

**AUTOMATIC PROGRESSION TRUNK TEST FRAME**  
**GENERAL DESCRIPTIVE INFORMATION**  
**NO. 5 CROSSBAR OFFICES**

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**1. GENERAL**

**1.01** This section provides general descriptive information for the automatic progression trunk test frame (APTT) and associated teletypewriter equipment for use in No. 5 crossbar offices. The APTT has been changed extensively since its original design and, as a result, exists in three basic configurations. These configurations are explained separately where necessary to describe the APTT.

**1.02** This section is reissued for the following reasons:

- (a) To include new provisions for switch control of priming information
- (b) To provide coverage for manual transmission testing
- (c) To make minor changes as required.

**1.03** The test frame and teletypewriter equipment are shown in Fig. 1. Two basic types of teletypewriter equipment and a typical test frame are shown. The differences in equipment are described in Part 2. This equipment is usually located in the maintenance center of the telephone office and is capable of testing the following circuits:

- (a) Outgoing trunks to panel, crossbar, step-by-step, crossbar tandem, toll, and manual PCI offices
- (b) Intraoffice trunks

- (c) Intermarker group trunks—subscriber-to-subscriber and subscriber-to-trunk (reverse battery supervision)
- (d) Incoming CAMA trunk circuits
- (e) CAMA junctor circuits
- (f) CAMA intermarker group trunks—subscriber-to-subscriber and subscriber-to-trunk
- (g) Outgoing junctors
- (h) Data trunks
- (i) Line link pulsing (LLP) circuits
- (j) Centrex trunks (phase II and III), including don't answer transfer
- (k) 4-wire trunks (without preemption)
- (l) Common control systems arrangement (CCSA) trunks
- (m) Trunks outgoing from a remote office which is equipped with a remote office test line (ROTL)
- (n) Home office test lines
- (o) TSP(S) trunks.

**1.04** Trunks in as many as three marker groups can be tested. When testing both trunks and CAMA trunk circuits, only one of the marker groups may be arranged for CAMA.

**1.05** The test circuit has an appearance on the line link frame (originating test line) and is connected to trunks and to CAMA junctors through the use of service linkages using the common control equipment to establish a connection on a customer outgoing basis. This test line thus simulates an originating customer.

**1.06** The test circuit appearance on the line link frame is also used as a toll originating test line simulating an incoming intertoll trunk. In this case, the test line is connected to outgoing intertoll, and toll completing trunks via service linkages using the common control equipment to establish a connection on a through-switched basis.

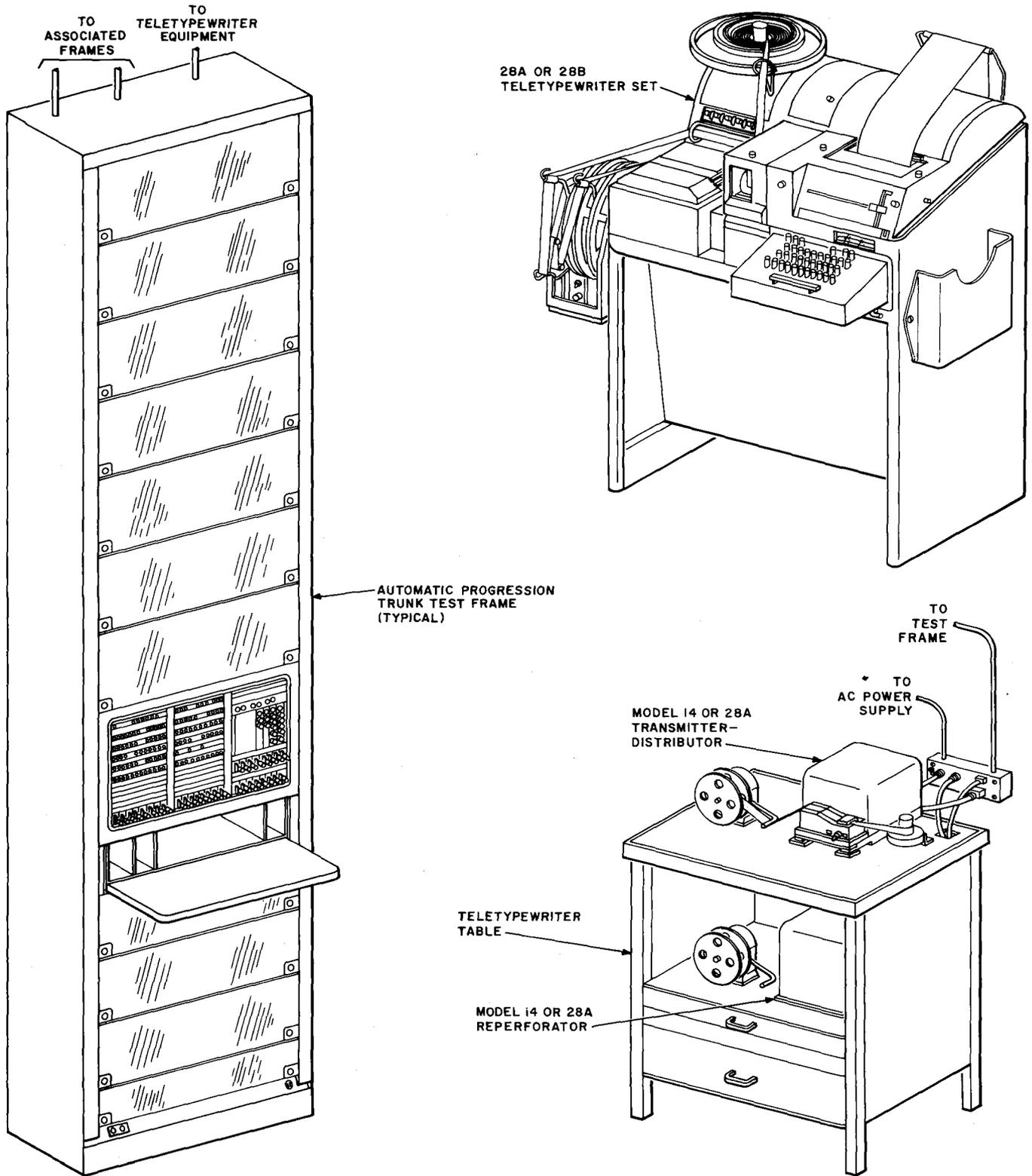


Fig. 1—Automatic Progression Trunk Test Frame and Teletypewriter Equipment

**1.07** For testing CAMA incoming trunk circuits or CAMA intermarker group trunks, the test circuit provides an access switch by which it gains access to these circuits. Service linkages are then used to direct calls through the selected CAMA trunk circuit to either a local terminating test line (APTT test circuit) or to an outgoing tandem or intertoll trunk for establishing a connection to the test circuit.

**1.08** The originating test line can be used as a tandem originating test line, simulating an incoming tandem trunk. In this case, the test line is connected to outgoing trunks via service linkages using the common control equipment to establish a connection on a through-switched basis, or connected to line link pulsing or home office test lines using the common control equipment to establish the connection.

**1.09** When testing an intraoffice or non-CAMA intermarker group trunk, the test frame gains access to the originating and terminating ends of the trunk. This is done by causing a connection to be established between the appropriate originating and terminating test lines via the desired trunk using service linkages under direction of the test frame.

**1.10** When testing an interoffice outgoing trunk, the test frame gains access to the originating end of the trunk. This is done by establishing a connection from the originating test line to the desired trunk using service linkages. The test frame gains access to the terminating end of a trunk circuit by directing common control equipment to connect the trunk circuit terminating tip and ring to a multiple which extends to the test frame. This is done by operating the trunk test relay. Provision is also made to connect the trunk to an operational or transmission test line in the distant office to which the trunk is normally routed.

**1.11** When a test connection is established, the test frame simulates originating and terminating customer line conditions and checks the results. Ringing, continuity-polarity, and supervisory tests can be applied and the charging operation of message register, coin, and AMA trunks and CAMA trunk circuits can be tested. The results of all tests may be displayed at the test frame by progress lamps or printed out when a teletypewriter set is provided. When the ATMS is provided, transmission and noise

measurements can be made with test results printed by the teletypewriter set.

**1.12** Test connections can be established and tests can be made on a fully automatic or on a particular circuit basis. When the test frame operates automatically, it does so under control of information read from a control tape.

**1.13** A control tape is a paper tape perforated with information which can prime the APTT to perform tests on the desired trunks. Depending on the vintage of the APTT, the arrangement of information on the tape varies. Control tapes are prepared using teletypewriter equipment. Great flexibility exists in the number of control tapes that may be made and the way in which test entries may be arranged on each tape.

**1.14** When the trunks are to be tested using a control tape, the tape is fed into the teletypewriter equipment. Control keys and switches are operated on the test frame to direct specific tests as desired. As each test entry on the control tape is read, the information from it is registered by the test frame. This information combined with the control key and switch operations cause the test frame to establish the desired test connection and perform the indicated tests. After a trunk has been tested, the next test entry is read, the corresponding trunk is tested, etc, until all test entries on the control tape have been read. Any test failure which occurs during this time causes the test frame either to produce a trouble printout or stop and sound an alarm.

**1.15** The ability to request any trunk at random may be provided for any vintage of the APTT but is limited to particular circuit selection only. This may be done by marker priming information sufficient enough to enable it to pick a trunk from a selected route. As in service calls, any idle trunk will be selected. The APTT will register and store the location of the trunk, as it is identified during marker selection, for possible use in printout if the trunk encounters a busy or trouble condition.

**1.16** A loudspeaker to permit monitoring of test progress may be provided for any vintage of the APTT. This loudspeaker is equipped with a volume control and is energized whenever the test circuit is in use.

## 2. DESCRIPTION OF EQUIPMENT

### A. Automatic Progression Trunk Test Frame With Model 14 or 28A Transmitter-Distributor and Reperforator—No Transmission Testing

2.01 The APTT (Fig. 2) is a single-bay unit.

Terminal strips are provided at the top of the frame for cabling to associated equipment. The timing equipment, selector switches, register circuit for receiving test information, test connectors, and equipment required to steer information to the register equipment and to read and perforate tape records are located in the upper part of the frame. Below this, the control equipment for gaining access to the master test frame connector and the equipment which controls the class of trunk test to be made are located. The jack, key, and lamp panel, pigeon holes, writing shelf, and equipment which performs the various trunk tests are located in the lower part of the frame. On the jack, key, and lamp panel are located the steering, register, test control, test progress, trouble, and busy lamps; the trunk class, test control, and alarm cutoff keys; the keys and lamps associated with perforating, checking, and copying tape records; and the telephone and originating test line jacks.

2.02 The CAMA automatic progression trunk test frame (Fig. 3) is a single-bay unit. At the top of the frame are terminal strips for terminating switchboard cables and for setting up certain cross-connections. Below the terminal strip are from one to five CAMA access switches and a mounting for associated selectors. Relays and related apparatus occupy the lower mounting plates. The tone detector is mounted on a miscellaneous rack.

2.03 The teletypewriter table shown in Fig. 1 is provided to mount the transmitter-distributor and reperforator. The transmitter-distributor mounts on top of the table and the reperforator mounts on a sliding shelf in the body of the table. Under this shelf is a drawer to store perforated tape and a supply of unperforated tape.

2.04 The transmitter-distributor, a tape unwinder, and a tape winder are mounted on the teletypewriter table. This equipment is used for reading, copying, and checking control tapes using lamp panel display on the test frame. The control

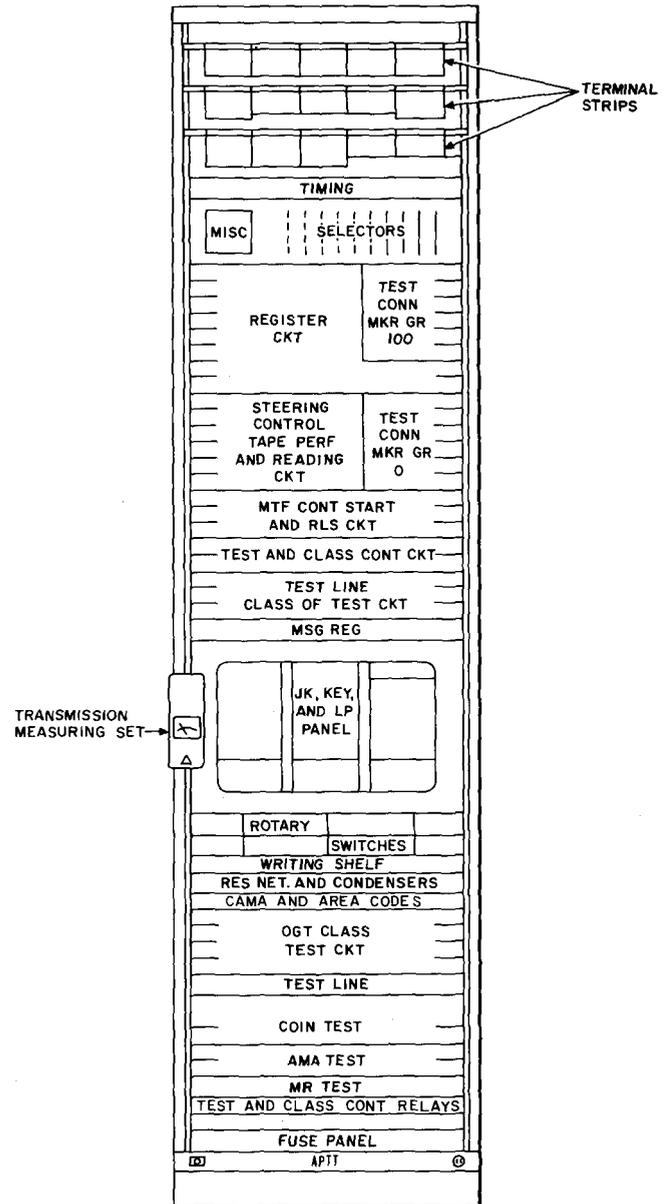


Fig. 2—Automatic Progression Trunk Test Frame

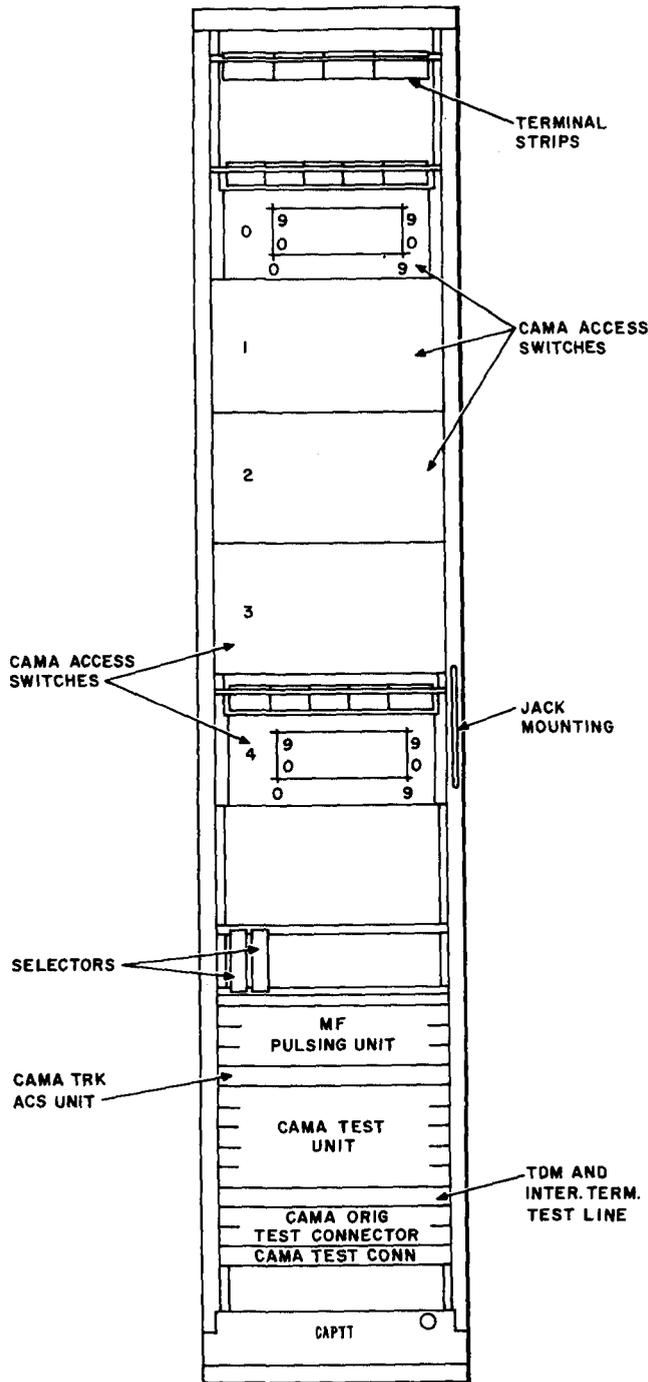


Fig. 3—CAMA Automatic Progression Trunk Test Frame

tape is threaded from the inner tape roll placed on the tape unwinder, under the retainer lid at the transmitter-distributor, and to the tape winder.

**2.05** The reperforator and a standard tape winder are mounted on the sliding shelf of the

teletypewriter table. This equipment is used for perforating control tapes under control of keys on the test frame or duplicating control tapes because of wear or damage.

**2.06** For this configuration of the APTT, tape used is a standard, heavy-duty, gray tape, 11/16-inch in width. A single trunk entry occupies approximately 1 inch of tape.

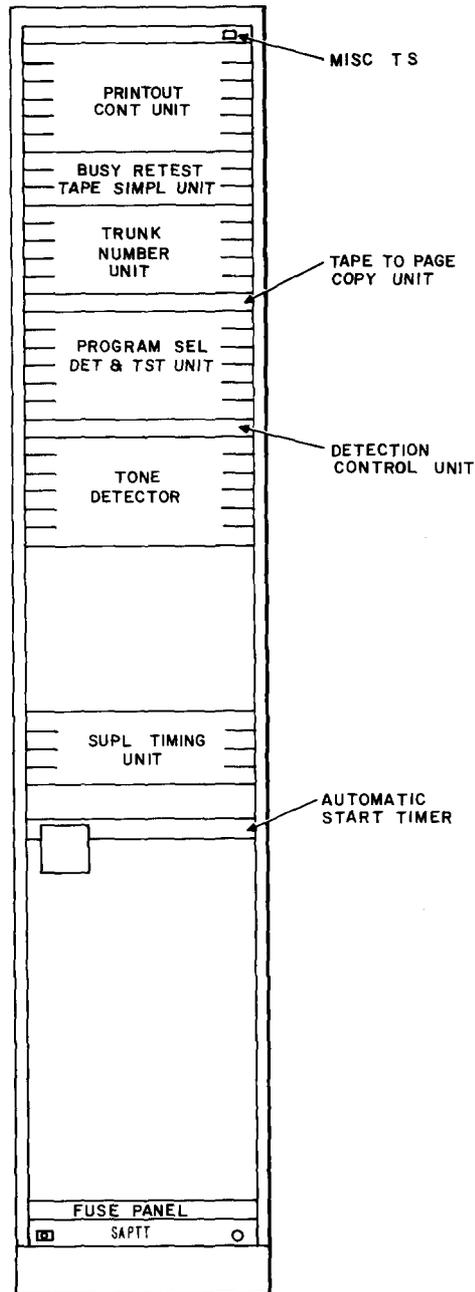
#### B. Automatic Progression Trunk Test Frame With 28A Teletypewriter Set—No Transmission Testing

**2.07** The test frame and CAMA test frame for this configuration of the APTT have the same arrangement of equipment as the frames just described. As features were added to this configuration of the APTT, it was necessary to add a supplementary automatic progression trunk test frame. This test frame is a single-bay unit (Fig. 4). A miscellaneous terminal strip is mounted at the top of the frame and a fuse panel at the bottom. All other mounting positions are intended to mount the various supplementary and auxiliary units of equipment associated with the basic APTT.

**2.08** The teletypewriter equipment shown in Fig. 1 is a cabinet-mounted standard 28ASR teletypewriter. Tape winder and tape unwinder equipment are mounted on the cabinet. By means of the teletypewriter keyboard, perforations in standard teletypewriter code can be punched on tape for subsequent use in controlling the automatic operation of the test frame. Some of the test frame control keys also appear on the teletypewriter. The reperforator, part of the teletypewriter set, is also used to duplicate existing tapes that have become worn or damaged or to produce data or busy retest tapes. The tape used with this configuration of the APTT is yellow KS-8485 L1 teletypewriter tape. These tapes are run through the transmitter-distributor, also part of the teletypewriter set, with the COPY key operated to cause the reperforator to produce a copy of the original tape.

#### C. Automatic Progression Trunk Test Frame With 28B Teletypewriter Set and Automatic Transmission Measuring System

**2.09** The 28B teletypewriter set, which is furnished with this configuration of the APTT, is the same as the 28A teletypewriter set just described with the exception that a tabbing feature is added. This tabbing feature produces a teletype page



**Fig. 4—Supplementary Automatic Progression Trunk Test Frame**

printout so that transmission cues and operational marks are printed in separate columns for easy identification (Fig. 5), when performing transmission tests.

**2.10** The test frame, CAMA test frame, and supplementary test frame for this configuration

of the APTT have basically the same arrangement of equipment as those just described. The jack, key, and lamp panel, pigeon holes, and writing shelf are shown in Fig. 6.

**2.11** An ATMS director is added to allow automatic transmission testing in addition to automatic operational testing of trunks by the APTT. The ATMS director consists of circuit packs mounted in four horizontal shelves on the transmission automatic progression frame (Fig. 7). In addition to the director, a loss and noise deviation register panel may be added to this frame.

**2.12** An ATMS responder in conjunction with a 105-type test line, an improved 100-type test line, 102-type test line, or 104-type test line must be supplied in the distant office to allow the ATMS to conduct transmission tests and noise measurements.

**2.13** When the adjacent office is equipped with a remote office test line (ROTL), the APTT can perform operational and transmission tests of the trunks in the remote office.

**2.14** The APTT in this configuration has features to allow it to perform automatic operational and transmission tests of home office test lines. Home office test lines are those test lines located in the APTT office which would be used by other offices testing their outgoing trunks terminating in the APTT office.

### 3. DESCRIPTION OF TESTS

**3.01** The tests which can be applied by the test frame are covered in 3.02 through 3.07. These include test line tests of ringing, supervision, and continuity-polarity features, and when the APTT has ATMS associated with it, transmission tests.

**3.02** The incoming trunk distant office (ITDO) class of test is a test line test which is applied to interoffice outgoing trunks when these trunks are directed to automatic test lines in distant offices. The ITDO class of test is also used for operational tests performed on remote office trunks when this feature is provided since this is the manner in which the access trunk is seized. The intraoffice test line (IAO1) class of test is a similar test line test which is applied to intraoffice and intermarker group trunks to check ringing, pretrip

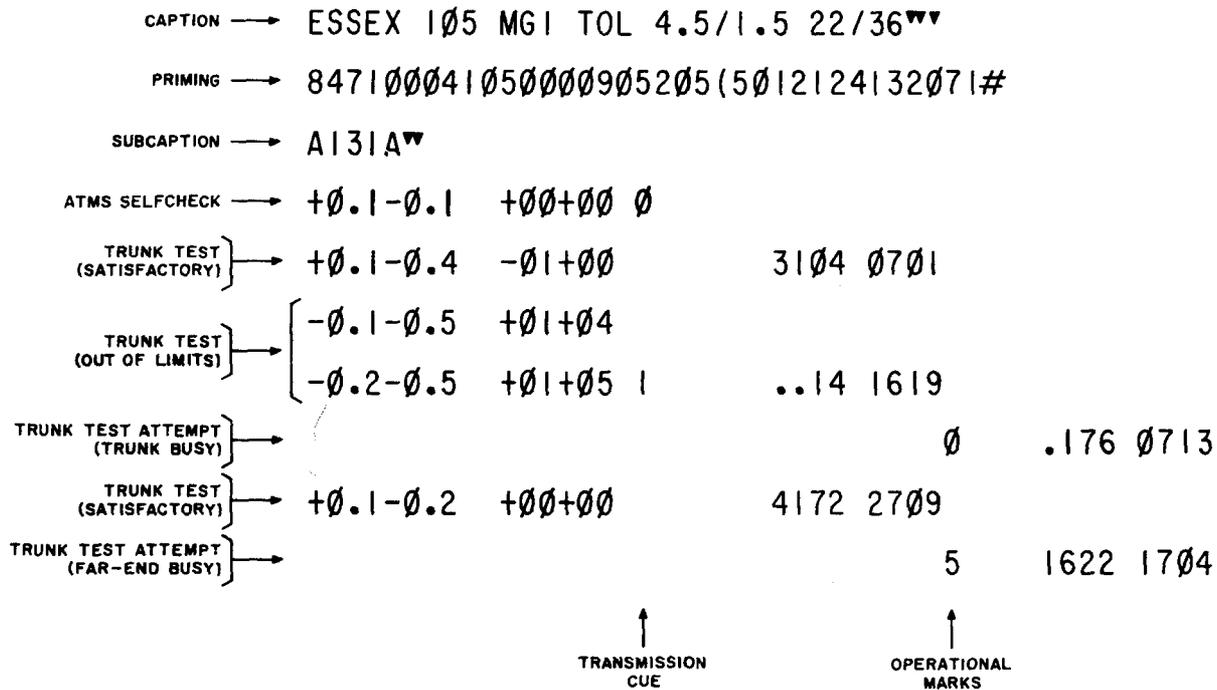


Fig. 5—Teletypewriter Page Printout—Typical

and trip, and operate and release of the calling supervisory relay.

**3.03** The ITDO class of test also includes a continuity-polarity test of the outgoing cable pair and a busy-line test where the trunk is directed to a busy line in the distant office.

**3.04** The outgoing trunk (OGT) class of test is applied to interoffice outgoing trunks when the charge features are tested. The intraoffice trunk-charge feature (IAO2) class of test is a similar test of the charge features of intraoffice and intermarker group trunks.

**3.05** The IAO2 class of test also includes a no-charge test of intraoffice trunks where the trunk tested is directed to a free number in the local office.

**3.06** The CAM0 class of test is made on all CAMA trunk circuits or junctors to check the relays and charging features. The CAM1 class of test is made only on CAMA intermarker group trunks and those CAMA incoming trunk circuits with local completion. The test is routed to the terminating

test line of the test circuit to check ringing, pretrip and trip, and terminating polarity.

**3.07** In addition to the operational tests, the test frame, when ATMS is provided, can perform loss and noise transmission tests on outgoing trunks.

#### 4. METHOD OF OPERATION

##### A. Tape Information With Model 14 or 28A Transmitter-Distributor—Operational Tests Only

**4.01** The information which directs the test frame to perform each trunk test is perforated on standard heavy-duty, gray teletypewriter tape. Each part of the test entry is coded in a 2-out-of-5 additive code. A typical test entry is shown in Fig. 8. The information required to test a trunk includes the route information (office code of called office, foreign area prefix, and the class of service); the class of trunk (flat rate, message register, coin, or AMA); the class of trunk test, type of test line, or if the trunk is an intermarker group subscriber-to-subscriber trunk, the number of the terminating marker group (furnished by the tape entry and key on test frame operated); the number of digits in the called office code; the number of the trunk

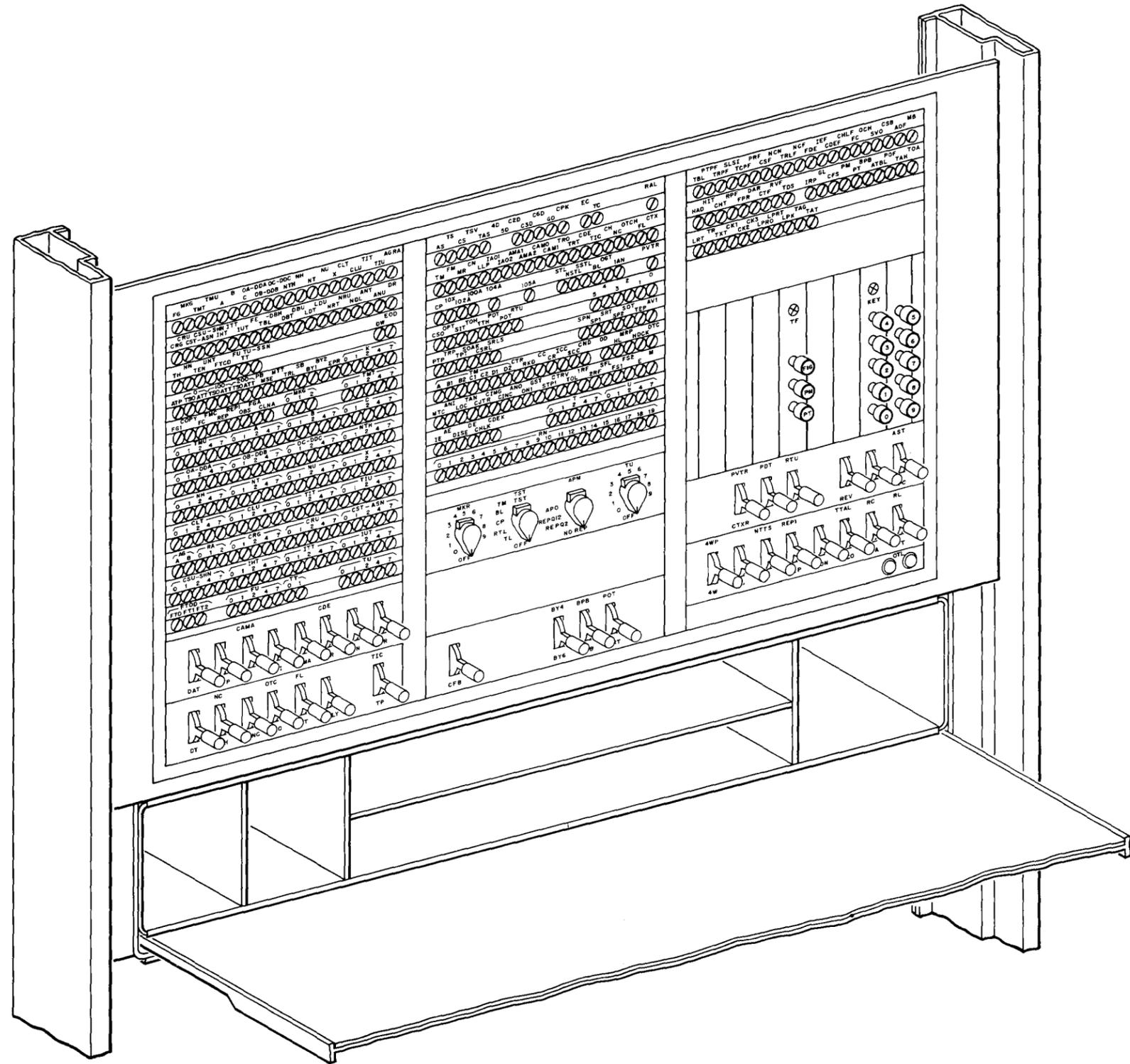
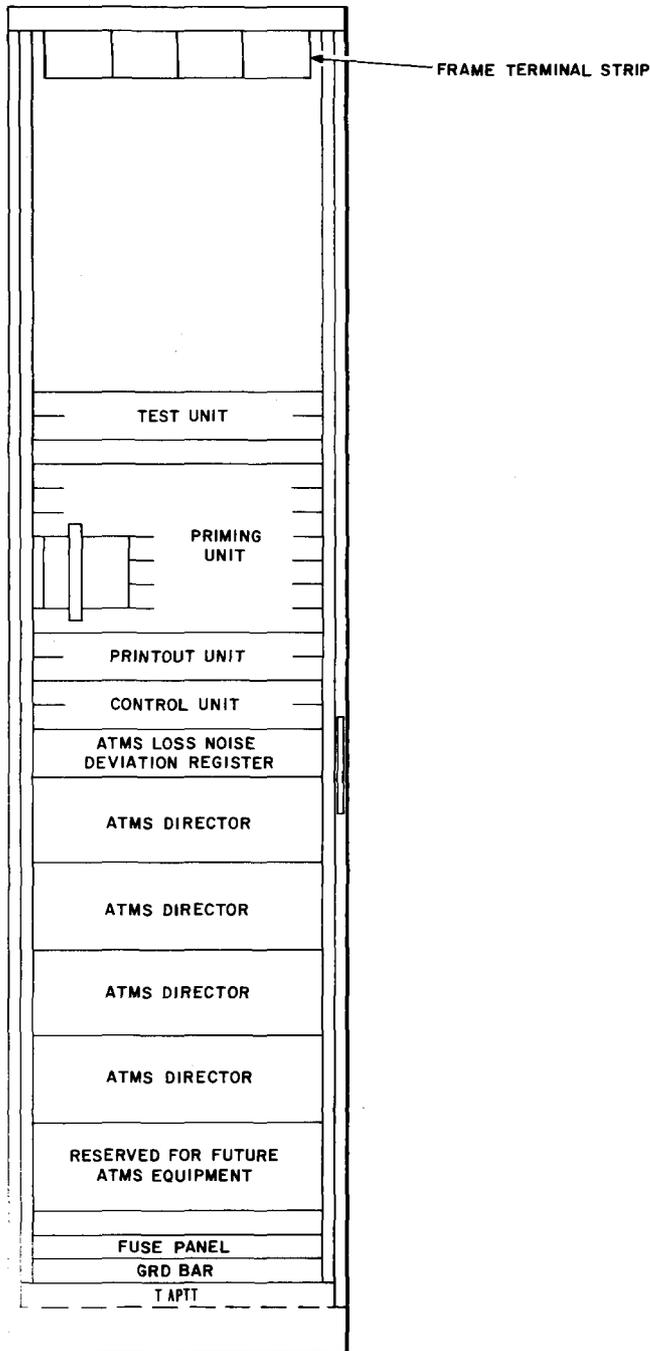
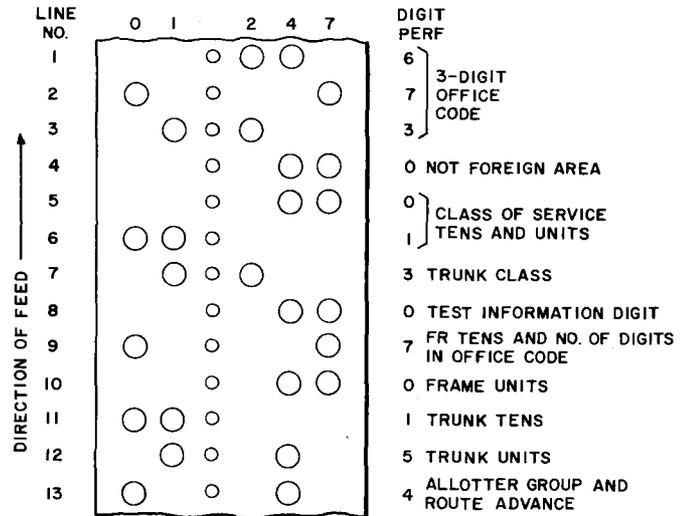


Fig. 6—Jack, Key, and Lamp Panel—Pigeon Holes and Writing Shelf—Typical



**Fig. 7—Transmission Automatic Progression Trunk Test Frame**

link frame on which the trunk appears; the number of the trunk within a block of 20 and route advance information so that the test frame can seize other than a first choice trunk.



**Fig. 8—Fully Perforated Tape Prepared by Model 14 or 28A Reperforator**

**4.02** A test entry is required for each trunk tested. If the trunk is a combined trunk and its charge features are to be tested, more than one test entry is required. For example, in respect to a trunk which handles both AMA and message register calls, there would be one entry for a test of its AMA functions and another entry for a test of its message register functions.

**4.03** For key control method of priming, the APTT has keys numbered 0 to 9 which may be used when perforating tape. It also provides progress lamps which light to indicate which part of a test entry is to be perforated. The APTT requires the operation of one of the 0 to 9 keys (lighting a check lamp corresponding to the key operated) followed by the operation of a perforate key to make a perforation in the tape. The fact that a perforation is not made directly by the operation of one of the 0 through 9 keys allows a visual check of the digit selected and a correction made if the wrong key has been operated before the perforation is made in the tape. In addition, if no visual check is desired, it is possible by the operation of another key to cause the tape to be perforated as soon as a 0 through 9 key is operated.

**4.04** Each operation of the 0 through 9 keys perforates one part of the information required for a complete trunk test entry. After a complete test entry is perforated, a key is operated

to produce spaces before perforating the next trunk test entry.

**4.05** Control tapes can be prepared by listing all trunks on one tape or by listing trunks on separate tapes according to some common feature such as trunk class.

**4.06** In addition to the check feature just described, control tapes can be checked by threading the tapes in the transmitter-distributor and operating the tape check key. This allows the test frame to read one trunk test entry at a time and display the entry on lighted lamps to provide a visual check. After the lamps are observed, an advance key can be operated to check the next trunk test entry. This operation can be repeated until the complete tape is checked.

**4.07** Control tapes can be duplicated by copying them. The original control tape is placed in the transmitter-distributor, the transmitter-distributor and the reperforator are turned on, and a copy key is operated. A start key is operated and a duplicate of the original tape is produced.

**4.08** Switch control of priming information (Fig. 22) may be provided for any vintage of the APTT. Rotary switches, one per line of input information, may be used to replace the 0 to 9 (G-type) keys presently used. Using the G-type keys makes it necessary to sequentially key in all the information required to direct the trunk tests. The number of lines of input required varies according to the features incorporated in the particular frame, but requires considerable effort in priming since all digits have to be repeated for each trunk tested where the key method is used. When manually selecting a particular trunk using the switch control method only the trunk location information (4 lines) need be changed from one trunk entry to another when the trunks are in the same group. This method requires only the resetting of the switches for those four lines instead of repeating all lines of input.

**B. Tape Information With 28A or 28B Teletypewriter Set**

**4.09** The information which directs the test frame to perform each trunk test when using a 28-type teletypewriter set is perforated on yellow, chadless teletypewriter tape. The perforated information is also shown in letters, digits, and

symbols on the tape. Each part of the test entry is coded in a standard teletypewriter 0-to-5-out-of-5 code (X/5). A typical test entry is shown in Fig. 9. Fig. 9 shows the relationship between the punches and the printing on the tape and illustrates a typical test entry. When the 28A teletypewriter set is used, the APTT does not have ATMS associated with it, the portion of the tape in Fig. 9 showing caption, transmission priming, and facility caption would not be used since the APTT without ATMS does not perform transmission testing or provide for caption information to be read and printed. In addition, the marker priming information would be in a different order; however, the information on the tape would be in the same X/5 code and would have basically the same format.

**4.10** The teletypewriter set provides for printout of test results and for putting caption information on tape and causing this caption information to appear on the printout to aid in identifying the trunk group, facility, type of test, etc (28B teletypewriter set). As a result of having information on tape which is to be printed on page copy but is not to be registered in the test frame, it is necessary to use teletypewriter symbols to instruct the test frame to register that information which is required for testing and to print that information which is not required by the test frame to perform a test. In addition, these symbols are used to instruct the printer in the teletypewriter set to start a new line or space between portions of the printed information. Some of the symbols instruct the test frame to register information which would be common to a group of trunks and release this information when the group has been tested.

**4.11** The APTT equipped with a 28A or 28B teletypewriter set requires basically the same information perforated on tape to perform an operational test on a trunk as the older test frame. The order in which the information is perforated on the tape varies and when the APTT has ATMS associated with it and a transmission test is desired, transmission information must also be perforated on the tape.

**4.12** The APTT equipped with 28A or 28B teletypewriter provides tape simplification so that a complete test entry is not required for each trunk in a group to be tested. The one exception is CAMA incoming trunk circuits which are accessed through special CAMA access switches

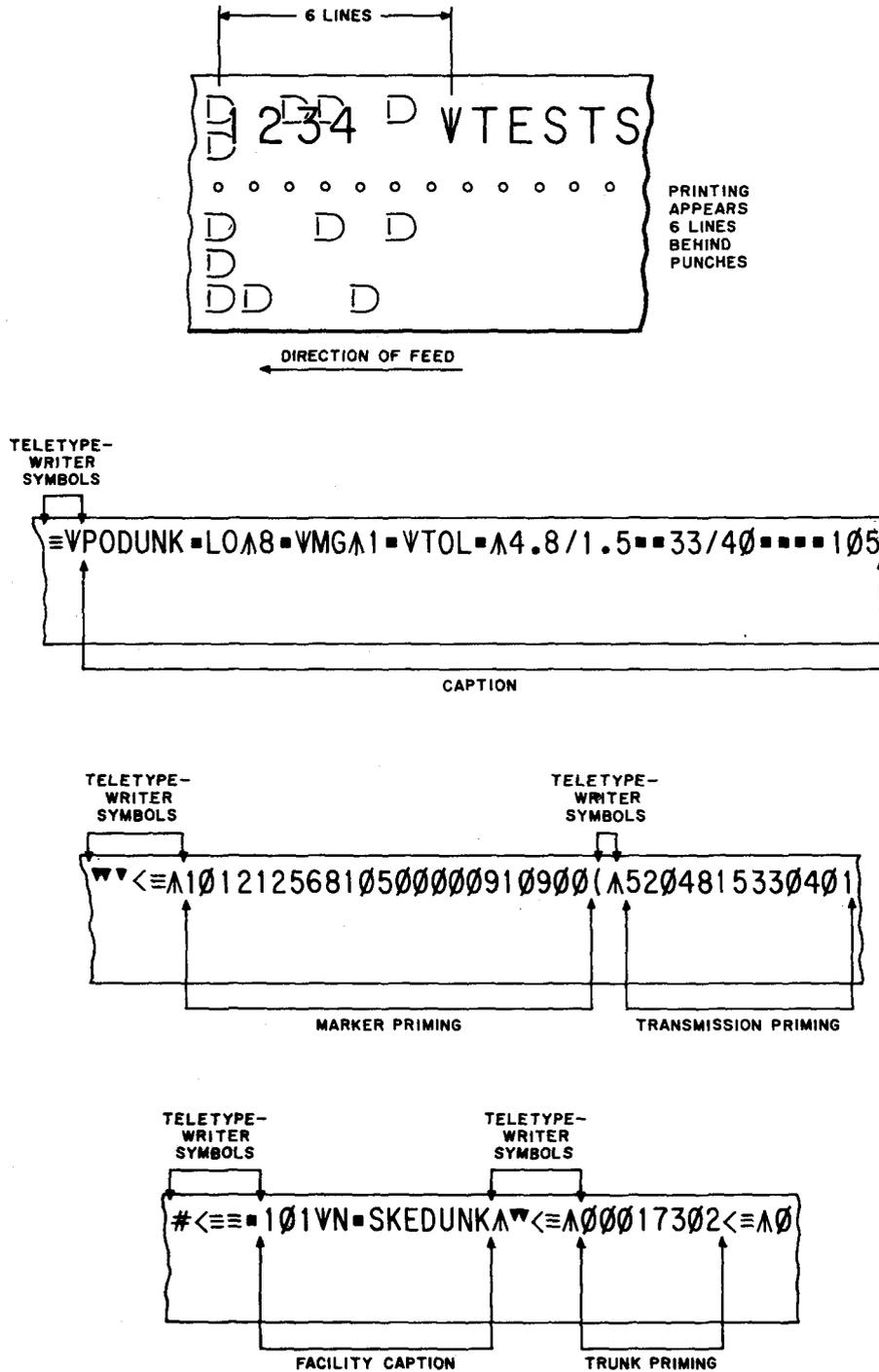


Fig. 9—Chedless Tape Prepared by 28A or 28B Teletypewriter Set—Typical

and as a result, tape simplification is not provided when using an APTT with a 28A teletypewriter. The information which is common to all the trunks in a group can be perforated on tape along with the proper machine instructions in the form of

teletype symbols to cause the test frame to register this information to be used for testing all the trunks in a group. The common information, or marker priming as it is called in Fig. 9, is followed by trunk location information and trunk priming

for each trunk in the group for operational testing. If the APTT has ATMS associated with it and a transmission test is desired, common transmission information (transmission priming), is included on tape ahead of the trunk priming information for all trunks in the group which have common transmission requirements. It is possible to change the transmission priming without changing the marker priming and follow it with trunk priming for trunks in the group which have different transmission requirements from those following the first transmission priming.

**4.13** The teletypewriter keyboard may be used to perforate tape on a local basis, however tape will normally be prepared at a centralized location. The keyboard allows letters and symbols as well as numbers to be perforated on tape. Unlike the earlier version of the test frame, once a start key is operated, tape is perforated directly from the operation of a key on the keyboard. Error checks for this version of the test frame are made by reading the printing on the tape or reading the page copy which can be produced when tape is perforated.

**4.14** Control tapes are arranged for testing in various sequences depending upon the purpose of the test. Usually, trunks will be arranged by transmission facility for transmission tests or by trunk groups for operational tests.

**4.15** With this version of the APTT, control tapes can be duplicated by copying them in the same manner as previously described.

**C. Preparation for Trunk Tests**

**4.16** Before trunk tests are started, the required trunk class and test control keys on the test frame must be operated. There are trunk class keys corresponding to flat rate, message register, coin, AMA, ANI, CAMA, data, line link pulsing, four wire, and centrex. These keys are operated according to the classes of trunks to be tested. For example, if the coin and message register keys are operated, only trunks whose tape test entries indicate that they are coin or message register trunks would be tested and all other trunks would be passed by. Trunk class keys are not operated for test line type of trunk tests where the same test is applied to all classes of trunks.

**4.17** The test control keys are operated according to the test which is to be performed. In addition to these keys, a marker group key is provided when the test frame has the 14 or 28 transmitter-distributor and reperforator. When a 28-type teletypewriter set is provided, the marker group is punched on tape. In addition to this key, there is a marker switch to select the particular marker within the group which should be seized to establish the test connection.

**4.18** If it is desired to check that each trunk tested restores to normal within the proper time interval after being released, a repeat test of each trunk is made. This causes each trunk on the tape to be tested twice.

**4.19** Once the trunk class and test control keys are operated and the tape is threaded on the transmitter-distributor or teletypewriter set, the test is started by operating a start key. This causes the information on each line of the first test entry to be read and recorded by the register relays in the test frame.

**4.20** The same information for a particular trunk can be put into the test frame on a manual basis by the operation of a particular circuit key, the start key, and the 0 through 9 keys on the APTT to cause test information to be recorded.

**4.21** When the APTT is equipped with a 28-type teletypewriter set, there are keys on the test frame, in addition to the 0 through 9 keys, which take the place of part of the teletypewriter symbols to instruct the test frame when performing a manual test.

**4.22** After all information is recorded by the test frame, either by tape reading or by particular circuit key punching, the test frame bids for preference in the master test control circuit of the master test frame. After preference is gained, it bids for the marker through the master test frame connector. When the marker has been seized, the test frame simulates the action of an originating register by passing to the marker the class of service and line location of the originating test line and the office code and terminating line number of the line to which the test call is to be directed. In addition, it operates test relays in the marker in order to direct it to the particular trunk to be tested. The marker proceeds to

establish the indicated test connection for each class-of-trunk test.

**4.23** If the marker or any associated equipment encounters trouble in establishing the connection, trouble cards are punched by the trouble recorder and a trouble release signal is returned to the test frame to cause it to release the test call and sound a minor audible alarm (APTT with 14 or 28 transmitter-distributor and reperforator) or produce a trouble printout (APTT with 28-type teletypewriter set).

**4.24** If the marker finds that all senders on the desired route are busy, an all-senders-busy signal is returned to the test frame. Since this signal indicates that traffic on the desired route is excessive, a minor audible alarm is sounded (APTT with 14 or 28 transmitter-distributor and reperforator) or a printout and busy retest tape entry is produced (APTT with 28-type teletypewriter set).

**4.25** If the marker finds that the trunk to be tested is busy, a signal is returned to the test frame which will cause the test frame to release the connection and attempt a retest of the same trunk in 2, 4, or 6 minutes (key control). If the attempted retest finds that the trunk is again busy, a minor alarm is sounded (APTT with 14 or 28 transmitter distributor and reperforator) or a printout is made (APTT with 28-type teletypewriter set). However, if the automatic pass-busy key is operated, the test frame will pass by the busy trunk without attempting a retest and will test the next trunk on the tape. Whenever a busy trunk is passed in this manner, the fact is recorded by scoring a busy register. When the APTT has ATMS associated with it, a bypass busy key is provided which causes the frame to pass by busy trunks without registration or printout.

**4.26** If the test frame attempts to seize the marker assigned to work with the line insulation test circuit, a signal is returned to the test frame which causes it to sound a minor alarm.

**4.27** Minor alarms sounded by the test frame can be cut off by operation of the alarm cutoff key. Each alarm condition which occurs causes the trouble register to be scored.

#### **D. Trunk Operational Tests**

##### **Incoming Trunk Distant Office (ITDO) Class-of-Trunk Test**

**4.28** This is a test line class of test which can be applied to flat-rate, message register, coin, or AMA interoffice outgoing trunks. In the case of an AMA trunk, the test frame prevents AMA equipment being called in and AMA tape entries being made. Since this is a test line test, the TL key or switch is operated on the test frame to cause a test line test.

**4.29** Tape reading occurs and the marker is seized. If the route advance information registered by the test frame indicates that the trunk to be tested is on an alternate route, the test frame causes the marker to route advance until a route relay corresponding to this alternate route is operated in the marker. If the trunk desired is in an allotted trunk group, the test frame will cause the marker to operate the correct group relay.

**4.30** Once the correct route and group relays are operated in the marker, the test frame prevents the marker from performing the usual frame and trunk hunting operations and directs the marker to bid for and seize the particular trunk link frame and outgoing trunk on that frame which is to be tested. The marker connects a sender to the trunk and then establishes a connection between the trunk appearance on the trunk link frame and the originating test line appearance on the line link frame. It also operates the trunk test relay and then performs the usual checks and restores to normal.

**4.31** The sender outpulses to the distant office, causing the switching equipment in the distant office to connect to an automatic test line. Once the sender has outpulsed, it connects the outgoing trunk tip and ring and restores to normal. The test connection has now been established as shown in Fig. 10.

**4.32** Once a satisfactory ITDO test connection has been established, the automatic test line applies supervisory tests to the incoming trunk in the distant office. Supervisory tests cause several reversals of the polarity from the distant office to the local office. Each of these reversals is a signal of the progress of the test and causes the operation

of the called supervisory relay in the outgoing trunk. During an ITDO test connection, the test frame counts and, in some cases, times these relay operations.

**4.33** If the automatic test line is of the synchronizing type, it returns a series of long and short reversals which can be timed and counted. If the test line is a nonsynchronizing type, the pulses are counted, but not timed. If the test line is a step-by-step automatic test line, only part of the pulses are counted since the first reversal may be too short and the last too long for a proper indication.

**4.34** When all the pulses are received, the test frame lights a test complete lamp and advances to the next trunk on the tape.

**4.35** If automatic test line ringing and supervisory tests fail, the test frame times out and sounds a minor alarm (teletypewriter set not furnished) or produces a trouble printout (teletypewriter set furnished). When the test frame sounds an alarm and no printout is furnished, the test which failed is indicated on the frame by lighted lamps.

**4.36** Five other types of tests are included in the ITDO class of trunk test. One occurs when the busy-line key rather than the test-line key is operated. This directs the connection to a busy line in the distant office and the busy-back pulses are counted by the test frame to indicate a complete test. This is true for APTTs which provide for cross connecting test line numbers. In later versions of the APTT, the test line number must be placed on tape as part of marker priming and would require that one tape be prepared for a test line test and another for a busy line test. A continuity and polarity test can be made by operation of the continuity-polarity key on the test frame. The marker establishes the same connection in the local office as before but no connection is established in the distant office since the sender is not allowed to outpulse. The trunk test equipment in the test frame tests the trunk for proper polarity. A reverse key may be operated when tip and ring are poled with battery on the tip and ground on the ring.

**4.37** Another test which can be made is a 103-type trunk test. This type of test directs the test call to a test trunk which is arranged to check the supervision and rering of an incoming intertoll trunk in the distant office.

**4.38** A data synchronous test circuit is provided which provides tone signaling in addition to the dc signaling normally used on a synchronous test line. These tones allow for four test failure conditions to be detected. These are prering failure, ringing polarity failure, pretrip failure, and polarity continuity failure.

**4.39** Since centrex trunks are used for completing either centrex or noncentrex calls, the only function peculiar to a centrex class call is the ability of the trunk to provide station transfer. This transfer function is tested in a centrex class test and all other functions of the trunk are tested on a noncentrex basis.

**4.40** The station transfer feature is tested by introducing the proper class test on the test tape to prime the marker with the centrex terminating test line number in the distant office. The incoming trunk test circuit in the distant office recognizes the call as a centrex class and after making operational tests, will also initiate a transfer request.

**4.41** The don't answer transfer feature is tested by introducing the proper class test on the tape and operating the don't answer transfer key on the test frame. This primes the marker for the don't answer transfer test line number in the distant office. The distant office test line is an on-hook termination that is cross-connected to provide don't answer transfer. Don't answer transfer timing may be 15, 30, 45, or 60 seconds depending on the arrangements of a particular office. When the trunk being tested is terminated in the test line, the APTT waits for the particular timing cycle of the trunk to stop ringing and automatically initiate a don't answer transfer. When the transfer is initiated, the trunk is connected to a post transfer subunit of the terminating test line, which recognizes a successful transfer and returns a tone to indicate a successful test. The test frame advances to the next trunk.

**4.42** A remote office test can be made in the ITDO class of trunk test using an APTT provided with this feature. The test may be an operational test or a transmission test. It requires the operation of a test feature key and the appropriate information on the tape to cause seizure of an access trunk and to prime the ROTL in the remote office with information to seize the remote office trunk to be tested. The access trunk is

seized in much the same manner that a trunk to be tested is seized. The number outpulsed is that of the ROTL in the remote office. As soon as the ROTL is seized, it returns a tone to the APTT to indicate that it is ready to receive information. The APTT receives the tone, reads the ROTL information from tape, and outpulses five digits to the ROTL. This information is received and translated into information required to select a particular trunk for testing. The desired trunk is selected (Fig. 11) and the test is performed. The ROTL converts the DC pulses received from the terminating test line into tone pulses which are sent over the access trunk to the APTT for counting. When the test is complete, the APTT sends a disconnect tone to the ROTL. The ROTL disconnects from the trunk that was tested and sends a tone to the APTT to indicate that it is ready to receive information for the next trunk to be tested. This procedure continues until all trunks in the ROTL group have been tested.

**4.43** Home office test lines can be tested in the ITDO mode. The connection is established using the trunk link frame appearance of the APTT and establishes a terminating connection in much the same manner that a line link pulsing test connection is established. Once the home office test line is seized, ringing is tripped and the test line may then operate the supervisory relay in the APTT in the same manner that it would function in an ITDO test call. If the home office test line test is a transmission test, when ringing is tripped, the tip and ring are cut through to a tone detector for tone only supervision. When the detector recognizes the tone supervision, the test proceeds as any other transmission test call. (Refer to Part 4, E.)

**Intraoffice and Intermarker Group Subscriber-to-Subscriber Test Line (IAO1) Class-of-Trunk Test**

**4.44** This is a test line class of test which can be applied to flat-rate, message register, coin, and AMA intraoffice trunks. In the case of the latter, the test frame prevents AMA equipment from being called in and AMA tape entries being made. Since this is a test line test, the proper key or switch is operated on the test frame to cause a test line test.

**4.45** Tape reading occurs and the marker is seized. The marker seizes the intraoffice trunk to be tested in exactly the same manner

that it seizes an outgoing trunk in the ITDO class of test. The marker then seizes the correct number group in accordance with the thousands digit of the terminating line number with which it has been primed. In this class of test, the terminating line number is the number of the terminating test line. This line appears in the number group in a PBX hunting group without battery on its sleeve lead to make the line always appear busy to service calls. On a test call, the test frame prevents the marker from performing the usual PBX hunting operation and directs the marker to seize this line directly. With the line location and the ringing combination information furnished to the marker by the number group and the test frame, the marker establishes a connection between the terminating test line and the originating test line through the intraoffice trunk. The marker connects the correct ringing supply to the intraoffice trunk, performs the usual checks, and restores to normal. The test connection has now been established as shown in Fig. 12.

**4.46** Once a satisfactory IAO1 test connection has been established, the test frame proceeds to apply the IAO1 sequence of tests. For these tests, the test frame has access to both the originating and terminating tip, ring, and sleeve conductors. The tests applied are continuity of connection, originating and terminating polarity, ringing, pretrip, trip, and S and S1 relay operation. As each test in the sequence is applied, a satisfactory outcome causes the test frame to step automatically to the next test until the entire test cycle is complete. At this point the test frame releases the connection and causes the next trunk on the control tape to be seized. If at any point a test fails, the test frame sounds a minor alarm or produces a printout and advances to the next trunk.

**4.47** The IAO1 class-of-trunk test can also be applied to intermarker group subscriber-to-subscriber trunks. The sequence of tests is the same, but the connection is established in a different manner. The marker in the calling marker group is directed to seize the intermarker group trunk to be tested and establish a connection between it and the originating test line. The marker also bids for an intermarker group sender and associates it with the trunk through the sender link. The marker then performs its usual checks and restores to normal. The intermarker group sender bids for a marker in the called marker group through the incoming register marker connector, and when

it gains connection to a marker, passes to it the location of the intermarker group trunk and the called number. This marker seizes the correct number group in accordance with the thousands digit of the terminating line number which denotes the terminating test line in that marker group. Since the test frame does not have control of this marker, it cannot prevent it from PBX hunting. It therefore places battery momentarily on the sleeve of the terminating test line so that it will be selected when the marker performs its PBX hunting operation. The marker receives the ringing combination from the number group instead of from the test frame. The marker then completes the connection in the usual manner. The test connection is now established and is shown in Fig. 13.

**Intraoffice and Intermarker Group Subscriber-to-Subscriber Trunk Charge Feature (IAO2) Class-of-Trunk Test**

**4.48** In this class of test, the charge features of message rate, coin, and AMA intraoffice trunks are tested. In order to prime the test frame to perform the IAO2 class of test, the return test line key or switch is operated together with other test control keys.

**4.49** Tape reading takes place and the marker is seized by the test frame. The marker then establishes the same test connection as in the IAO1 class-of-trunk test. This connection is shown in Fig. 14.

**4.50** Since the charging operation of the seized trunk is tested during the IAO2 class of test, coin deposit is simulated when coin trunks are seized, and when AMA trunks are seized, the appropriate AMA equipment is called in.

**4.51** If AMA equipment is called in, the marker bids for a sender and registers in the sender the calling line location, party identification, called number, and a signal that the call is a test call. The marker causes the sender to be connected to the intraoffice trunk and prevents the sender from outpulsing. The sender then bids for a transverter, and when the transverter is seized, the required information is passed to it by the sender and the test frame also signals the transverter that the call is a test call. This causes the transverter to convert the message billing index to zero so that any entries perforated on tape will be recognized as test entries. The transverter obtains a translation of the calling line location, seizes a recorder, and

causes the recorder to perforate an initial entry on the AMA tape. At the same time, the transverter operates test relays in the recorder to connect it to a multiple which extends from the test frame. This multiple allows the test frame to monitor and record recorder functions to obtain test results for the trunk under test. When the test is completed, the test frame restores the test relay in the recorder.

**4.52** Once a satisfactory IAO2 test connection is established, the test frame proceeds to apply the IAO2 sequence of tests to the intraoffice trunk which it directed the marker to seize. For the IAO2 class of test, the test frame has access to both originating and terminating tip, ring, and sleeve conductors, and in the case of an AMA call, the AMA recorder. As each test is applied, successful completion causes the test frame to step automatically to the next test until the entire IAO2 test cycle is complete. At this point the test frame lights the test complete lamp and causes the next trunk programed on the control tape to be seized. If at any point a test fails, the test frame is blocked and sounds a minor alarm or produces a trouble printout and proceeds to the next trunk.

**4.53** At the start of the IAO2 class of test, certain tests, such as a test of continuity and polarity, are applied to all classes of trunks. When these tests are applied satisfactorily, the test frame will apply one of several possible charge feature tests depending on which test control keys are operated. These tests include noncharge, charge, overtime charge, originating or terminating timed release, and cancel disconnect entry tests.

**4.54** Two other types of tests are included in the IAO2 class of test. One of these tests is a free-line test and occurs when the free-line key is operated. When the marker seizes the appropriate number group and gives it the free-line number for a line number translation, the information that the call is a free-line call is then registered in the marker. Cross-connections in the number group give the marker the line location of the terminating test line. The marker then proceeds to establish the usual IAO2 test connection between the originating test line and the terminating test line. The marker does not call in any AMA equipment on AMA calls and on other calls prevents the seized trunk from performing its charging operation. When the test connection is established, the test frame checks that the trunk being tested does not charge.

**4.55** The other type of test is an AMA trunk identity check. This is a special test of AMA trunks which is designed to be performed when trouble recorder cards indicate that the trunk identity check (TIC) lead of some AMA trunk is faulty. Since the trouble card does not identify the particular trunk which is faulty, a test is required to determine which AMA trunk is faulty. This test is performed by the test frame when the trunk identity check key, the return test line key, and the charge keys are operated. Since a faulty TIC lead prevents the AMA recorder from perforating an initial entry, the test frame tests each AMA trunk for initial entry only. This permits a rapid check of all AMA trunks.

**4.56** All tests in the IAO2 class of trunk test, except the free-line test can be applied to intermarker group subscriber-to-subscriber trunks. The sequence of tests is the same but the test connection is different. The test connection is established in the manner described for IAO1 class of test for intermarker group subscriber-to-subscriber trunks. The connection is similar to that shown in Fig. 13 except that AMA and coin supervisory equipment are included.

#### **Outgoing Interoffice Trunk (OGT) Class-of-Trunk Test**

**4.57** In this class of test, the charge features of message register, coin, and AMA interoffice outgoing trunks are tested. To prime the test frame for the OGT class of test, the return test line key or switch is operated with the other test control keys mentioned in subsequent paragraphs.

**4.58** Tape reading takes place and the marker is seized by the test frame. The marker then establishes the same connection in the local office as in the ITDO class of test. No connection is established in the distant office as the sender is prevented from outpulsing. Since the charging operation of the seized trunk is tested during the OGT class of test, coin deposit is simulated when coin trunks are seized, and when AMA trunks are seized, the appropriate AMA equipment is called in. AMA equipment is called in as in the IAO2 class-of-trunk test. The test connection is shown in Fig. 15.

**4.59** Once a satisfactory OGT test connection has been established, the test frame proceeds to apply the OGT sequence of tests to the outgoing trunk. The trunk test relay in the interoffice

outgoing trunk circuit is operated by the marker. This gives the test frame access to both the tip and ring of the outgoing trunk relay circuit and the terminating tip and ring of the trunk relay circuit. The test frame also has access to the CS lead which allows it to monitor operation of the called supervisory relay. In addition, the test frame has access to the tip, ring, and sleeve conductors of the originating test line. As each test in the sequence is applied to these conductors, a satisfactory outcome causes the test frame to step automatically to the next test until the entire OGT test cycle is complete. At this point, the test complete lamp lights on the test frame and the test frame releases the connection and causes the next trunk on the control tape to be seized. If at any point the test fails, the test frame blocks and sounds an alarm or produces a trouble printout. Lighted lamps identify the point of failure.

**4.60** At the start of the OGT class of test, certain tests, such as tests of tip and ring polarity and continuity, are applied to all types of trunks. When these tests are successfully applied, the test frame will apply one of several possible charge feature tests in accordance with the operated test control keys. These tests include noncharge, charge, overtime-charge, originating timed release, and cancel disconnect entry tests. For trunks outgoing to TSP(S), operational tests are conducted via the return test line enabling the APTT to control both ends of the trunk. Test calls terminating to an operational test line in the distant office cannot be made from the APTT.

#### **Line Link Pulsing Trunk (OGT) Class-of-Trunk Test**

**4.61** In this class of trunk test, the tripping feature and the calling supervisory relay are checked. In order to prime the test frame for the line link pulsing (LLP) trunk OGT class of test, the return test line key or switch is operated.

**4.62** Tape reading takes place and the marker is seized by the test frame. The marker is then primed by the test frame in a manner similar to an incoming register. This information allows the marker to set up a connection from the test trunk appearance on the trunk link frame to the selected LLP trunk on the line link frame. The terminating test line has access to the LLP trunk through the operated line test relay in the line link frame. The test connection is shown in Fig. 16.

**4.63** Once a satisfactory LLP OGT test connection has been established, the test frame proceeds to apply tests to the tripping diode in the trunk circuit to determine proper polarity and to check the operation and release of the called supervisory relay in the circuit. For trunks having E and M lead signaling, the tripping diode test is the same but the supervisory test consists of a check of the operation of the E relay in the trunk circuit.

**4.64** After the tests just described are complete, the trunk is released and the test frame proceeds to the next trunk on the control tape.

**CAMA Incoming (CAM0) Class-of-Trunk Test**

**4.65** In this class of test, the relay equipment and charging features are tested for CAMA incoming trunk circuits, CAMA junctors, and CAMA intermarker group trunks. In order to prime the test frame to perform the CAM0 class of test, the return test line key or switch is operated together with the CAMA and charge or no-charge keys depending on the type of test required.

**4.66** Tape reading takes place and the marker is seized. The originating test line is connected to the originating end of the trunk via the line link frame if the test is for a CAMA junctor or through the CAMA access switch if the trunk is a CAMA incoming trunk circuit or CAMA intermarker group trunk. The trunk is then connected to a CAMA sender by the marker. If the trunk under test requires operator identification, the test circuit connects a simulated operator position.

**4.67** A continuity and polarity check is made at this time and then a check of the calling supervisory relay. After the CAMA sender receives the calling number, it will request the CAMA transverter to start an initial entry. The transverter makes a translation and selects a designated recorder and the recorder makes an initial entry. As soon as the test frame records the trunk number and checks for an initial entry, the transverter and recorder release.

**4.68** When the CAMA sender is satisfied that an initial entry has been made, it will request the marker to terminate the test setup. It passes the necessary information to the marker and releases.

**4.69** If the local completion feature of a CAMA trunk circuit is to be tested, the termination

must be established to the line link location of the terminating test line (APTT). After this connection is established, the test frame proceeds to test for tripping, ringing, and terminating polarity. It then checks supervisory relay operation and performs a noncharge test to determine that an answer entry will not be made. A relay release check is made, the test frame and trunk are released, and the test frame advances to the next trunk test entered on the tape.

**4.70** If tandem or intertoll completion features of a CAMA trunk circuit are to be tested, a termination must be established to a tandem or intertoll trunk. After this connection is established, as shown in Fig. 17, and the trunk test relay in the tandem or intertoll trunk circuit is operated, the test frame has access to the terminating end of the CAMA trunk circuit. The test frame then checks relay operation in the trunk circuit and performs a noncharge test to determine that an answer entry will not be made. A relay release check is made, the trunk is released, and the test frame advances to the next trunk on the tape.

**4.71** In addition to the tests described for CAMA trunk circuits, the following tests can be made. If the charge key was operated on the test frame, a charge test would have been made to determine that an answer entry had been made rather than the no charge test just described. After the charge test is made, an originating end disconnect test is made. If the cancel disconnect entry key was operated prior to the start of the test, a cancel disconnect entry test will be made. If the timed release originating hold key was operated along with the charge key, a timed release originating hold test will be made or a timed release terminating hold test could be made by operation of the corresponding key in conjunction with the charge key.

**4.72** If any of the preceding tests fail, appropriate lamps will light to indicate the failure or a trouble printout will be produced.

**CAMA Incoming (CAM1) Class of Trunk Test**

**4.73** This is a test line type of test performed on CAMA incoming trunk circuits provided with local completion and CAMA intermarker group subscriber-to-subscriber trunks. In order to prime the test frame for this test, the return test line key or switch along with the CAMA key is operated.

The test is made primarily to check for ringing and to apply a pretrip and trip ringing test.

**4.74** Tape reading takes place and marker is seized by the test frame. The trunk circuit is then seized in the same manner as described in the CAM0-type test.

**4.75** When the CAMA trunk circuit is connected through the access switch, a continuity and polarity check is made through to the trunk supervisory relay. The CAMA sender and position link are attached at this time. The calling number is pulsed into the CAMA sender. After the CAMA sender has received the calling number, it will request the CAMA transverter to start an initial entry. The sender passes to the transverter the information required for a CAMA recording. The transverter proceeds with a translation and selects the designated recorder and an initial entry is made. Before the CAMA circuits release, the test circuit records the trunk number and checks that an initial entry is made.

**4.76** When the CAMA sender is satisfied that the initial entry has been made, it will request a marker to terminate the test setup. The CAMA sender passes all the information necessary to the marker to complete the connection and then releases. The test connection shown in Fig. 18 is established.

**4.77** The test frame now applies a ringing test, a pretrip test, and a ringing test. After the ringing tests, the test frame applies a continuity and polarity test of the called end of the trunk.

**4.78** After performing the preceding checks, the trunk is released and the test frame advances to read the next trunk on the tape and seize that trunk for testing. If any of the tests described had failed, the test frame would have sounded an alarm and lighted appropriate indicating lamps or produced a trouble printout to indicate the trunk trouble.

#### **E. Trunk Transmission Tests**

**4.79** When the APTT has ATMS provided, it is possible to perform transmission tests in addition to operational tests. These tests consist of loss and noise measurements. The results of these tests are printed by the printing unit of the teletypewriter set. The printout for transmission

tests includes operational failure indications, when encountered, as well as transmission information.

**4.80** Transmission testing may be performed automatically by punching the appropriate information on tape or manually on a particular circuit basis by operating keys on the test frame to provide the same input information for a particular trunk as is provided by the tape on a trunk progression test basis. An example of tape for transmission testing is shown in Fig. 9.

**4.81** The test frame performs basically the same operations in setting up a transmission test call as it does in setting up an operational test line call. After the information required for seizing the trunk and performing the test is read from the tape, a bid is made for a marker to set up a connection to the far-end test line. If any busy or trouble conditions exist at this point, a printout of these conditions is made. The APTT may be arranged to pass by a trunk group under test whenever expected audible ring is received on any two trunks in the group. If a voice announcement is received, only the trunk under test is bypassed and the next trunk in the group is tested. A new arrangement may be provided for the APTT to pass by the trunk group whenever unexpected audible ring is detected on one trunk and voice announcement on another, or voice announcement is detected on any two trunks, or unexpected audible ring is detected on any two trunks. The only difference in this printout and that made on an operational test is the tabbing feature which allows operational results and transmission results to be printed in different columns on the printout format for easy identification. After digit registration and a connection has been set up to the far end (see Fig. 10 and 19 as typical examples of transmission test setups) the ATMS is given time to perform the test and the results are printed out.

**4.82** The types of tests which can be made are determined by the test lines being used. For example, an improved 100-type test line may be used for far-to-near loss measurement and near-end noise measurement. A 102-type test line may be used for far-to-near loss measurements only. A 104-type test line can be used for far-to-near loss, near-to-far loss, near-end noise measurements, and far-end noise check. A 105-type test line can be used for far-to-near loss, near-to-far loss, near-end noise, and far-end noise measurements. The same

types of tests may be performed on a remote office basis when the APTT office has access to a remote office test line office.

**4.83** Several printout modes can be selected under control of a switch on the test frame. There is a no repeat mode, repeat Q2 failures, repeat Q1 or Q2 failures, or abbreviated printout mode. Q1 indicates that a loss has exceeded the maintenance limit and Q2 indicates that a loss has exceeded the immediate action limit. For a more detailed treatment of ATMS tests and printout modes, refer to Section 103-250-100.

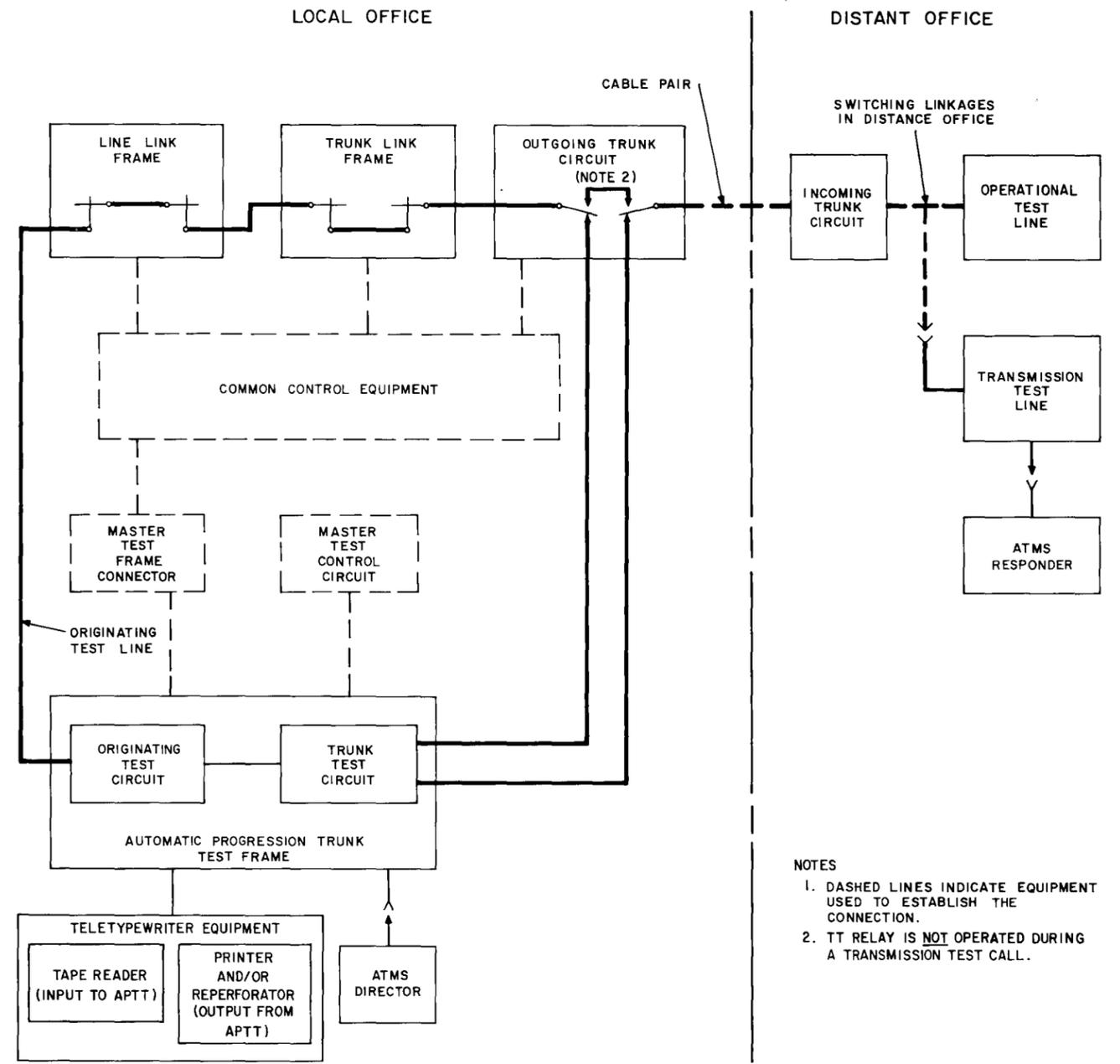
**4.84** Manual transmission tests may be performed using the APTT frame of any vintage, when the frame is so equipped. A 23C transmission measuring set for making manual loss measurements and a loudspeaker for monitoring test tones is provided. Tests can be made to code 100-, 102-, 104-, or loop-around type test lines as shown in Fig. 20 and 21.

#### **F. Termination of Trunk Tests**

**4.85** Trunk tests are terminated when the end of the tape is reached or when the test frame is blocked by a test failure during the test of a faulty trunk. When using the test frame equipped with a 28-type teletypewriter set, a faulty trunk will not cause the test frame to block.

**4.86** When a printout is not provided and the test frame sounds an alarm due to a test failure, the lamp display should be checked. If a repeat test is desired, operate the repeat key, followed by the circuit advance key. This causes the test frame to release, reseize, and retest the faulty trunk. The test frame can also be caused to perform repeat tests by remote control by operating the repeat key and then plugging a 32A test set into an RCA jack on any remote frame where these jacks are provided.

**4.87** When the test frame equipped with a 28-type teletypewriter set is used, the printout resulting from a test can be read and the faulty trunks indicated on the printout can be retested on a particular circuit basis by operating keys on the test frame to provide the frame with information to reseize the faulty trunk. In addition, trunks which were found busy on the test may be entered on a busy-retest tape which can be used to reattempt testing these trunks. The ability to perforate a retest tape for any trunk found to be busy or in trouble, when the APTT has been directed to test that trunk, may be provided for all vintages of the APTT. At the completion of testing, the tape produced as the result of such busy or trouble conditions may be used as a new input tape thereby enabling retest. Key control to read only the busy trunk or trunks in trouble is provided to allow either of these conditions to be entered on the retest tape.



- NOTES
1. DASHED LINES INDICATE EQUIPMENT USED TO ESTABLISH THE CONNECTION.
  2. TT RELAY IS NOT OPERATED DURING A TRANSMISSION TEST CALL.

Fig. 10—Incoming Trunk Distant Office (ITDO) Class-of-Trunk Test

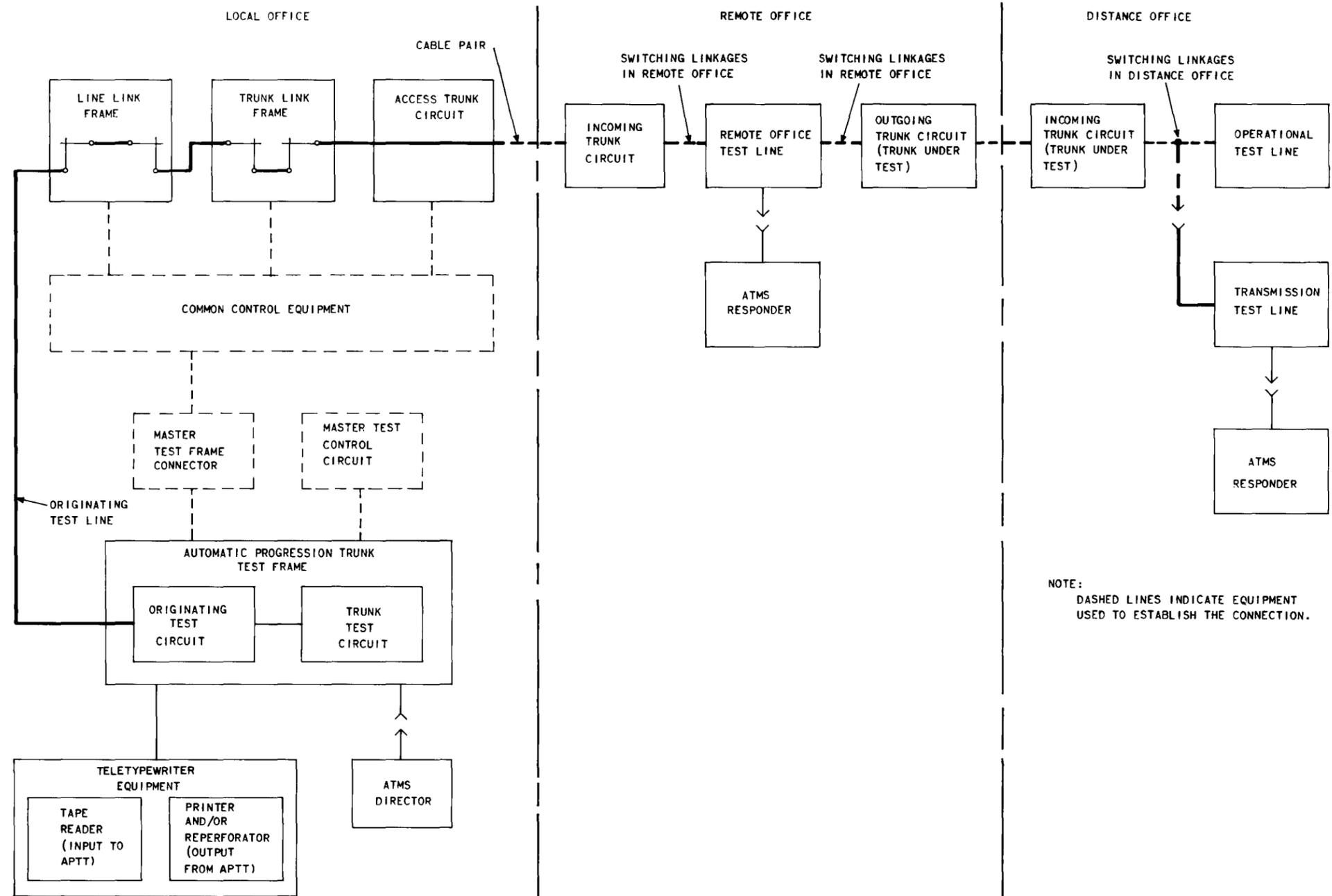
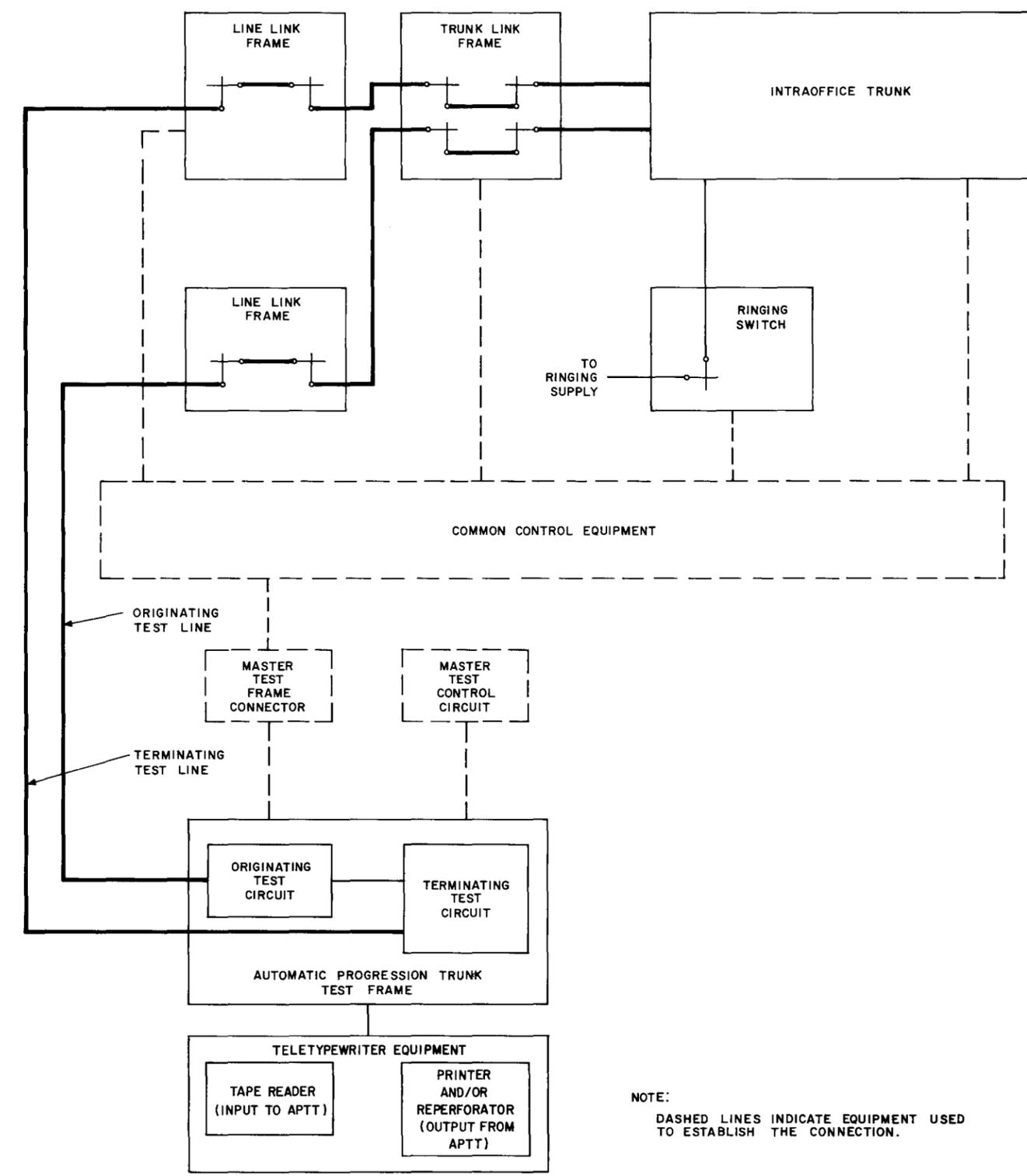
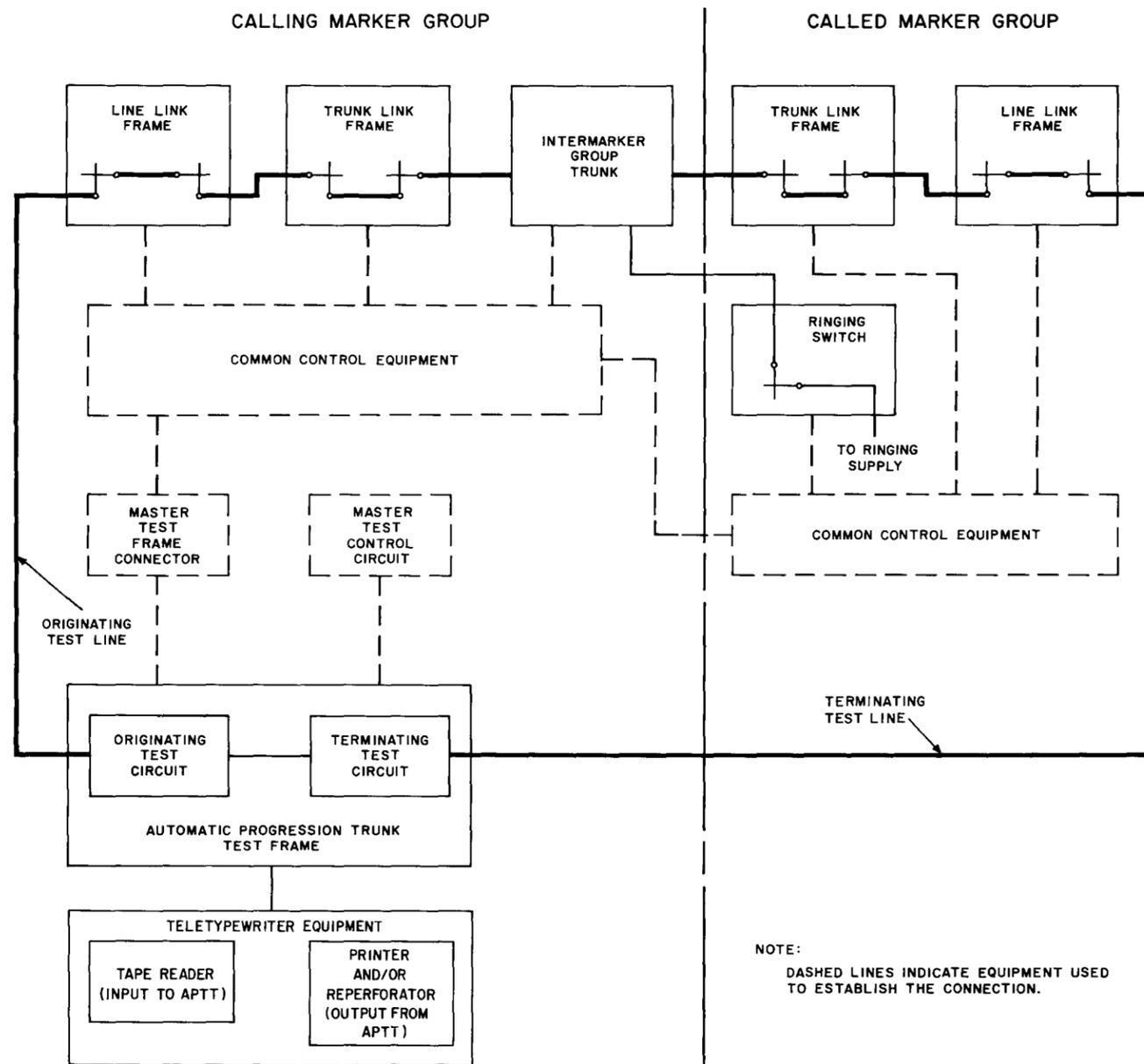


Fig. 11—Remote Office Test Line Trunk Test



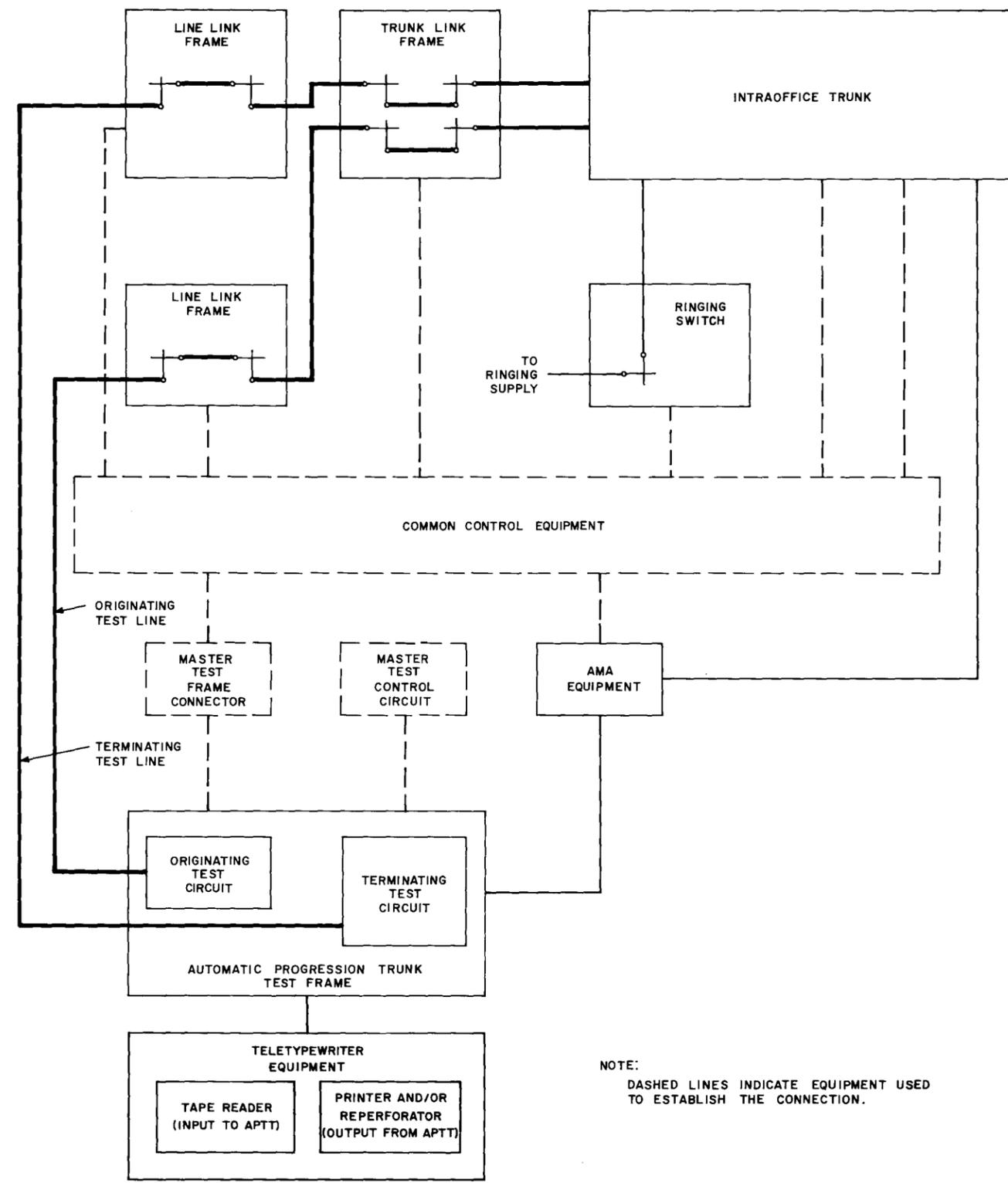
NOTE:  
DASHED LINES INDICATE EQUIPMENT USED TO ESTABLISH THE CONNECTION.

Fig. 12—Intraoffice Test Line (IAO1) Class-of-Trunk Test—Intraoffice Trunk



NOTE:  
DASHED LINES INDICATE EQUIPMENT USED  
TO ESTABLISH THE CONNECTION.

Fig. 13—Intraoffice Test Line (IAO1) Class-of-Trunk Test—Intermarker Group Subscriber-to-Subscriber Trunk



NOTE:  
DASHED LINES INDICATE EQUIPMENT USED  
TO ESTABLISH THE CONNECTION.

Fig. 14—Intraoffice Trunk Charge Feature (IAO2)  
Class-of-Trunk Test

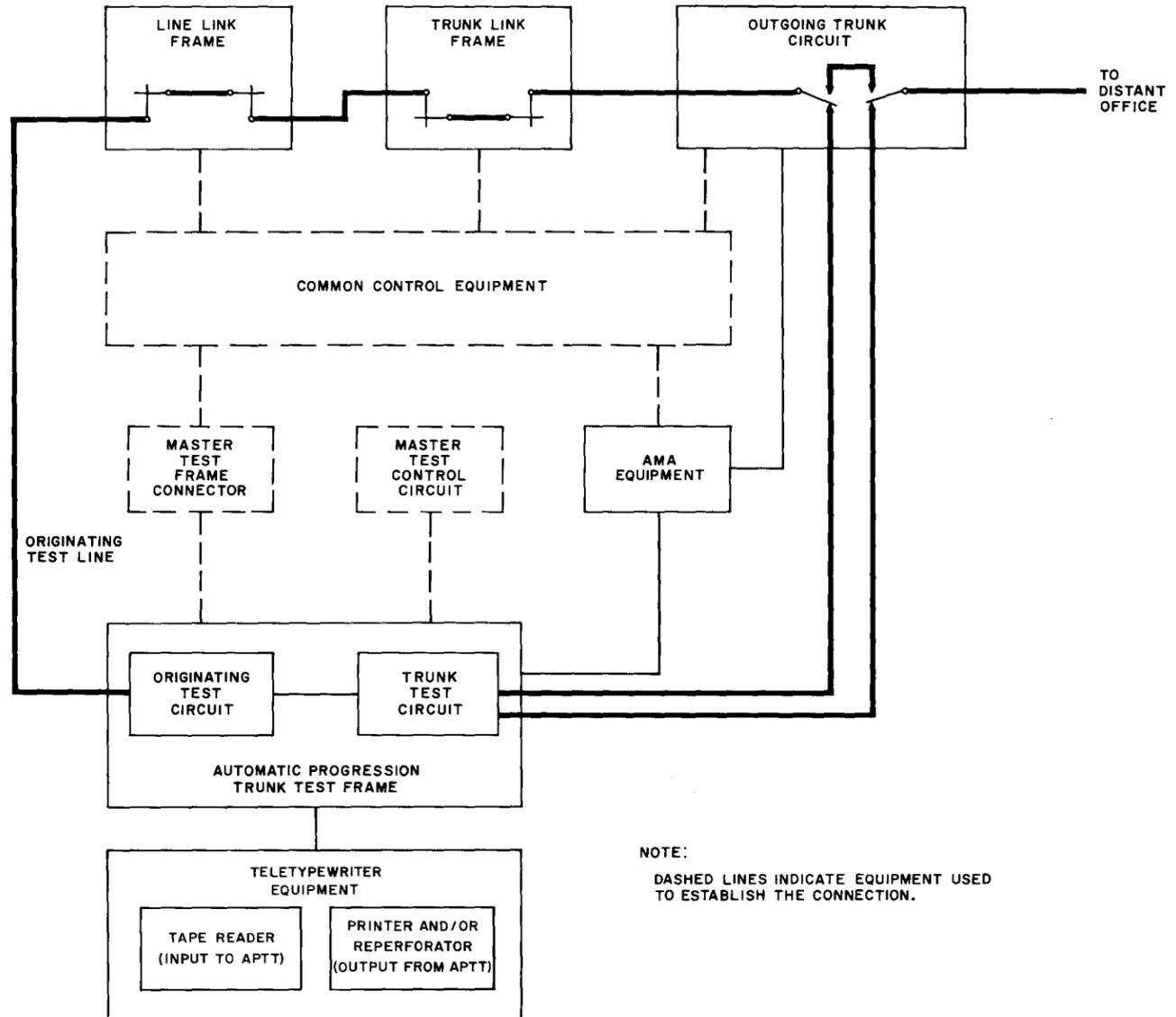


Fig. 15—Outgoing Trunk (OGT) Class-of-Trunk Test

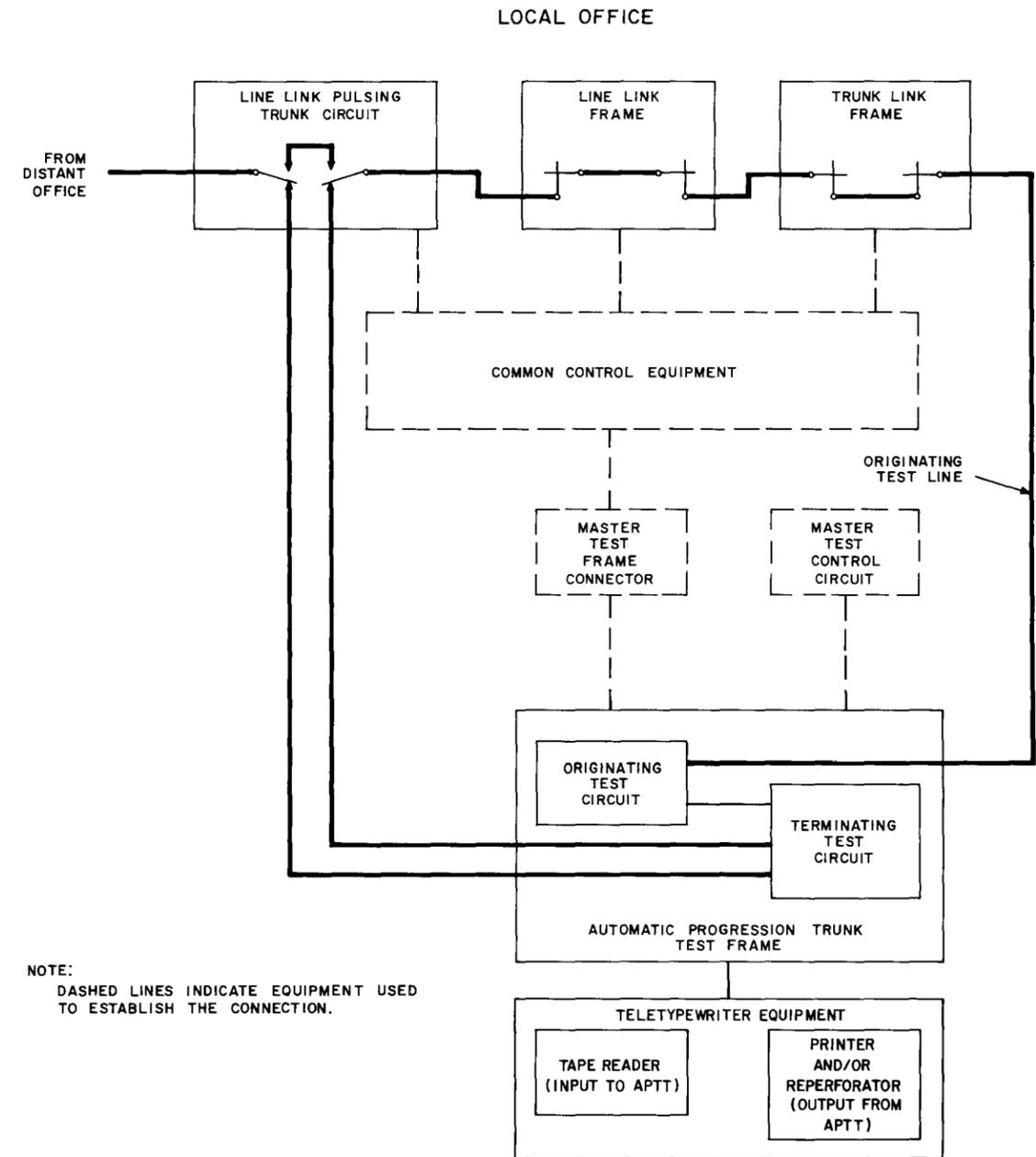


Fig. 16—Line Link Pulsing Trunk (OGT) Class-of-Trunk Test

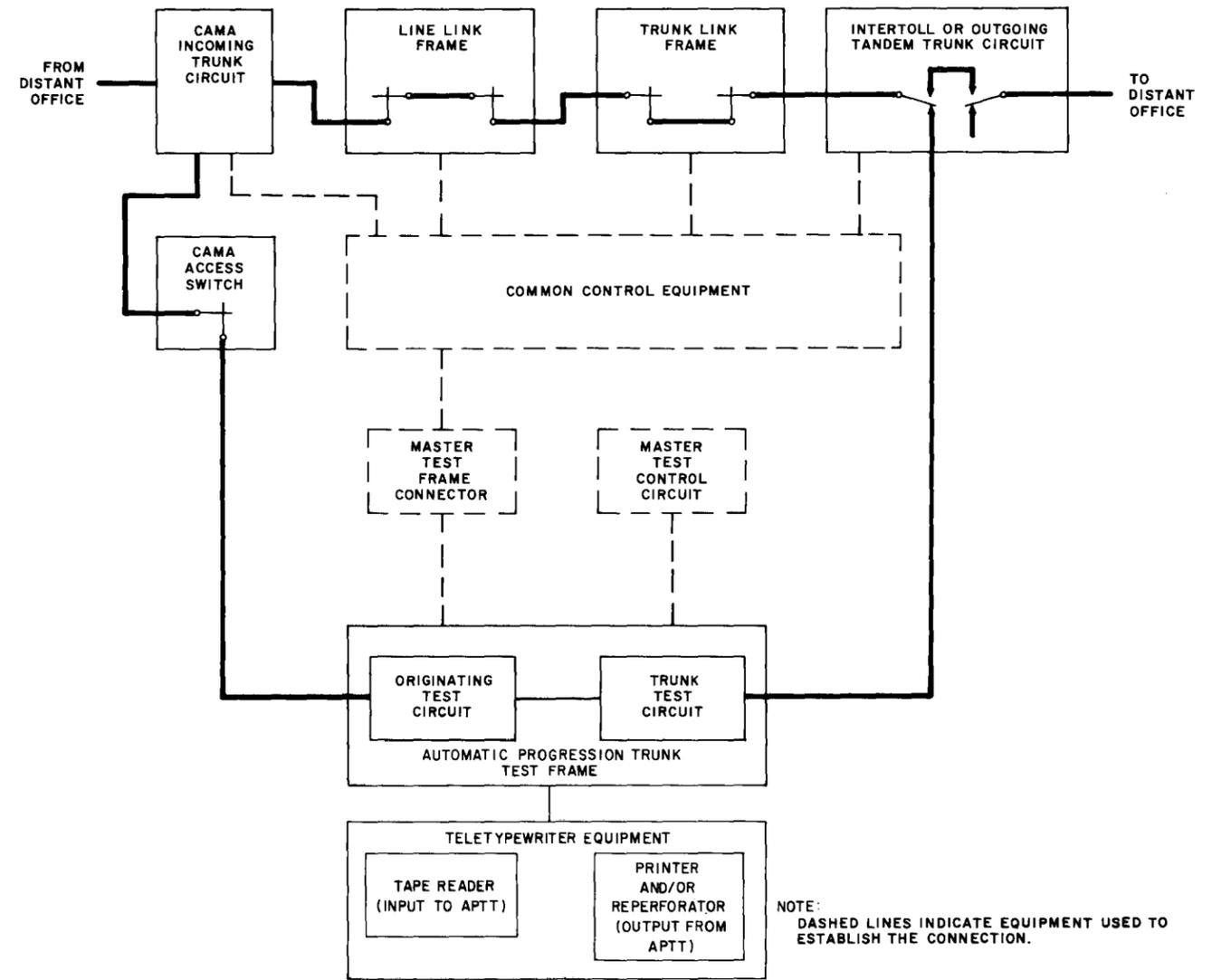


Fig. 17—CAMA Incoming (CAM0) Class-of-Trunk Test

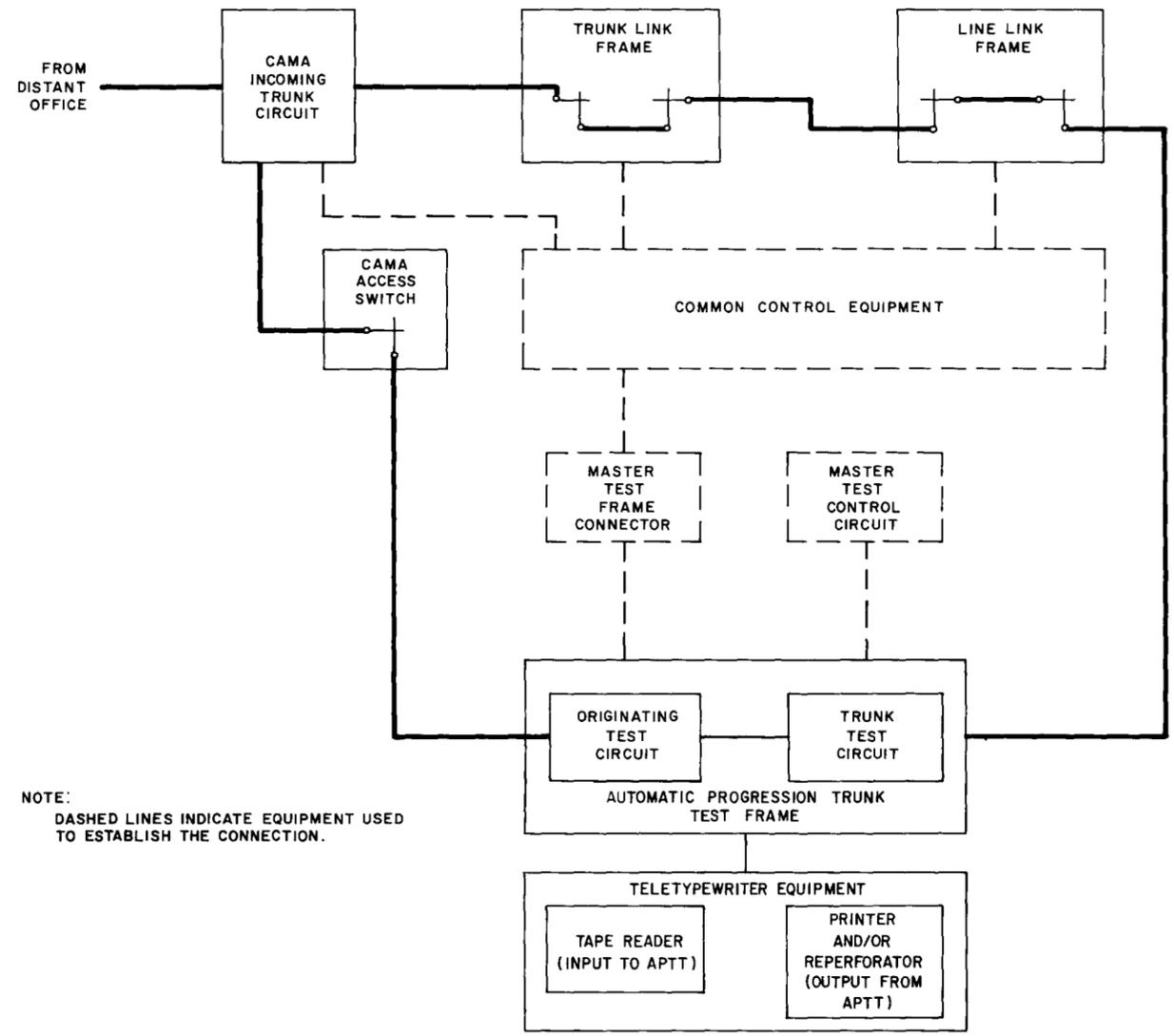
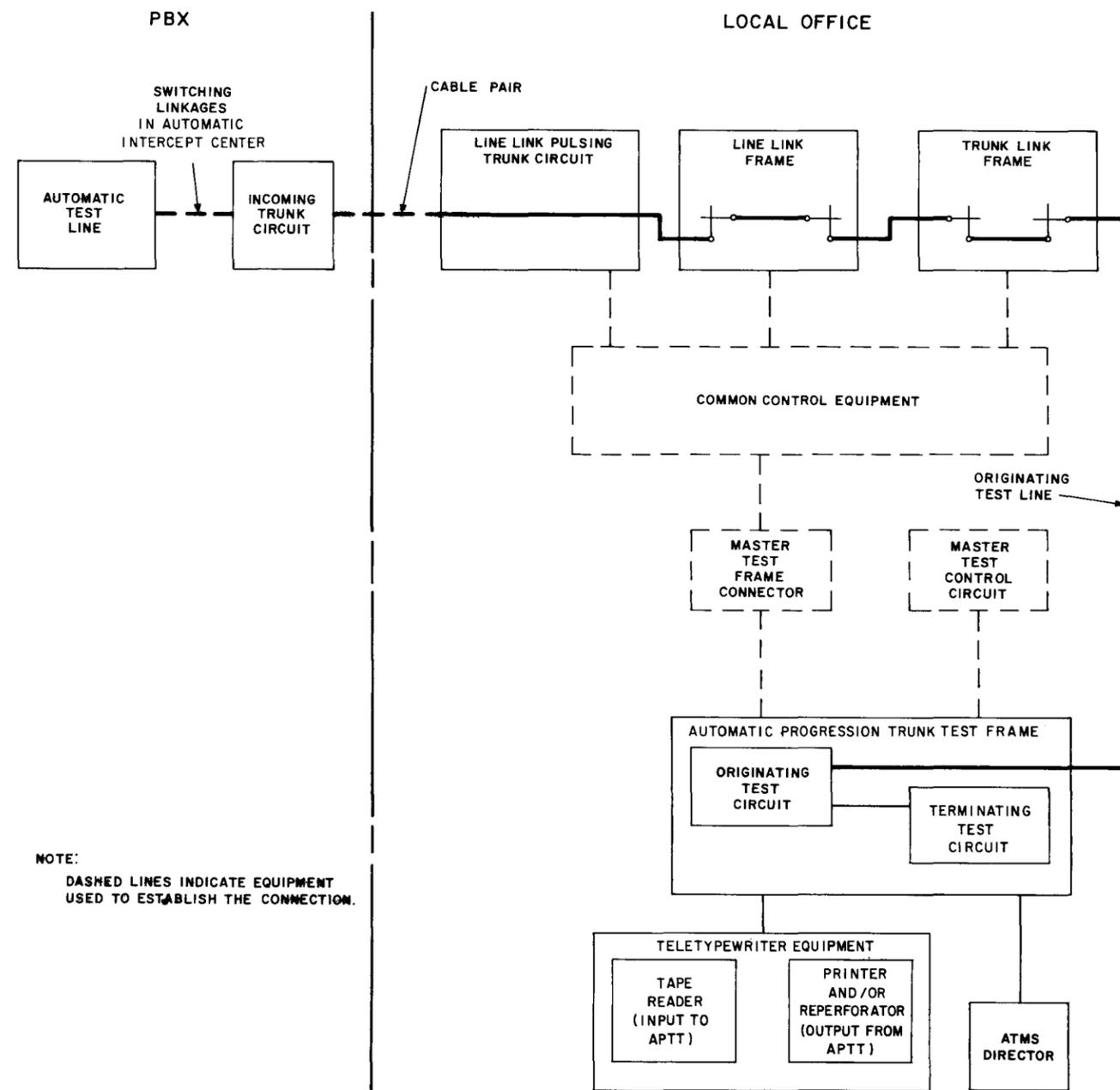
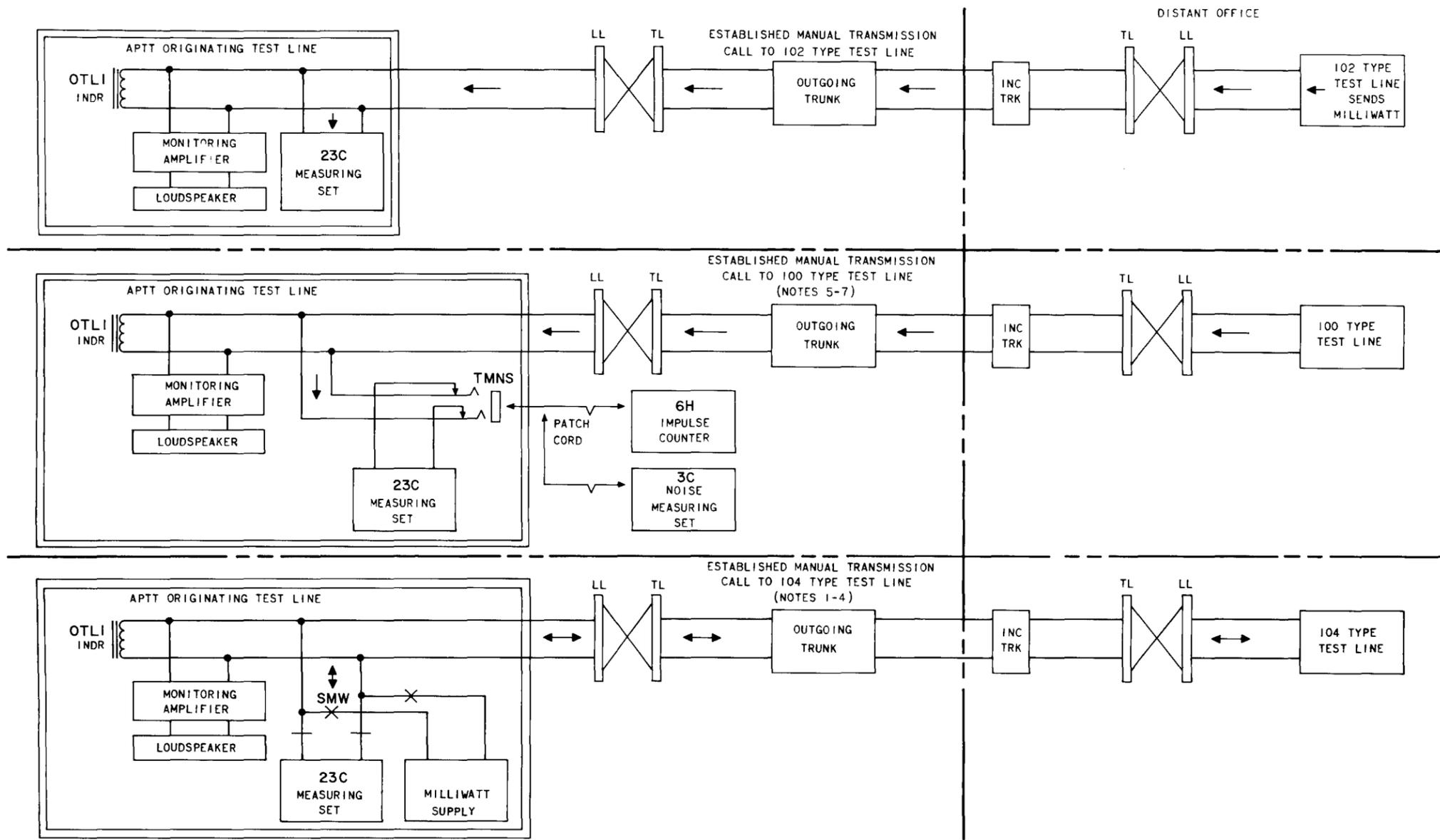


Fig. 18—CAMA Incoming (CAM1) Class-of-Trunk Test



NOTE:  
DASHED LINES INDICATE EQUIPMENT  
USED TO ESTABLISH THE CONNECTION.

Fig. 19—Line Link Pulsing Trunk Transmission Test



- NOTES:
1. APTT SENDS MILLIWATT (3 SECONDS DURATION MIN); 104 MEASURES NEAR-TO-FAR LOSS
  2. 104 SENDS MILLIWATT; APTT MEASURES FAR-TO-NEAR LOSS
  3. 10 SECONDS LATER, 104 SENDS MILLIWATT REDUCED BY AMOUNT OF LOSS IT MEASURED ON NEAR-TO-FAR MEASUREMENT
  4. NOISE MEASUREMENT MADE BY 104:
    - A. IF UNDESIRABLE LEVEL, 104 SENDS INTERRUPTED 2225HZ TONE
    - B. IF LEVEL SATISFACTORY, 2225HZ TONE SENT
  5. IF MESSAGE CKT NOISE TO BE TESTED, PATCH (3C) NOISE MEASURING SET TO (TMNS) JACK
  6. IF IMPULSE NOISE TO BE TESTED, PATCH (6H) IMPULSE COUNTER TO (TMNS) JACK
  7. COMBINED MILLIWATT-BALANCE LINE SENDS 5 SECONDS OF MILLIWATT TONE BEFORE QUIET TERMINATI

Fig. 20—Manual Transmission Tests to 102, 100, or 104 Test Lines

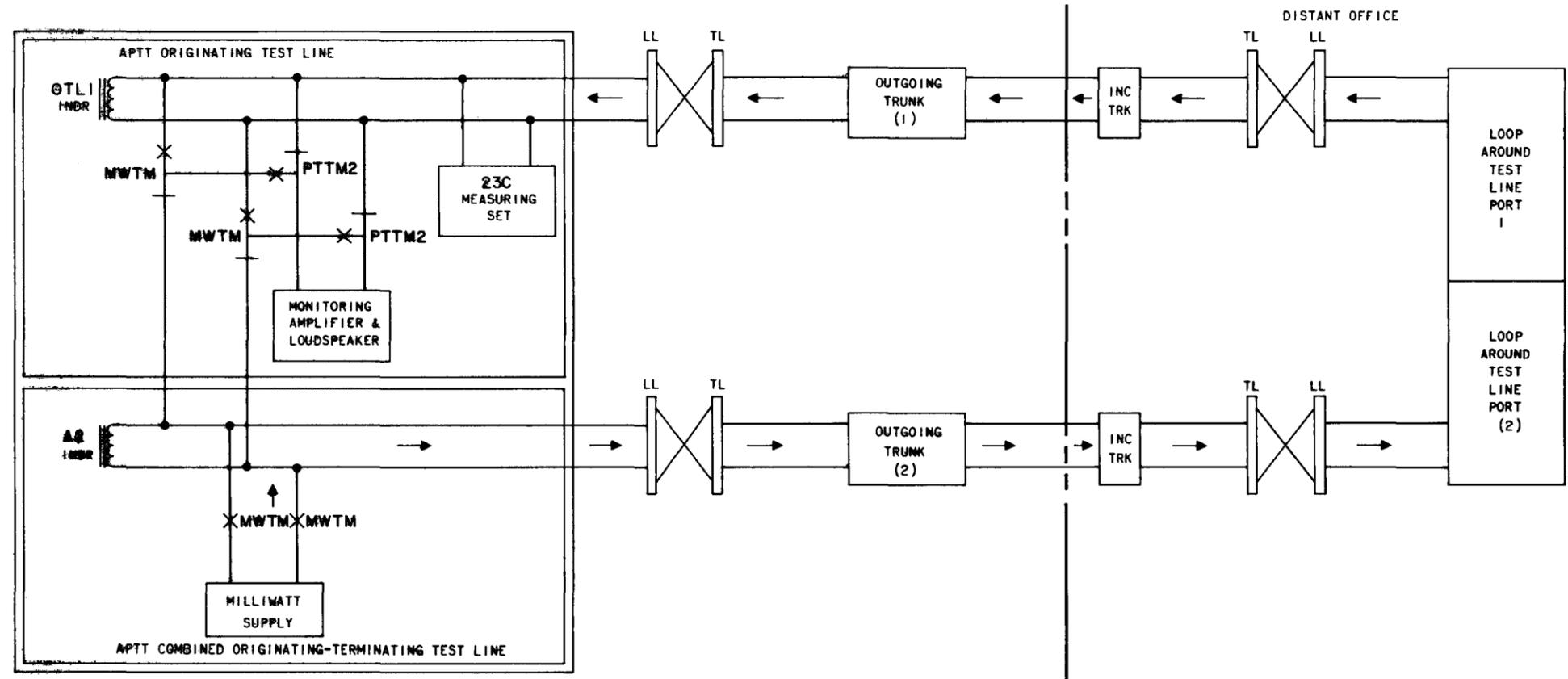


Fig. 21—Manual Transmission Tests to Loop-Around Test Line

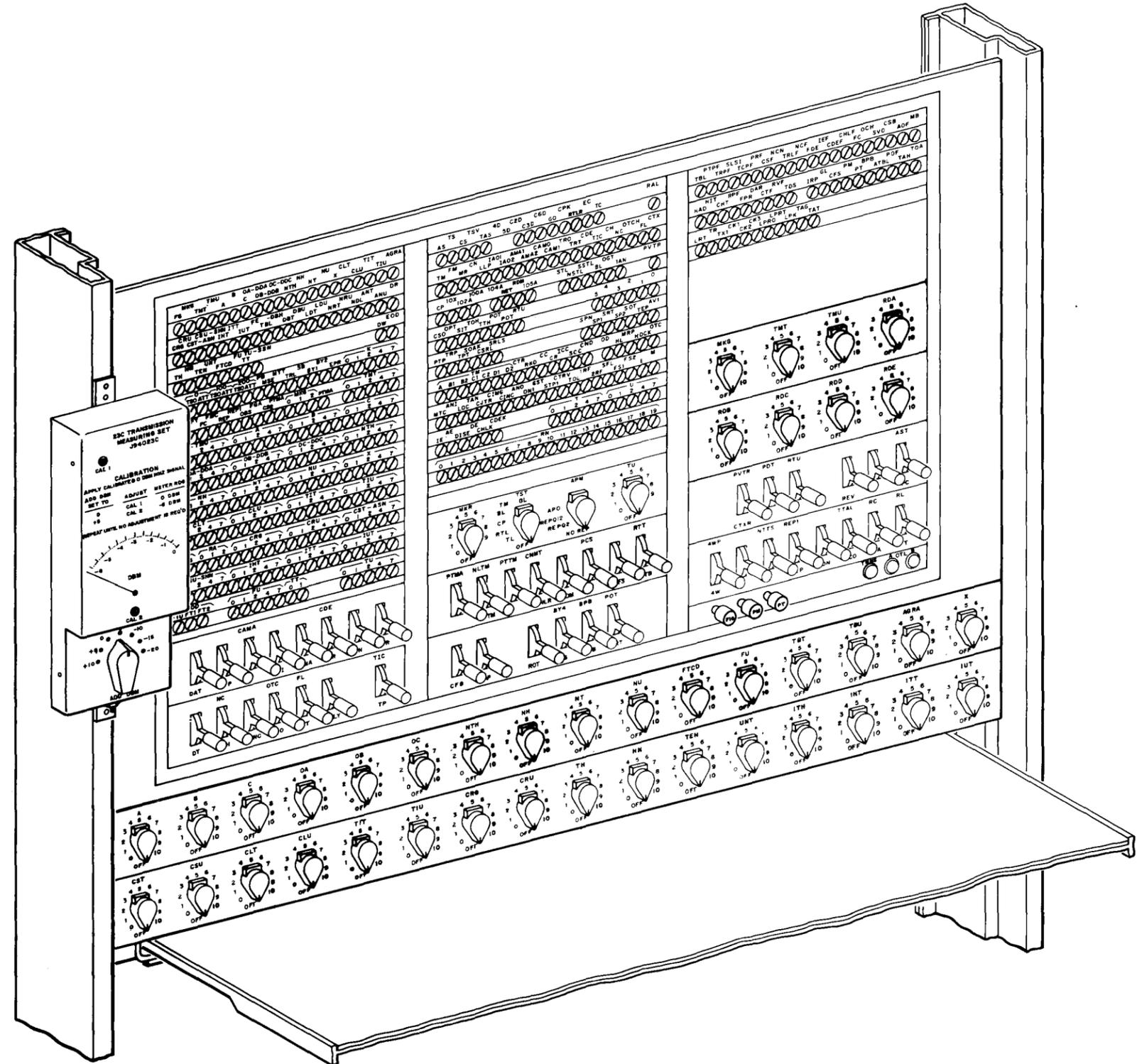


Fig. 22—Jack, Key, Lamp Panel, and Writing Shelf—Typical Switch Control Frame