921A DATA TEST SET

MAINTENANCE

CONTENTS PAGE

1. GENERAL

1.01 This section contains troubleshooting procedures, assembly and disassembly instructions, and certain replacement procedures for the 921A data test set (DTS) J79921A, Versions 1 through 3. The version number appears on the DTS display when RST is pressed, eg, 921A VERS #01 and on the test code label in the cover. The replacement procedures refer only to circuit packs (CPs) and read-only memories (ROMs).

When removing internal circuit packs (CP1-CP6, CP11), care must be taken to ensure that the boards are not subjected to static electrical charges. Such an occurrence can result in destruction of sensitive integrated circuits (ICs) or sufficient damage to ICs to cause eventual failure. Removal of CPs should be performed in an environment not susceptible to static electrical charge buildup and personnel handling the boards should be "grounded." It is recommended that personnel use grounded, metal or conductive plastic wrist straps with one megohm series resistance. The equipment used to handle the boards should be conductive. The metal parts of associated fixtures, tools, and table tops should be grounded to a common point.

1.02 This section is reissued to add coverage on Version 3 of the 921A DTS.

1.03 In order to use the troubleshooting procedures given in this section, a complete set of spare circuit packs is required. A list of these circuit packs and their functions appears in Table A. Included in the table are the accessories stored in the DTS cover or cable accessory case ("saddle bag") which are also shown in Fig. 1. The chassis, power supply, display, light emitting diodes (LEDs), and other parts of the DTS which are not part of the plug-in CPs are not repairable in the field. If the trouble cannot be cleared by replacement of CPs, then the DTS must be returned to a Western Electric repair center.

1.04 No spare ROMs are required. The replacement of ROMs will be required normally only to update or change the DTS programmed itinerary.

1.05 ▶A Version 1 DTS can be converted to a Version 2 at a Western Electric repair center. A Version 2 DTS can be field-converted to a Version 3 by installing a kit of parts from WECo.◀

2. MAINTENANCE AIDS

2.01 Troubleshooting is arranged to cover three conditions; DTS totally inoperative, one or more self-test failures, or DTS does not function properly. For each condition, various trouble symptoms which may occur are listed. Also, information is given which will enable the user to locate the circuit board which is the most likely cause of the trouble. Figure 2 is a repair sequence flowchart to enable a systematic approach to troubleshooting. Before attempting repairs consider guidance and help from your local DATEC organization.

2.02 Special tools required to implement the replacement and troubleshooting procedures are: cable extractor, 3M Company, 3438 or

TABLE A

921A DATA TEST SET CIRCUIT PACKS AND ACCESSORIES

CIRCUIT PACK	FUNCTION	ACCESSORY*	QTY
CP1	Microcomputer	Power Cord	1
CP2	Interval Timer, Frequency Counter, Event Counter, Audio, Start-Stop Distortion	Interface Cable	2
		EIA RS-232-C Interface Adapters	1 pr
CP3	Multimeter RCV and Trmt Data Buffer	CCITT V.35 Interface Adapters	1 pr
CP4	Clock, Isochronous Distortion	CSU 550 Interface Adapters	1 pr
CP5	Cross-Connect Network, LED Drivers, Keyword and Display Interface	Telephone Line Adapter Cable	1
		Telephone Interface Adapter	1
CP6	Pseudorandom Word Generator (Version 1 Only)	Loopback Connectors	3
CP7	EIA RS-232 Interface Module	Meter Leads	1 pr
CP8	550 CSU Interface Module	Detachable Feet	1 pr
CP9	CCITT V.35 Interface Module	Clip Lead	1 pr
CP10	LED Indicators, Interface Lead Switches, and Jacks	Terminating Resistors	4
		Jumper Wires (Short)	10
CP11	Pseudorandom Word Generator and Expanded Memory (Versions 2 and 3—Replaces Version 1 CP6)	Jumper Wires (Medium)	10
		Jumper Wires (Long)	10
CP12	Transaction Network Plug-in Module (Versions 2 and 3)		

* Refer to J79921A drawing for specific part number when ordering.

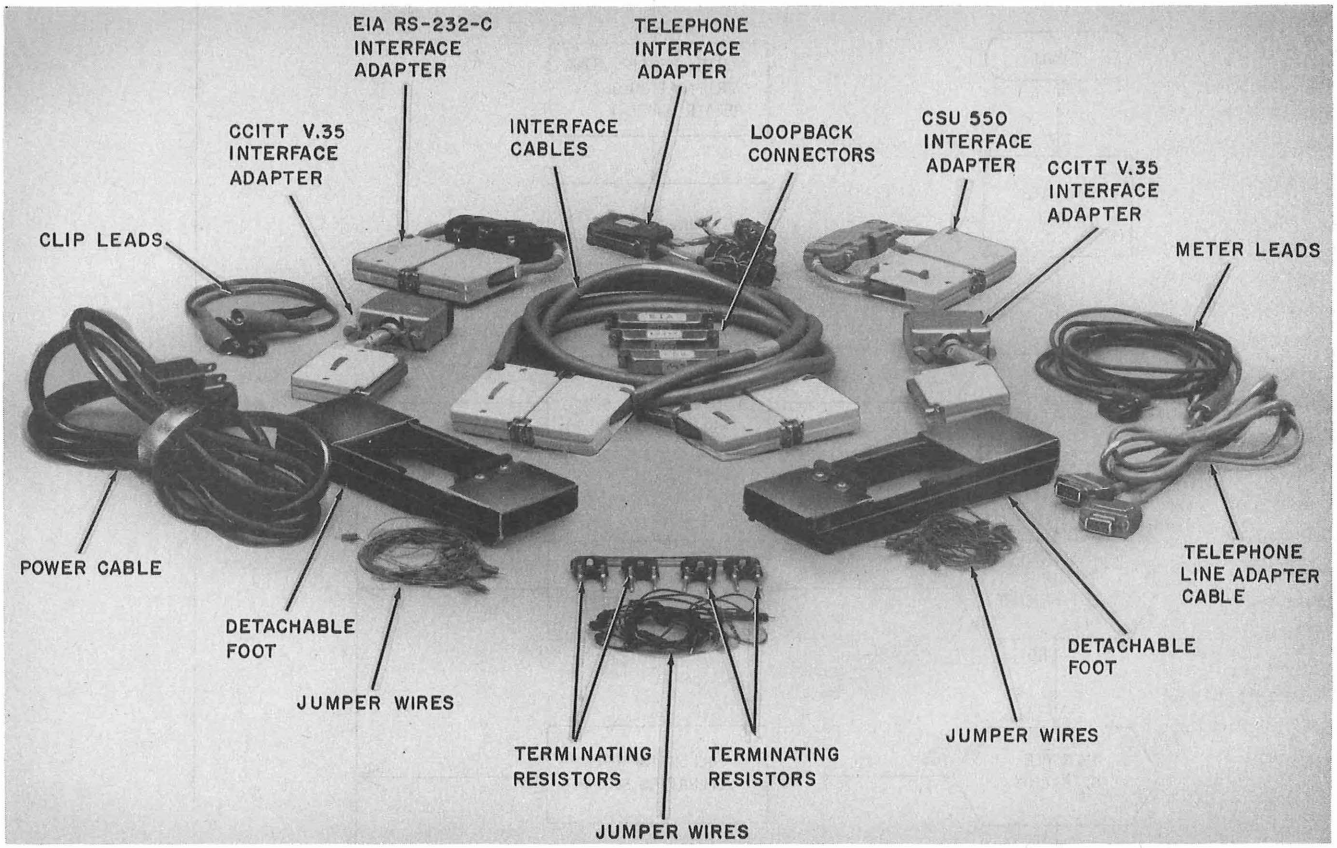

Fig. 1—921A DTS Accessories

equivalent; 24-pin IC extractor tool, Augat Co. T-114-1, or equivalent; and 24-pin IC insertion tool, Techni-Tool, Inc., 103, or equivalent.

A. DTS Totally Inoperative

2.03 A totally inoperative set may have a no-power indication. This is characterized by any of the following conditions: (1) POWER lamp ***off;*** (2) LEDs always extinguished; (3) display remains blank and there is no dim background glow.

2.04 If there is a no-power indication, verify that 117 Vac is present at the outlet, check the power cord, and check the three circuit breakers located on the side of the set. The circuit breakers are reset by pressing them inward.

2.05 For a totally inoperative set, in which power is present, the trouble conditions most likely to appear are: (1) display blank, however background glow is present; (2) random or incorrect display; (3) random access memory (RAM) failure. These troubles are likely to be caused by a defective microcomputer board (CP1), a defective switch network board (CP5), or loose connectors on the CPs. A secondary source of failure is the remaining CPs: CP2, CP3, CP4, and CP6 (in Version 1) or CP11 (in Versions 2 and 3). If the trouble cannot be eliminated by changing the CPs or by securing the connectors, then the DTS must be returned to a repair center.

2.06 A RAM self-test failure is indicated by the message RAM TEST FAILED appearing after RST is pressed. The message may be garbled; however, all forms would have exactly 15 characters, for example, RRRRRRRRRRRRRR. The most likely reason for a RAM failure is a defective CP1. If replacement of CP1 does not clear the trouble, check for loose connectors on the CPs. If trouble is still evident, the DTS must be returned to a repair center.

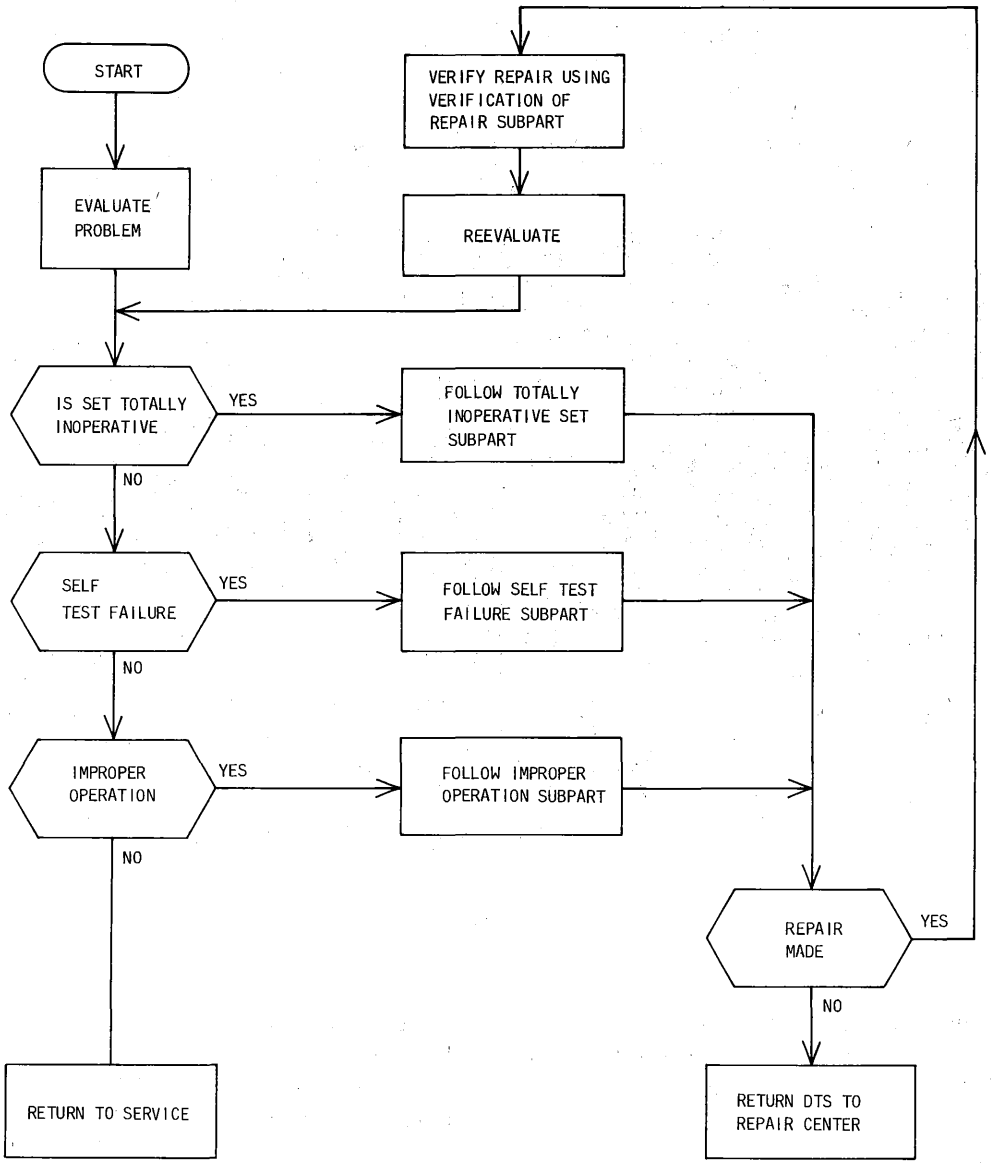

Fig. 2—Repair Sequence Flowchart

B. Self-Test Failure

2.07 Each 921A has built-in self-tests which diagnose most problems down to functional areas. There are two types of self-tests.

2.08 The first type of self-test includes tests which are performed when the RST key is pressed. There are nine of these tests, excluding the RAM test previously mentioned. Failure of any of these tests (except RAM) results in one of the following messages:

F = PROCEED	ROM TEST FAILED
F = PROCEED	ROM ORDER TEST FAILED
F = PROCEED	SW NET. TEST FAILED
F = PROCEED	TIMER TEST FAILED
F = PROCEED	CLOCK TEST FAILED

F = PROCEED	STRT-STOP TEST FAILED
F = PROCEED	BUFFER TEST FAILED
F = PROCEED	ISO DIST TEST FAILED
921A VERS #XX	(Display locked-up to this message, where XX is the version number)

If all self-tests pass, the DTS display will read DATA SET:. If a failure message appears, the self-testing stops and the display remains until the following action is taken. For the first eight tests, F key is pressed to bypass the failure. In order to bypass the last test (921A VERS #XX lockup condition), the TST key must be held down and the RST key pressed. The TST key can be released when TEST SEQ: appears. Note, that in bypassing the lockup failure, the DATA SET: message does not appear. Therefore, the data set code cannot be entered. This may prevent testing of certain data sets.

2.09 ***Version 1 Self-Test Failures:*** When a self-test fails, it should be noted. The test should be bypassed so that self-testing will continue. A list of the self-tests which fail prior to the display message DATA SET: should be compiled. This list can then be used in conjunction with Table B to find the most likely cause of the failure; for example, the timer test fails, F is pressed and the clock test fails, F is pressed and DATA SET: appears. Using the sixth column of Table B shows the most likely malfunctioning board to be CP2, followed by CP5, followed by CP4.

2.10 ***Versions 2 and 3 Self-Test Failures:*** There are increased diagnostic outputs from the self-tests in Versions 2 and 3 sets. In Versions 2 and 3 sets, when a self-test fails, the same message appears as in Version 1; for example, ROM TEST FAILED F=PROCEED appears on the display. The F key may be pressed to bypass the failure. However, if the A, B, and then C keys are pressed (in order), the display will show the diagnostic message PC=XXXX HL=XXXX M(HL)=XX A=XX. Each X represents a hexadecimal digit. The most important information is provided by the program counter (PC) which is the address in the self-test program where the malfunction was detected. The PC directly matches an address given in the left-hand column of Table C. The adjacent column of Table C gives the most likely cause of the problem (CP number). For example, suppose the clock test failed. After pressing the A, then B, then C keys, the message PC=3343 HL=1234 M(HL)=56 A=78 appears. Using Table C, locate PC=3343 which indicates that the most probable defective CPs are CP2, then CP4. The other information given [HL, M(HL) and A] is not important for replacing boards in the field. It may be useful in determining specific circuit failures at a repair center. ◗By pressing the ← key, additional information is obtained. The display will show the following diagnostic message: DE=XXXX M(DE)=XX BC=XXXX PSW=XX.◖

2.11 The second type of self-test includes four tests which require manual intervention by the craft person. These tests are run by pressing the TST key in response to the display message DATA SET:. A 2-digit code followed by GO is then entered in response to the message TEST SEQ:. The four tests and their 2-digit codes are: pseudorandom word (94); multimeter (95); keyboard and display (96); and interface (97). In Version 1 sets, the interface test will test any one of the three interface cards inserted in the DTS. (The interface test requires the proper loopback connector be inserted into the DCE 37 pin connector.) In Versions 2 and 3 sets, the interface test will also test the TNS interface, but no loopback connector is required.

C. Improper Operation

2.12 Improper operation covers sets which pass the self-tests but have some other operating problem. Table D contains a list of possible problems complemented by a list of CPs most likely to cause the condition. For example, if the external frequency measurement cannot be made, Table D indicates that CP2, followed by CP1, is most probably the cause of the malfunction.

D. Verification of Repair

2.13 After replacing a CP, the DTS must be tested to verify proper operation. If an interface card were replaced, the interface card self-test (97) is a sufficient test. If CP1 or CP4 were replaced, successful passing of all self-tests after RST key is pressed is a sufficient test. If CP2 or CP3 is replaced, the following test procedure is suggested in addition to passing all self-tests (Fig. 3).

TABLE B

FAULT ANALYSIS BY SELF-TEST FAILURES

SELF-TEST WHICH FAILED	CIRCUIT PACK SELECTION																	
RAM	X																	
ROM		X																
ROM ORDER			X															
SW NET.				X														
TIMER					X	X												
CLOCK						X	X	X										
STRT-STOP								X	X									
BUFFER										X								
ISO DIST											X							
VERS = 01												X						
PSEUDORANDOM WORD (94)													X					
MULTIMETER (95)														X				
KEYWORD TEST (96)															X			
INTERFACE TEST (97)—EIA																X		
INTERFACE TEST (97)—CSU																	X	
INTERFACE TESTS (97)—CCITT																		X
CIRCUIT PACK CHOICES																		
FIRST CHOICE	CP1	CP1	CP1	CP5	CP2	CP2	CP4	CP2	CP2	CP3*	CP4	CP4	CP6	CP3*	CP5	CP7	CP8	CP9
SECOND CHOICE	CP5			CP1	CP5	CP5	CP2	CP4	CP4	CP5	CP1	CP1	CP3*			CP5	CP5	CP5
THIRD CHOICE						CP4	CP5	CP5	CP5		CP5	CP5						
FOURTH CHOICE											CP2	CP2						

* Recalibration of multimeter on CP3 may be necessary if CP3 is replaced. Recalibration should be performed at a repair center.

TABLE C

FAULT ANALYSIS BY SELF-TEST DIAGNOSTICS
(VERSIONS 2 AND 3 DTS)

PROGRAM COUNTER ADDRESS	MOST PROBABLE CP FAILURE	PROGRAM COUNTER ADDRESS	MOST PROBABLE CP FAILURE
30C0	CP1, CP11	35F9	CP3*
30E2	CP1	3600	CP3*
30F3	CP11	3607	CP3*
314C	CP2, CP5	3616	DP3*
3156	CP2, CP5	4451	CP5
31C5	CP4, CP1	4461	CP7, CP5
3197	CP4, CP1	4468	CP7, CP5
3208	CP3*	446B	CP7, CP5, CP2
3217	CP3*	4477	CP7, CP5
3337	CP4, CP2, CP5	447A	CP7, CP5
3343	CP2, CP4	447D	CP7, CP5, CP2
3349	CP4, CP2	4494	CP7, CP5
3355	CP4, CP2	44A1	CP7, CP5
335A	CP4, CP2	44B8	CP7, CP5
33F0	CP2, CP5	44C5	CP7, CP5
33F7	CP2, CP5	440A	CP9, CP5
33FE	CP2, CP5	44E4	CP9, CP5
3404	CP2	44E7	CP9, CP5, CP2
3420	CP2	44F7	CP9, CP5, CP2
342E	CP2	4500	CP9, CP5
3435	CP2	4507	CP9, CP5
343C	CP2	4519	CP8, CP5
3441	CP2	4523	CP8, CP5
3447	CP2	453A	CP8, CP5
3455	CP2	4547	CP8, CP5
355B	CP2	456B	CP12, CP5, CP11
34A8	CP5	457E	CP12, CP5, CP11
34BY	CP5	4591	CP12, CP5, CP11
353B	CP2, CP1, CP5	459B	CP12, CP5, CP11
3554	CP2	45A5	CP12, CP5, CP11
355A	CP2	45AF	CP12, CP5, CP11
359A	CP3*	45C1	CP12, CP5, CP11
35C0	CP3*	45CB	Cp12, CP5, CP11
35C6	CP3*	45E2	CP12, CP5, CP11
35D0	CP3*	45FD	CP12, CP5, CP11
35E6	CP3*	4619	CP12, CP5, CP11

* Recalibration of multimeter on CP3 may be necessary if CP3 is replaced. Recalibration should be performed at repair center.

TABLE D

IMPROPER OPERATION AND MOST PROBABLE CIRCUIT PACK REPLACEMENT

MALFUNCTION	CIRCUIT PACK
External frequency, period, or event measurement	CP2, CP1
Parity or receive fox message errors	CP2, CP3,* CP4
Talk circuit: no 2713-Hz or 1004-Hz tone	CP2, CP4
Level for 2713-Hz or 1004-Hz tone not 0 dBm	CP2
Inaccurate 2713-Hz or 1004-Hz frequency	CP4
Inaccurate any clock frequency	CP4
Speaker not functioning	CP2
Handset not functioning	CP2
Any multimeter inaccuracy	CP3*
Inaccurate Ischronous distortion readings	CP4, CP1
Test points not operating	CP5
Assignable status or control not working	CP5
Errors output missing	CP6, (Version 1), CP11 (Versions 2 and 3)
Interface problem	CP7, or CP8, or CP9, CP5, CP12 (Versions 2 and 3)

* Recalibration of CP3 may be necessary if CP3 is replaced. Recalibration should be performed at a repair center.

(1) Place SPKR JACKS/RCV LINE switch to the SPKR JACKS position.

(2) Connect the TRG jack in the interface and jack switch field located on the upper right of the front panel to the top SPKR JACKS jack (located in the same area) and to METER + jack (located in the same area).

(3) Connect the COM jack located adjacent to the TRG jack to lower SPKR JACKS jack (located just below) and to METER - jack (located just above).

(4) Plug 600-ohm terminator into INPUTS METER +, - jacks located on the lower right of the front panel.

(5) Connect test clips between 600-ohm terminator and LINE TRMT T and R terminals.

(6) Press keys TST, 27, 18, 11, 6, and GO. Display should read 2713 ±1 Hz.

(7) Press GO. Display should read 0 dBm ±1 dBm.

(8) Adjust VOL control to maximum. The 2713-Hz tone should be audible.

(9) Remove METER +, - jack connections and 600-ohm terminator from INPUTS METER +, - jacks. Press TST, 95, GO, and A. After seven seconds display should indicate TEST PASSED.

3. MAINTENANCE PROCEDURES

3.01 The procedures for the removal and replacement of CPs and ROMs are given in the following paragraphs.

A. Removal of Set From Carrying Case

(1) Open cover and disengage cover stay by lifting cover stay latch with a screwdriver (Fig. 4). Move cover stay to right and rotate toward front panel.

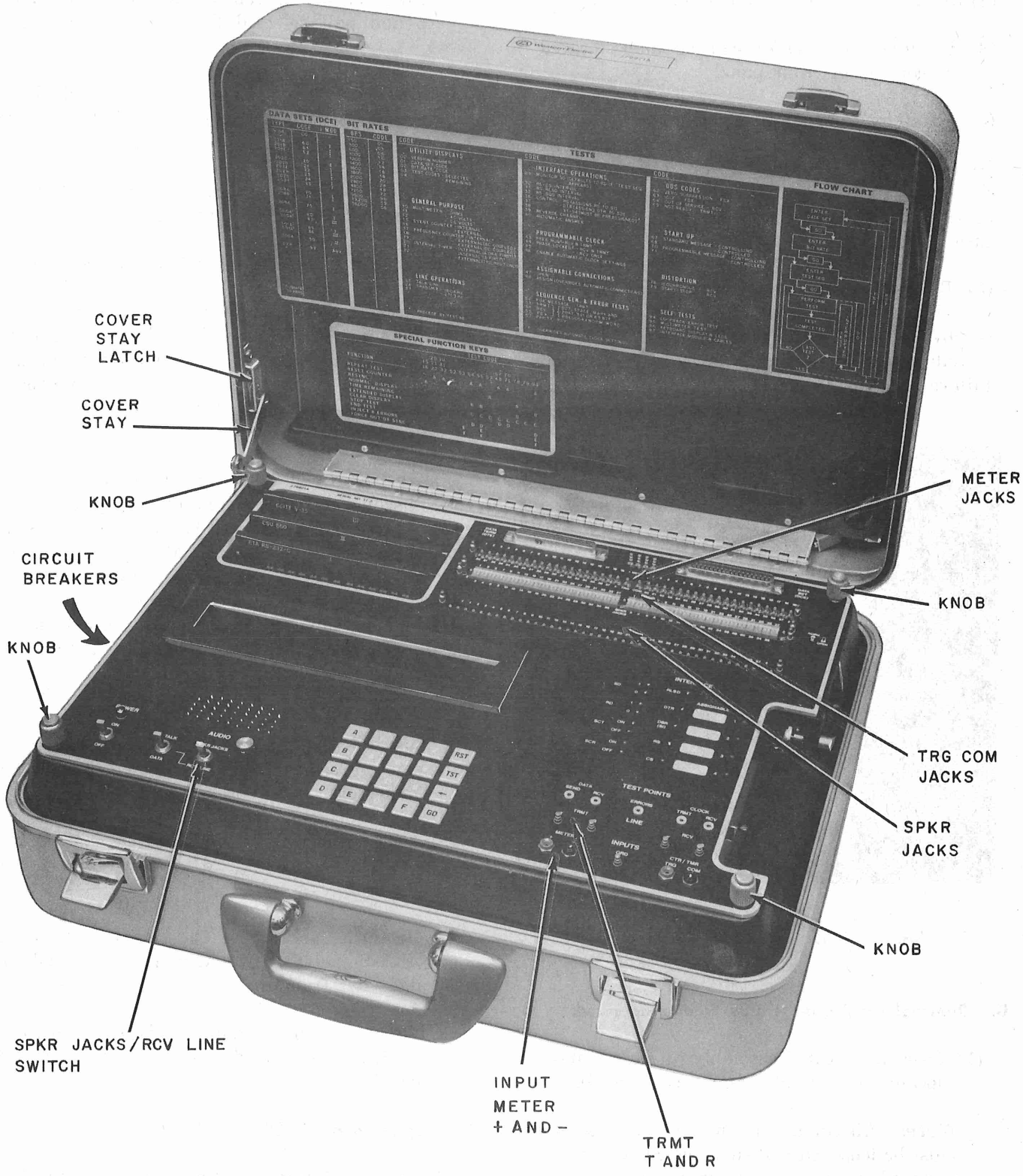

Fig. 3—921A Data Test Set

(2) Slide cover to right and remove.

(3) Unscrew four knurled captive knobs located at corners of front panel.

(4) Grasp two diagonally opposite knobs and lift set upward approximately 7 inches to clear framework from lower section of carrying case. Set may have to be tilted slightly to keep protruding test connectors from snagging on the case.

(5) Before proceeding with removal of CPs, visually inspect unit for loose connectors, or obvious defects. If possible, operate the DTS outside the case under the same conditions which failure was observed to occur.

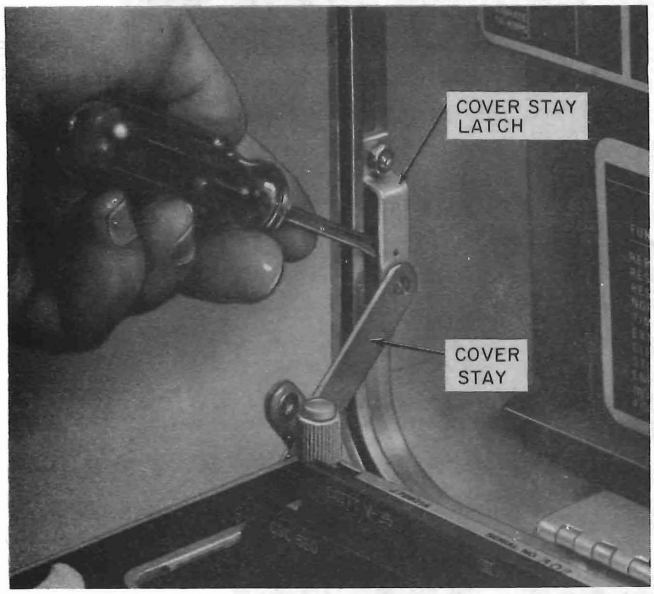

Fig. 4—921A DTS Cover Removal

B. Removal of Version 1 CPs From Framework

(1) Disconnect cable assembly (groups 8 and 9) located at rear of framework (Fig. 5).

Note: All connectors in the cable assembly must be loosened and then the cable assembly removed as a unit. Connectors should not be removed individually.

(2) Select CP to be removed and, using Table E and Fig. 6, remove front connectors.

(3) Lift lockbar for removal of CPs 1 through 5 and pull selected CP straight out from rear.

Note: Lockbar handle may be released when CP has been withdrawn approximately 1/2 inch.

(4) CP6 is removed by pulling straight out from rear. (Lockbar need not be lifted.)

C. Removal of Versions 2 and 3 CPs From Framework

(1) To remove CP11, first disconnect the uppermost connectors (CP5 and CP11) of cable assembly group 9, CP11 connector of cable assembly group 28, and CP11 connector of cable assembly group 27, all located at the rear of the framework (Fig. 7).

(2) To remove other CPs (CP1—CP5), first disconnect cable assembly group 9, cable assembly group 27, and CP11 connector of cable assembly group 28, located at the rear of the framework (Fig. 7) using the cable connector extraction tool. Some early versions of the 921A DTS have "cable pulls" attached, as shown on cable groups 27 and 28 in Fig. 7. These do not require use of the extraction tool.

Note: All connectors in the cable group must be loosened and the cable group connectors removed as a unit for CPs other than CP11. Connectors cannot be removed individually.

(3) Select the CP to be removed, and using Table E and Fig. 6, remove the front connectors.

(4) Lift the lockbar for the removal of CPs 1 through 5 (Fig. 6) and pull the selected CP straight out from the rear.

Note: Lockbar handle may be released when CP has been withdrawn approximately 1/2 inch.

D. Replacement of CPs

(1) Slide CP into test set from rear until it touches lockbar (Fig. 6).

(2) Lift lockbar and slide CP approximately 1/4 inch further.

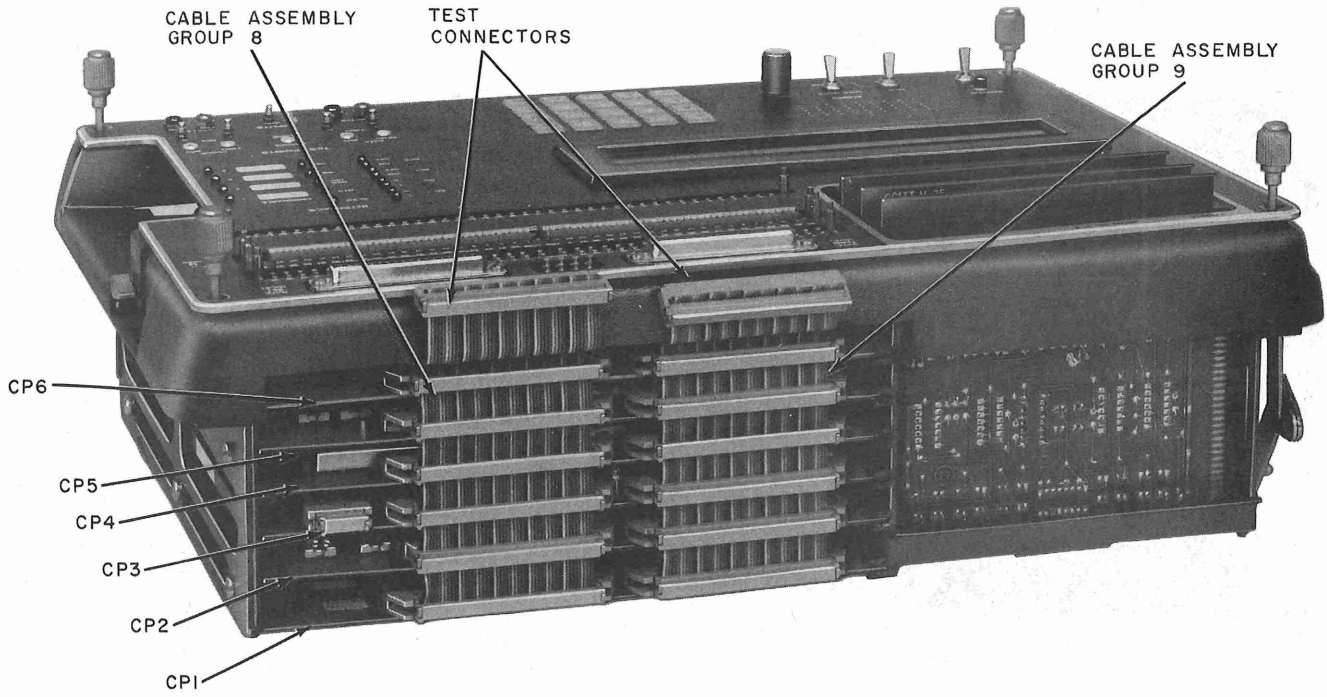

Fig. 5—921A DTS (Version 1) Removed From Case—Rear View

TABLE E

CIRCUIT PACK FRONT CONNECTORS

CIRCUIT PACK	CONNECTORS
CP1	CP1/J3, CP2/J3, CP1/J4
CP2	CP1/J3, CP2/J3, CP2/J4, CP2/J5
CP3	CP3/J3, CP4/J3, CP3/J5, CP4/J4, CP3/J4
CP4	CP3/J3, CP4/J3, CP4/J4, CP4/J5
CP5	CP5/J3, CP2/J4, CP4/J4, CP3/J4, CP5/J4, CP5/J5
CP6	No Connectors
CP11	No Connectors

(3) Release lockbar and make sure all CPs are locked in position (lockbar handle returns to original position and CPs cannot be pulled out).

Note: In early versions of the 921A DTS, the lockbar is used to restrain one end of the connector mounting of CP11. Care should be taken to assure proper position of connector and lockbar.

(4) Reconnect both front and rear cables.

Note: Care should be taken to ensure that the connectors are properly mated before they are finally seated.

E. Replacement of ROMs on CP1

(1) Remove CP1 as described in paragraph 3.01 B or C.

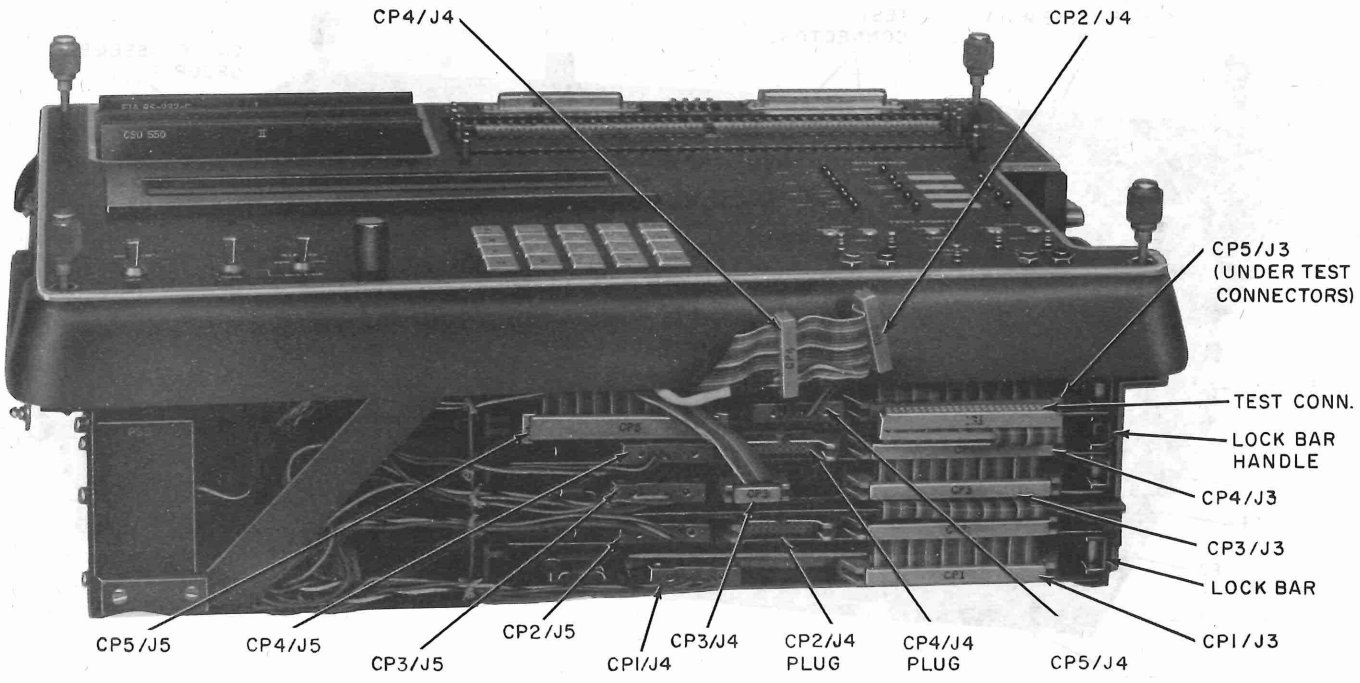

Fig. 6—921A DTS Removed From Case—Front View

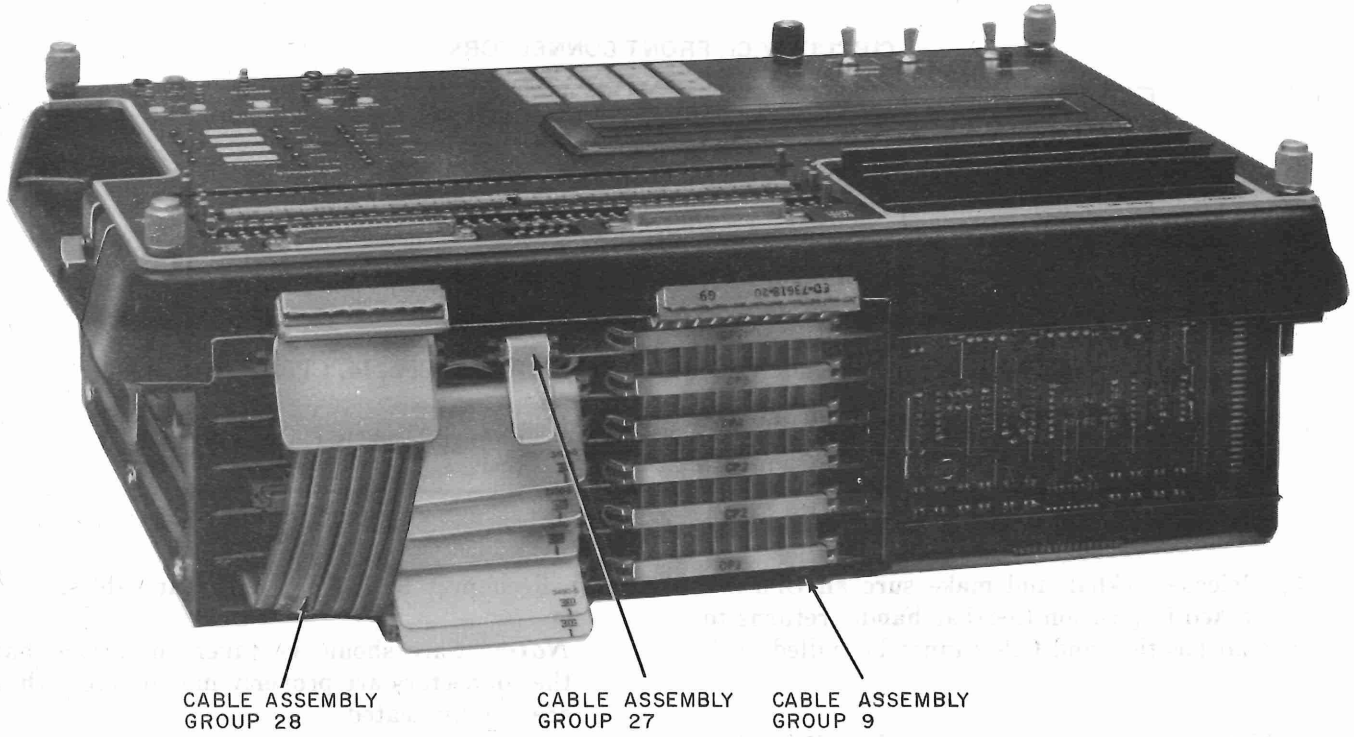

Fig. 7—921A DTS (Version 2) Removed From Case—Rear View

(2) Orient CP1 so that connectors P1 and P2 are to the left as shown in Fig. 8.

Note: Figure 8 is an illustration of a Version 2 or 3 CP1 (cable assembly group 28 required and shown).

(3) Remove shield if ROM 24, 25, or 26 is to be replaced as shown in Fig. 8.

Note: Figure 9 is an illustration of a Version 1 CP1 (cable assembly group 28 not required).

(4) Remove required ROM (Fig. 9 and 10) using IC removal tool specified in paragraph 2.02.

(5) Replace ROM using IC insertion tool specified in paragraph 2.02 making sure pin 1 is in lower right (notched) corner of dual in-line package (DIP) socket.

F. Replacement of ROMs on CP11

(1) Remove CP11 as described in paragraph 3.01 C.

(2) Orient CP11 so that the three connectors are forward.

(3) Remove the desired ROM using the IC extractor tool specified in paragraph 2.02.

(4) Replace the ROM using the IC insertion tool specified in paragraph 2.02, making sure that pin 1 is in the lower right (notched) corner of the DIP socket.

G. Replacement of DTS Into Carrying Case

(1) Place case and test set side by side with handle forward and set it up in the operating position.

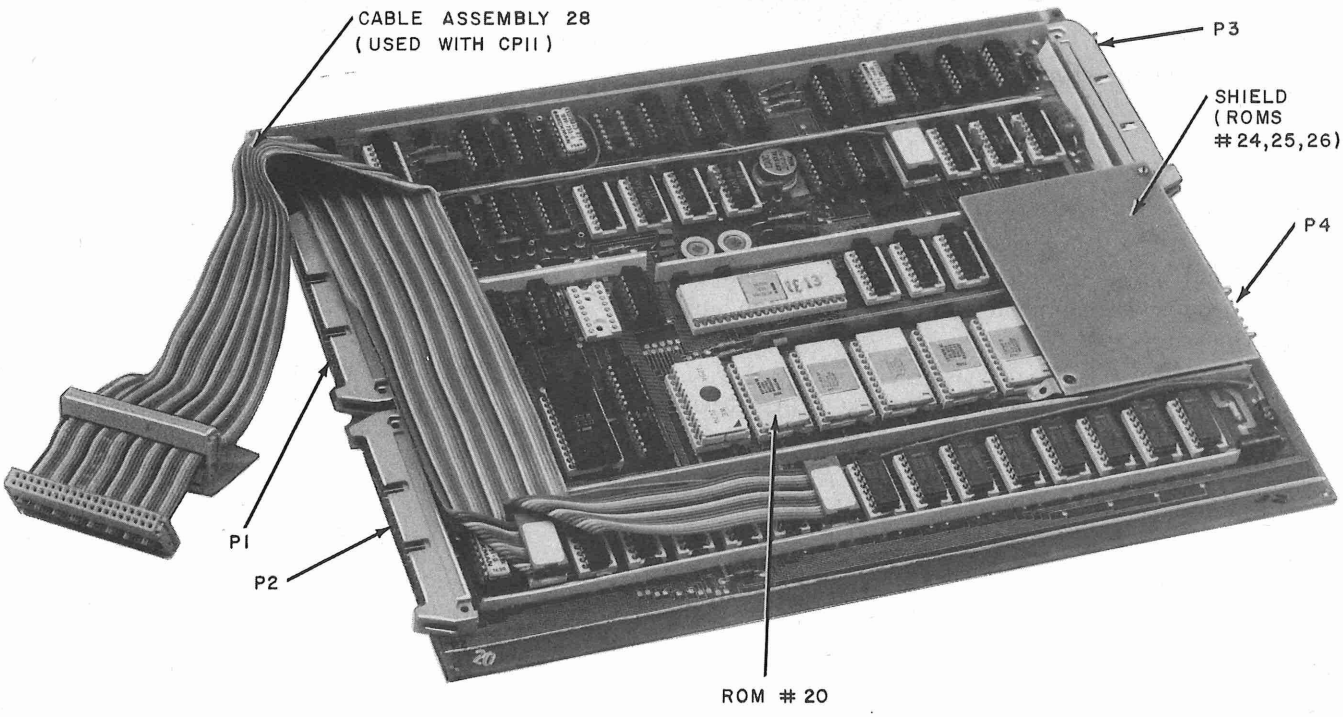

Fig. 8—Circuit Pack CP1 Showing Cable Assembly 28 and ROM Shield

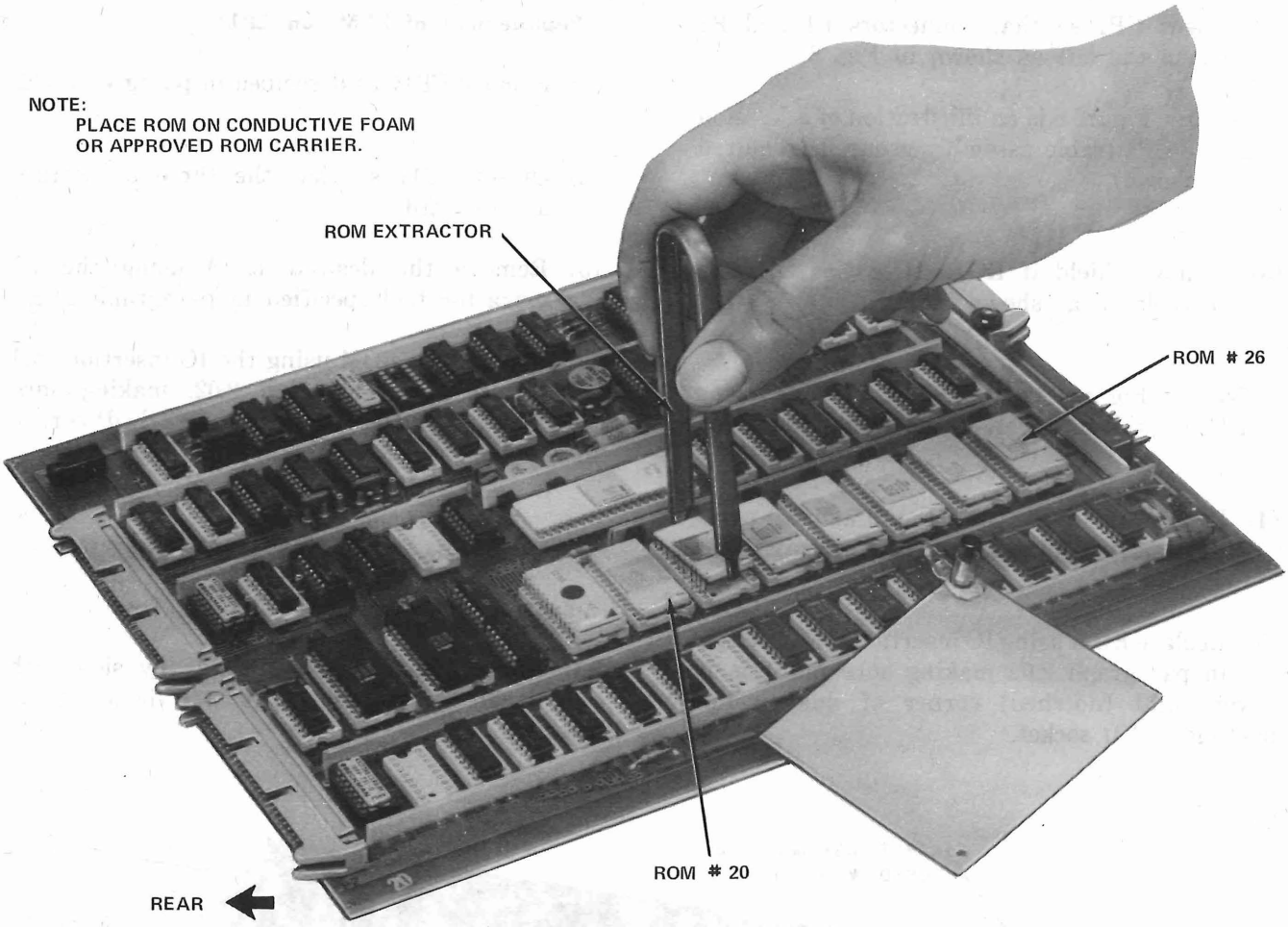

Fig. 9—Circuit Pack CP1 With ROM Shield Removed—ROM Removal

(2) Fold three test connectors (cable assembly groups 8, 9, and 10 or 9, 10, and 28) out of the way.

(3) Grasp diagonal knurled knobs and insert set into lower section of carrying case.

(4) Tighten four knurled knobs.

(5) Replace case cover and reinsert and latch the cover stay.

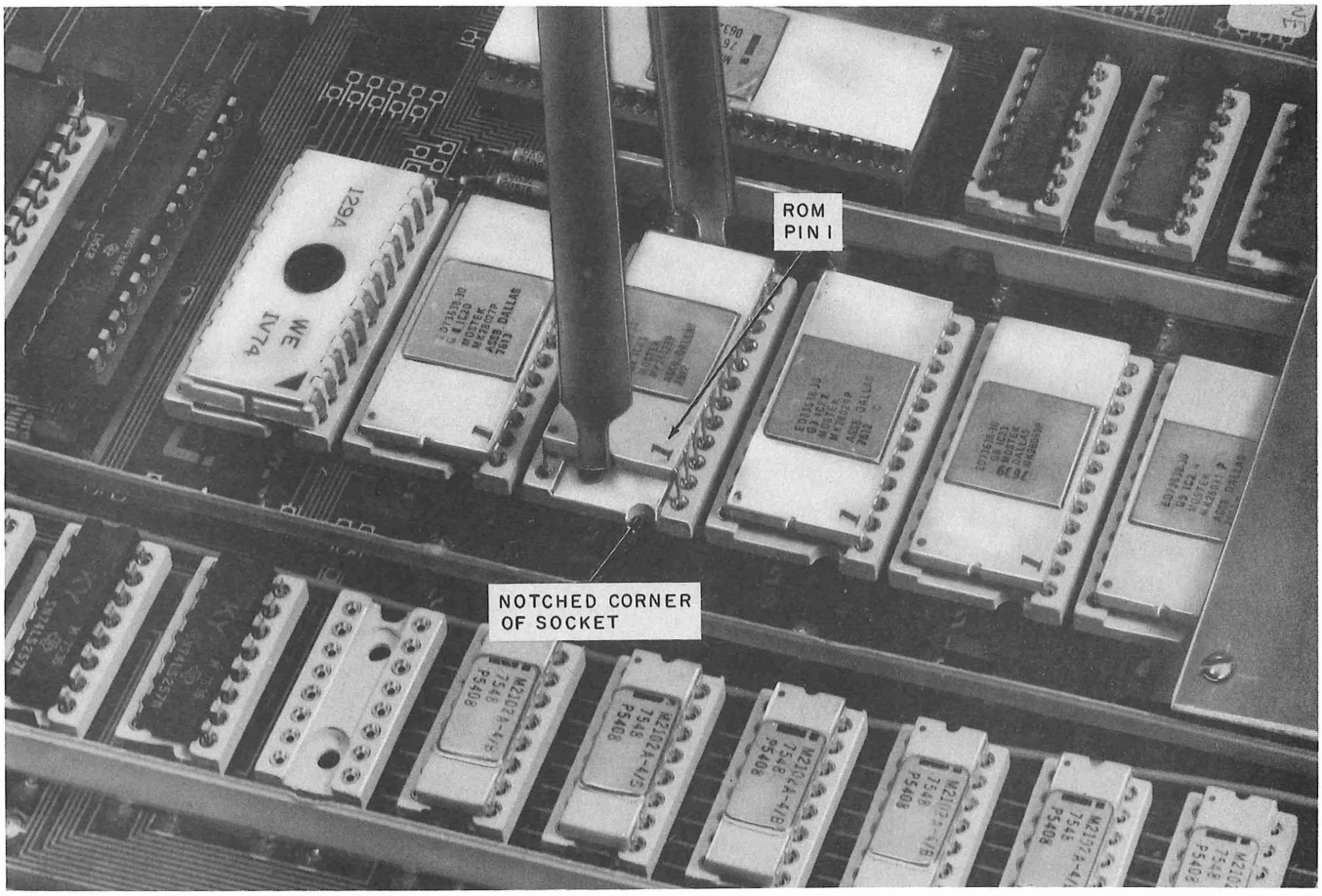

Fig. 10—Close-Up of ROM Removal