1 fitted into it so that all items are accessible and easily located.

3. DESCRIPTION OF UNITS

a. CASE CY-703A/U. (See figure 1-1.) - The Case consists of two drawn aluminum covers 9-1/2 x 9-1/2 x 3-1/2 inches which are hinged together, forming a box 7 inches deep. Latches, fittings, and a handle are provided.

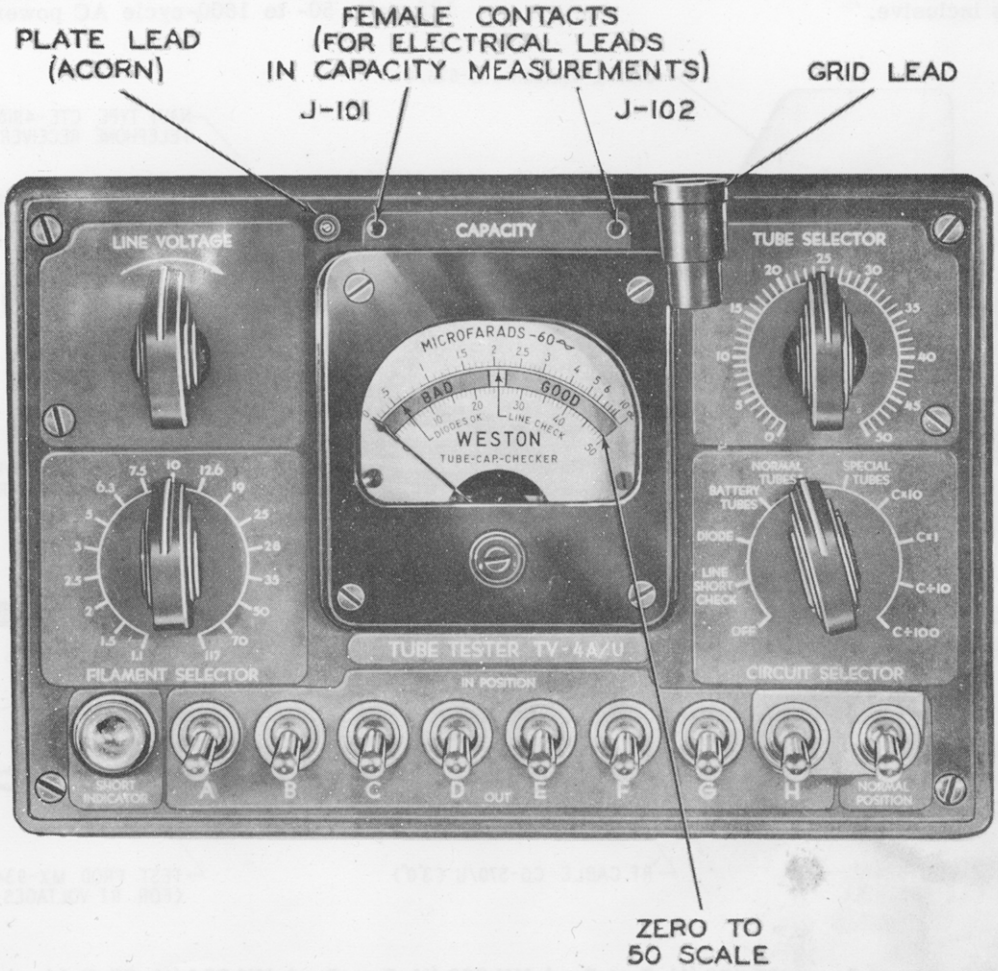

Figure 1-2. Tube Tester TV-4A/U, Identification of Controls on Control Panel

b. TUBE TESTER TV-4A/U. (See figure 1-2.) - This unit consists of a molded bakelite control panel on which are mounted the meter and all of the controls, a socket panel for all of the tube test sockets, and a wrap-around case enclosing the complete unit. Pin jacks are available at the top of the control panel for capacity readings in addition to all of the tube test functions. The complete assembly is mounted in a steel case and is pivoted on a full length hinge so that it can be raised into operating position through an angle of 45 degrees. The hinge is fastened to the front face of the Tube Tester and the front edge of the Case. A supporting arm, hinged at the bottom of the Case, holds the Tube Tester at a 45-degree angle when it is pivoted into position for operation.

Two grid leads are provided and extend from the front panel. One is a captive double-ended connector for contacting the top cap stud on metal and glass vacuum tubes; the other is an acorn connector lead that terminates in a small, split phosphor-bronze connector for attachment to the top pin of acorn tubes.

A 105- to 125-volt. AC only, 50- to 1600-cycle single phase power supply source is required. The power demand at 115 volts is approximately 25 watts. From such a power source, tube test filament potentials at power line frequency are available in 17 steps: from 1.1 to 117 volts inclusive.

For the tube test function, two electrode potentials and four load impedances are available for diode, battery type, normal, and special type tubes. One meter reversing toggle switch and eight electrode toggle switches provide the required flexibility for the total emission and individual electrode emission tests on the various tube types listed in the Tube Data Index.

The indicating meter is calibrated with three scale arcs; the top arc for capacity readings, the middle arc for tube indications in three different colors, and the inside, or bottom, arc for comparative readings between different tubes of the same type. This inside arc is linear and is used for several purposes, as outlined in Section 2, paragraph 1(b).

The Tube Data Index is a small booklet attached to the Tube Tester by a panel bracket and is folded over the front face of the Tester when not in use. When the Tube Tester is raised to the operating position, the Tube Data Index can be rotated to the right and swung forward for ready reference.

c. SIGNAL TRACER TS-673/U. (See figure 1-3.) - This equipment consists of a variable gain amplifier and output meter. A Navy Type CQG-62472 Power Cable Assembly is provided for plugging in a 105- to 125-volt, 50- to 1600-cycle AC power source. Navy

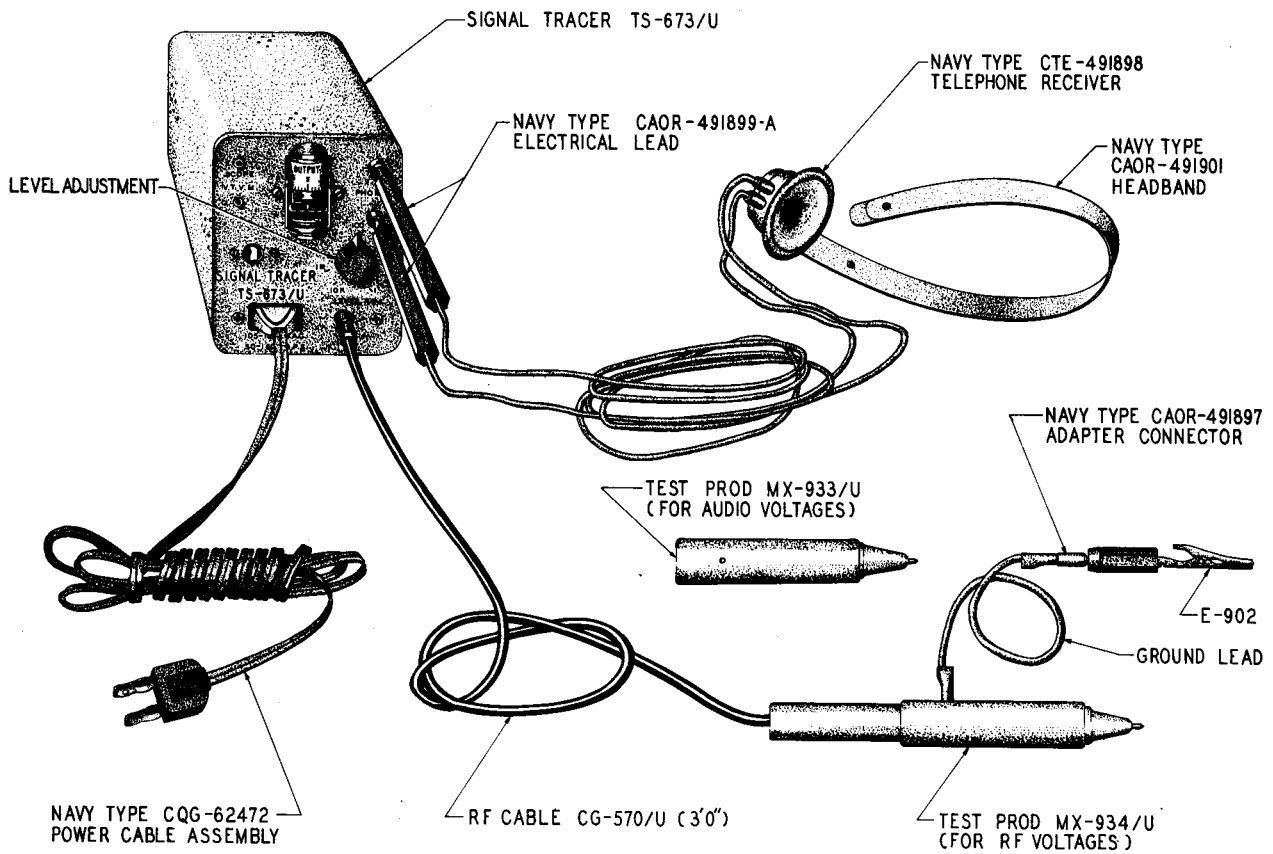

Figure 1-3. Signal Tracer TS-673/U, Test Prod MX-933/U, Test Prod MX-934/U, RF Cable Assembly CG-570/U (3'0"), Navy Type CTE-491898 Telephone Receiver, Navy Type CAOR-491901 Headband, and Navy Type CQG-62472 Power Cable Assembly; Identification of Units

Type CAOR-491897-A Electrical Leads are provided for connecting an oscilloscope, an earphone, or an electronic voltmeter to the output. The RF Cable Assembly CG-570/U (3'0'') is used with Test Prod MX-934/U (for RF signals) and Test Prod MX-933/U (for audio signals). The Navy Type CAOR-491895 Electrical Lead with Navy Type CAOR-491897 Adapter Connector and Alligator Clip E-902 are used to ground the prod.

The amplifier is capable of amplifying AC voltages from 47 to 15,000 cycles per second when used with the Test Prod MX-933/U. Audio modulation on voltages having frequencies from 15,000 cycles to 400 megacycles is detected by Test Prod MX-934/U and amplified by the Signal Tracer. The Signal Tracer is located behind the Tube Tester as shown in figure 1-1.

The Telephone Receiver and Headband, RF Cable Assembly, Electrical Leads CAOR-491895, and Test Prods are in the Accessory Case to the left of the Tube Tester (see figure 1-1) and are listed in table 1-3 under Accessories.

d. INTERFERENCE GENERATOR SG-23/U. (See figure 1-4.) - This unit is an aperiodic impulse buzzer type generator housed in a probe case. Pressing the button at the top connects the battery to the buzzer. The white line on the button indicates the position of the attenuator. The buzzer is connected directly to the probe tip in position 1 and through a variable capacitor in positions 2 through 10. The buzzer frequency is approximately 1000 cycles per second with harmonics extending up to approximately 400 megacycles. It is used to generate audio and radio frequency voltages for test purposes. It is used with Navy Type CAOR-491895 Electrical Lead, Navy Type CAOR-491897 Adapter Connector, and Alligator Clip E-902. These items are located in the Accessory Case and in the Tool Holder. (See figure 1-1.)

The Interference Generator is located next to the Signal Tracer in the back of the Case as shown in figure 1-1.

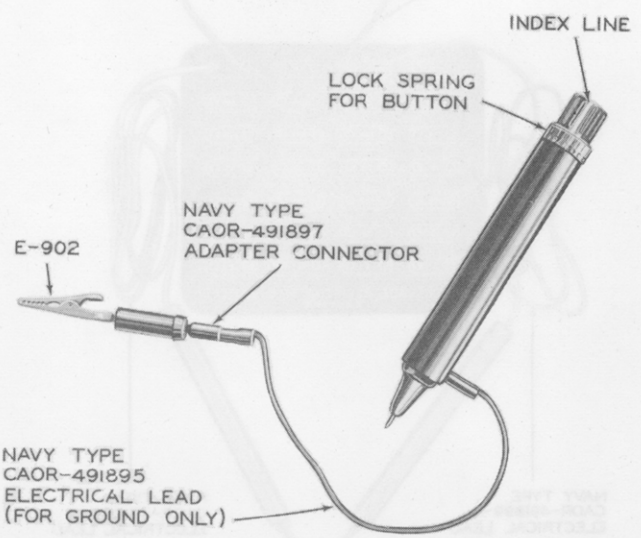

Figure 1-4. Interference Generator SG-23/U and Navy Type CAOR-491895 Electrical Lead, Identification

e. VOLTAGE INDICATOR-PROBE ID-265/U. (See figure 1-5.) - This unit is shown with its lead attached for a complete circuit. It consists of two meter elements so arranged electrically that one, M-401, indicates whether the line is AC or DC. If the line is DC, the polarity of the probe tip is indicated. The second meter movement M-402 indicates the magnitude of the voltage. The scale is marked 0, 55, 110, 220, and 440 volts. The AC voltage measured can be in the frequency range of 10 to 10,000 cycles. The lead used with this probe is Navy Type CAOR-491899-A, which is located on the Cord and Test Lead Holder H-918 behind the Accessory Case.

This Probe is located in the Case behind the Tube Tester. (See figure 1-1.)

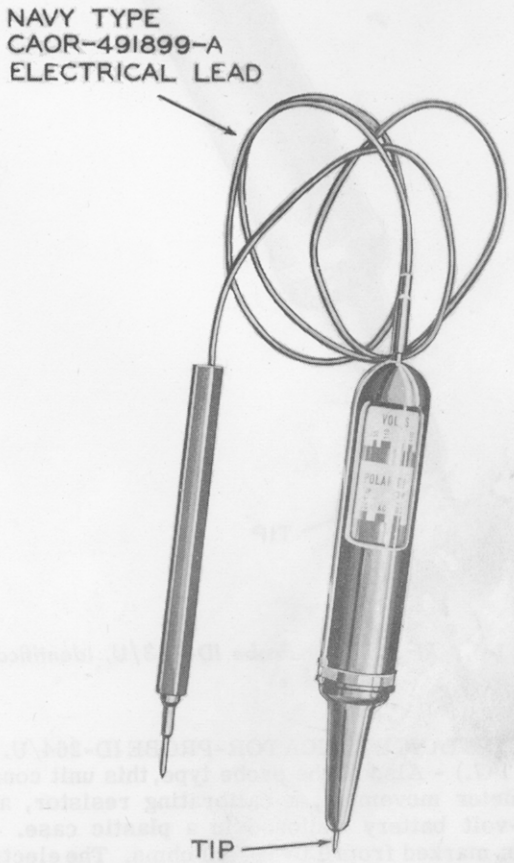

Figure 1-5. Voltage Indicator-Probe ID-265/U and Navy Type CAOR-491899-A Electrical Lead, Identification

f. RF INDICATOR-PROBE ID-263/U. (See figure 1-6.) - This unit contains a meter movement and a crystal rectifier circuit housed in a plastic body. It is used to indicate the presence of electric RF fields of relatively large magnitude. Its sensitivity is of the order of 25% of full-scale when one volt of RF voltage is applied to the tip of the Probe. The hand capacitance of the operator supplies the return RF connection.

To reach into a deep chassis or into high voltage areas, the Extension Rod O-904 is provided. This rod slips onto the tip of the Probe. When used, it normally increases the sensitivity of the unit. It is stowed in the Tool Holder, and the Probe is located at the rear of the Case as shown in figure 1-1.

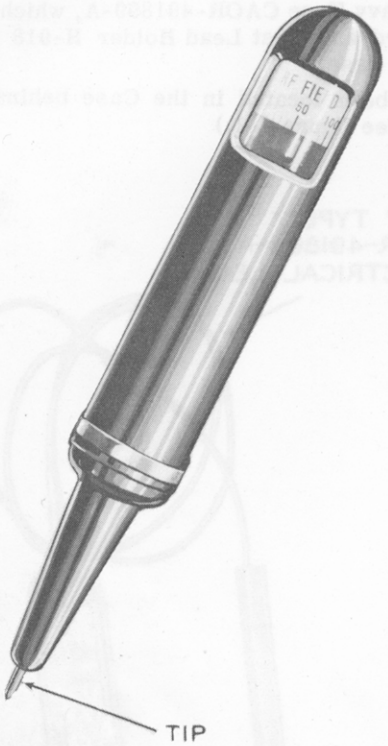

Figure 1-6. RF Indicator-Probe ID-263/U, Identification

g. RESISTANCE INDICATOR-PROBE ID-264/U. (See figure 1-7.) - Also of the probe type, this unit consists of a meter movement, a calibrating resistor, and a 1-1/2-volt battery enclosed in a plastic case. The scale is marked from 0 to 10,000 ohms. The electrical connections are at the probe tip and through a test lead plugged into the top of the case. This Probe is used with Electrical Lead CAOR-491899-A, which is located on the Cord and Test Lead Holder. For its location in the Test-Tool Set refer to figure 1-1.

h. DECADE RESISTOR TS-672A/U. (See figure 1-8.) - This unit consists of a molded plastic case housing 28 two-watt resistors, each insulated from the other. The values are arranged in a one, two, three, six series from one ohm to six megohms; thus allowing any value between one ohm and 12 megohms to be obtained in steps of one ohm by connecting the proper resistors in series by means of the Navy Type CAOR-491895 Electrical Leads. Figure 1-1 shows its location in the rear of the Case.

Figure 1-7. Resistance Indicator-Probe ID-264/U, Identification

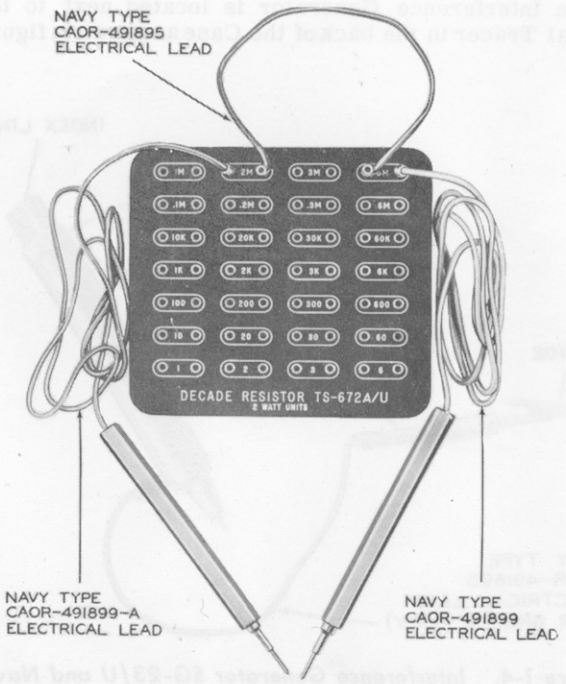

Figure 1-8. Decade Resistor TS-672A/U, Identification

i. DECADE CAPACITOR TS-671/U. (See figure 1-9.) - Consisting of a molded case similar to the Decade Resistor, this unit contains a series of capacitors covering a range between 0.0001 microfarad and 48 microfarads. Individual capacitors having values of 0.0001, 0.0003, 0.001, 0.003, 0.01, 0.02, 0.1, and 0.25 microfarads, rated at 600 volts, are placed as indicated by the front panel markings. The two 20/4-microfarad electrolytic capacitors each have a common negative. Other values in the range covered can be obtained by the use of electrical leads. The Decade Capacitor is located in the Case immediately in front of the Probes as shown in figure 1-1.

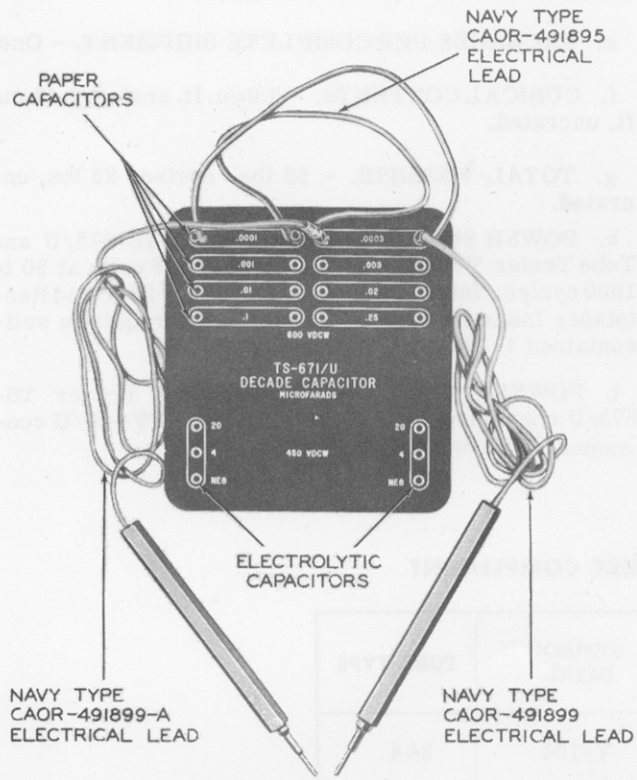

Figure 1-9. Decade Capacitor TS-761/U, Identification

j. NAVY TYPE CQG-62472 POWER CABLE ASSEMBLY. - This cable is used with the Tube Tester as a line cord or with the Signal Tracer as required. The cord is two-conductor, #18 AWG, 57 inches long with a male plug on one end and a female plug on the other end.

k. NAVY TYPE CAOR-491899 AND CAOR-491899-A ELECTRICAL LEADS. - These consist of two red and two black 30-inch leads with miniature banana plug terminals at one end and phone tip plugs on the other. The Navy Type CAOR-491897 Adaptor Connectors fit the capacity pin jacks directly above the meter of the Tube Tester and adapt the banana plugs of these leads to the pin jacks.

l. NAVY TYPE CAOR-491897 ADAPTER CONNECTORS. - Four of these units are provided. Two are used for the capacity meter function of the Tube Tester. They are stowed in the Tool Holder CY-704/U as shown in figure 1-1. The units adapt a banana plug to a phone tip jack.

m. NAVY TYPE CAOR-491895 ELECTRICAL LEADS. - These leads are eight inches long and have a combination banana plug and female connector on each end. They are used as grounding leads for the Test Prods and as patch cords for the Decade Capacitor and Decade Resistor.

n. TOOL HOLDER CY-704/U. (See figure 1-1.) - It consists of two pressed, transparent, plastic sheets with recesses provided for stowing each tool. The bottom sheet is fastened to the inside top of Case CY-703A/U. The top sheet holds the tools in their respective compartments and is secured by two snap-slides. The name and standard Navy stock number of each tool appears in the bottom of its individual compartment, and all tools are installed in the top of the Case. The top sheet, or tool cover, is held by a wire to prevent its loss when open.

o. TECHNICIAN'S HANDBOOK. (See figure 1-1.) - This book is provided for ready reference on the part of the operator when making emergency repairs and includes sufficient technical data and information necessary to use the Test-Tool Set. It is located in the Case in back of the Tube Tester.

p. BATTERY AND BULB CASE. (See figure 1-1.) - Pressed from plastic, this case provides storage space for four 1-1/2-volt flashlight batteries JAN BA-58, two flashlight bulbs, 10 feet of hook-up wire, and one foot of 50/50 rosin core solder.

q. TOOLS AND MINOR ITEMS. (See figure 1-1.) - The tools and items listed below are contained in the Tool Holder in the top of the Case, unless otherwise noted.

(1) Fuse Puller H-914 - flat dual size.
(2) Pilot Light Extractor H-916 - a rubber cup device to aid in the removal of pilot lamps from inaccessible locations.
(3) Hex Head Wrench Set H-904 to H-909 - 0.050, 1/16, 5/64, 3/32, 1/8, and 5/32.
(4) Insulated dental type Mirror O-903 - can be attached to Flashlight Extension O-902 to examine areas hidden from direct view.
(5) Insulated Tweezers H-915 - 6 inches.
(6) Flashlight O-901 with lucite Flashlight Extension O-902.
(7) Long Nose Pliers H-912 - 4 inches.
(8) Side Cutting Pliers H-913 - 4-1/2 inches.
(9) Socket Wrench Set H-910 - 3/16, 7/32, 1/4, 9/32, 5/16, 11/32, 3/8 and 7/16 with Handle H-911.
(10) Neon Test Light I-901 - 200,000 ohms impedance, 60-500 v AC, and 90-500 v DC - tests for presence of voltage.
(11) Combination Screwdriver H-903 with interchangeable 1/4-inch slot drive bit and #2 Phillips drive - stubby size.
(12) Screwdriver H-901 - 4 inches with 3/16-inch blade.

(13) Screwdriver H-902 - 2 inches with 3/32-inch blade.

(14) Extension Rod O-904 - for use with all Probe units. It has a metal center conductor and plastic exterior. A removeable insulating cover is provided for use with the RF Indicator-Probe ID-263/U and for Test Prod MX-934/U.

(15) Three Alligator Clips E-902 - for test leads.

(16) Two Spade Lugs E-903 - for test leads.

(17) Alignment Tool H-917 - an insulated low capacitance screwdriver for adjusting variable trimmer capacitors.

(18) Pen type Soldering Iron H-919-115 volts, 50 to 1600 cycles. The unit is stored in Cord and Test Lead Holder H-918 as shown in figure 1-1.

(19) Cord and Test Lead Holder H-918 - frame for holding Navy Type CAOR-491899 and CAOR-491899-A Electrical Leads, Navy Type CQG-62472 Power Cable Assembly, and Soldering Iron Handle H-919. This unit is stored in Case as shown in figure 1-1.

(20) Accessory Case A-902 - container for stowing Test Prods MX-933/U and MX-934/U, RF Cable Assembly CG-570/U, Navy Electrical Leads CAOR-491895, Navy Type Telephone Receiver CTE-491898, and Navy Type Headband CAOR-491901. This unit is stored in Case as shown in figure 1-1.

(21) Soldering Iron Tip Holder H-922 - provides positive gripping of Soldering Iron Tips H-920 and H-921 for removal from Soldering Iron Handle H-919 when hot and for storage of same. This unit is stored in Case as shown in figure 1-1.

(22) Soldering Iron Tips H-920 and H-921, chisel type, 20 watts and 37.5 watts respectively. These units are mounted in Soldering Iron Tip Holder H-922.

4. REFERENCE DATA.

a. NOMENCLATURE. - Test-Tool Set AN/USM-3A.

b. CONTRACT. - NObsr-52269, dated 23 May 1951.

c. CONTRACTOR. - Radio Frequency Laboratories, Inc., Boonton, New Jersey.

d. COGNIZANT NAVAL INSPECTOR. - Inspector of Navy Materiel, Newark, New Jersey.

e. PACKAGES PER COMPLETE SHIPMENT. - One.

f. CUBICAL CONTENTS. - 5.9 cu. ft. crated; 0.42 cu. ft. uncrated.

g. TOTAL WEIGHTS. - 53 lbs. crated; 23 lbs. uncrated.

h. POWER SUPPLY. - Signal Tracer TS-673/U and Tube Tester TV-4A/U require 105 to 125 volts at 50 to 1600 cycles. Interference Generator SG-23/U and Resistance Indicator-Probe ID-264/U each require a self-contained 1-1/2-volt battery JAN BA-58.

i. POWER CONSUMPTION. - Signal Tracer TS-673/U consumes 7 watts. Tube Tester TV-4A/U consumes 25 watts at 115 volts, 60 cycles.

TABLE 1-1. ELECTRON TUBE COMPLEMENT

UNIT	SYMBOL DESIG.	TUBE TYPE
Tube Tester TV-4A/U	V-101	3A4
Signal Tracer TS-673/U	V-201 V-202 V-203	12AX7 12AX7 6AL5

TABLE 1-2. BATTERY COMPLEMENT

UNIT	JAN TYPE	STANDARD NAVY STOCK NUMBER OF UNIT	VOLTAGE	MAX SIZE (INCHES)		NO. REQ.
				DIA.	LENGTH	
Flashlight	BA-58		1-1/2	37/64	1-31/32	2
Interference Generator	BA-58	F16-G-59001-1001	1-1/2	37/64	1-31/32	1
Resistance Indicator-Probe	BA-58	F17-P-84841-1831	1-1/2	37/64	1-31/32	1

TABLE 1-3. EQUIPMENT SUPPLIED

QUANTITY PER EQUIPMENT	NAME OF UNIT	NAVY TYPE DESIGNATION	OVER-ALL DIMENSIONS (INCHES)			VOLUME (CU FT)	WEIGHT (LBS)
			HEIGHT	WIDTH	DEPTH		
	MAJOR UNITS:						
1	Case	CY-703A/U	7	9-3/4	10-1/2	0.42	5.0
1	Tool Holder	CY-704/U	3/4	9-1/4	9-1/4	0.037	
1	Tube Tester	TV-4A/U	5-1/2	8-1/4	5-1/2	0.145	9.0
1	Signal Tracer	TS-673/U	3-1/2	3	5-3/4	0.035	2.0
1	Interference Generator	SG-23/U		3/4 diam	5-3/4		
1	Voltage Indicator-Probe	ID-265/U		1 diam	6		
1	RF Indicator-Probe	ID-263/U		1 diam	6		
1	Resistance Indicator-Probe	ID-264/U		1 diam	6		
1	Decade Resistor	TS-672A/U	3/4	4-3/4	4-3/8	0.009	
1	Decade Capacitor	TS-671/U	1-1/4	4-3/8	4-3/4	0.015	
	ACCESSORIES:						
1	Test Prod	MX-933/U					
1	Test Prod	MX-934/U					
1	RF Cable Assembly	CG-570/U (3'0")					
1	Telephone Receiver	CTE-491898					
1	Headband	CAOR-491901					
1	Power Cable Assembly	CQG-62472					
2	Electrical Lead (red)	CAOR-491899					
2	Electrical Lead (black)	CAOR-491899-A					
4	Adapter Connector	CAOR-491897					
12	Electrical Lead	CAOR-491895					
1	Extension Rod						
1	Cord and Test Lead Holder						
1	Battery and Bulb Case (w/2 bulbs, 10' of hook-up wire and 1' of solder)						
1	Accessory Case						
1	Technician's Handbook						
1	Tube Data Index						
	TOOLS:						
3	Alligator Clips						
2	Spade Lugs						
1	Screwdriver (4-inch)						
1	Screwdriver (2-inch)						
1	Combination Screwdriver						
1	Hex Head Wrench Set (0.050, 1/16, 5/64, 3/32, 1/8, 5/32)						
1	Socket Wrench Set						
1	Socket Wrench Handle						
1	Long Nose Pliers						
1	Side Cutting Pliers						
1	Fuse Puller						
1	Insulated Tweezers						
1	Pilot Light Extractor						
1	Alignment Tool						
1	Soldering Iron Handle						
1	Soldering Iron Tip (Chisel) 20 watt						
1	Soldering Iron Tip (Chisel) 37.5 watt						
1	Soldering Iron Tip Holder						
1	Neon Test Light						
1	Flashlight						
1	Flashlight Extension						
1	Mirror						
1	Instruction Book	NAVSHIPS 91688					

TABLE 1-4. TECHNICAL SUMMARY

TUBE TESTER TV-4A/U	Power supply:	105 to 125 volts, 50 to 1600 cycles.
	Power consumption:	25 watts at 115 volts and 60 cycles.
	Measurements:	(1) Tests all tubes listed in Tube Data Index for filament continuity, emission, shorted elements, and open elements. (2) Capacities from 0.001 to 100 microfarads when operated from 60 cycle per second power supply. See figure 4-1.
SIGNAL TRACER TS-673/U	Power supply:	105 to 125 volts, 50 to 1600 cycles.
	Power consumption:	7 watts.
	AF range:	47 to 15,000 cycles per second.
	RF range:	Audio modulated signals 15 kc to 400 megacycles per second.
	Audio sensitivity:	0.002 volt audible in earphone. 0.004 volt for 1/2-scale M-201.
	RF sensitivity:	0.005 volt of 50% modulated RF audible in earphone. 0.05 volt of 50% modulated RF for 1/2-scale M-201.
INTERFERENCE GENERATOR SG-23/U	Power supply:	1-1/2-volt battery JAN BA-58.
	Current:	0.09 amp.
	Frequency:	Audio approx 1000 cycles per second. Harmonics to approx 400 megacycles per second.
VOLTAGE INDICATOR-PROBE ID-265/U	Measurements:	(1) 0 to 440 volts AC or DC. (2) DC polarity.
	Frequency range AC:	10 to 10,000 cycles per second.
	Impedance:	510,000 ohms.
RF INDICATOR-PROBE ID-263/U	Useful frequency range:	100 kc to 400 megacycles per second.
	Sensitivity:	25% full-scale for one volt RF direct connected.
	Sensitivity, approx with extension rod in RF field:	5 volts/meter for 25% full-scale.
	Max RF signal:	10 volts across crystal diode.

TABLE 1-4. TECHNICAL SUMMARY, CONT'D

RESISTANCE INDICATOR-PROBE ID-264/U	Measurements:	0 to 10,000 ohms.
	Power supply:	1-1/2-volt battery JAN BA-58.
DECADE RESISTOR TS-672A/U	Power rating:	Two watts per resistor. 10 watts for unit.
	Tolerance:	±10%.
	Range:	One ohm to 12 megohms in one-ohm steps.
DECADE CAPACITOR TS-671/U	Range:	0.0001 to 48 microfarads.
	Tolerance (paper):	±10%.
	Voltage rating (paper):	500 volts DC.
	Tolerance (electrolytic):	-0% +75%.
	Voltage rating (electrolytic):	450 volts DC.
TEST PROD MX-934/U	Maximum RF signal:	20 volts.
	Voltage rating:	400 volts DC.
TEST PROD MX-933/U	Maximum AF signal:	100 volts.
	Voltage rating:	400 volts DC.
	Input resistance:	One megohm.
	Input capacitance:	0.0001 microfarad.