

CENTRAL OFFICE

TELETYPEWRITER AN/FGC-30 ()

ITS REQUIREMENTS, OPERATING FEATURES,
TECHNIQUES AND ADVANTAGES

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Presented by

AUTOMATIC ELECTRIC SALES CORPORATION

at the

OFFICE OF THE CHIEF SIGNAL OFFICER

U.S. ARMY SIGNAL CORPS

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WASHINGTON, D. C.

27 FEBRUARY 1953

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TELETYPEWRITER SWITCHING CENTER AN/GGC-2(XC-1), HEADQUARTERS FIFTH ARMY
VIEW SHOWING INCOMING LINE, INTERCEPT, CROSS OFFICE, AND SWITCHING UNITS

SUMMARY OF REQUIREMENTS
FOR A
FULLY AUTOMATIC MILITARY TYPEWRITER
RELAY CENTER

1. ASSURE MAXIMUM ECONOMY AND EFFICIENCY THROUGH UTILIZATION OF THE "COMMON" AND "POOLED" EQUIPMENT CONCEPT.
2. PROCESS MESSAGES IN ACCORDANCE WITH THE ASSIGNED DEGREE OF PRECEDENCE.
3. ASSURE PREFERENTIAL HANDLING OF HIGH PRECEDENCE MESSAGES, EVEN TO THE EXTENT OF INTERRUPTING TRANSMISSION OF LOWER PRECEDENCE MESSAGES.
4. RECOGNIZE AND PROCESS ROUTING INDICATORS OF 4, 5, OR 6 CHARACTERS.
5. PROVIDE ADEQUATE STORAGE FOR ROUTINE AND DEFERRED MESSAGES DESTINED TO PART TIME STATIONS DURING CLOSED PERIODS; AUTOMATICALLY ROUTE PRIORITY OR HIGHER PRECEDENCE MESSAGES FOR SUCH STATIONS DURING CLOSED PERIODS TO INTERCEPT POSITIONS FOR OPERATOR ATTENTION.
6. AUTOMATICALLY PROCESS MULTIPLE CALL MESSAGES; RELEASE INDIVIDUAL TRANSMISSIONS RESULTING FROM MULTIPLE CALL PROCESSING WITHOUT THE NEED FOR HOLDING ANY ONE UNTIL ALL LINES ARE AVAILABLE.
7. PERMIT COMBINATIONS OF LINE OPERATING SPEED OF 60, 75, AND 100 WORDS PER MINUTE ON BOTH INCOMING AND OUTGOING LINES.
8. PROVIDE FOR MULTI-POINT OPERATION WITH FROM TWO TO TEN STATIONS ON ANY MULTI-POINT CIRCUIT; PROVIDE INDEPENDENT CHANNEL NUMBERING TO AND FROM EACH STATION ON A MULTI-POINT CIRCUIT.
9. PROVIDE FOR EITHER FULL-DUPLEX OR HALF-DUPLEX CIRCUIT OPERATION AS DICTATED BY INDIVIDUAL CIRCUIT REQUIREMENTS.

10. PROVIDE FLEXIBILITY IN "TRANSLATOR" DESIGN TO ACCOMODATE ADDITIONS OR CHANGES IN ROUTING INDICATORS OR TRAFFIC PATTERNS.
11. PERMIT OPERATION AT ANY POINT IN THE NETWORK WITHOUT THE INSTALLATION OF SIMILAR EQUIPMENT AT OTHER POINTS.
12. BE CAPABLE OF OPERATION ON RADIO CIRCUITS.
13. BE CAPABLE OF HANDLING ENCRYPTED TEXT MESSAGES WITHOUT ERRORS IN SWITCHING.
14. AUTOMATICALLY DETECT AND ROUTE MESSAGES WITH GARBLED OR INVALID ROUTING INFORMATION TO AN INTERCEPT POSITION.
15. PROVIDE MONITOR RECORD OF ALL OUTGOING TRANSMISSIONS. ALL MESSAGE TAPES MUST BE PRINTED AS WELL AS PERFORATED.
16. PROVIDE FACILITIES FOR TIME STAMPING BOTH INCOMING AND OUTGOING MESSAGE TAPES TO FACILITATE STATISTICAL REVIEW.
17. ASSURE PACKAGING THAT FACILITATES STOCKING OF COMPONENTS FOR RAPID INSTALLATION OR EXPANSION AT ANY POINT IN THE NETWORK.
18. ASSURE MAXIMUM RELIABILITY THROUGH PROVISION OF AN AUDIBLE AND VISUAL ALARM SYSTEM THAT IDENTIFIES ANY CONDITION THAT INTERFERES OR COULD INTERFERE WITH THE NORMAL FLOW OF MESSAGE TRAFFIC.
19. AUTOMATICALLY CHECK SEQUENTIAL CHANNEL NUMBERS.
20. PERMIT OPERATION OF ANY DESIRED NUMBER OF CHANNELS OR TRUNKS TO ANY ONE DESTINATION.
21. ASSURE EASE AND ECONOMY OF EXPANSION OF A SWITCHING CENTER TO A MAXIMUM OF 250 LINES.

SUMMARY OF ADVANTAGES

CENTRAL OFFICE, TELETYPEWRITER AN/FGC-30

DESIGNED AND BUILT BY

AUTOMATIC ELECTRIC COMPANY

1. MESSAGES ARE PROCESSED FOR DESTINATION AND FOR SIX DEGREES OF PRECEDENCE, AND ROUTED TO CROSS-OFFICE EQUIPMENT IMMEDIATELY UPON RECEIPT OF ROUTING INFORMATION AT SWITCHING CENTER.
2. CHANNEL NUMBERS ARE CHECKED AS SOON AS MESSAGE ENTERS SWITCHING CENTER.
3. DESIGNED TO EFFECT MAXIMUM USE OF COMMON EQUIPMENT.
4. A "DIRECTOR", COMMON TO A GROUP OF INCOMING LINES, ROUTES MESSAGES TO APPROPRIATE CROSS OFFICE UNITS FOR ONWARD TRANSMISSION.
5. A TRANSLATOR, DESIGNED FOR USE WITH THE COMBINED ROUTING INDICATOR PLAN, PROVIDES THE DIRECTORS WITH THE OUTGOING LINE DESIGNATION REQUIRED FOR EACH ROUTING INDICATOR.
6. THE TRANSLATOR HAS A PATCH PANEL TO PROVIDE MAXIMUM FLEXIBILITY AND RAPID CHANGE OF ROUTING INDICATORS. ONLY THOSE CENTERS ACTUALLY IN USE AND TRIBUTARY STATIONS OF THE CENTER REQUIRE PATCHING. ALL OTHERS ARE ROUTED AUTOMATICALLY TO INTERCEPT.
7. THE TRANSLATOR IS OF THE RELAY TYPE, GIVING ANSWERS IN MILLI-SECONDS. IT PROVIDES FOR A POSSIBLE 936 RELAY CENTERS EACH HAVING POSSIBLE 702 TRIBUTARY STATIONS. ONLY ONE TRANSLATOR IS REQUIRED FOR A 100-LINE OFFICE BUT A SPARE IS FURNISHED. A SPECIAL FEATURE IS THAT ALL MESSAGES WITH PRIORITY OR HIGHER PRECEDENCE DESTINED FOR "NIGHT FILE" STORAGE ARE AUTOMATICALLY ROUTED TO INTERCEPT FOR SUPERVISORY ATTENTION.

8. CROSS OFFICE UNITS, WHICH ARE USED FOR TEMPORARILY STORING MESSAGES IN ACCORDANCE WITH LINE ASSIGNMENT AND PRECEDENCE, ARE NOT ASSOCIATED NORMALLY TO ANY OUTGOING OR INCOMING LINE NOR TO ANY DEGREE OF PRECEDENCE. THEY CONSTITUTE A COMMON POOL FROM WHICH THE DIRECTOR SELECTS A UNIT AND SETS UP THE CONDITIONS INDICATED. THE USE OF THE COMMON POOL PROVIDES MAXIMUM FLEXIBILITY FROM MINIMUM EQUIPMENT.
9. MULTIPLE CALL MESSAGES ARE ROUTED TO AS MANY REGULAR CROSS OFFICE UNITS AS ARE REQUIRED TO ROUTE THE MESSAGES TO ALL ROUTING INDICATORS. AFTER HEADINGS HAVE BEEN TRANSMITTED TO EACH CROSS OFFICE UNIT, THE BODY OF THE MESSAGE IS TRANSMITTED SIMULTANEOUSLY TO ALL UNITS. FROM THE CROSS OFFICE UNIT THEY ARE HANDLED THE SAME AS SINGLE CALL MESSAGES.
10. OUTGOING LINES ARE NOT DISTURBED DURING MULTIPLE CALL MESSAGE PROCESSING.
11. INCOMING LINES AND OUTGOING LINES MAY RECEIVE AND TRANSMIT AT DIFFERENT SPEEDS. CROSS OFFICE SPEED IS THE SAME FOR ALL UNITS AND IS SLIGHTLY HIGHER THAN THE HIGHEST INCOMING OR OUTGOING SPEED IN THE OFFICE.
12. MULTI-CHANNEL SELECTION IS ACCOMPLISHED BY A VERY SIMPLE MEANS WITHOUT THE USE OF LINE FINDERS.
13. FULL DUPLEX MULTI-CHANNEL LINES ARE EFFECTIVELY HANDLED ON A TERMINAL-PER-STATION BASIS WITH EACH STATION HAVING FULL CHANNEL NUMBER CHECK.
14. MESSAGES OF THE THREE HIGHEST PRECEDENCES AUTOMATICALLY BREAK IN ON MESSAGES OF LOWER PRECEDENCE AND A SPECIAL TRANSMITTER SENDS THE "CANCEL TRANSMISSION" SUPERVISORY INSTRUCTIONS.

15. INDICATOR LAMPS AND AUDIBLE SIGNALS ARE EMPLOYED AS ALARMS AND APPEAR AT BOTH THE SUPERVISOR'S CONSOLE AND THE UNIT ORIGINATING THE ALARM. THESE ALARMS IDENTIFY AND LOCATE CONDITIONS WHICH INTERFERE OR COULD INTERFERE WITH THE NORMAL FLOW OF MESSAGE TRAFFIC.
16. A COMMUNICATION SYSTEM USING BOTH TELEPHONE AND SPEAKER SYSTEMS IS A BUILT-IN FEATURE, PROVIDING A VERY ADEQUATE MEANS OF COMMUNICATION WITHIN THE OFFICE.
17. THE TELETYPEWRITER EQUIPMENT IS GOVERNMENT FURNISHED AND MANUFACTURED BY KLEINSCHMIDT LABORATORIES, INC. IT HAS MANY EXCELLENT FEATURES AND IS PARTICULARLY DESIGNED FOR APPLICATION TO THE AUTOMATIC SWITCHING OF TELETYPEWRITER MESSAGES.
18. ALL TAPES ARE PRINTED AS WELL AS BEING PERFORATED SO THAT OPERATORS CAN READILY READ THE TAPE. THIS IS DONE WITHOUT APPRECIABLE INCREASE IN COST.
19. THE AN/FGC-30 IS CAPABLE OF EXPANSION ON A BUILDING BLOCK BASIS IN INCREMENTS OF TWO INCOMING LINES AND SINGLE CROSS OFFICE UNITS. THE COMMON EQUIPMENT IS DESIGNED IN STEPS OF 25 FOR INCOMING AND OUTGOING LINES AND IN STEPS OF 50 FOR CROSS OFFICE FACILITIES. THE EQUIPMENT IS PRESENTLY DESIGNED FOR A MAXIMUM REQUIREMENT OF 250 LINES. THERE IS NO PRACTICAL LIMIT AS TO THE NUMBER OF CHANNELS OR TRUNKS TO ANY ONE DESTINATION.
20. ROUTING INDICATORS OF FOUR, FIVE OR SIX CHARACTERS CAN BE PROCESSED.
21. EXTREMELY HIGH CROSS OFFICE SPEEDS ARE NOT REQUIRED DUE TO IMMEDIATE ACTION ON ALL MESSAGES. THIS AVOIDS EXCESSIVE MAINTENANCE OF HIGH SPEED EQUIPMENT.

22. ALTERNATE ROUTING IS PROVIDED AT THE TERMINAL EQUIPMENT FOR MESSAGES IN CROSS OFFICE STORAGE. ALTERNATE ROUTING CAN ALSO BE ACCOMPLISHED AT THE ROUTING TRANSLATOR UNIT BY CHANGING LINE DESIGNATION PATCHING.

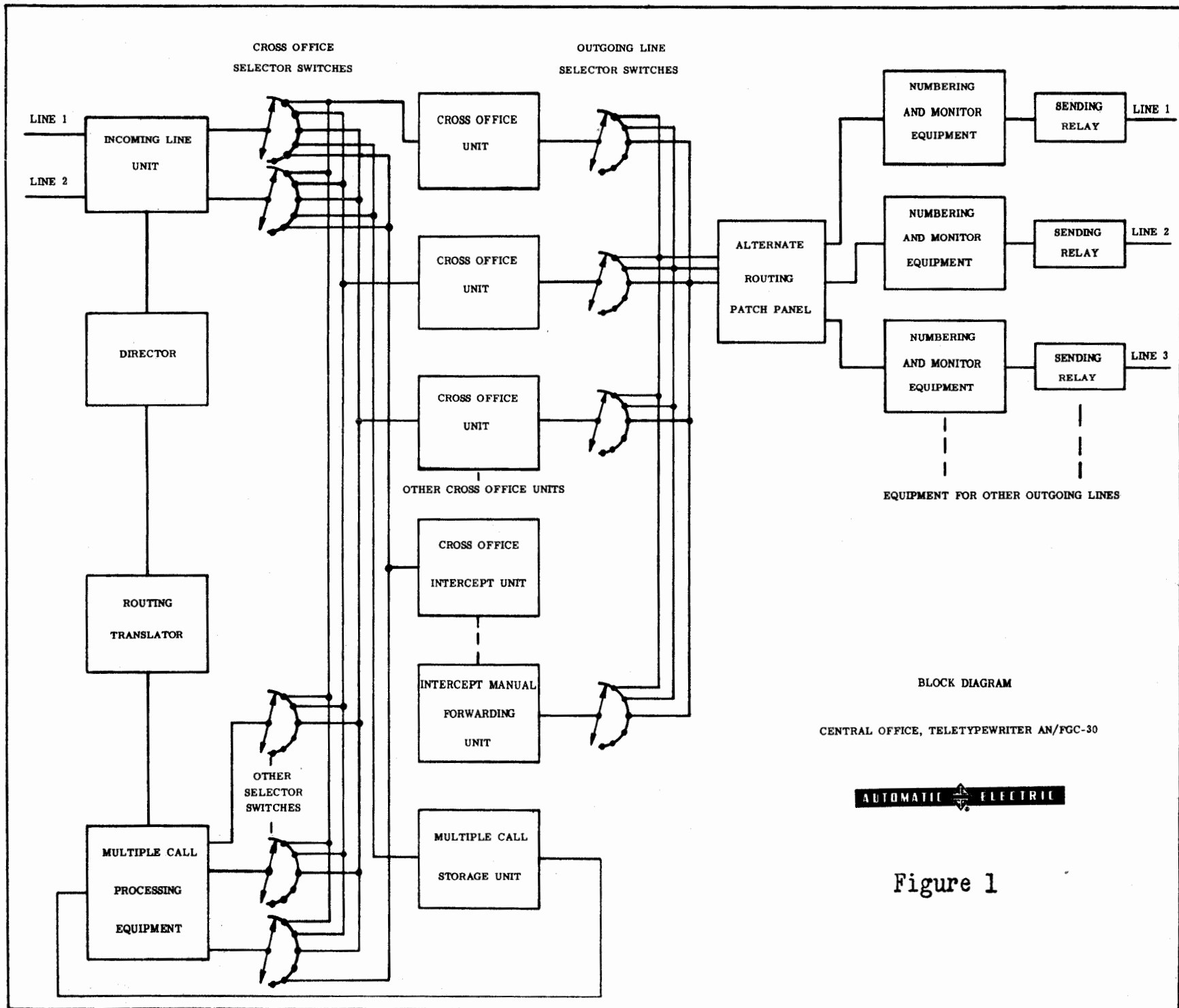


Figure 1

BLOCK DIAGRAM

CENTRAL OFFICE, TELETYPEWRITER AN/FGC-30

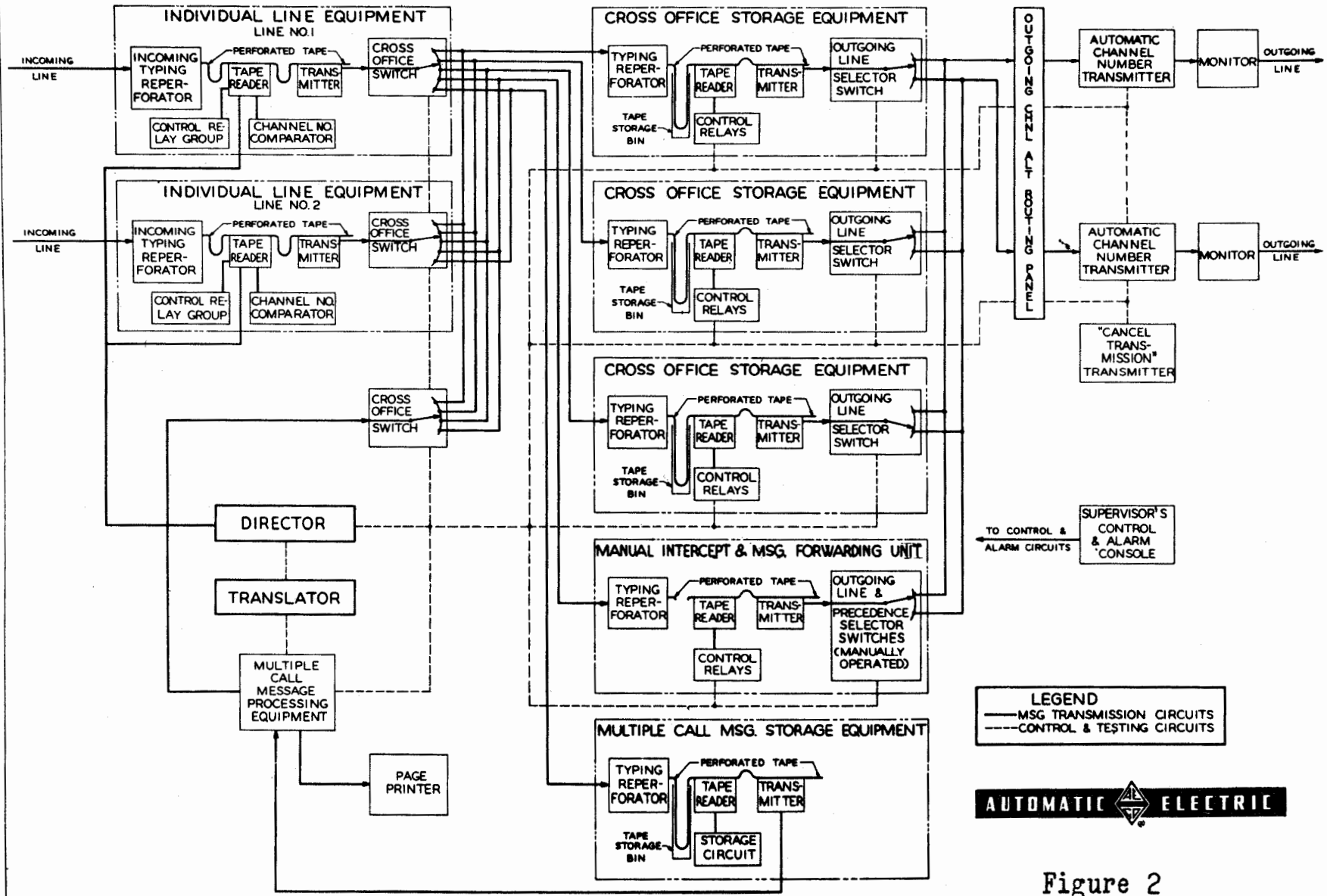


Figure 2

SYSTEM DESCRIPTION

TELETYPEWRITER SWITCHING CENTER AN/FGC 30 HAS BEEN DESIGNED FOR USE WITH TELETYPEWRITER CIRCUITS OF ALL TYPES PRESENTLY AVAILABLE. ITS PRIMARY USE IS FOR LINES OF THE FULL DUPLEX TYPE WHICH PERMIT SIMULTANEOUS TRANSMISSION TO AND FROM A STATION OVER SEPARATE INCOMING AND OUTGOING LOOPS. EQUIPMENT CONNECTED TO THE INCOMING SIDE OF A FULL DUPLEX CIRCUIT IS CAPABLE OF CONTINUOUS RECEPTION OF SIGNALS WITHOUT ANY CONTROL OVER SENDING EQUIPMENT AT THE OTHER END OF THE LINE. SHOULD ANY OF THE INCOMING LINE GROUPS BE OPERATED ON A HALF DUPLEX CIRCUIT, CONTROL OF THE DISTANT SENDING STATION IS PROVIDED. THE CENTER HAS ALSO BEEN DESIGNED TO SWITCH MESSAGES ARRIVING FROM STATIONS ON MULTI-POINT CIRCUITS. AS IN THE CASE FOR HALF DUPLEX CIRCUITS, CONTROL OF THESE MULTI-POINT STATION TRANSMITTERS IS PROVIDED.

ALL LINES INTO THE CENTER ARE TERMINATED ON AN INCOMING TERMINAL EQUIPMENT UNIT WHICH CONTAINS JACK FACILITIES FOR INTER-CONNECTION OF LINES AND INCOMING LINE EQUIPMENT. ALSO ON THE INCOMING TERMINAL UNIT ARE JACKS BY MEANS OF WHICH MAINTENANCE PERSONNEL CAN MONITOR ANY PARTICULAR LINE. SINCE IT IS ASSUMED THAT THE LINE CURRENT FOR MOST LINES WILL BE PROVIDED BY THE ORGANIZATION CONTROLLING THE LINES, REPEATER EQUIPMENT IS NOT PROVIDED AS PART OF THE SWITCHING CENTER ON THE MAJORITY OF LINES. HOWEVER, APPROXIMATELY 25% OF THE INCOMING TERMINALS WILL BE EQUIPPED WITH POLAR REPEATING RELAYS WHICH WILL PERMIT LOCAL POWER TO BE SUPPLIED TO THE INCOMING TELETYPEWRITER EQUIPMENT.

BEFORE PROCEEDING TO A DESCRIPTION OF ACTUAL MESSAGE PROCESSING A GENERAL DESCRIPTION OF THE COMPONENTS SHOULD BE CONSIDERED. FOR THIS PURPOSE THE BLOCK DIAGRAM OF FIGURE 2 CAN BE USED TO GOOD ADVANTAGE THIS DIAGRAM IS ESSENTIALLY THE SAME AS THAT SHOWN IN FIGURE 1, WITH THE ADDITION OF THE DETAILS OF THE COMPONENTS.

COMPONENT DESCRIPTIONS

THE INCOMING LINE UNIT IS THE FIRST PIECE OF EQUIPMENT USED FOR RECEIVING A MESSAGE AS IT ENTERS THE CENTER OTHER THAN THE TERMINAL EQUIPMENT WHICH HAS BEEN DESCRIBED PREVIOUSLY. IT CONSISTS OF TWO SETS OF INDIVIDUAL LINE EQUIPMENT EACH INDEPENDENT OF THE OTHER BUT PACKAGED TOGETHER FOR CONVENIENCE. THE LINE TELETYPEWRITER UNIT CONSISTS OF A TYPING REPERFORATOR, A COMBINATION TAPE-READER TAPE-TRANSMITTER, A TAPE SUPPLY REEL, AND A TAPE TAKE UP REEL, ALL OF WHICH IS PACKAGED TOGETHER ON A SLIDING SHELF. ONE OF THE INTERESTING FEATURES OF THE TELETYPEWRITER UNIT IS ITS TAPE POSITION WHICH PERMITS EASY READING OF THE PRINTED MESSAGE, INCLUDING THE LAST CHARACTER TO BE PRINTED. THE TAPE TAKE UP REEL IS DESIGNED IN SUCH A MANNER THAT THE REEL CAN BE LIFTED OUT COMPLETELY FREE OF ITS DRIVING MECHANISM, THUS PERMITTING EASY TAPE CHANGES.

EACH INCOMING LINE UNIT IS EQUIPPED WITH A CONTROL AND INDICATOR PANEL ON WHICH ARE MOUNTED TWO SETS OF CONTROLS AND INDICATORS.

THE PANEL CONTAINS TWO CHANNEL NUMBER COMPARATORS WHICH REGISTER THE SEQUENTIAL NUMBER OF THE NEXT MESSAGE TO BE RECEIVED OVER THE ASSOCIATED INCOMING LINE. THESE COMPARATORS ARE AUTOMATICALLY CONTROLLED BY THE INCOMING LINE CONTROL RELAY BOX OF WHICH THERE ARE TWO LOCATED IN THE INCOMING LINE UNIT. THE RELAY BOXES CONTROL ALL OPERATIONS AND SEQUENCES OF THE ASSOCIATED INCOMING LINE EQUIPMENT. TRANSMISSION FROM THIS UNIT IS AT A SPEED SLIGHTLY HIGHER THAN THAT OF THE HIGHEST INCOMING LINE.

THE CROSS OFFICE UNIT IS A COMPONENT WHICH IS CAPABLE OF RECEIVING MESSAGES FROM ANY OF THE INCOMING LINE OR MULTIPLE CALL UNITS IN THE CENTER, STORING THEM TEMPORARILY IF REQUIRED IN A STORAGE BIN AND RE-TRANSMITTING THEM TO ANY OF THE OUTGOING LINES WITH FULL PRECEDENCE RECOGNITION. THE UNIT CONSISTS OF A TELETYPEWRITER EQUIPMENT SHELF ON WHICH IS MOUNTED A TYPING REPERFORATOR LIKE THE ONE IN THE INCOMING LINE UNIT, A COMBINATION TAPE-READER TAPE-TRANSMITTER SIMILAR TO THE ONE IN THE INCOMING LINE UNIT, TAPE SUPPLY AND TAKE UP REELS, AND A TAPE-IN-STORAGE INDICATOR. THE READER TRANSMITTER UNIT IS SUBSTANTIALLY LIKE THE ONE IN THE INCOMING LINE UNIT, BUT IN THIS UNIT THE TRANSMITTER OPERATES AT LINE SPEED AND DOES NOT HAVE PROVISION FOR TAPE STORAGE BETWEEN THE READER AND THE TRANSMITTER. THE TAKE UP REEL IS LIKE THE ONE IN THE INCOMING LINE UNIT AND PERMITS "LIFT OUT" OPERATION FOR TAPE CHANGES. THE MOST IMPORTANT DIFFERENCE IN THE TELETYPEWRITER EQUIPMENT OF THIS UNIT IS THE TAPE-IN-STORAGE INDICATOR WHICH RECORDS ON A DIAL THE NUMBER OF FEET OF TAPE IN STORAGE IN THE UNIT STORAGE BIN. THIS HAS VALUE TO AN OPERATOR, AND ALSO SERVES TO AUTOMATICALLY MAKE THE UNIT UNAVAILABLE TO THE DIRECTOR WHEN THE BIN IS FULL. BELOW THE TELETYPEWRITER SHELF IS THE TAPE STORAGE BIN WHICH CAN HOLD FROM 100 TO 175 FEET OF TAPE DEPENDING UPON ATMOSPHERIC CONDITIONS. ALSO BELOW THE TELETYPEWRITER SHELF IS THE CROSS OFFICE UNIT CONTROL RELAY BOX WHICH ACTS TO CONTROL ALL OPERATIONS AND SEQUENCES OF THE CROSS OFFICE UNIT. THE UNIT IS COMPLETELY ENCLOSED IN ITS OWN CABINET WHICH IS EQUIPPED WITH EASILY OPENING DOORS AND COVER.

THE MULTIPLE CALL CROSS OFFICE UNIT IS SIMILAR IN APPEARANCE TO THE NORMAL CROSS OFFICE UNIT AND USES THE SAME CABINET DESIGN. IT CONSISTS OF A TELETYPEWRITER UNIT LIKE THAT OF THE INCOMING LINE UNIT WHICH PERMITS TAPE STORAGE BETWEEN THE TAPE READER AND THE TAPE TRANSMITTER. THIS UNIT ALSO CONTAINS A TAPE STORAGE BIN, A TAPE-IN-STORAGE INDICATOR, AND A CONTROL RELAY BOX.

THE SYSTEM PROVIDES INTERCEPT FACILITIES FOR MANUAL HANDLING OF SUPERVISORY OR DEFECTIVE MESSAGES OR OTHER MESSAGES REQUIRING THE ATTENTION OF AN OPERATOR. THE CROSS OFFICE INTERCEPT UNIT IS CAPABLE OF RECEIVING MESSAGES FROM INCOMING LINE AND MULTIPLE CALL POSITIONS. THE MESSAGES ARE REPRODUCED ON TAPES WHICH CAN BE TORN TO PERMIT SUPERVISORY ACTION. THE UNIT CONSISTS OF THREE SHELVES OF IDENTICAL TELETYPEWRITER EQUIPMENT. EACH SHELF CONTAINS A TYPING REPERFORATOR AND A TAPE SUPPLY REEL. THE UNIT IS EQUIPPED WITH A CONTROL AND INDICATOR PANEL FOR CONVENIENT CONTROL OF THE TYPING REPERFORATORS. ANOTHER UNIT IS KNOWN AS THE INTERCEPT MANUAL FORWARDING UNIT AND IS USED FOR THE FORWARDING OF INTERCEPTED AND SUPERVISORY MESSAGES. IT CONSISTS OF A CABINET WHICH CONTAINS THREE FORWARDING POSITIONS. AT EACH POSITION THE OPERATOR CAN CONTROL A COMBINATION TAPE-READER TAPE-

TRANSMITTER BY MEANS OF SPECIAL CONTROL SWITCHES. EACH READER-TRANSMITTER UNIT CAN BE TEMPORARILY CONNECTED TO ANY OUTGOING LINE. EACH POSITION IS ALSO EQUIPPED WITH A CONTROL RELAY GROUP WHICH CONTROLS THE SEQUENCE OF OPERATIONS REQUIRED TO SELECT AND GAIN ACCESS TO ANY OF THE OUTGOING LINES. THE UNIT IS EQUIPPED WITH A LARGE TAPE BIN WHICH HOLDS ALL TRANSMITTED TAPES.

ANOTHER INTERCEPT FUNCTION IS THAT OF INTERCEPTION OF INCOMING LINE TRAFFIC PRIOR TO SWITCHING BY THE AUTOMATIC EQUIPMENT. FOR THIS PURPOSE A SPECIALLY MOUNTED TYPING REPERFORATOR CAN BE WHEELED TO THE INCOMING LINE UNIT CONCERNED AND PLUG-CONNECTED INTO THE LINE, EITHER IN SERIES WITH OR IN PLACE OF THE INCOMING TYPING REPERFORATOR. THIS PROCESS WILL FACILITATE MAINTENANCE, OBSERVATION, AND TAPE CHANGING.

THE AUTOMATIC NUMBERING AND MONITOR UNIT CONTAINS EQUIPMENT TO AUTOMATICALLY INSERT IN EACH OUTGOING MESSAGE A CHANNEL NUMBER AND TO DATE-TIME STAMP THE TRANSMITTED TAPE AND ALSO A TYPING REPERFORATOR ON WHICH A PERMANENT LINE RECORD CAN BE KEPT OF ALL OUTGOING TRANSMISSION. THIS EQUIPMENT CONSISTS OF A CABINET WITH FIVE MONITOR TYPING REPERFORATORS LOCATED IN LINE AT A CONVENIENT WORKING HEIGHT. UNDER THIS EQUIPMENT ARE MOUNTED THE AUTOMATIC NUMBERING TRANSMITTERS AND THE RELAY GROUPS FOR CONTROLLING THE OUTGOING LINES.

MOST OF THE SWITCHING EQUIPMENT IN THE CENTER IS MOUNTED ON SMALL BASES OR SHELVES WHICH CAN BE PLUGGED OR JACK CONNECTED INTO THE CIRCUIT. SEVERAL OF THESE SUB-COMPONENTS ARE GROUPED TOGETHER TO FORM UNITS WHICH CAN BE IDENTIFIED WITH A PARTICULAR FUNCTION OF THE CENTER. ONE OF THESE UNITS IS THE DIRECTOR UNIT. THIS CONSISTS OF TWO DIRECTORS HOUSED IN A CABINET WHICH IS APPROXIMATELY TWO FEET DEEP, FOUR FEET WIDE BY SEVEN FEET HIGH. THE CABINET HAS FRONT AND REAR ACCESS WITH ONE DIRECTOR MOUNTED ON EACH SIDE. THE FUNCTION OF THE DIRECTOR IS THAT OF ESTABLISHING THE NECESSARY INTRA-OFFICE CONNECTIONS FOR EACH MESSAGE.

THE TRANSLATOR UNIT IS ANOTHER OF THE SWITCHING UNITS. EACH CENTER OF 100 LINES OR LESS IS EQUIPPED WITH TWO TRANSLATORS HOUSED TOGETHER IN A SWITCHING CABINET IDENTICAL IN EXTERNAL APPEARANCE TO THE DIRECTOR UNIT. THE FUNCTION OF THE TRANSLATOR IS THAT OF PROVIDING THE DIRECTORS OF THE OFFICE WITH LINE IDENTIFICATION. ONLY ONE OF THE TWO TRANSLATORS IS IN USE AT ONE TIME, THE OTHER BEING IMMEDIATELY AVAILABLE IN A STAND-BY CONDITION. ACTUAL TRANSLATION OF ROUTING INDICATORS IS ACCOMPLISHED BY RELAYS IN ONE TWENTIETH OF A SECOND, AND THE SUBSEQUENT LINE IDENTIFICATION IS ACCOMPLISHED INSTANTANEOUSLY BY MEANS OF PIN JACK CONNECTIONS.

TO FACILITATE THE CABLING OF THE CENTER THE SELECTOR SWITCHES ARE GROUPED TOGETHER AND HOUSED IN SELECTOR SWITCH UNITS. ONE OF THESE IS THE CROSS OFFICE SELECTOR SWITCH UNIT WHICH IS A SWITCHING UNIT IDENTICAL IN EXTERNAL APPEARANCE TO THE OTHER SWITCHING UNITS AND WHICH CONTAINS A MAXIMUM OF FIFTY CROSS OFFICE SELECTOR SWITCHES. THE SWITCHES ARE DIRECTIVELY CONTROLLED BY THE DIRECTOR TO ESTABLISH CONNECTIONS FROM THE INCOMING LINE UNITS TO THE CROSS OFFICE POSITIONS. ANOTHER OF THESE UNITS IS THE OUTGOING LINE SELECTOR SWITCH UNIT WHICH HOUSES A MAXIMUM OF FIFTY OUTGOING LINE SELECTOR SWITCHES. THE UNIT IS SIMILAR IN APPEARANCE TO THE CROSS OFFICE SELECTOR SWITCH UNIT AND IS DIRECTIVELY CONTROLLED BY THE DIRECTOR TO ESTABLISH CONNECTIONS BETWEEN THE CROSS OFFICE POSITIONS AND THE OUTGOING LINES.

THE MULTIPLE CALL PROCESSING EQUIPMENT CONSISTS PRIMARILY OF RELAY AND ROTARY SWITCH EQUIPMENT MOUNTED ON SMALL SUB-ASSEMBLIES WHICH ARE JACK CONNECTED INTO THE CIRCUIT. IT IS THE FUNCTION OF THIS EQUIPMENT TO ESTABLISH MULTIPLE TRANSMISSION PATHS FROM THE MULTIPLE CALL STORAGE UNITS TO THE CROSS OFFICE UNITS.

THE TERMINAL EQUIPMENT, SHOWN ON THE OUTGOING SIDE OF THE BLOCK DIAGRAM OF FIGURE 1, IS MOUNTED ON THE SAME UNIT AS IS THE INCOMING TERMINAL EQUIPMENT PREVIOUSLY MENTIONED. IT CONSISTS OF THE ALTERNATE ROUTING PATCH PANEL, ONE POLAR SENDING RELAY FOR EACH OUTGOING LINE, AND JACK FACILITIES FOR MAINTENANCE MONITORING OF ANY OUTGOING LINE. THE ALTERNATE ROUTE PATCH PANEL CONSISTS OF SETS OF TELEPHONE TYPE PLUGS AND JACKS BY MEANS OF WHICH A GROUP OF CROSS OFFICE UNITS CONNECTED TO A PARTICULAR LINE CAN TEMPORARILY BE CONNECTED TO AN ALTERNATE LINE.

MESSAGE PROCESSING

TO UNDERSTAND MORE CLEARLY THE OPERATION OF THE SYSTEM A TYPICAL MESSAGE CAN BE FOLLOWED THROUGH THE SYSTEM WITH THE AID OF THE BLOCK DIAGRAM SHOWN IN FIGURE 1. DISREGARDING THE TERMINAL EQUIPMENT, WHICH IS NOT SHOWN ON THE DIAGRAM, ENTRY INTO THE CENTER CAN BE CONSIDERED TO BE AT THE INCOMING LINE UNIT. AS THE MESSAGE COMES IN IT IS REPRODUCED ON THE INCOMING LINE TYPING REPERFORATOR. THE TAPE READER IMMEDIATELY STARTS TO READ THE PERFORATIONS IN THE TAPE AND THE ASSOCIATED RELAY EQUIPMENT IS PREPARED TO DETECT A START-OF-MESSAGE INDICATOR (ABBREVIATED SOM). WHEN THE SOM HAS BEEN DETECTED THE CHANNEL NUMBER COMPARATOR IS CONDITIONED TO RECEIVE THE SEQUENTIAL CHANNEL NUMBER WHICH FOLLOWS IMMEDIATELY BEHIND THE SOM. IF THE NUMBER REGISTERED IN THE COMPARATOR IS NOT THE SAME AS THE CHANNEL NUMBER OF THE INCOMING MESSAGE AN ALARM IS INDICATED IMMEDIATELY AND THE TAPE READER STOPS. THIS SITUATION THEN REQUIRES THE SERVICES OF AN OPERATOR. IF THE CHANNEL NUMBER IS CORRECT THE TAPE READER IS PERMITTED TO CONTINUE TO SCAN THE TAPE UNTIL SUCH TIME AS THE BEGINNING OF THE ROUTING LINE IS DETECTED. AT THIS TIME THE LINE CIRCUIT CALLS FOR THE SERVICES OF A DIRECTOR. AN IDLE DIRECTOR FINDS THE CALLING LINE CIRCUIT AND SIGNALS THE TAPE READER TO SEND ROUTING INFORMATION. THE PRECEDENCE AND ROUTING INDICATORS OF THE MESSAGE ARE THEN SENT TO THE DIRECTOR BY THE TAPE READER. WHILE THE DIRECTOR IS FUNCTIONING THE TAPE SCANNED BY THE READER IS ACCUMULATING IN THE STORAGE BIN BETWEEN THE READER AND THE TRANSMITTER.

THE DIRECTOR DETECTS AND STORES THE ROUTING AND PRECEDENCE INDICATORS. FOLLOWING RECEIPT OF THE ROUTING INDICATOR THE DIRECTOR CALLS FOR THE SERVICES OF THE TRANSLATOR WHICH THEN FINDS AND ATTACHES ITSELF TO THE CALLING DIRECTOR. FOLLOWING THIS THE DIRECTOR SENDS THE ROUTING INDICATOR TO THE TRANSLATOR AND THEN RECEIVES BACK FROM THE TRANSLATOR A LINE IDENTIFICATION WHICH IT STORES. THE TRANSLATOR IS THEN RELEASED FOR USE BY OTHER DIRECTORS.

THE DIRECTOR NOW PROCEEDS WITH ITS TASK OF ESTABLISHING A CONNECTION. FIRST, HOWEVER, IT MUST MAKE A TEST OF THE CROSS OFFICE POOL TO DETERMINE WHETHER ANY CROSS OFFICE UNITS ARE ALREADY SET TO THE PROPER LINE WITH THE PROPER DEGREE OF PRECEDENCE. DEPENDING UPON

WHAT THE DIRECTOR FINDS AS A RESULT OF THIS TEST ANY ONE OF THESE THREE COURSES OF ACTION IS OPEN TO IT:

CASE I - NO CROSS OFFICE UNITS PRE-SET TO THE DESIRED LINE WITH THE DESIRED DEGREE OF PRECEDENCE.

THE DIRECTOR MAY PLACE TWO OR MORE MESSAGES IN THE SAME CROSS OFFICE UNIT PROVIDING THAT THEY ARE DESTINED FOR THE SAME OUTGOING LINE WITH THE SAME DEGREE OF PRECEDENCE. THUS, THE FIRST TEST BY A DIRECTOR IS TO HUNT FOR CROSS OFFICE UNITS ALREADY PRE-SET. SINCE IN THIS CASE THERE WERE NO SUCH UNITS INDICATED, THE DIRECTOR THEN MUST SELECT AN IDLE CROSS OFFICE UNIT WHICH IS SET TO NO OUTGOING LINE AND WHICH HAS NO PRECEDENCE REGISTERED THEREIN.

CASE II - ONE OR MORE CROSS OFFICE UNITS PRE-SET.

IN THIS CASE THE ANSWER TO THE DIRECTOR'S TEST SHOWS ONE OR MORE UNITS SET TO THE RIGHT LINE WITH THE RIGHT DEGREE OF PRECEDENCE. THE PROCESS OF SELECTING A CROSS OFFICE UNIT IN THIS CASE INVOLVES TESTING EACH INDICATED CROSS OFFICE UNIT AND CONNECTING TO ONE OF THEM. IF THE DIRECTOR TESTS ONE OF THESE CROSS OFFICE UNITS AND FINDS IT BUSY RECEIVING FROM ANOTHER INCOMING LINE UNIT, IT MUST, OF COURSE, SELECT ANOTHER OF THE INDICATED UNITS.

CASE III - ONE OR MORE CROSS OFFICE UNITS PRE-SET BUT ALL OF THEM BUSY.

IN THIS CASE AFTER A TEST SHOWS ALL PRE-SET UNITS BUSY RECEIVING FROM LINE CIRCUITS OR IF THE PRECEDENCE OF THE MESSAGE IS OPERATIONAL IMMEDIATE OR HIGHER THE DIRECTOR MUST MAKE A FURTHER TEST AND SELECT AN IDLE AND EMPTY CROSS OFFICE UNIT AND SET IT FOR THE PROPER OUTGOING LINE AND THE INDICATED DEGREE OF PRECEDENCE. FOLLOWING THIS SELECTION BY THE DIRECTOR THE CONNECTION FROM THE INCOMING LINE UNIT TRANSMITTER TO THE CROSS OFFICE UNIT REPERFORATOR IS COMPLETED AND TRANSMISSION BEGINS. THE DIRECTOR THEN RELEASES FROM THE CONNECTION AND IS AVAILABLE TO OTHER LINE UNITS. TOTAL ELAPSED DIRECTOR HOLDING TIME WILL VARY FROM 3 TO 5 SECONDS.

THE MESSAGE IS THEN REPRODUCED IN THE CROSS OFFICE UNIT AND IF THE OUTGOING LINE IS NOT IMMEDIATELY AVAILABLE TO IT THE MESSAGE WILL GO INTO STORAGE IN THE TAPE STORAGE BIN. AS SOON AS THE MESSAGE STARTS TO FLOW INTO THE STORAGE BIN THE TAPE READER STARTS TO SCAN THE TAPE HUNTING FOR THE SOM. WHEN IT IS DETECTED BY THE RELAY CONTROL GROUP THE MESSAGE IS ADVANCED TO THE TRANSMITTER TO SUCH A POSITION THAT IT WILL BE READY TO BE TRANSMITTED TO THE LINE. IF THE LINE IS BUSY AT THE TIME, TRANSMITTING A MESSAGE FROM ANOTHER CROSS OFFICE UNIT AND THE MESSAGE TO BE HANDLED IS NOT OF HIGH PRECEDENCE, THE MESSAGE WAITS UNTIL THE LINE BECOMES IDLE. WHEN THIS OCCURS ALL CROSS OFFICE UNITS WITH MESSAGES READY FOR THAT LINE PUT IN A BID FOR THE LINE. AT THIS TIME A PRECEDENCE SELECTION IS MADE AND THE CROSS OFFICE UNIT WITH THE HIGHEST DEGREE OF PRECEDENCE IS PERMITTED TO GAIN CONTROL OF THE LINE. FOLLOWING SEIZURE OF THE LINE THE AUTOMATIC NUMBERING EQUIPMENT IS

USED TO TRANSMIT A NEW SOM AND THE NEXT SEQUENTIAL CHANNEL NUMBER TO THE LINE, FOLLOWING WHICH THE MONITOR TAPE IS DATE-TIME STAMPED AND THE MESSAGE IS TRANSMITTED TO THE LINE FROM THE TRANSMITTER IN THE CROSS OFFICE UNIT. SIMULTANEOUSLY WITH TRANSMISSION OF THE NEW SOM TO THE LINE THE MONITOR IS REMOVED FROM THE LINE FOR INSERTION OF A NUMBER ON THE TAPE IDENTIFYING THE CROSS OFFICE UNIT.

IF A CROSS OFFICE UNIT RECEIVES A MESSAGE OF SUFFICIENTLY HIGH PRECEDENCE IT WILL CAUSE THE IMMEDIATE INTERRUPTION AND CANCELLATION OF THE TRANSMISSION OF A MESSAGE OF LOWER PRECEDENCE. THE CROSS OFFICE UNIT CONTAINING THE INTERRUPTED MESSAGE IS THEN LOCKED OUT AND INDICATED AS AN ALARM CONDITION. SUBSEQUENTLY, AN OPERATOR MUST RE-POSITION THE MESSAGE TAPE IN THE TRANSMITTER AND RE-SET THE CONTROLS TO PERMIT RE-TRANSMISSION OF THE LOWER PRECEDENCE MESSAGE IN A NORMAL MANNER.

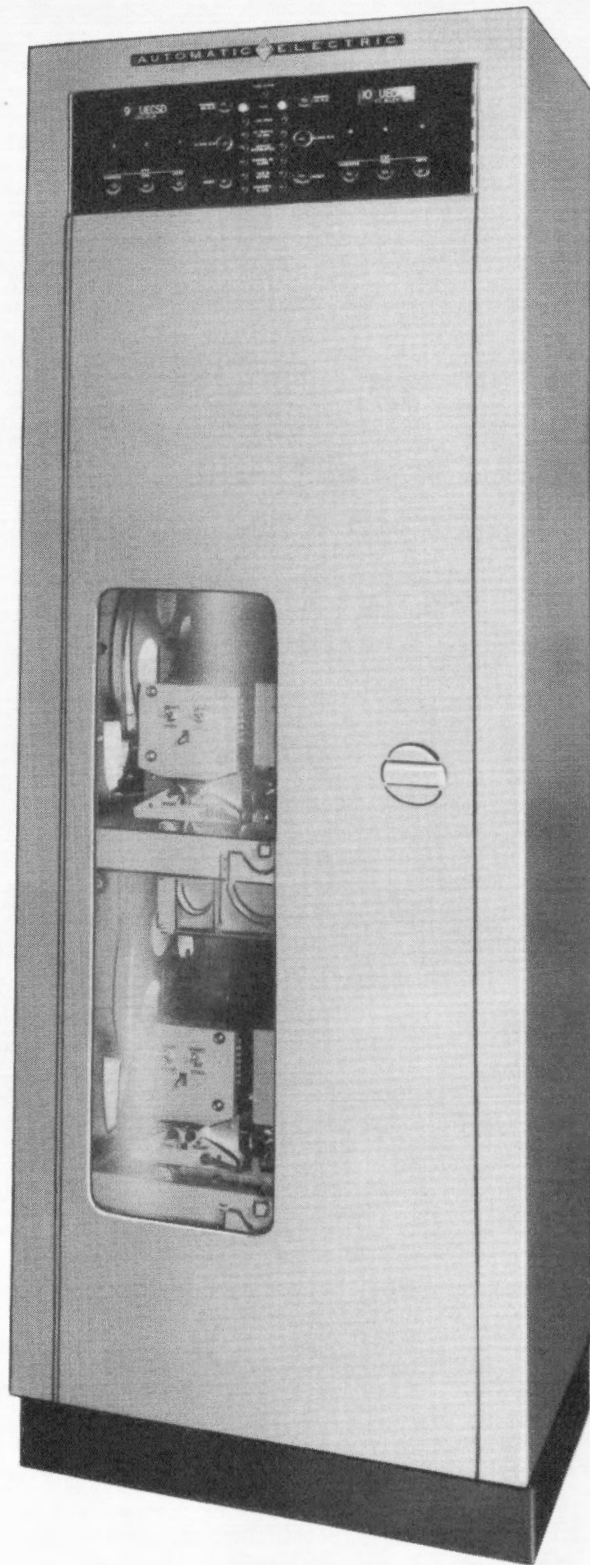
MESSAGES WHICH ARRIVE AT THE SWITCHING CENTER IN A CONDITION WHICH PREVENTS FURTHER PROCESSING ARE DIRECTED BY THE DIRECTOR TO INTERCEPT POSITIONS WHERE THE MESSAGES ARE REPRODUCED ON TAPES WHICH CAN BE EASILY HANDLED BY A SUPERVISOR. AFTER SUPERVISORY ACTION ON THESE MESSAGES HAS BEEN COMPLETE THEY ARE RE-ENTERED INTO THE SYSTEM AT THE INTERCEPT MANUAL FORWARDING POSITIONS WHICH CAN BE SET BY AN OPERATOR TO TRANSMIT DIRECTLY TO ANY OF THE OUTGOING LINES AND IN ACCORDANCE WITH ANY SELECTED DEGREE OF PRECEDENCE. THESE FORWARDING POSITIONS ALSO PROVIDE A CONVENIENT MEANS FOR ENTRY INTO THE SYSTEM OF OUTGOING SUPERVISORY MESSAGES. INCOMING SUPERVISORY MESSAGES ARE ROUTED BY THE DIRECTOR TO THE INTERCEPT POSITIONS.

MULTIPLE CALL MESSAGE

AS A MESSAGE IS BEING PROCESSED BY THE DIRECTOR THE ENTIRE ROUTING LINE IS SCANNED FOR INFORMATION. IF MORE THAN ONE ROUTING INDICATOR IS PRESENT BUT TRANSLATION SHOWS THAT THEY ARE ALL REACHED VIA THE SAME OUTGOING LINE THE MESSAGE WILL BE HANDLED AS A SINGLE CALL MESSAGE. IF, HOWEVER, THE MESSAGE CONTAINS TWO OR MORE ROUTING INDICATORS FOR DIFFERENT LINES THE DIRECTOR THEN DIRECTS THE MESSAGE TO ONE OF THE MULTIPLE CALL CROSS OFFICE UNITS. AS THE MESSAGE IS REPERFORATED IN THIS UNIT THE TAPE READER SCANS THE TAPE HUNTING FOR THE SOM. WHEN IT IS DETECTED THE UNIT CALLS FOR THE COMMON MULTIPLE CALL PROCESSING EQUIPMENT. THIS EQUIPMENT ATTACHES ITSELF TO THE CALLING UNIT AND SIGNALS THE TAPE READER TO SEND ITS ROUTING INFORMATION. AS THE ROUTING INFORMATION IS SENT TO THE PROCESSING EQUIPMENT SEVERAL CROSS OFFICE UNITS AS REQUIRED (ONE FOR EACH OUTGOING LINE TO BE USED) ARE SEIZED AND PERTINENT ROUTING INFORMATION IS SENT TO EACH. FOLLOWING THE TRANSMISSION OF THIS INFORMATION TO INDIVIDUAL CROSS OFFICE UNITS, A MULTIPLE TRANSMISSION FROM THE MULTIPLE CALL UNIT TO ALL SEIZED CROSS OFFICE UNITS IS MADE. WHILE THIS MULTIPLE TRANSMISSION OF THE MESSAGE IS BEING MADE THE COMMON PROCESSING EQUIPMENT IS AVAILABLE FOR FURTHER USE BY OTHER MULTIPLE CALL UNITS.

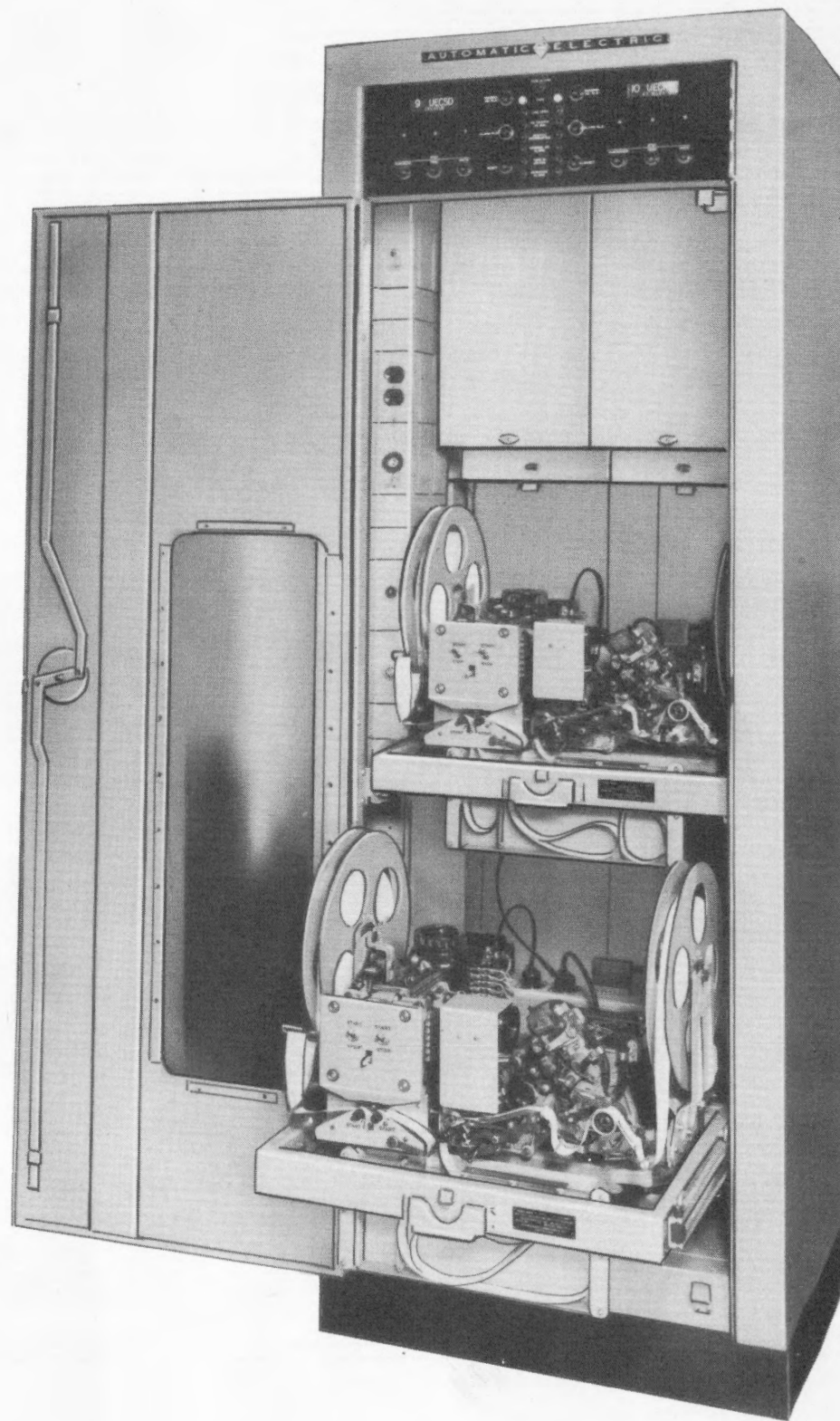
WHILE THE HEADINGS ARE BEING PREPARED TO THE CROSS OFFICE UNITS A MONITOR PAGE PRINTER IS USED ON WHICH IS RECORDED THE HEADINGS OF ALL CROSS OFFICE TRANSMISSIONS. THIS ASSISTS SUPERVISORS IN KEEPING RECORDS OF MULTIPLE CALL PROCESSING.

THUS IT CAN BE SEEN THAT MESSAGE TRAFFIC FLOWS SMOOTHLY AND QUICKLY THROUGH THE SWITCHING CENTER IN STRICT COMPLIANCE WITH OPERATING PROCEDURES. THE SERVICE TEST MODEL IN USE AT THE HEADQUARTERS FIFTH ARMY HAS PROVED THAT THESE PRINCIPLES ARE SOUND. IT HAS ALSO MET WITH WHOLEHEARTED AND ENTHUSIASTIC SUPPORT OF OPERATING PERSONNEL.



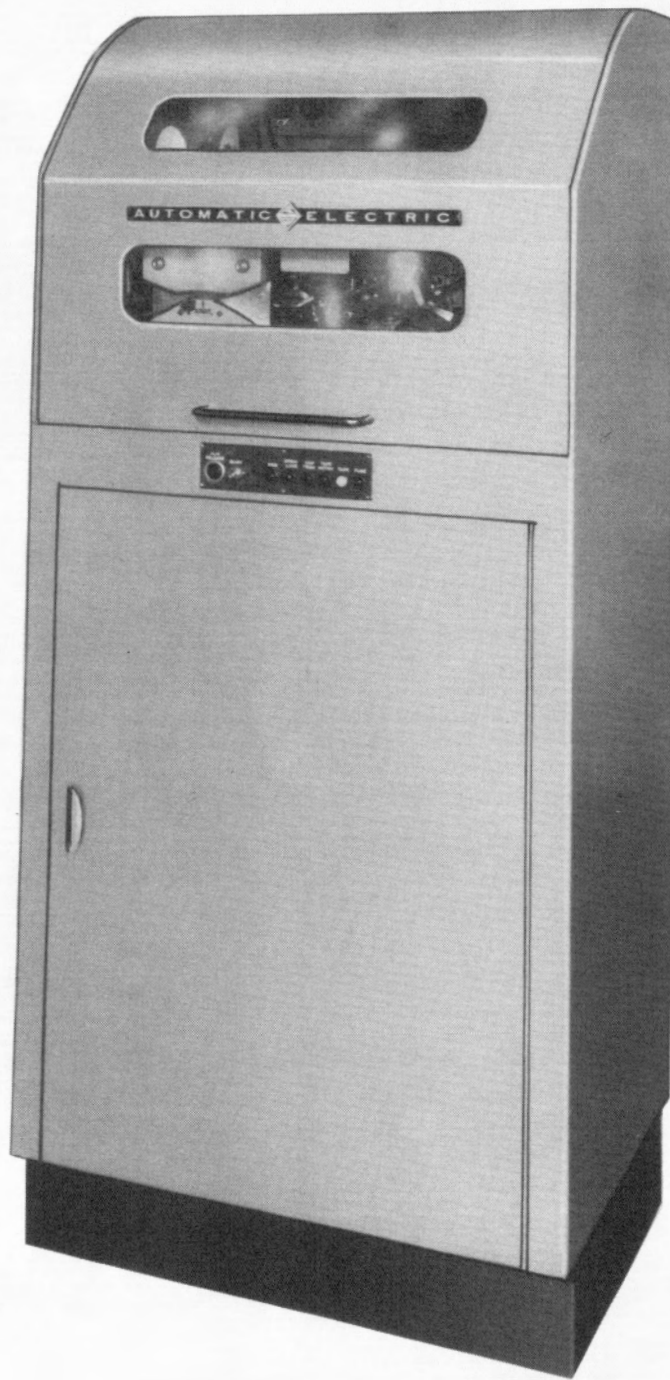
CENTRAL OFFICE, TELETYPEWRITER AN/FGC-30

INCOMING LINE UNIT



CENTRAL OFFICE, TELETYPEWRITER AN/FGC-30

**INCOMING LINE UNIT
(DOOR OPEN)**



CENTRAL OFFICE, TELETYPEWRITER AN/FGC-30

CROSS OFFICE UNIT



CENTRAL OFFICE, TELETYPEWRITER AN/FGC-30

**CROSS OFFICE UNIT
(COVERS OPEN)**



CENTRAL OFFICE, TELETYPEWRITER AN/FGC-30
CROSS OFFICE UNIT
(COVERS OPEN AND TELETYPEWRITER EQUIPMENT IN
EXTENDED POSITION)