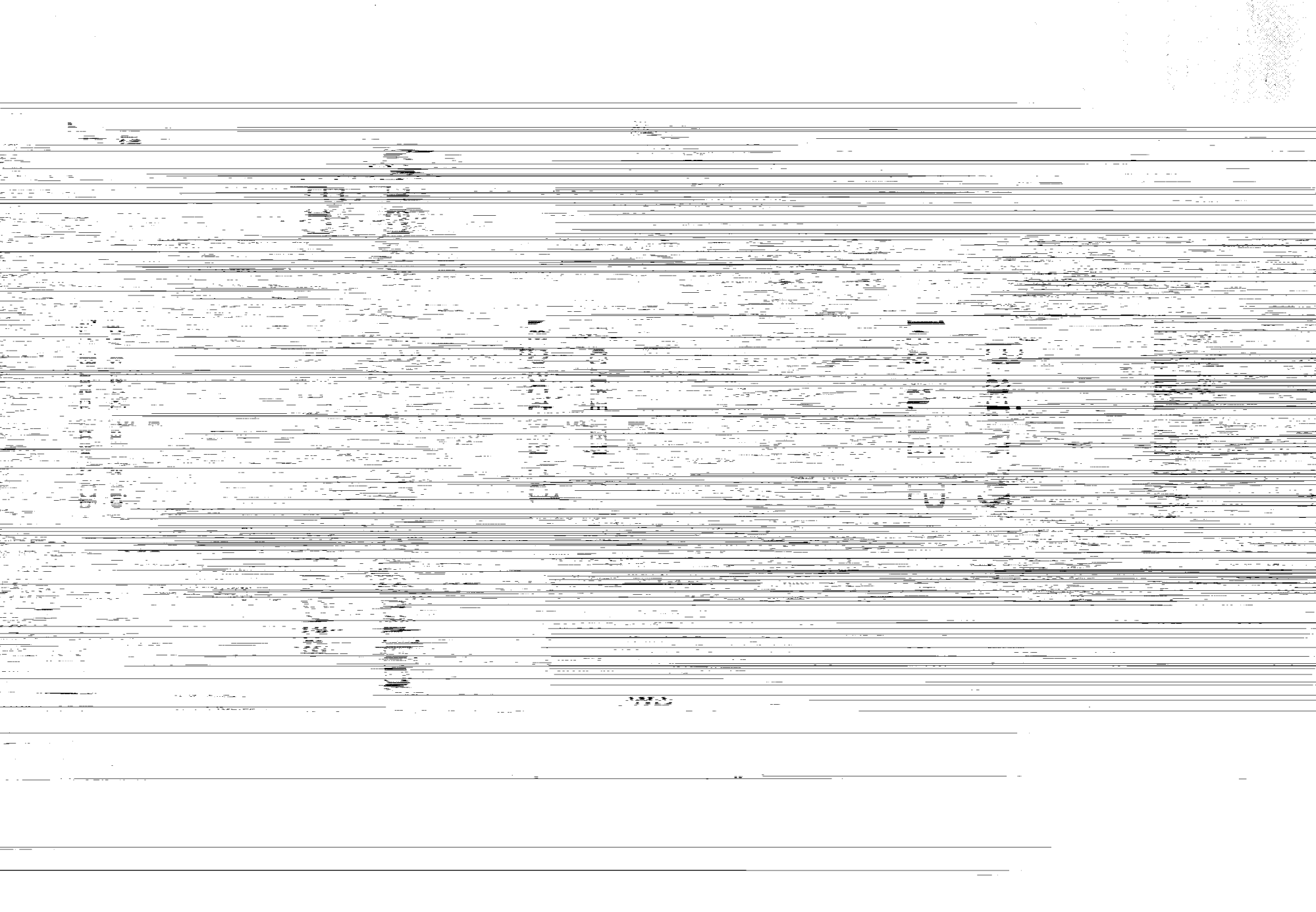

CONTENTS

American Railway Signaling Principles and Practices

CHAPTER II

Symbols, Aspects and Indications

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CHAPTER II

SYMBOLS, ASPECTS AND INDICATIONS

SYMBOLS

In railway signaling, symbols are the characters used on drawings to represent signal and interlocking apparatus, tracks, buildings, bridges and various other parts of the railway structure.

Without the use of symbols, it would be extremely difficult for the engineer to express himself clearly. Their use contributes to an understanding between the designer and the mechanic building or installing the apparatus or circuits.

Symbols to be of use, however, must be understood by the designer and by the craftsman who is to read the plan, thus the necessity for standard symbols in any given field of endeavor. In railway signaling, standard symbols are the work of the Signal Section, Association of American Railroads. The symbols, comprising 24 sheets, were prepared by a committee of signalmen and representatives of the various signal companies.

The portion of this chapter devoted to symbols will describe the symbols and their use; no attempt will be made to describe the signal apparatus, its use or operation, as these features are covered in other chapters.

Figure 1 indicates wayside signal operating characteristics. A study of these symbols will show that all the various functions of a signal can be indicated. Where two or three-arm signals are to be shown, the same symbols are used for each arm. Where a semaphore signal is in use, the letter E or M indicates it is operated by an electric motor or is mechanically operated. Light signals are indicated by P for position light, CP for color position, C for color light and SL for searchlight. The shape of the blade on semaphore type signals is not shown as this depends on the standard of the railroad. Generally, the absolute stop signal has a square-end blade, the permissive a round end, the automatic a pointed end, and the approach or distant in other than automatic block system territory, a fishtail end. Other types of signal blades may be used for certain purposes as required by the needs of each individual railroad.

Figure 2 shows symbols for various types of signal supports, and Fig. 3 shows symbols for tracks and highway crossing signals.

Figure 4 shows symbols for buildings, bridges and tunnels. Figure 5 shows symbols for wayside fixtures.

Symbols for interlocked switches and derails are shown in Figs. 6 and 7, respectively. The shaded triangle indicates the position of the switch. On plans, the switches and derails are always shown in their normal position. When the symbol is used for non-interlocked functions the shading is omitted.

Symbols in Fig. 8 are those for miscellaneous devices applied to tracks. Figure 9 shows symbols for lead-outs, bolt locks, cranks and deflecting bars. Figure 10 shows symbols for pipe and wire lines.

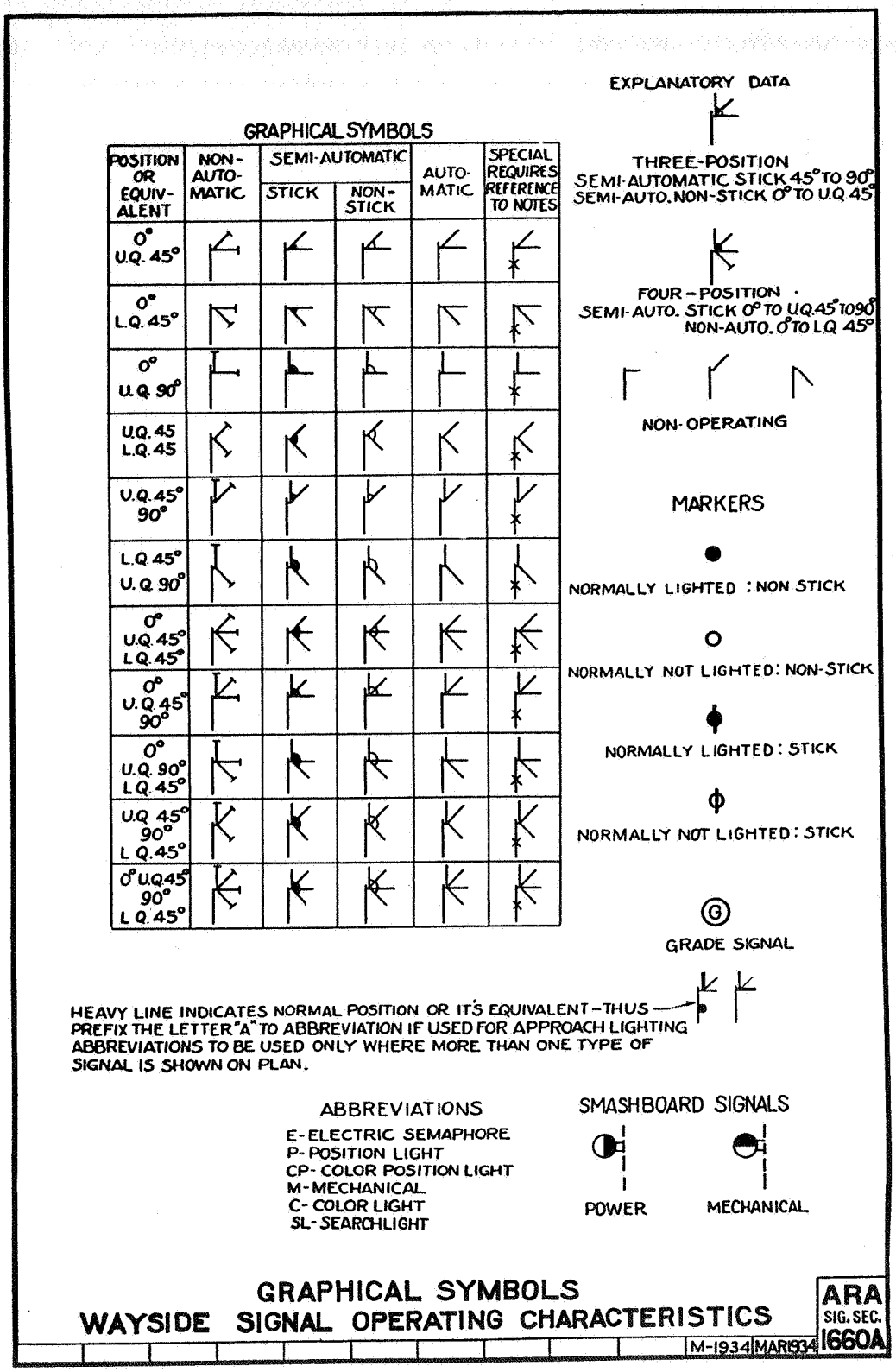

GRAPHICAL SYMBOLS
POSITION OR EQUIV-ALENT
NON-AUTO-MATIC
SEMI-AUTOMATIC
STICK
NON-STICK
AUTO-MATIC
SPECIAL REQUIRES REFERENCE TO NOTES
0° U.Q. 45°
0° L.Q. 45°
0° U.Q. 90°
U.Q. 45 L.Q. 45
U.Q. 45° 90°
L.Q. 45° U.Q. 90°
0° U.Q. 45° L.Q. 45°
0° U.Q. 45° 90°
0° U.Q. 90° L.Q. 45°
U.Q. 45° 90° L.Q. 45°
0° U.Q. 45° 90° L.Q. 45°
EXPLANATORY DATA
THREE-POSITION
SEMI-AUTOMATIC STICK 45° TO 90°
SEMI-AUTO. NON-STICK 0° TO U.Q. 45°
FOUR-POSITION
SEMI-AUTO. STICK 0° TO U.Q. 45° TO 90°
NON-AUTO. 0° TO L.Q. 45°
NON-OPERATING
MARKERS
NORMALLY LIGHTED : NON STICK
NORMALLY NOT LIGHTED: NON-STICK
NORMALLY LIGHTED : STICK
NORMALLY NOT LIGHTED : STICK
G
GRADE SIGNAL
HEAVY LINE INDICATES NORMAL POSITION OR IT'S EQUIVALENT - THUS
PREFIX THE LETTER "A" TO ABBREVIATION IF USED FOR APPROACH LIGHTING
ABBREVIATIONS TO BE USED ONLY WHERE MORE THAN ONE TYPE OF SIGNAL IS SHOWN ON PLAN.
ABBREVIATIONS
E - ELECTRIC SEMAPHORE
P - POSITION LIGHT
CP - COLOR POSITION LIGHT
M - MECHANICAL
C - COLOR LIGHT
SL - SEARCHLIGHT
SMASHBOARD SIGNALS
POWER
MECHANICAL
GRAPHICAL SYMBOLS
WAYSIDE SIGNAL OPERATING CHARACTERISTICS
ARA
SIG. SEC.
1660A
M-1934 MAR1934

Fig. 1.

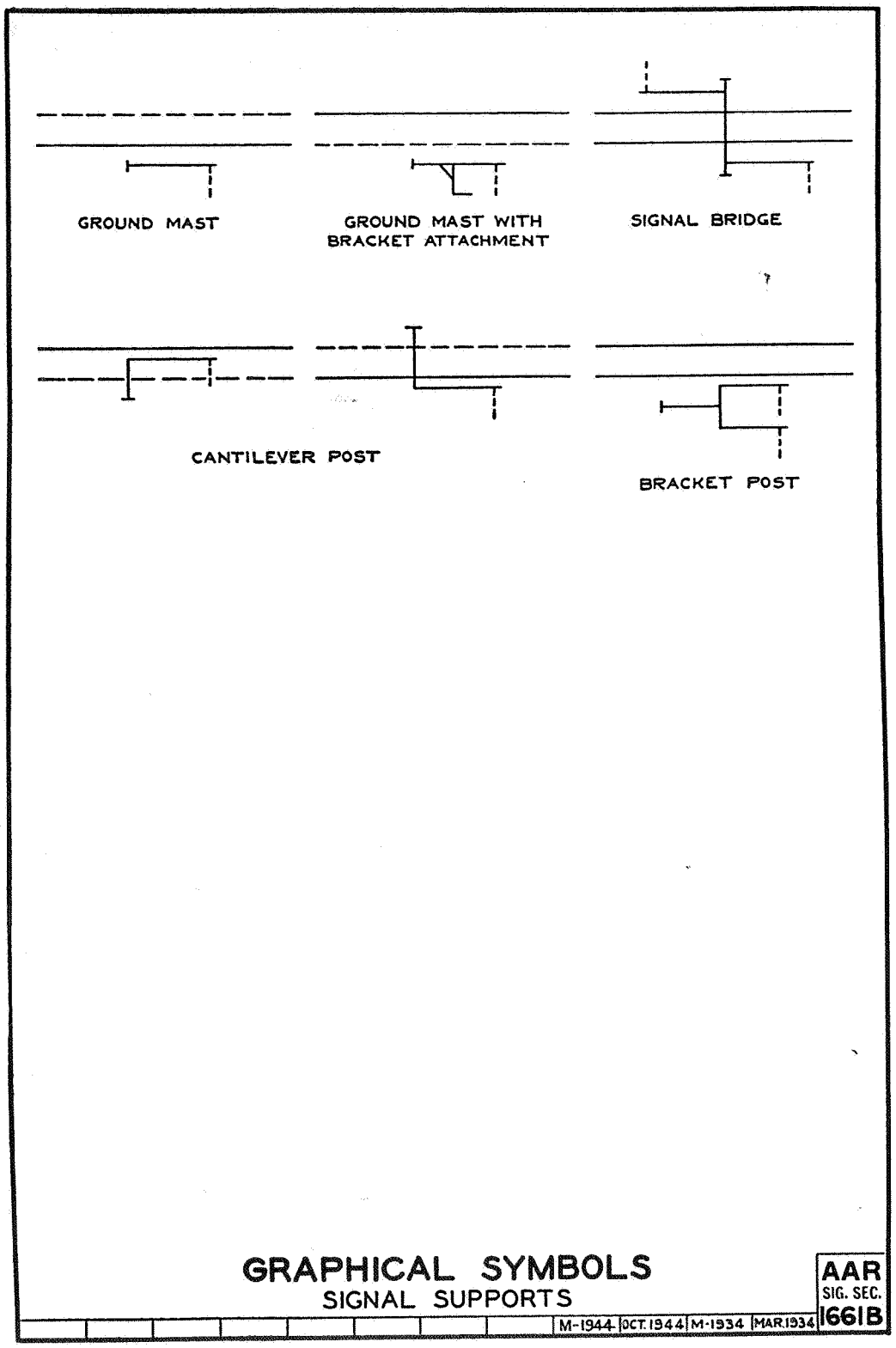

GROUND MAST
GROUND MAST WITH BRACKET ATTACHMENT
SIGNAL BRIDGE
CANTILEVER POST
BRACKET POST
GRAPHICAL SYMBOLS
SIGNAL SUPPORTS
M-1944 OCT. 1944 M-1934 MAR. 1934
AAR SIG. SEC. 1661B

Fig. 2:

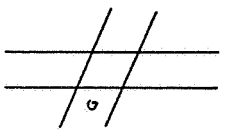
RAILROAD TRACKS

SIGNIFY STEAM OR ELECTRIC WHERE ELECTRIC TRACKS CROSS OR JOIN STEAM TRACKS

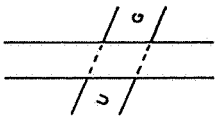
RAILROAD TRACK TO REMAIN	TRACK TO BE TAKEN UP (RED)	PROPOSED TRACKS (YELLOW)	PROPOSED (FUTURE) TRACKS (YELLOW)	FOREIGN TRACKS (TO BE INDICATED BY NAME OR SYMBOL OR BOTH)

NOTE: WHERE OTHER COLORS ARE USED, EXPLANATION OF COLOR IS TO BE SHOWN ON PLAN.

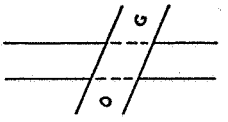
HIGHWAY CROSSINGS



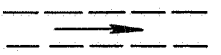
GRADE CROSSING



UNDERGRADE CROSSING



OVERGRADE CROSSING



TRAFFIC DIRECTION

NOTE: EXPLAIN AS FOLLOWS: STREET NAME, HIGHWAY NAME AND NUMBER, FARM AND PRIVATE CROSSINGS, ANY OTHER IDENTIFICATIONS.

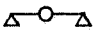
MERIDIAN

HIGHWAY CROSSING SIGNALS

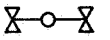
CROSSING SIGN

BELL

WIG-WAG



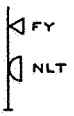
FRONT LIGHTS ONLY FLASHING



FRONT AND BACK LIGHTS LIGHTS

NUMBER OF TRACKS SIGN MOUNTED ON SIGNAL MAST

NUMBER OF TRACKS TO BE SHOWN ON PLAN OR COVERED BY NOTE (SEE 1691)

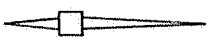


NO TURN SIGNAL

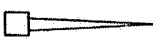
FY: FLASHING YELLOW
NLT: NO LEFT TURN
NRT: NO RIGHT TURN

STOP ON RED SIGNAL SIGN

STOP WHEN SWINGING SIGN

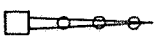


CROSSING GATE WITH SIDEWALK ARM



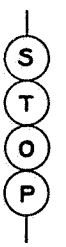
CROSSING GATE WITHOUT SIDEWALK ARM

GATE ARM SIDEWALK



GATE ARM WITH LAMPS

ROTATING DISC.



ILLUMINATED STOP SIGN

NOTE: HIGHWAY CROSSING SIGNAL SYMBOLS INDICATE BASIC CHARACTERISTICS AND MAY BE COMBINED TO FORM ADDITIONAL SYMBOLS. THESE BASIC SYMBOLS MAY ALSO BE USED IN CONJUNCTION WITH OTHER GRAPHICAL SYMBOLS AS REQUIRED. LETTERS SHOULD BE INCLUDED WITHIN SYMBOLS OR ADJACENT THERETO TO INDICATE CHARACTERISTICS, SUCH AS: A-AUTOMATIC, M-MANUAL, A-M-AUTO-MANUAL.

GRAPHICAL SYMBOLS
TRACKS AND HIGHWAY CROSSINGS

AAR SIG. SEC. 1662E

		M-1954	OCT. 1954	M-1950	SEPT. 1950	M-1947	SEPT 1947	M-1944	OCT 1944	M-1934	MAR 1934

Fig. 3.

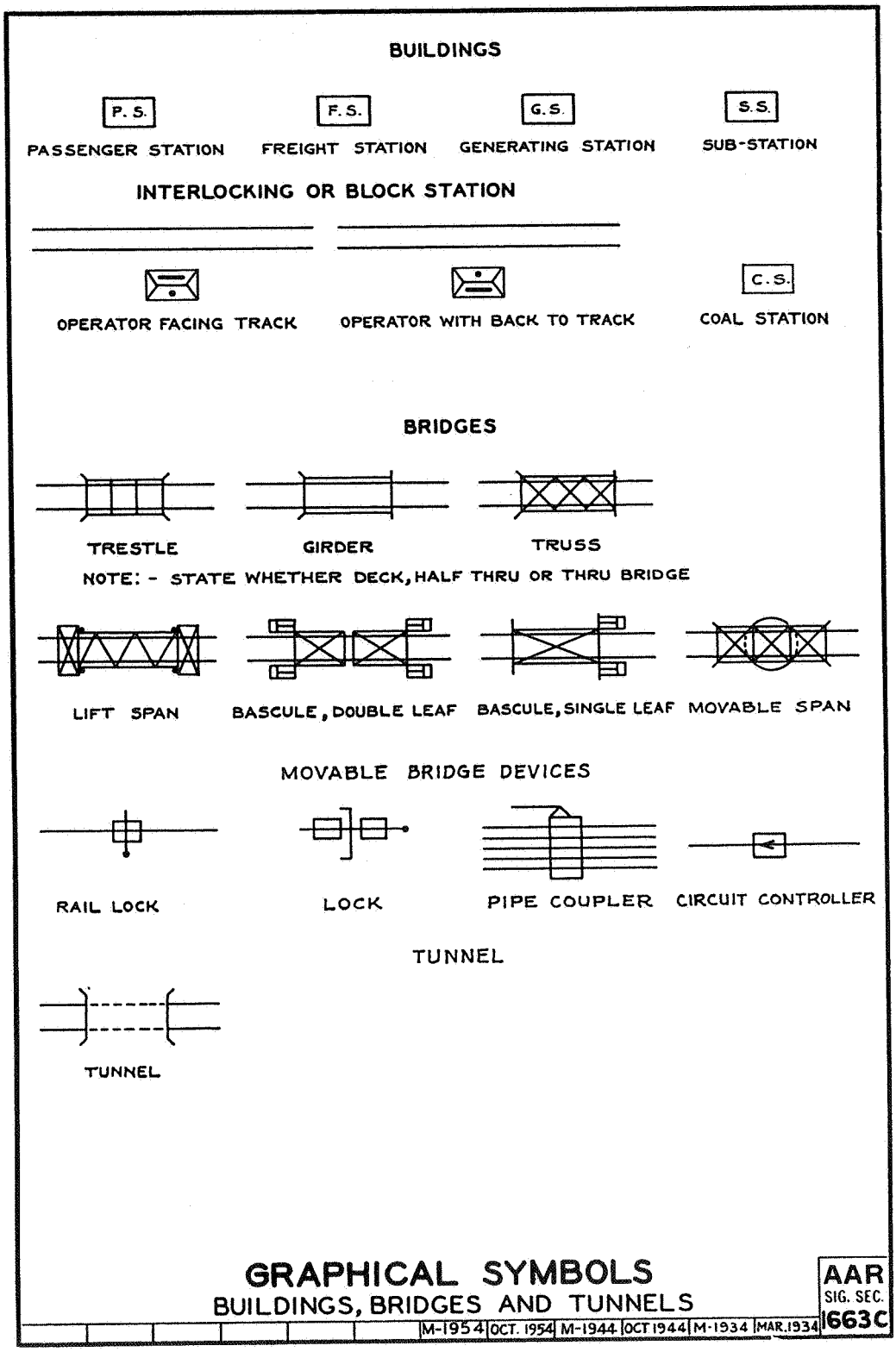

BUILDINGS
P. S.
PASSENGER STATION
F. S.
FREIGHT STATION
G. S.
GENERATING STATION
S. S.
SUB-STATION
INTERLOCKING OR BLOCK STATION
OPERATOR FACING TRACK
OPERATOR WITH BACK TO TRACK
C. S.
COAL STATION
BRIDGES
TRESTLE
GIRDER
TRUSS
NOTE: - STATE WHETHER DECK, HALF THRU OR THRU BRIDGE
LIFT SPAN
BASCULE, DOUBLE LEAF
BASCULE, SINGLE LEAF
MOVABLE SPAN
MOVABLE BRIDGE DEVICES
RAIL LOCK
LOCK
PIPE COUPLER
CIRCUIT CONTROLLER
TUNNEL
TUNNEL
GRAPHICAL SYMBOLS
BUILDINGS, BRIDGES AND TUNNELS
M-1954 OCT. 1954 M-1944 OCT 1944 M-1934 MAR. 1934
AAR
SIG. SEC.
1663C

Fig. 4.

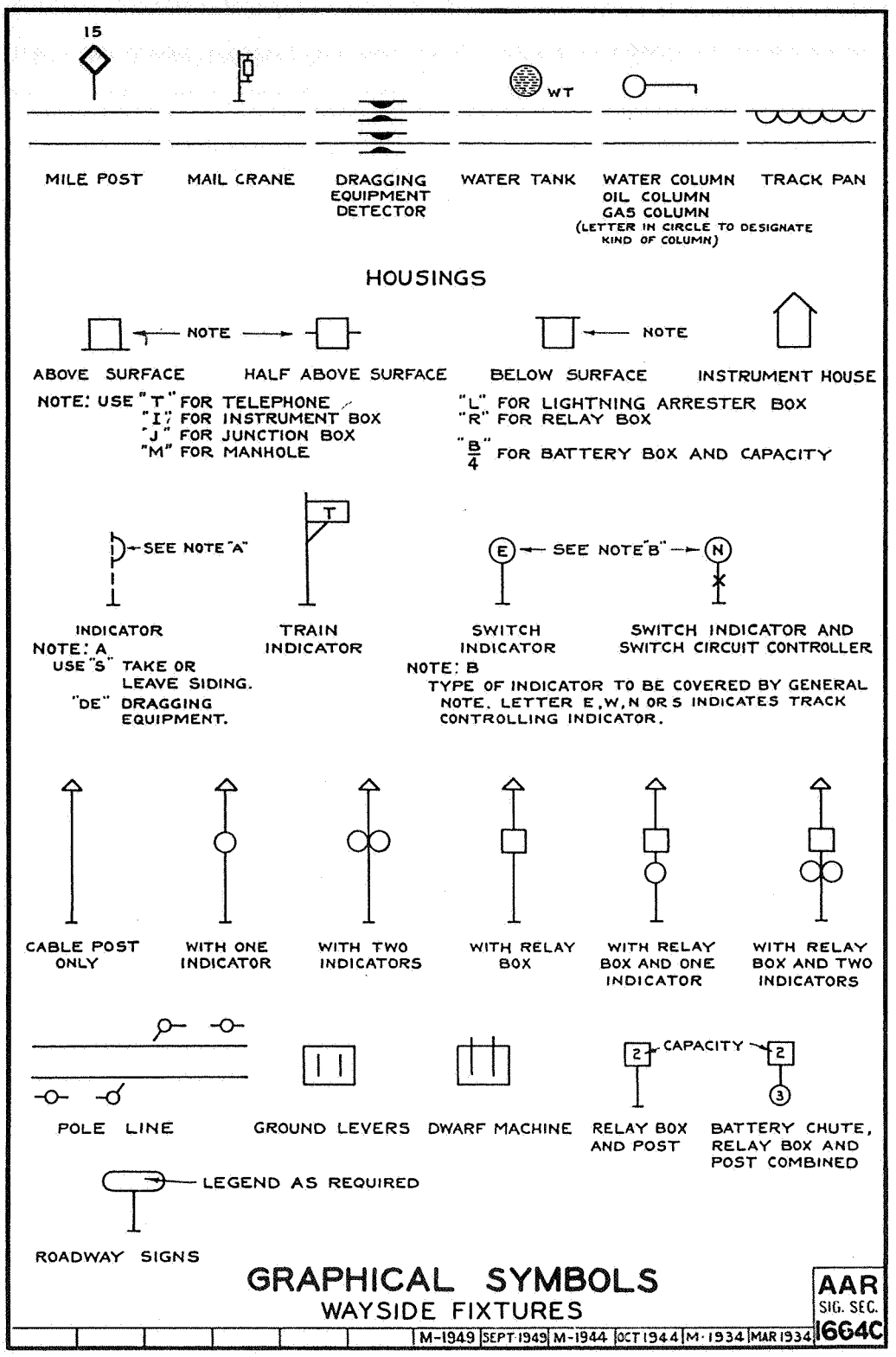
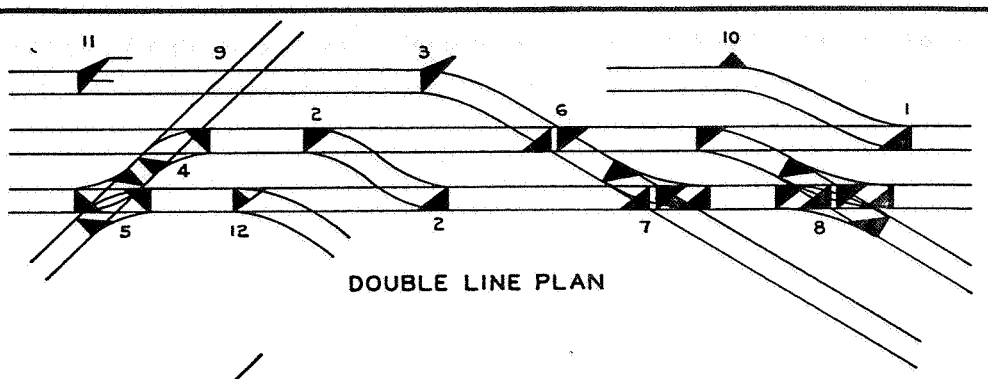
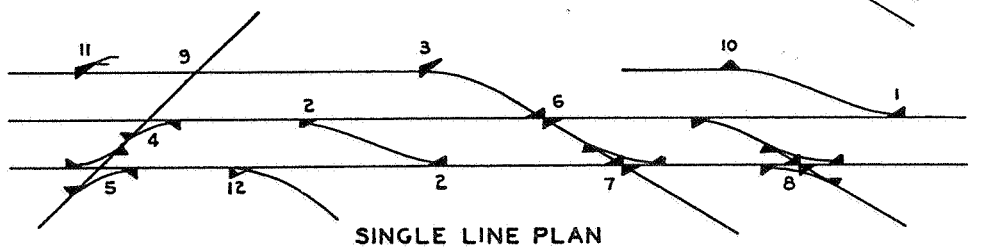

15
WT
MILE POST
MAIL CRANE
DRAGGING EQUIPMENT DETECTOR
WATER TANK
WATER COLUMN
OIL COLUMN
GAS COLUMN
(LETTER IN CIRCLE TO DESIGNATE KIND OF COLUMN)
TRACK PAN
HOUSINGS
NOTE
NOTE
ABOVE SURFACE
HALF ABOVE SURFACE
BELOW SURFACE
INSTRUMENT HOUSE
NOTE: USE "T" FOR TELEPHONE
"I" FOR INSTRUMENT BOX
"J" FOR JUNCTION BOX
"M" FOR MANHOLE
"L" FOR LIGHTNING ARRESTER BOX
"R" FOR RELAY BOX
"B/4" FOR BATTERY BOX AND CAPACITY
SEE NOTE "A"
T
E
SEE NOTE "B"
N
INDICATOR
NOTE: A
USE "S" TAKE OR LEAVE SIDING.
"DE" DRAGGING EQUIPMENT.
TRAIN INDICATOR
SWITCH INDICATOR
SWITCH INDICATOR AND SWITCH CIRCUIT CONTROLLER
NOTE: B
TYPE OF INDICATOR TO BE COVERED BY GENERAL NOTE. LETTER E,W,N OR S INDICATES TRACK CONTROLLING INDICATOR.
CABLE POST ONLY
WITH ONE INDICATOR
WITH TWO INDICATORS
WITH RELAY BOX
WITH RELAY BOX AND ONE INDICATOR
WITH RELAY BOX AND TWO INDICATORS
POLE LINE
GROUND LEVERS
DWARF MACHINE
2
CAPACITY
2
3
RELAY BOX AND POST
BATTERY CHUTE, RELAY BOX AND POST COMBINED
LEGEND AS REQUIRED
ROADWAY SIGNS
GRAPHICAL SYMBOLS
WAYSIDE FIXTURES
AAR
SIG. SEC.
1664C
M-1949 SEPT 1949 M-1944 OCT 1944 M-1934 MAR 1934

Fig. 5.



DOUBLE LINE PLAN



SINGLE LINE PLAN

EXPLANATION

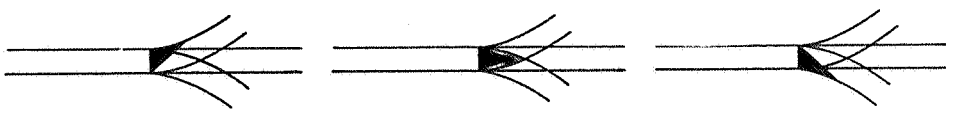
1-SINGLE SWITCH
2-CROSSOVER
3-SINGLE POINT DERAIL
4-SINGLE SLIP SWITCH
5-DOUBLE SLIP SWITCH
6-MOVABLE POINT CROSSING FROG
7-SINGLE SLIP SWITCH WITH M.P.F.
8-DOUBLE SLIP SWITCH WITH M P.F.
9-RIGID CROSSING FROG
10-LIFTING BLOCK DERAIL
11-LIFTING RAIL DERAIL
12-DUAL CONTROL SWITCH.

SINGLE SWITCH

SET FOR TURNOUT

SET FOR STRAIGHT TRACK

THREE-WAY SWITCH



SET FOR LEFT TURNOUT

SET FOR STRAIGHT TRACK

SET FOR RIGHT TURNOUT

NOTE:-THE ABOVE SYMBOLS ARE FOR INTERLOCKED SWITCHES.
NON-INTERLOCKED SWITCHES TO BE SHOWN SAME AS ABOVE EXCEPT SHADING IN TRIANGLES OMITTED. WHERE HAND-THROWN SWITCHES ARE PIPE-CONNECTED TO OTHERS, AT LEAST ONE SWITCH (THE ONE FARTHEST FROM POINT OF OPERATION) SHOULD HAVE LETTERS "PC" PLACED BESIDE IT.

GRAPHICAL SYMBOLS
SWITCHES

AAR SIG. SEC. 1665B

M-1944 | OCT 1944 | M-1934 | MAR 1934

Fig. 6.

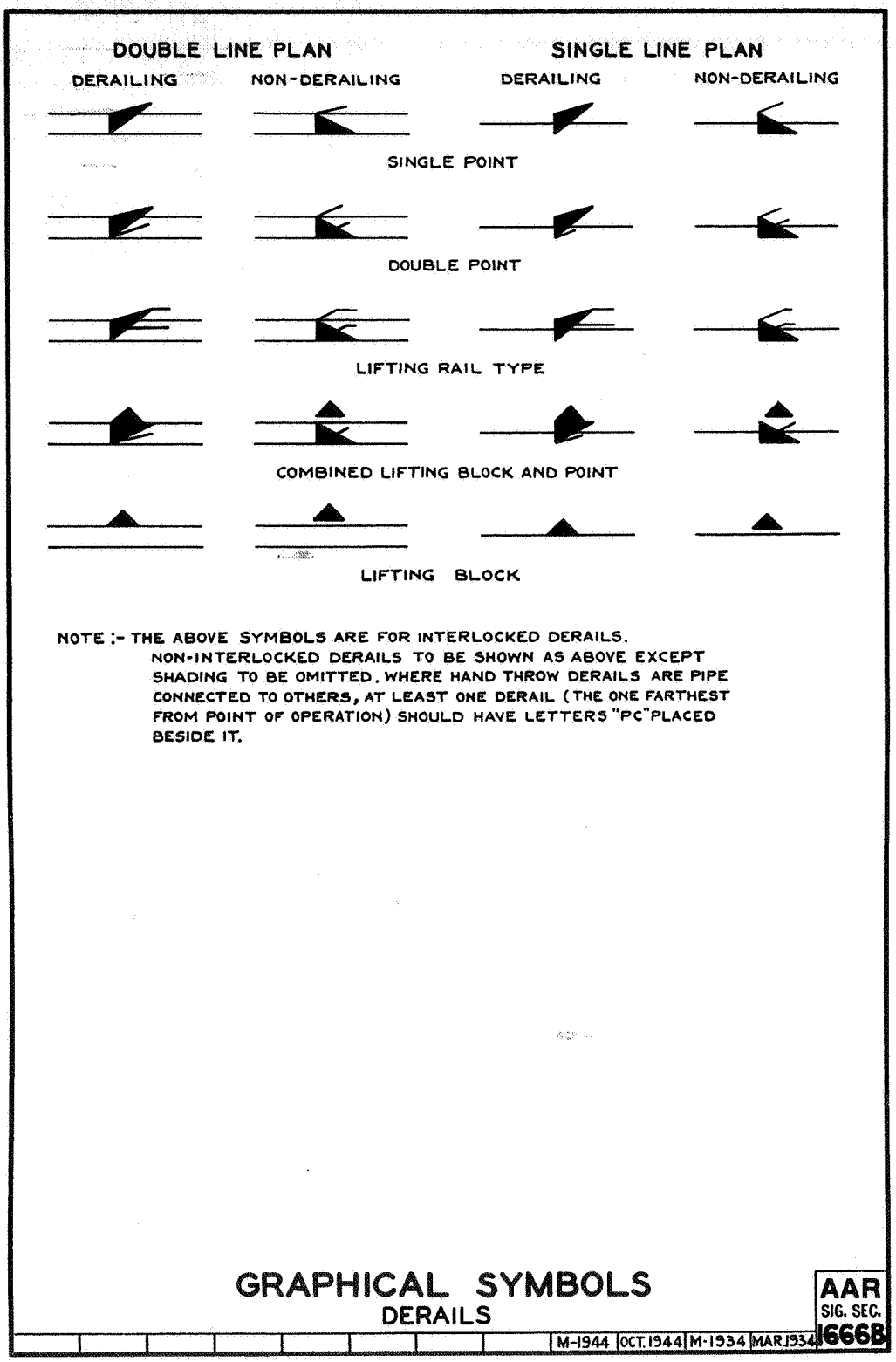

DOUBLE LINE PLAN
SINGLE LINE PLAN
DERAILING
NON-DERAILING
DERAILING
NON-DERAILING
SINGLE POINT
DOUBLE POINT
LIFTING RAIL TYPE
COMBINED LIFTING BLOCK AND POINT
LIFTING BLOCK
NOTE :- THE ABOVE SYMBOLS ARE FOR INTERLOCKED DERAILS.
NON-INTERLOCKED DERAILS TO BE SHOWN AS ABOVE EXCEPT SHADING TO BE OMITTED. WHERE HAND THROW DERAILS ARE PIPE CONNECTED TO OTHERS, AT LEAST ONE DERAIL (THE ONE FARTHEST FROM POINT OF OPERATION) SHOULD HAVE LETTERS "PC" PLACED BESIDE IT.
GRAPHICAL SYMBOLS
DERAILS
AAR
SIG. SEC.
1666B
M-1944 OCT. 1944 M-1934 MAR. 1934

Fig. 7.

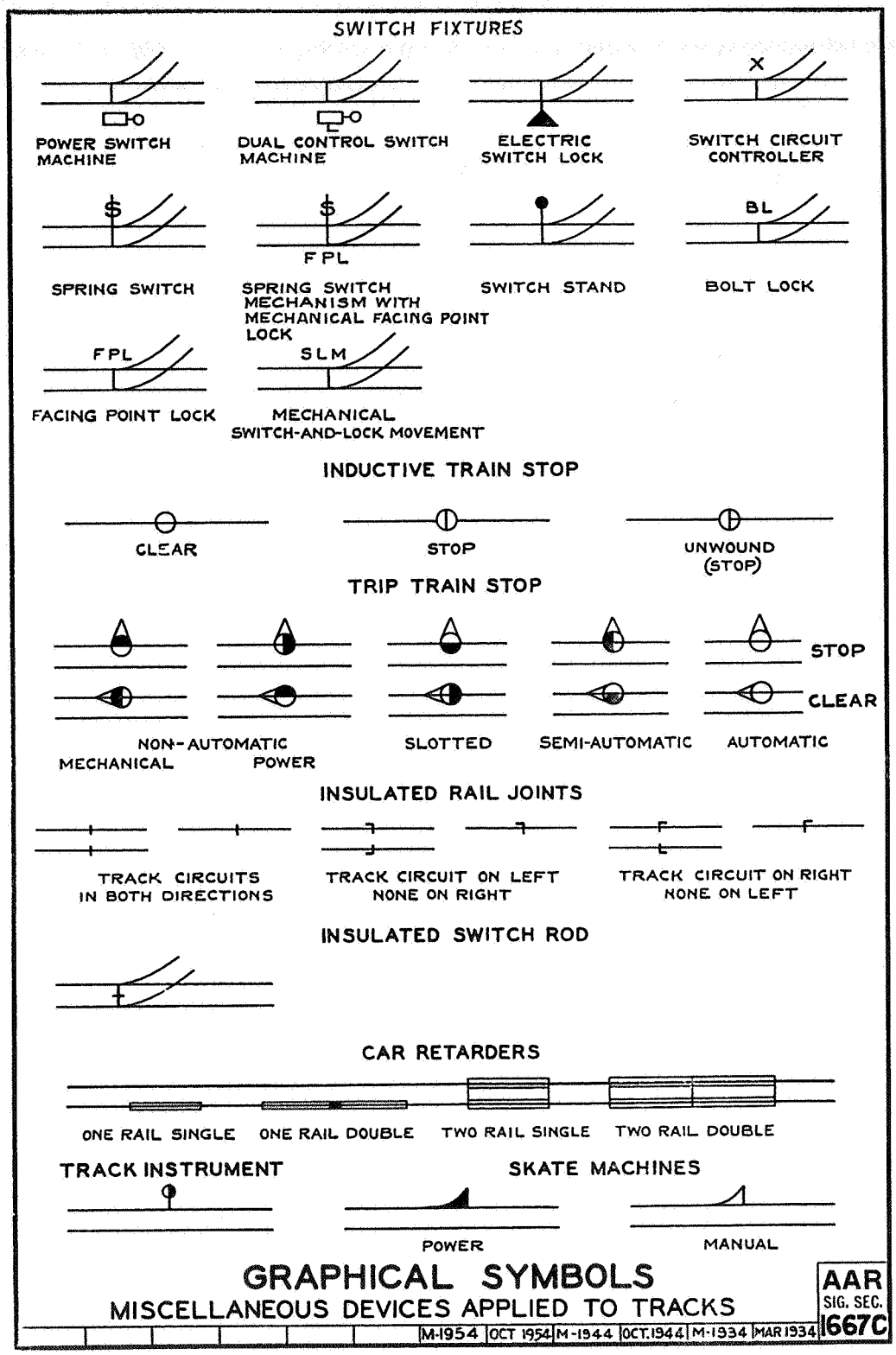

SWITCH FIXTURES
POWER SWITCH MACHINE
DUAL CONTROL SWITCH MACHINE
ELECTRIC SWITCH LOCK
X
SWITCH CIRCUIT CONTROLLER
$
SPRING SWITCH
$
FPL
SPRING SWITCH MECHANISM WITH MECHANICAL FACING POINT LOCK
SWITCH STAND
BL
BOLT LOCK
FPL
FACING POINT LOCK
SLM
MECHANICAL SWITCH-AND-LOCK MOVEMENT
INDUCTIVE TRAIN STOP
CLEAR
STOP
UNWOUND (STOP)
TRIP TRAIN STOP
STOP
CLEAR
NON-AUTOMATIC MECHANICAL
POWER
SLOTTED
SEMI-AUTOMATIC
AUTOMATIC
INSULATED RAIL JOINTS
TRACK CIRCUITS IN BOTH DIRECTIONS
TRACK CIRCUIT ON LEFT NONE ON RIGHT
TRACK CIRCUIT ON RIGHT NONE ON LEFT
INSULATED SWITCH ROD
CAR RETARDERS
ONE RAIL SINGLE
ONE RAIL DOUBLE
TWO RAIL SINGLE
TWO RAIL DOUBLE
TRACK INSTRUMENT
SKATE MACHINES
POWER
MANUAL
GRAPHICAL SYMBOLS
MISCELLANEOUS DEVICES APPLIED TO TRACKS
M-1954 OCT 1954 M-1944 OCT. 1944 M-1934 MAR 1934
AAR SIG. SEC. 1667C

Fig. 8.

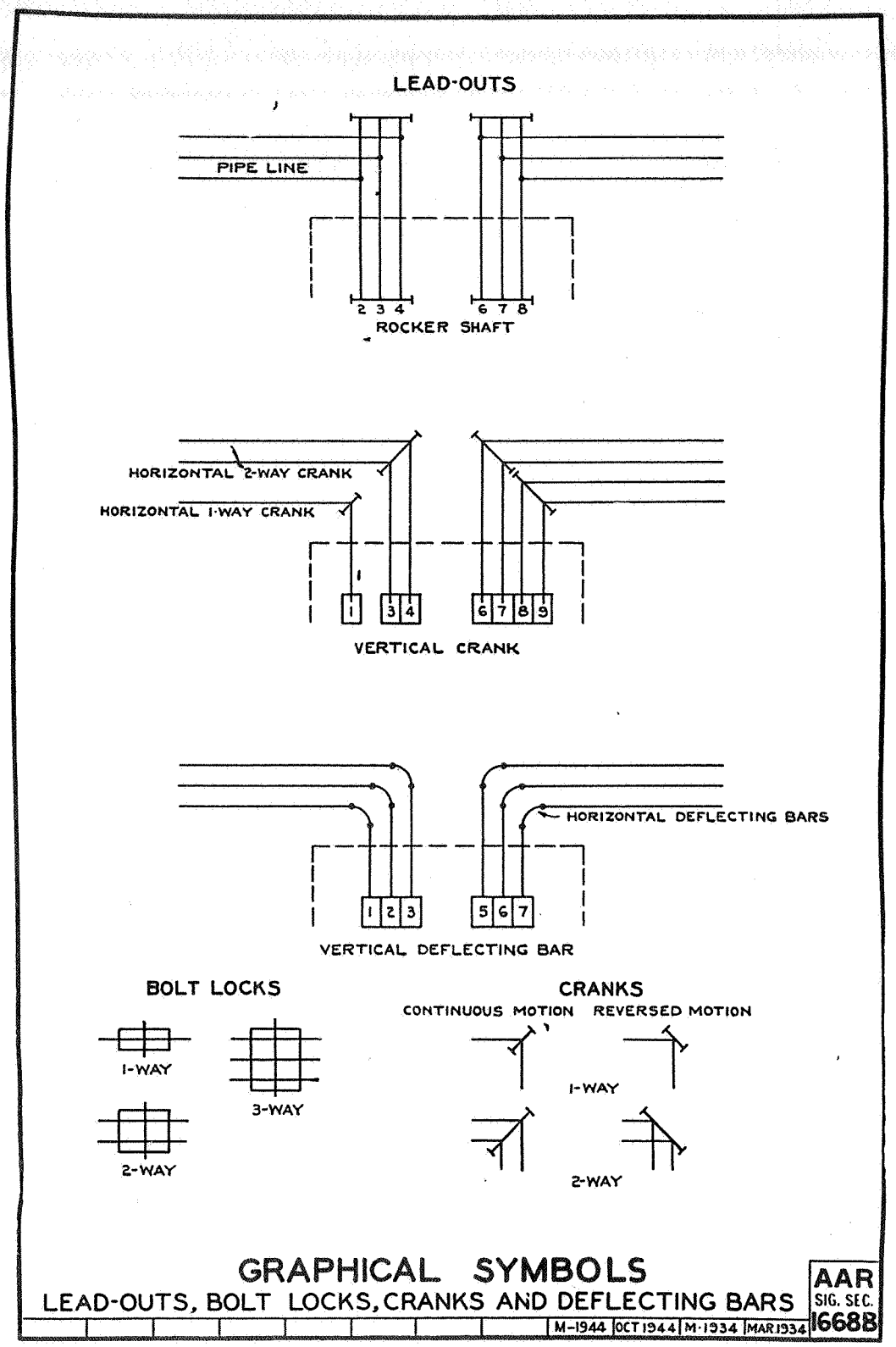

LEAD-OUTS
PIPE LINE
2 3 4
6 7 8
ROCKER SHAFT
HORIZONTAL 2-WAY CRANK
HORIZONTAL 1-WAY CRANK
1
3 4
6 7 8 9
VERTICAL CRANK
HORIZONTAL DEFLECTING BARS
1 2 3
5 6 7
VERTICAL DEFLECTING BAR
BOLT LOCKS
1-WAY
3-WAY
2-WAY
CRANKS
CONTINUOUS MOTION
REVERSED MOTION
1-WAY
2-WAY
GRAPHICAL SYMBOLS
LEAD-OUTS, BOLT LOCKS, CRANKS AND DEFLECTING BARS
M-1944 OCT 1944 M-1934 MAR 1934
AAR
SIG. SEC.
1668B

Fig. 9.

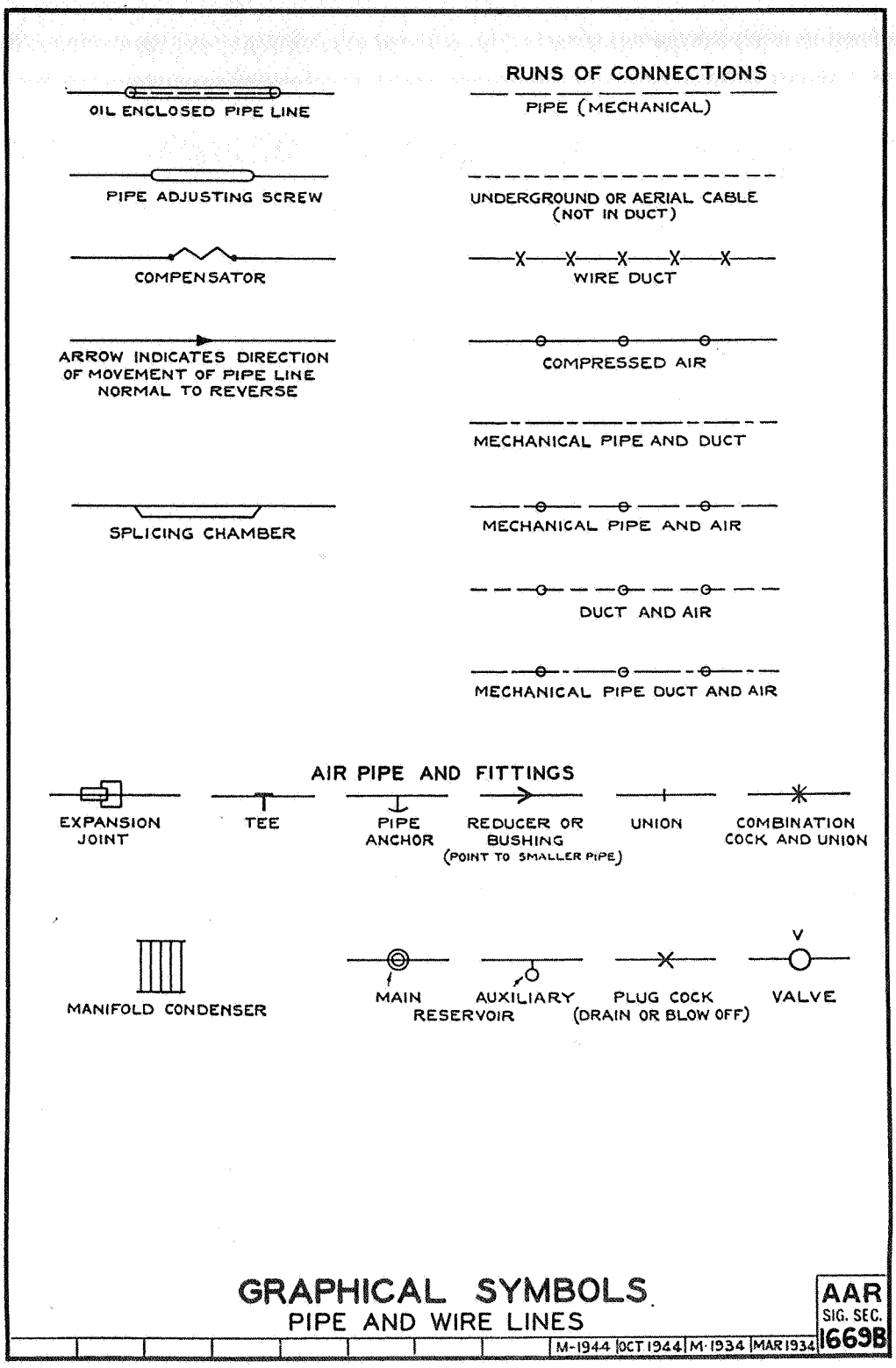

OIL ENCLOSED PIPE LINE
PIPE ADJUSTING SCREW
COMPENSATOR
ARROW INDICATES DIRECTION OF MOVEMENT OF PIPE LINE NORMAL TO REVERSE
SPLICING CHAMBER
RUNS OF CONNECTIONS
PIPE (MECHANICAL)
UNDERGROUND OR AERIAL CABLE (NOT IN DUCT)
WIRE DUCT
COMPRESSED AIR
MECHANICAL PIPE AND DUCT
MECHANICAL PIPE AND AIR
DUCT AND AIR
MECHANICAL PIPE DUCT AND AIR
AIR PIPE AND FITTINGS
EXPANSION JOINT
TEE
PIPE ANCHOR
REDUCER OR BUSHING (POINT TO SMALLER PIPE)
UNION
COMBINATION COCK AND UNION
MANIFOLD CONDENSER
MAIN RESERVOIR
AUXILIARY
PLUG COCK (DRAIN OR BLOW OFF)
V
VALVE
GRAPHICAL SYMBOLS
PIPE AND WIRE LINES
AAR
SIG. SEC.
1669B
M-1944 OCT 1944 M-1934 MAR 1934

Fig. 10.

The application of a number of the symbols to signal layout plans is shown in Fig. 11, which depicts a single-track railroad running north and south crossing a two-track road running east and west, the single-track road having a siding just north of the crossing. The two-track road continues as a three-track road just east of the crossing, the middle track of which is used for traffic in either direction. Automatic block signals are provided for each direction. The eastward and westward main tracks have automatic block signals for movements in one direction only (with current of traffic). The single-track road is not equipped with automatic block signals.

The signaling at the interlocking on the east and west road is commonly known as three-arm signaling, while that on the single-track line is known as two-arm signaling. The terms two and three-arm signaling are derived from the number of arms used on the interlocking signals.

The signal symbols may be readily understood by reference to Fig. 1, and as applied in Fig. 11, the symbols used for the two high signals (one on each side of the crossing) on the north and south road show that each of these signals has two arms. The top arms are semi-automatic, stick, power-operated, zero to 90 degrees. The bottom arms are semi-automatic, stick, power-operated, zero to 45 degrees.

The two approach signals on the north and south road show they are automatically operated and work 45 to 90 degrees. The letter E close to each signal on the north and south road indicates they are electric semaphore type. The letter M near the dwarf signal governing movements from the siding indicates this is a mechanical semaphore signal.

On the east and west road, in addition to the signal symbols thus far described are various others. An arm fixed in the stop position is shown on the signal at the west end of the middle track. Some of the other arms indicate that all three positions of the arms are used, which is shown by the diagonal line in the symbols. All signals on this road are color light type.

The symbol for a signal mast is a straight line parallel to the track to which the symbols for the arms are attached. A long line indicates a high signal, a short one a dwarf signal. In the case of three-arm semaphore signals, the bottom arm usually has a shorter blade than the other two arms.

All the high signals on the three-track road shown are located on signal bridges.

All one-arm signals are shown with a marker light, this being the practice on many roads. Where the marker light is shown to the right of the mast it is in a vertical line with the top light, and where it is shown to the left of the mast it is said to be staggered; that is, on the opposite side of the mast from the top light.

The aspects and indications are explained later in this chapter.

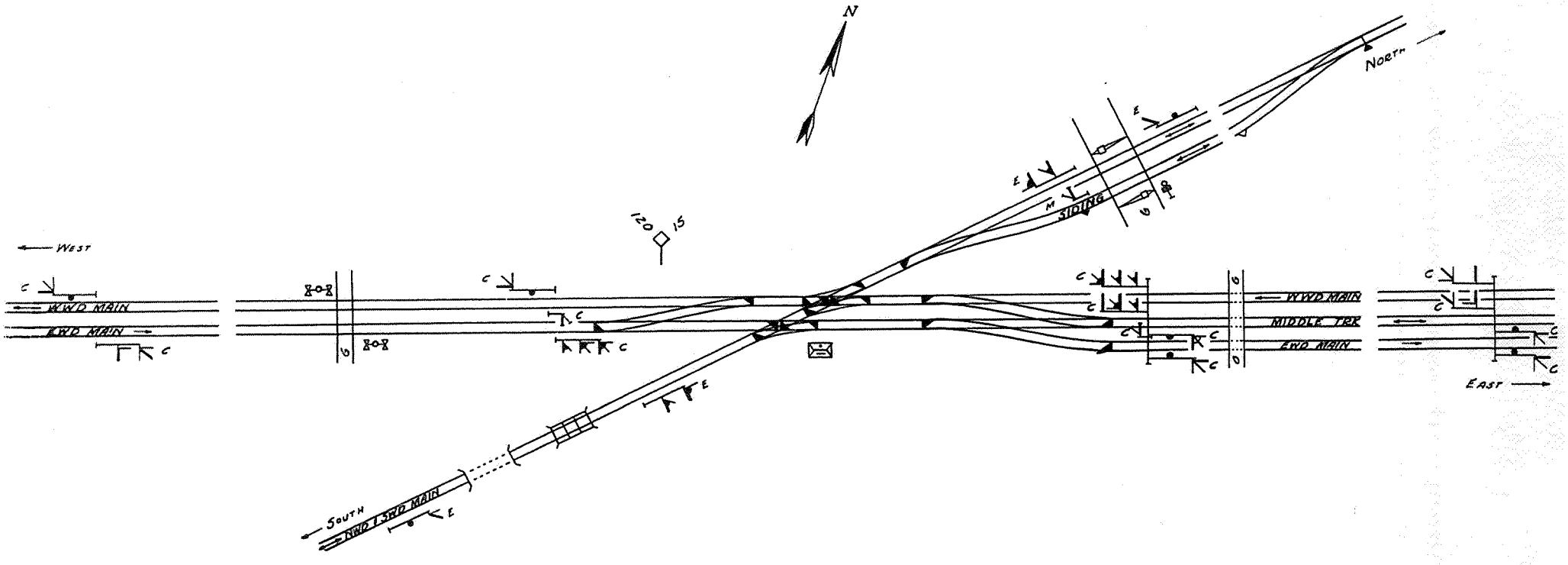

N
WEST
NORTH
EAST
SOUTH
WWD MAIN
EWD MAIN
NWD 13RD MAIN
SIDING
MIDDLE TRK
120
15

Fig. 11.

The various switch and derail symbols need no further explanation here, as they are in accordance with Figs. 6 and 7 and the explanation given with them. It will be seen, however, that the double-slip switch with movable point frogs is used where the north and south road crosses the westward main track of the east and west road, and a single-slip switch and movable point frogs at the crossing in the eastward main track. As a rule, rigid center frogs are not recommended for use in tangent main tracks where the angle of the crossing is below 9 degrees 30 minutes unless all movements over the crossing are restricted to slow speed in which case the angle may be 8 degrees 11 minutes. The double-slip switch permits train movements to be made from one road to the other as follows:

Northward movements from the single-track road to the westward main track of the other road, or vice versa.

Southward movements from the single-track road to the westward main track of the other road, or vice versa.

The single-slip switch provides for northward train movements from the single-track road to the eastward main track of the other road, or vice versa. The switches in tracks of the east and west road also permit these movements to be made to and from the middle track.

Other symbols such as highway crossing signals, water columns, mile posts, grade crossings, bridges, tunnels, etc., are used, which may be identified by a study of the symbols.

Symbols for relays and relay contacts are shown in Figs. 12, 13, 14 and 15. The symbols for relays in Fig. 12 indicate basic relay characteristics and may be combined as required. These basic symbols may also be used in conjunction with symbols for circuit appurtenances, Figs. 23, 24 and 25. The symbols may be modified to denote alternating current relays by placing two diagonal lines which intersect within the rectangle.

Figures 16 and 17 illustrate the manner in which contacts on miscellaneous types of circuit controllers are shown and it is believed a study of these figures will indicate that symbols are provided for most types of contacts.

Figure 18 indicates circuit controller contacts actuated mechanically by interlocking machine levers. A study of this figure, keeping in mind the position of the lever in question, should give any position required.

Figures 19 and 20 illustrate the arrangement of contacts in switch machines and Fig. 21 illustrates the arrangement of contacts in signal mechanisms.

Figure 22 covers symbols for indicators, locks, buzzers and bells. The locks are generally connected to levers, the various positions and names of which are illustrated. The locking positions shown indicate in which positions the lever is locked. For instance, if the letters N and R are shown under the armature of lock, it means that with the lock de-energized the lever would be locked in both the normal and reverse positions and the only way in which the lever could be moved would be for the lock to be energized.

Figures 23 and 24 illustrate the symbols for various circuit appurtenances, which are self-explanatory.

Figure 25 covers symbols for miscellaneous apparatus frequently encountered in circuit work. It is sometimes necessary to show some special symbol or arrangement of contact or apparatus in which an explanatory note is generally made on the plan.

Chapter VI—Direct Current Relays and Chapter X—Alternating Current Relays show certain special contacts and contact combinations.

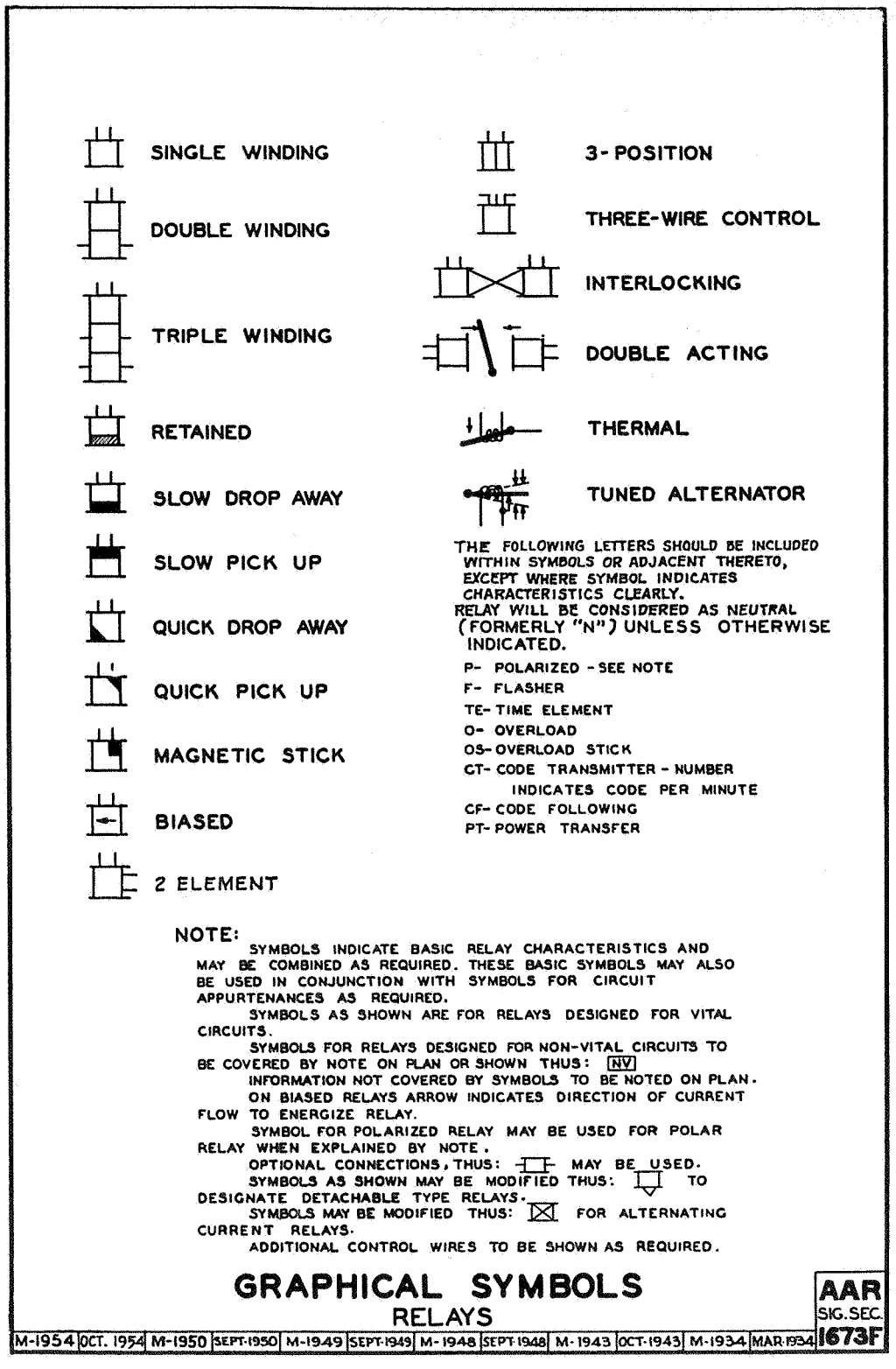
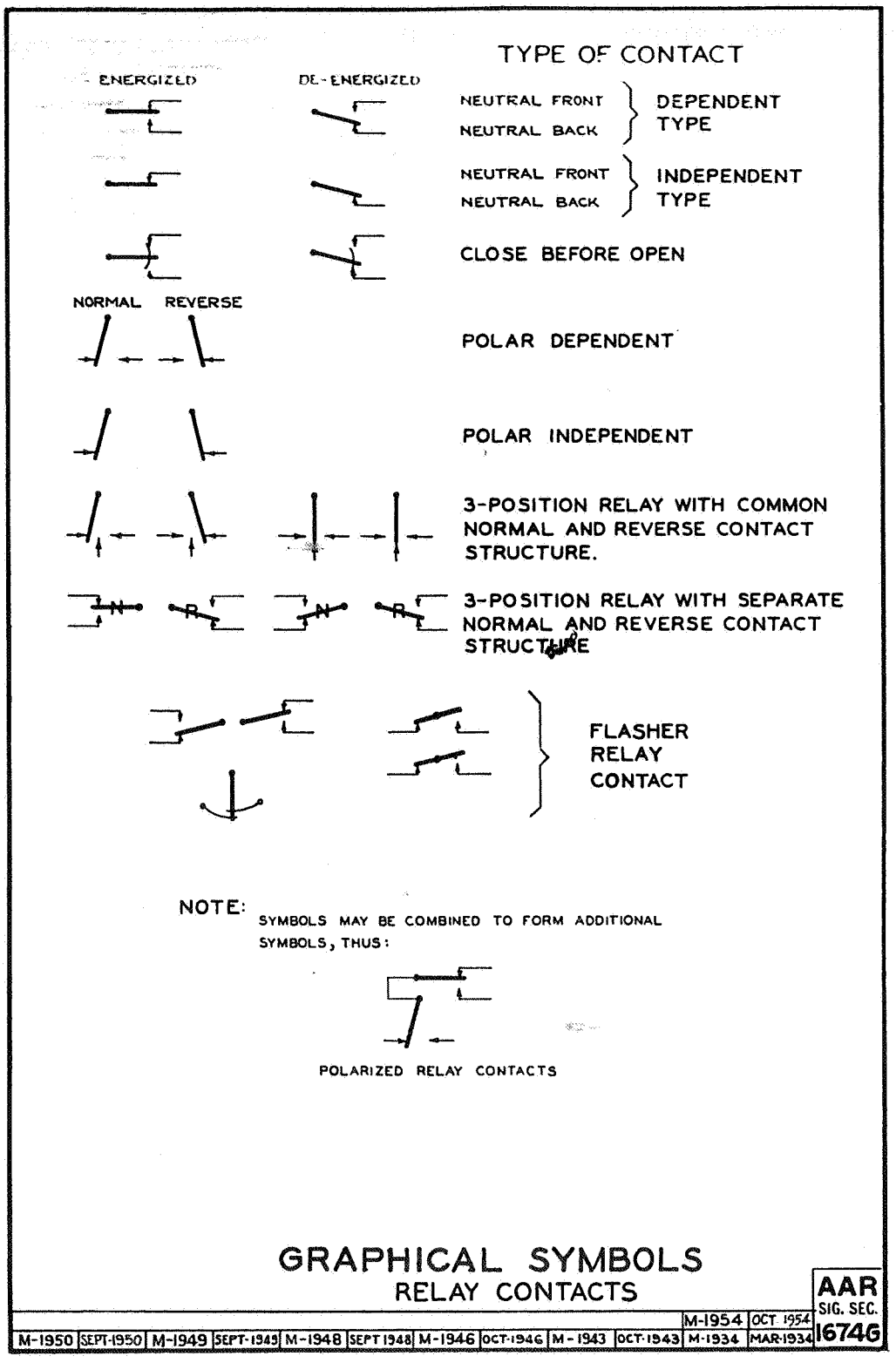

SINGLE WINDING
DOUBLE WINDING
TRIPLE WINDING
RETAINED
SLOW DROP AWAY
SLOW PICK UP
QUICK DROP AWAY
QUICK PICK UP
MAGNETIC STICK
BIASED
2 ELEMENT
3-POSITION
THREE-WIRE CONTROL
INTERLOCKING
DOUBLE ACTING
THERMAL
TUNED ALTERNATOR
THE FOLLOWING LETTERS SHOULD BE INCLUDED WITHIN SYMBOLS OR ADJACENT THERETO, EXCEPT WHERE SYMBOL INDICATES CHARACTERISTICS CLEARLY.
RELAY WILL BE CONSIDERED AS NEUTRAL (FORMERLY "N") UNLESS OTHERWISE INDICATED.
P- POLARIZED - SEE NOTE
F- FLASHER
TE- TIME ELEMENT
O- OVERLOAD
OS- OVERLOAD STICK
CT- CODE TRANSMITTER - NUMBER INDICATES CODE PER MINUTE
CF- CODE FOLLOWING
PT- POWER TRANSFER
NOTE:
SYMBOLS INDICATE BASIC RELAY CHARACTERISTICS AND MAY BE COMBINED AS REQUIRED. THESE BASIC SYMBOLS MAY ALSO BE USED IN CONJUNCTION WITH SYMBOLS FOR CIRCUIT APPURTENANCES AS REQUIRED.
SYMBOLS AS SHOWN ARE FOR RELAYS DESIGNED FOR VITAL CIRCUITS.
SYMBOLS FOR RELAYS DESIGNED FOR NON-VITAL CIRCUITS TO BE COVERED BY NOTE ON PLAN OR SHOWN THUS: NV
INFORMATION NOT COVERED BY SYMBOLS TO BE NOTED ON PLAN.
ON BIASED RELAYS ARROW INDICATES DIRECTION OF CURRENT FLOW TO ENERGIZE RELAY.
SYMBOL FOR POLARIZED RELAY MAY BE USED FOR POLAR RELAY WHEN EXPLAINED BY NOTE.
OPTIONAL CONNECTIONS, THUS: MAY BE USED.
SYMBOLS AS SHOWN MAY BE MODIFIED THUS: TO DESIGNATE DETACHABLE TYPE RELAYS.
SYMBOLS MAY BE MODIFIED THUS: FOR ALTERNATING CURRENT RELAYS.
ADDITIONAL CONTROL WIRES TO BE SHOWN AS REQUIRED.
GRAPHICAL SYMBOLS
RELAYS
AAR
SIG. SEC.
1673F
M-1954 OCT. 1954 M-1950 SEPT. 1950 M-1949 SEPT. 1949 M-1948 SEPT. 1948 M-1943 OCT. 1943 M-1934 MAR. 1934

Fig. 12.



(Sheet 1 of 3 sheets)

Fig. 13.

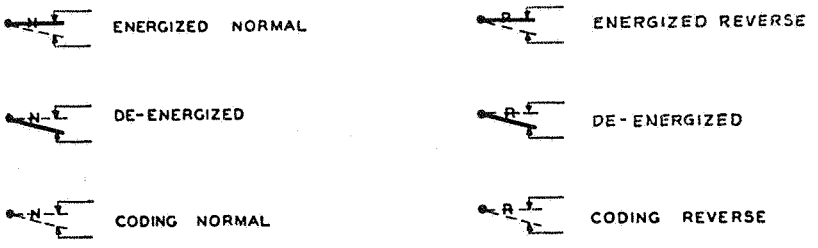
CODING CONTACTS

2 – POSITION NEUTRAL

2 – POSITION POLAR

3 – POSITION NEUTRAL

THREE-POSITION CODE FOLLOWING RELAY WITH SEPARATE NORMAL AND REVERSE CONTACT STRUCTURE



GRAPHICAL SYMBOLS
RELAY CONTACTS

AAR SIG SEC 1674G

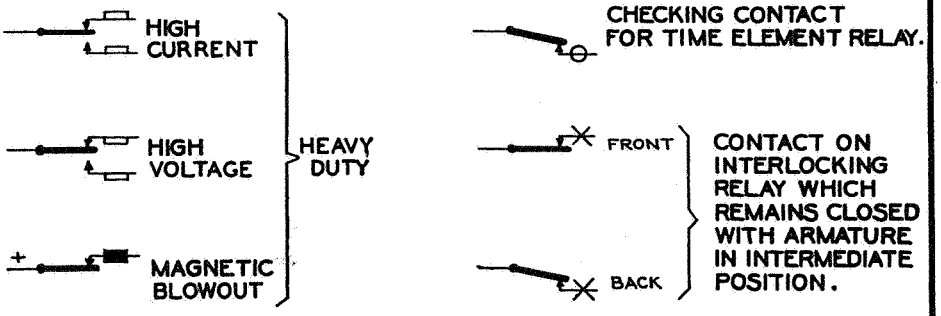
M-1950	SEPT 1950	M-1949	SEPT 1949	M-1948	SEPT 1948	M-1946	OCT 1946	M-1943	OCT 1943	M-1934	MAR 1934

M-1954 OCT. 1954

(Sheet 2 of 3 sheets)

Fig. 14.

RELAY CONTACTS WITH SPECIAL CHARACTERISTICS



NOTE: CONTACT CHARACTERISTICS MAY BE COMBINED TO FORM ADDITIONAL SYMBOLS AS REQUIRED.

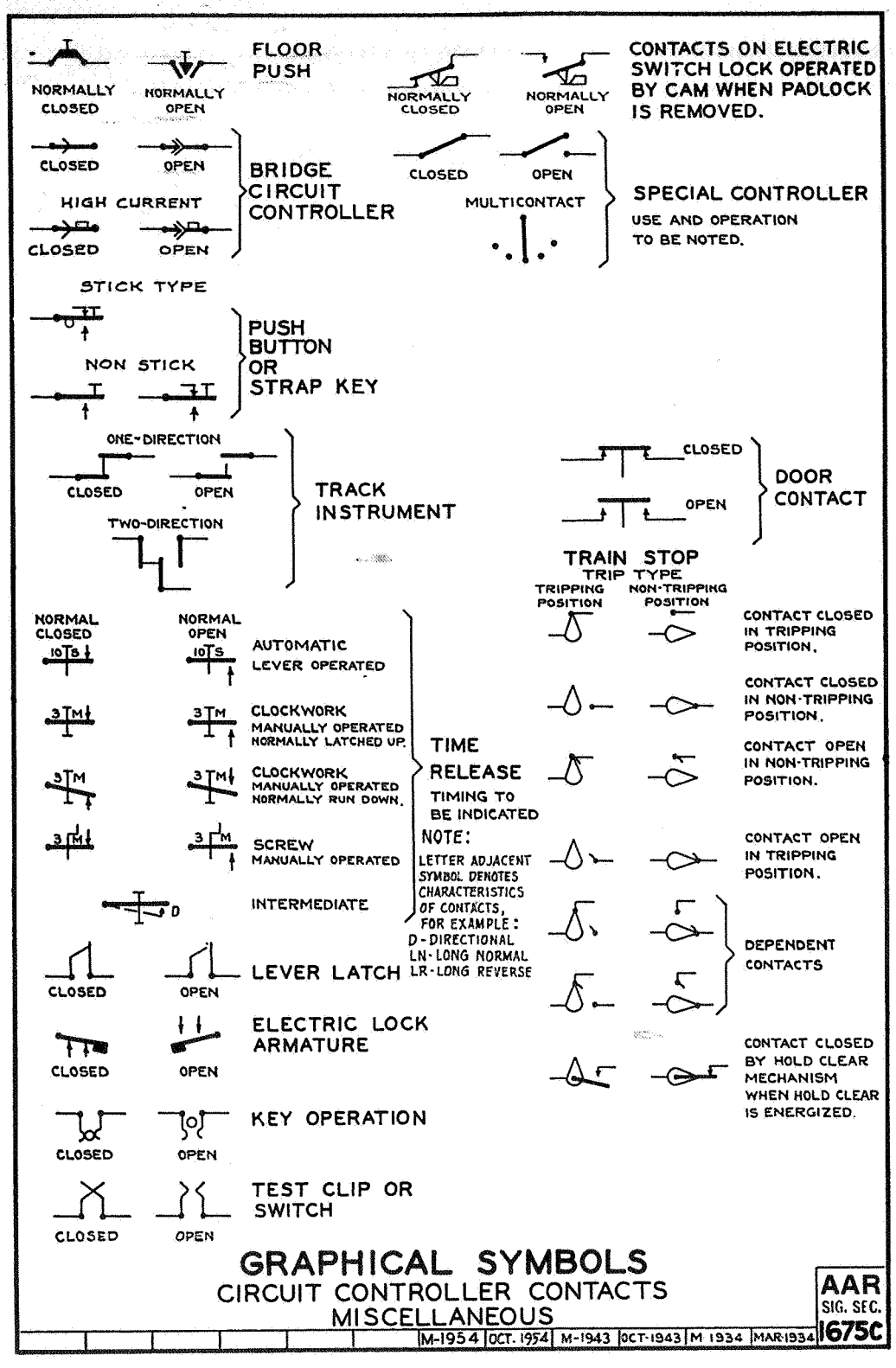
GRAPHICAL SYMBOLS

RELAY CONTACTS

M-1950	SEPT-1950	M-1949	SEPT-1949	M-1948	SEPT-1948	M-1946	OCT-1946	M-1943	OCT-1943	M-1934	MAR-1934	M-1954	OCT. 1954	AAR SIG. SEC. 674G

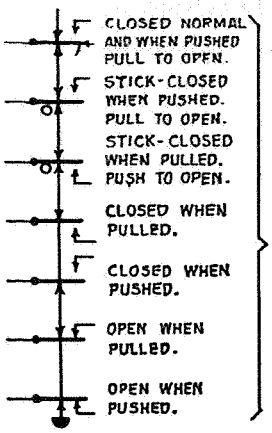
(Sheet 3 of 3 sheets)

Fig. 15.



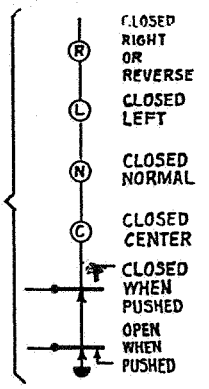
(Sheet 1 of 2 sheets)

Fig. 16.



PUSH-PULL BUTTON

PUSH-TURN BUTTON



NOTE:

CONTACT CHARACTERISTICS MAY BE COMBINED TO FORM OTHER SYMBOLS.

TURN SEQUENCE MAY BE INDICATED BY USE OF LETTERS PLACED ADJACENT SYMBOL, SUCH AS:

P-P - PUSH PULL
P-T - PUSH THEN TURN
T-P - TURN THEN PUSH
PP-T - PUSH OR PULL THEN TURN
T-PP - TURN THEN PUSH OR PULL

HEAVY DUTY CONTACT DESIGNATION AS SHOWN FOR RELAY CONTACTS MAY BE USED ON CIRCUIT CONTROLLER CONTACTS TO INDICATE SPECIAL CHARACTERISTICS.

GRAPHICAL SYMBOLS

CIRCUIT CONTROLLER CONTACTS MISCELLANEOUS

						M-1954	OCT. 1954	M-1943	OCT. 1943	M-1934	MAR 1934

AAR SIG. SEC. 1675C

(Sheet 2 of 2 sheets)

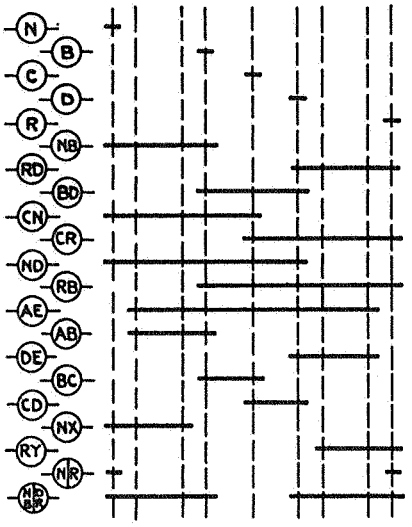
Fig. 17.

LEVERS WITH END POSITION AS NORMAL

N-NORMAL POSITION
A-LEVER SLIGHTLY MOVED FROM N TOWARD B
X-LEVER SLIGHTLY MOVED FROM B TOWARD N
B-NORMAL INDICATION POSITION
C-CENTRAL POSITION
D-REVERSE INDICATION POSITION
Y-LEVER SLIGHTLY MOVED FROM D TOWARD R
E-LEVER SLIGHTLY MOVED FROM R TOWARD D
R-REVERSE POSITION

POSITIONS INDICATED

SYMBOLS N A X B C D Y E R

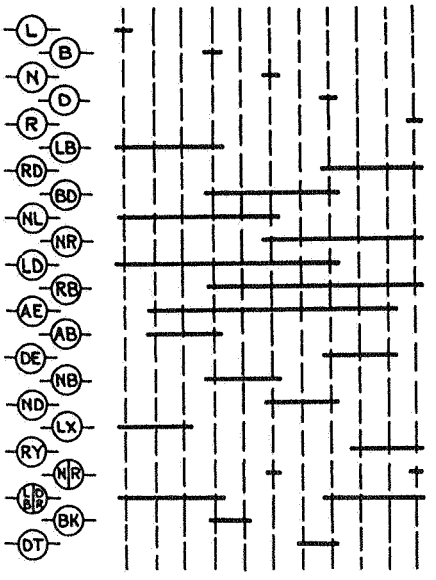


LEVERS WITH MIDDLE POSITION AS NORMAL

L-REVERSE POSITION TO LEFT.
A-LEVER SLIGHTLY MOVED FROM L TOWARD B
X-LEVER SLIGHTLY MOVED FROM B TOWARD L
B-INDICATION POSITION TO LEFT.
K-LEVER SLIGHTLY MOVED FROM N TOWARD B
N-NORMAL POSITION.
T-LEVER SLIGHTLY MOVED FROM N TOWARD D
D-INDICATION POSITION TO RIGHT.
Y-LEVER SLIGHTLY MOVED FROM D TOWARD R
E-LEVER SLIGHTLY MOVED FROM R TOWARD D
R-REVERSE POSITION TO RIGHT.

POSITIONS INDICATED

SYMBOLS L A X B K N T D Y E R



INDEPENDENT TYPE CONTACT

HEAVY DUTY TYPE CONTACT

DEPENDENT TYPE CONTACTS N R

HORIZONTAL LINES INDICATE THAT PORTION OF THE CYCLE OF LEVER MOVEMENT DURING WHICH THE CIRCUIT IS CLOSED.

VERTICAL LINE BETWEEN LETTERS IN SYMBOL INDICATES THAT THE CIRCUIT IS CLOSED AT AND OPEN BETWEEN POINTS INDICATED.

GRAPHICAL SYMBOLS

CIRCUIT CONTROLLER CONTACTS

CONTACTS ACTUATED MECHANICALLY BY INTERLOCKING MACHINE LEVER OR LATCH

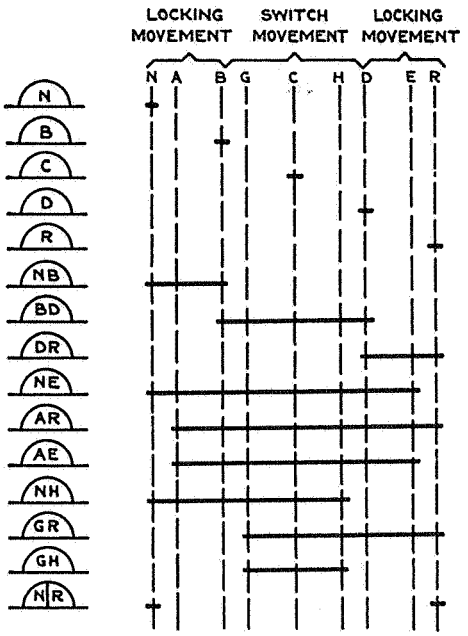
AAR SIG. SEC. 1676B

M-1943 | OCT-1943 | M-1934 | MAR-1934

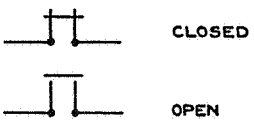
Fig. 18.

SWITCH MACHINE

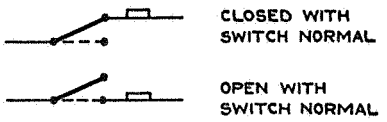
N - SWITCH IN NORMAL POSITION AND LOCKED.
A - LOCKING SLIGHTLY MOVED FROM NORMAL.
B - SWITCH IN NORMAL POSITION AND UNLOCKED.
G - SWITCH SLIGHTLY MOVED FROM NORMAL.
C - SWITCH IN CENTRAL POSITION.
H - SWITCH SLIGHTLY MOVED FROM REVERSE.
D - SWITCH IN REVERSE POSITION AND UNLOCKED.
E - LOCKING SLIGHTLY MOVED FROM REVERSE.
R - SWITCH IN REVERSE POSITION AND LOCKED.



F. P. L. CIRCUIT CONTROLLER CONTACT



SWITCH CIRCUIT CONTROLLER CONTACT
HIGH CURRENT



HORIZONTAL LINES INDICATE THAT PORTION OF THE MOVEMENT DURING WHICH THE CIRCUIT IS CLOSED.

VERTICAL LINE BETWEEN LETTERS IN SYMBOL INDICATES THAT THE CIRCUIT IS CLOSED AT AND OPEN BETWEEN POINTS INDICATED.

GRAPHICAL SYMBOLS

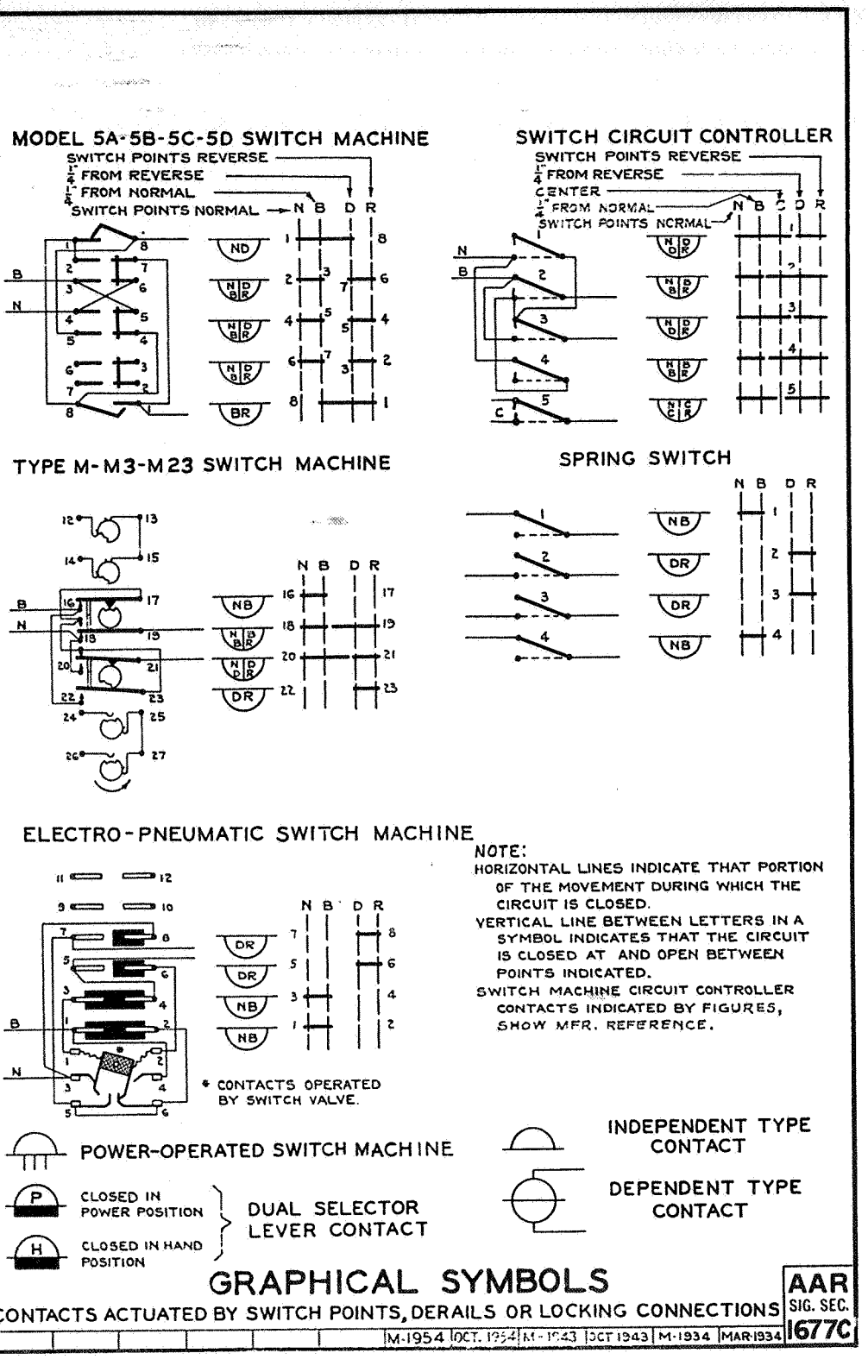
CONTACTS ACTUATED BY SWITCH POINTS, DERAILS OR LOCKING CONNECTIONS

AAR SIG. SEC. 1677C

						M-1954	OCT. 1954	M-1943	OCT. 1943	M-1934	MAR. 1934

(Sheet 1 of 2 sheets)

Fig. 19:



(Sheet 2 of 2 sheets)

Fig. 20

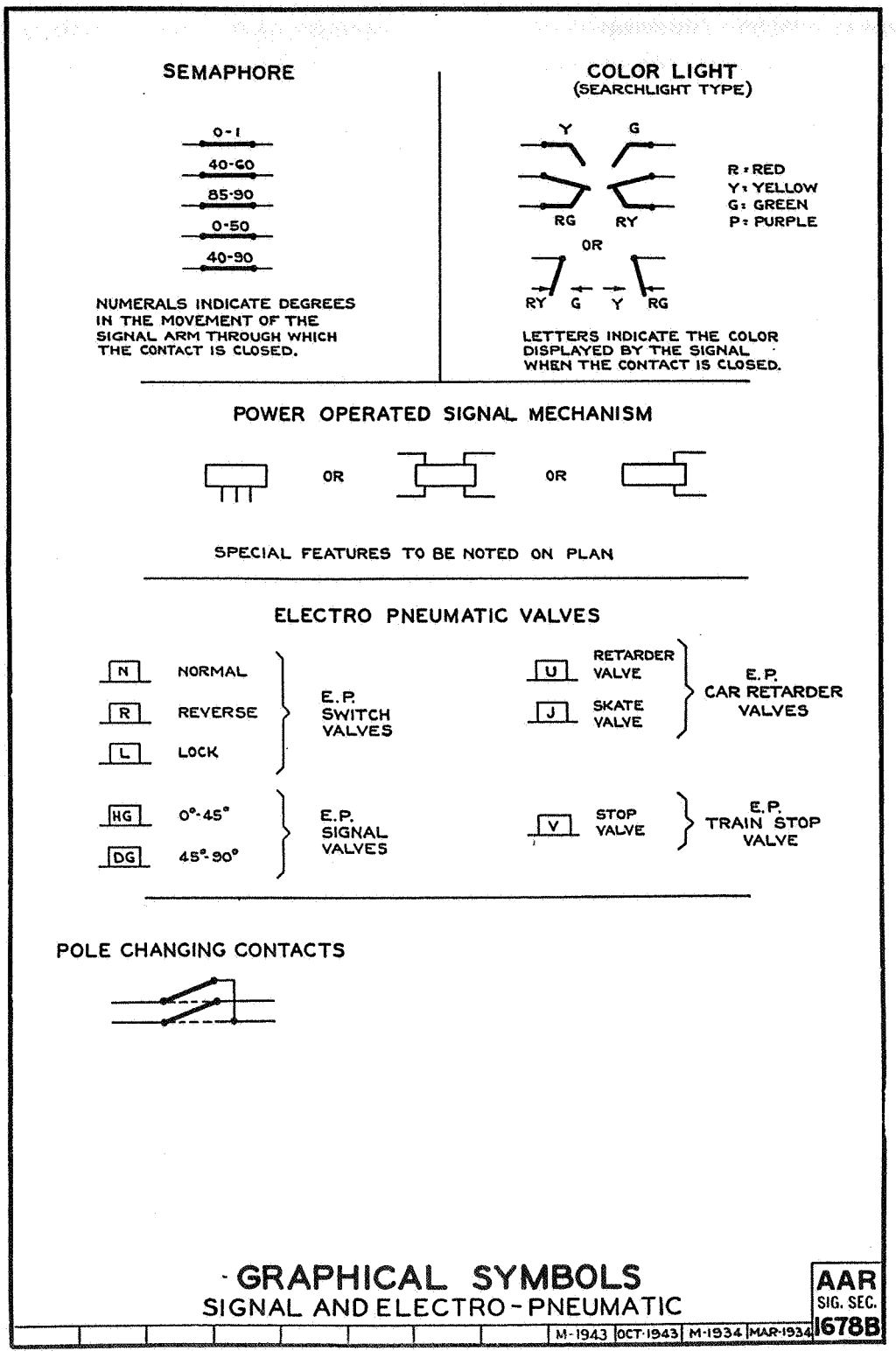

SEMAPHORE
0-1
40-60
85-90
0-50
40-90
NUMERALS INDICATE DEGREES IN THE MOVEMENT OF THE SIGNAL ARM THROUGH WHICH THE CONTACT IS CLOSED.
COLOR LIGHT
(SEARCHLIGHT TYPE)
Y
G
RG
RY
OR
RY
G
Y
RG
R = RED
Y = YELLOW
G = GREEN
P = PURPLE
LETTERS INDICATE THE COLOR DISPLAYED BY THE SIGNAL WHEN THE CONTACT IS CLOSED.
POWER OPERATED SIGNAL MECHANISM
OR
OR
SPECIAL FEATURES TO BE NOTED ON PLAN
ELECTRO PNEUMATIC VALVES
N
NORMAL
R
REVERSE
L
LOCK
E.P. SWITCH VALVES
HG
0°-45°
DG
45°-90°
E.P. SIGNAL VALVES
U
RETARDER VALVE
J
SKATE VALVE
E.P. CAR RETARDER VALVES
V
STOP VALVE
E.P. TRAIN STOP VALVE
POLE CHANGING CONTACTS
GRAPHICAL SYMBOLS
SIGNAL AND ELECTRO-PNEUMATIC
M-1943
OCT-1943
M-1934
MAR-1934
AAR
SIG. SEC.
1678B

Fig. 21.

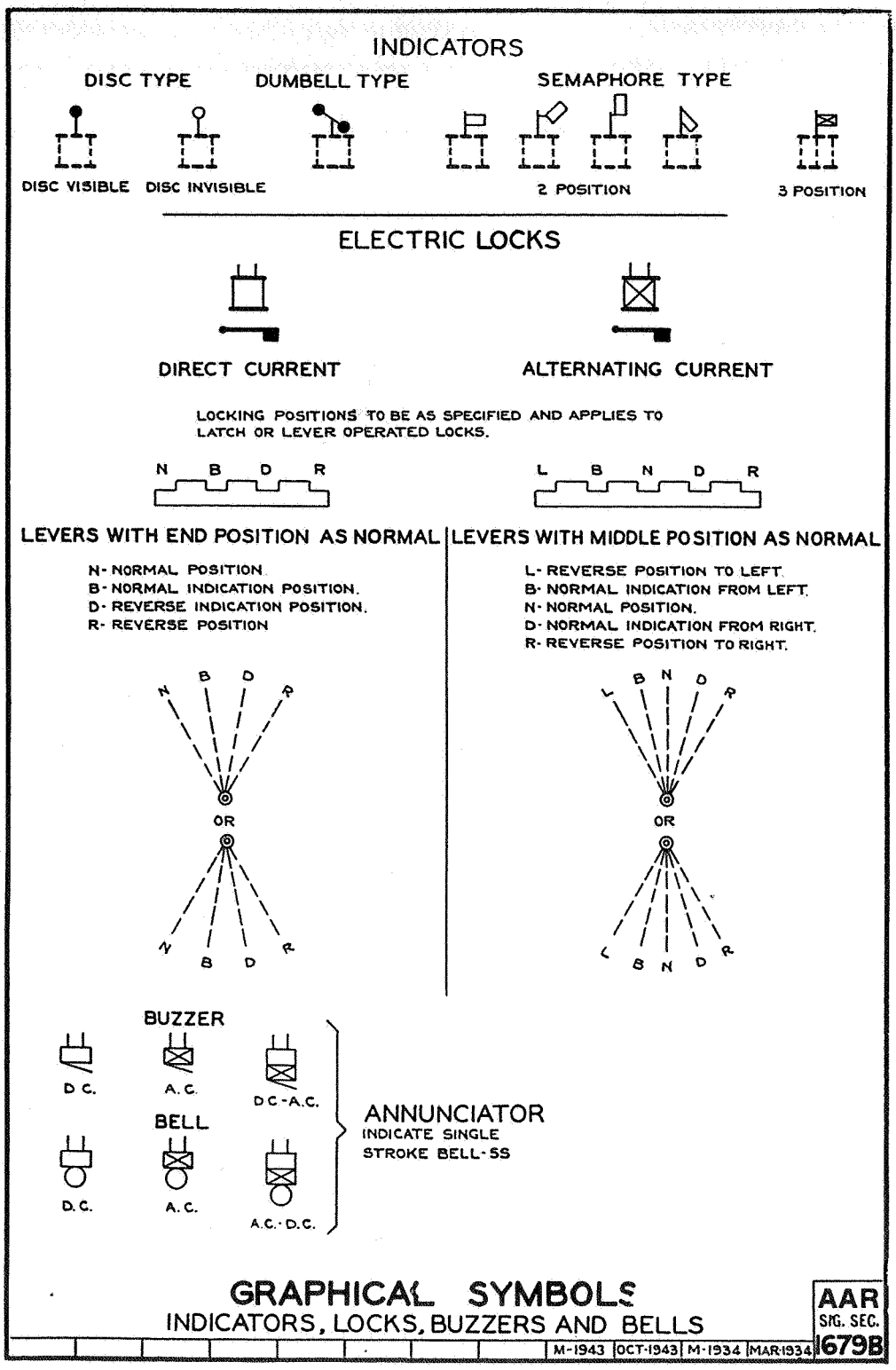
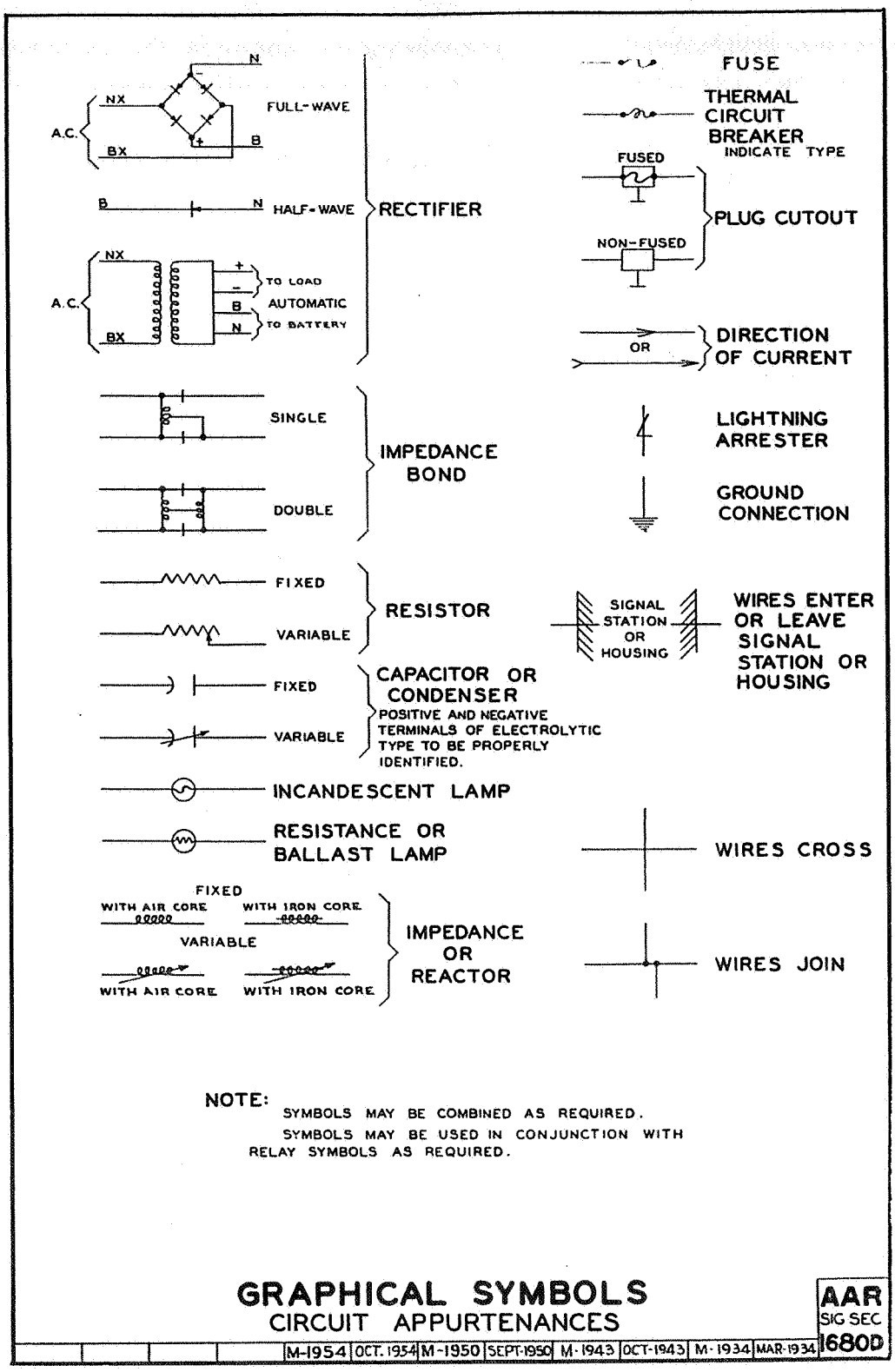

INDICATORS
DISC TYPE
DUMBELL TYPE
SEMAPHORE TYPE
DISC VISIBLE
DISC INVISIBLE
2 POSITION
3 POSITION
ELECTRIC LOCKS
DIRECT CURRENT
ALTERNATING CURRENT
LOCKING POSITIONS TO BE AS SPECIFIED AND APPLIES TO LATCH OR LEVER OPERATED LOCKS.
N B D R
L B N D R
LEVERS WITH END POSITION AS NORMAL
N- NORMAL POSITION.
B- NORMAL INDICATION POSITION.
D- REVERSE INDICATION POSITION.
R- REVERSE POSITION
OR
LEVERS WITH MIDDLE POSITION AS NORMAL
L- REVERSE POSITION TO LEFT.
B- NORMAL INDICATION FROM LEFT.
N- NORMAL POSITION.
D- NORMAL INDICATION FROM RIGHT.
R- REVERSE POSITION TO RIGHT.
OR
BUZZER
D.C.
A.C.
D.C.-A.C.
BELL
D.C.
A.C.
A.C.-D.C.
ANNUNCIATOR
INDICATE SINGLE STROKE BELL-SS
GRAPHICAL SYMBOLS
INDICATORS, LOCKS, BUZZERS AND BELLS
AAR
SIG. SEC.
679B
M-1943 OCT-1943 M-1934 MAR-1934

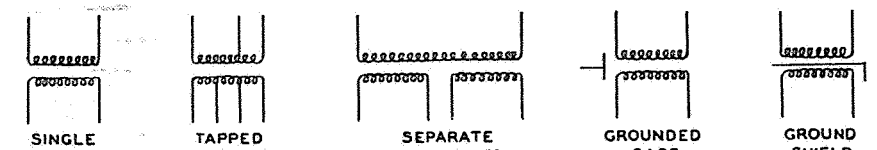
Fig. 22.



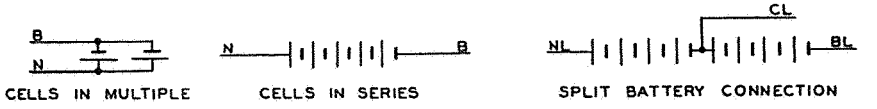
(Sheet 1 of 2 sheets)

Fig. 23.

TRANSFORMER



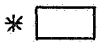
BATTERY



NOTE:
SPECIFY NUMBER, TYPE AND CAPICITY OF CELLS.
SL - STORAGE - LEAD
SA - STORAGE - ALKALINE
D - DRY
P - PRIMARY

EXAMPLE - 5 SL 80 AH

INTERNALLY WIRED UNITS



NOTE:
* THIS SYMBOL TO BE USED FOR INTERNALLY WIRED UNITS WITH AN IDENTIFYING LEGEND WITHIN OR ADJACENT THERETO, FOR EXAMPLE:

SU	- ARC SUPPRESSOR UNIT
CT	- CARRIER TRANSMITTER
CR	- CARRIER RECEIVER
TRU	- TRACK RESONANT UNIT
180DU	- 180 DECODING UNIT. NUMBER INDICATES CODE PER MINUTE TO WHICH UNIT IS TUNED.

AUTOMATIC TRAIN STOP INDUCTOR

GRAPHICAL SYMBOLS
CIRCUIT APPURTENANCES

AAR SIG.SEC. 680D

M-1954 | OCT. 1954 | M-1950 | SEPT. 1950 | M-1943 | OCT-1943 | M-1934 | MAR-1934

(Sheet 2 of 2 sheets)

Fig. 24.

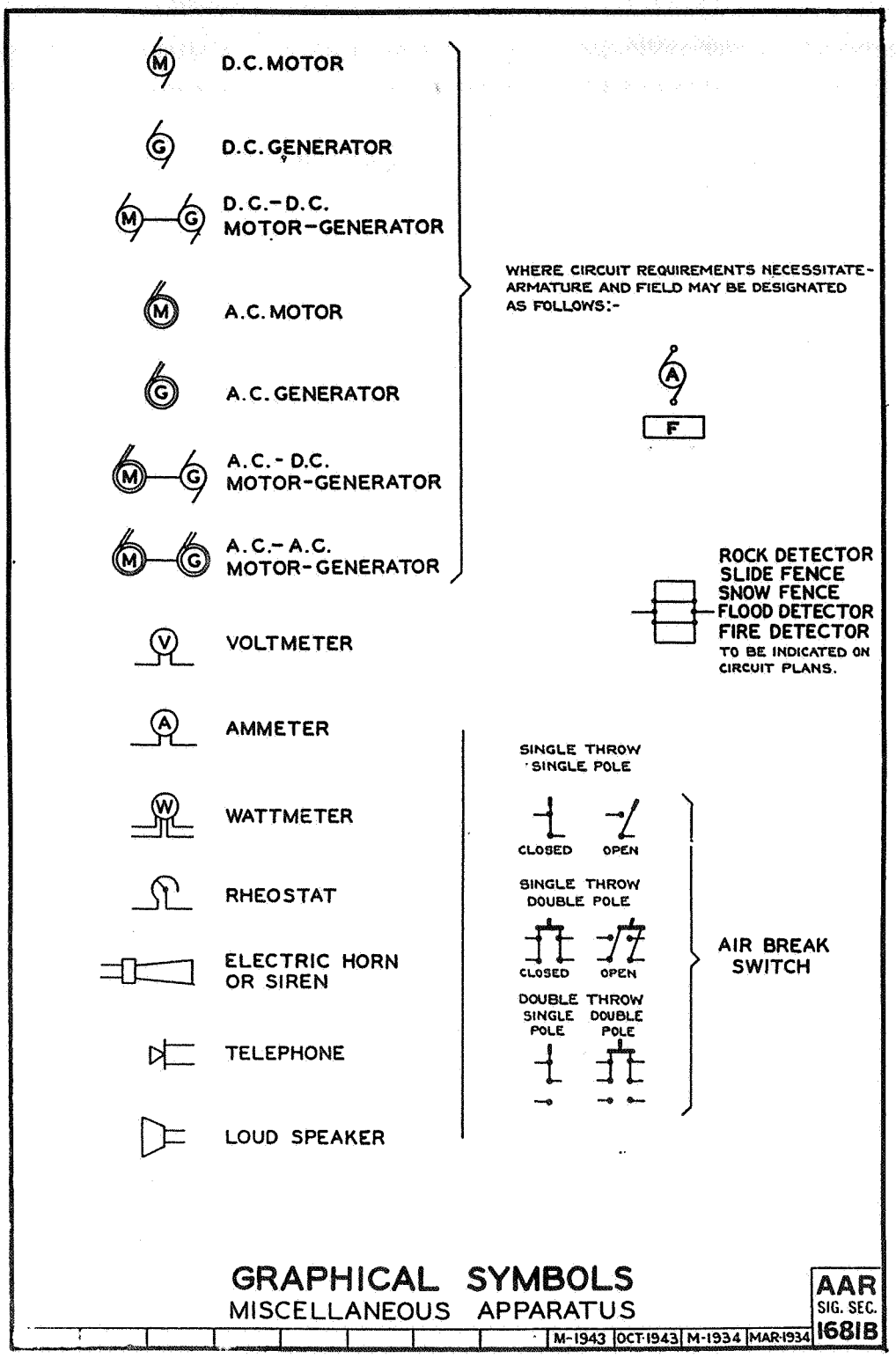

D.C. MOTOR
D.C. GENERATOR
D.C.-D.C. MOTOR-GENERATOR
A.C. MOTOR
A.C. GENERATOR
A.C.- D.C. MOTOR-GENERATOR
A.C.-A.C. MOTOR-GENERATOR
VOLTMETER
AMMETER
WATTMETER
RHEOSTAT
ELECTRIC HORN OR SIREN
TELEPHONE
LOUD SPEAKER
WHERE CIRCUIT REQUIREMENTS NECESSITATE- ARMATURE AND FIELD MAY BE DESIGNATED AS FOLLOWS:-
A
F
ROCK DETECTOR
SLIDE FENCE
SNOW FENCE
FLOOD DETECTOR
FIRE DETECTOR
TO BE INDICATED ON CIRCUIT PLANS.
SINGLE THROW SINGLE POLE
CLOSED
OPEN
SINGLE THROW DOUBLE POLE
CLOSED
OPEN
DOUBLE THROW SINGLE POLE
DOUBLE THROW DOUBLE POLE
AIR BREAK SWITCH
GRAPHICAL SYMBOLS
MISCELLANEOUS APPARATUS
AAR
SIG. SEC.
1681B
M-1943
OCT-1943
M-1934
MAR-1934

Fig. 25.

CIRCUIT NOMENCLATURE AND WRITTEN CIRCUITS

In order that the student may have knowledge of the manner in which circuits are generally shown and arranged, the recommended practice of the Signal Section, A.A.R., for circuit nomenclature and written circuits is given here.

The purpose of the following is to supply a standard scheme of abbreviated designations for electrically operated signal units and wires.

Letters suggestive of the words they represent have been assigned as far as practicable but there are some letters that stand for names that cannot be associated, such as "G" Signal; "W" Switch; etc. Some of the letters represent several different meanings or words, such as "N" Normal; "N" Negative; "N" North, depending upon the use and location with respect to numerals and other letters, but if the scheme is consistently used there should be no mistake in the meaning.

Nomenclature of Electrically Operated Units

The term "electrically operated unit" is used to signify a signaling device in which an electric light or magnetic coil is usually essential to its operation, as, for instance, color light signal, a relay, electric lock, etc. In order to provide a concise, suggestive graphic code for marking these units on plans, the following system has been evolved, which makes use of a designation made up of two parts: namely,

First—Numerical Prefix: The number of the principal lever, signal, track circuit, or other device entering into the control of or controlled by the unit.

Second—Alphabetic Term: Consisting of one or more letters. The last letter of this term designates the general kind of unit, while the first letter or letters, when used, describe specifically the operated unit.

The complete designation of a unit is written as follows:

(Numerical Prefix)	(First Letter)	(Last Letter)
10	H	R

Written 10HR

In this example, 10 is the number of a signal. 10R means relay having to do with signal 10, and 10HR means home relay for signal 10. In other words, the letter R means relay in general. The letter H indicates that the function of this relay is to control the approach indication of a three-position signal or the proceed indication of a two-position signal in one-arm signaling. The number 10 definitely indicates the signal which this relay controls.

Track Circuit Numbering

A track circuit is designated by the letter T preceded by a number. If within interlocking limits, it will take a number of a movable point frog, switch or derail lying within the track circuit, the preference being in the order named.

When there are no interlocked switches in a track circuit, it is numbered from a signal governing over the track circuit. Progressive alphabetical prefixes are used in the case of a plurality of track sections that govern one signal. Arbitrary numbers, as O1T, O2T, O3T, etc., are given track circuits in which there are no interlocked switches and which do not govern signals.

Wire Nomenclature

A wire carrying positive energy to one or more operated units is in general designated by nomenclature similar to that applied to the operated unit controlled by it, followed by a number indicating the number of circuit controlling contacts in the circuit between the wire and unit.

A wire carrying negative energy from one or more operated units is designated in the same manner except that the designation is preceded by the letter N.

Example: See Fig. 26.

In case of branch wiring the above method is applied to the principal circuit. The letter A is appended to distinguish the first branch, the letter B distinguishes the second, etc. The branch connection is shown terminated at point desired. This latter feature eliminates necessity of tagging wire to show destination or source.

Example: See Fig. 26.

Table of Meaning of Letters
Descriptive and Designative Terms

A—Approach
B—Block—Button—Positive energy—Bridge—Back
C—Common—Changer—Counter—Correspondence—Circuit—Controller—Code—Checking contacts—Change
D—Proceed indication of a signal—Detector—Decoding—Dragging
E—East—Eastward—Electric light—Element—Equipment—Electronic
F—Traffic—Front—Frequency
G—Green—Signal (operating mechanism)—Ground—Gate
H—Home—Approach indication of a signal
J—Skate—Dual control
K—Indicator
L—Left—Lock preventing initial movement of a lever from normal or reverse position—Locking—Lever—Light—Split battery—Lock valve—Lock
M—Lock preventing final or indicating movement of a lever—Magnetic—Marker—Manual
N—Normal—North—Northward—Negative
O—Order—Operating—Off—Overload—Out—Over
P—Pole—Power—Purple—Push—Repeating—Primary
Q—Local or secondary coil (as in two-element relay or mechanism)
R—Right—Red—Reverse—Relay—Power-operated controller or contactor—Route—Stop indication of a signal—Rail
S—South—Stick—Storage—Southward
T—Track—Time—Train—Telephone—Transformer—Transmitter
U—Retarder—Unit
V—Train stop (track element)—Electro-pneumatic stop valve
W—Switch (operating mechanism)—West—Westward—White
X—Crossing—Interlocking—Bell—Buzzer—A.C.
Y—Slot—Yellow—Hold clear
Z—Use for any special term (to be noted on plan)

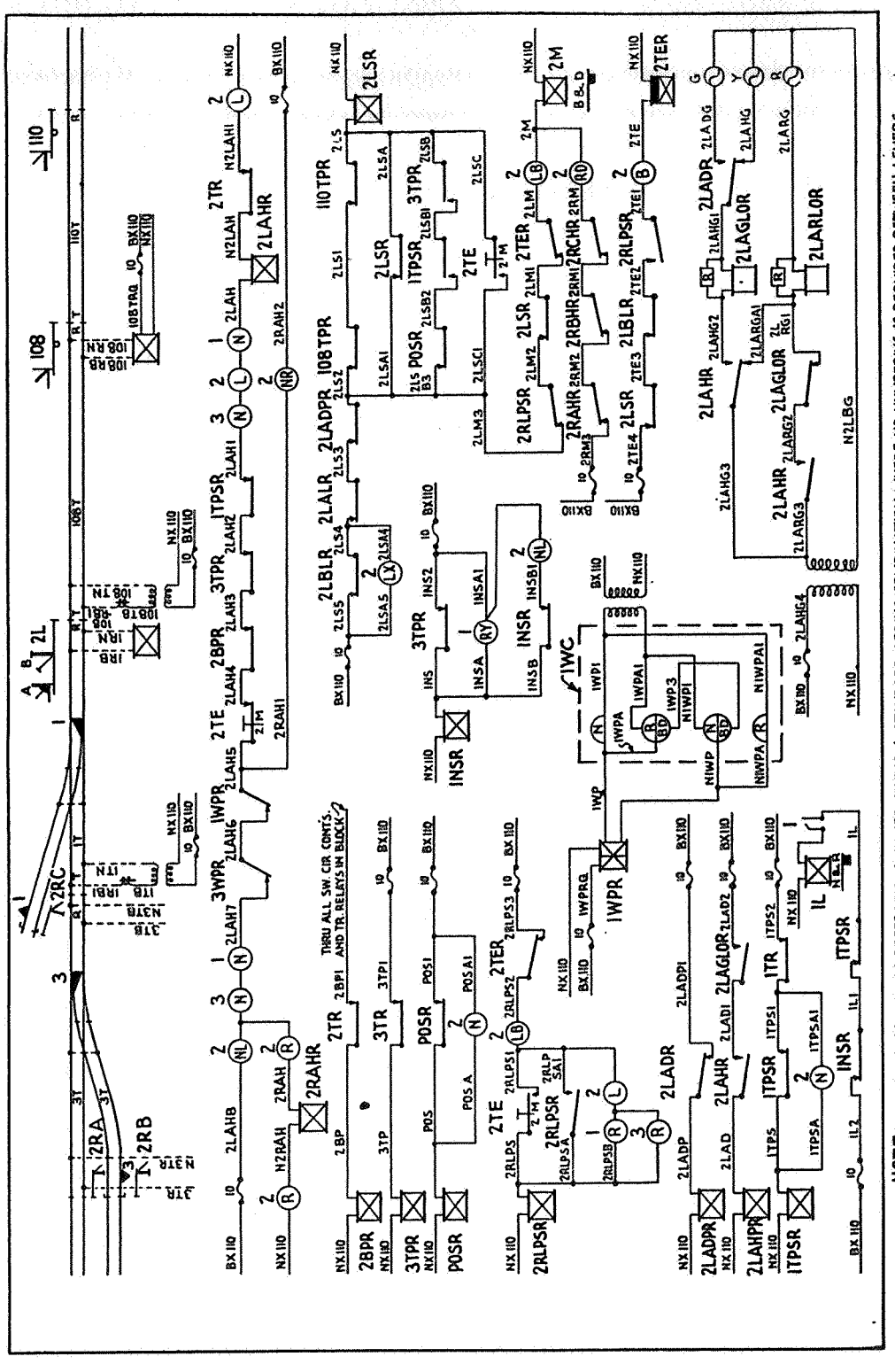


Fig. 26.
Example of Application of Symbols and Wire Nomenclature.

Written circuits as illustrated in Fig. 26 save time in drafting the circuit plans. Circuits are covered in Chapter XX—Interlocking Circuits.

In order to distinguish between right and left position of three-position levers, use R (right) or L (left) after the lever number, as 10R, 10L.

When one lever controls two or more functions, use letters A, B, C, etc., after the lever numbers: for example, 10A, 10B, 10C, etc.

In case of three-position levers controlling two or more functions in each position, use combinations as follows: 10RA, 10LA, etc.

Example of Combinations Used to Designate Wires and Operated Units

Energy Wires

(Suffix figure should be used to indicate voltages: for example, CX110 meaning common AC 110 volts.)

C	—Common D.C.
EC	—Common east, meaning D.C. from system east, likewise north, south and west
FC	—Common traffic locking
CX	—Common A.C.
ENX	—Negative energy A.C. from POR for an electric light, or east negative A.C. energy, likewise north, south and west
NX	—Negative A.C. energy
BL	—Positive side of split battery
NL	—Negative side of split battery
CL	—Common of split battery
N	—Negative D.C. energy
B	—Positive D.C. energy
EB	—Positive energy east, likewise north, south and west
BB	—Battery, second battery
BBB	—Battery, third battery
BX	—Positive A.C. energy
EBX	—Positive energy A.C. from POR for an electric light or east positive A.C. energy, likewise north, south and west

Operated Units Relating to Track Circuits

T	—Track section
TR	—Track relay
TPR	—Relay repeating track relay
TPPR	—Relay repeating track repeating relay
TSR	—Track stick relay
TSPR	—Relay repeating track stick relay
TK	—Indicator, indicating condition of a track circuit
TPSR	—Stick relay repeating track relay
BPR	—Block repeater relay, relay repeating the track circuits in a block
BK	—Block indicator

Wires Relating to Track Circuits

TB	—Track positive—Positive energy to rail
TN	—Track negative—Negative energy from rail

RB —Relay positive—Wire from positive rail to relay
RN —Relay negative—Wire from negative rail to relay
TQ —Positive control of local coil, two-element A.C. track relay
TP —Positive control of TPR
TPP —Positive control of TPPR
TPS —Positive control of TPSR
TK —Positive control of TK
BP —Positive control of BPR
WB —Positive rail to switch circuit controller
WN —Negative rail to switch circuit controller

Operated Units Relating to Switches

W —Switch operating mechanism or lock valve
WR —Relay, controller or contactor controlling both normal and reverse operations of a switch or an electric switch lock
WNR —Relay, controller or contactor controlling the normal operation of a switch or an electric switch lock
WRR —Relay, controller or contactor controlling the reverse operation of a switch or an electric switch lock
WRPR —Relay repeating WR
WNRPR —Relay repeating WNR or normal position of WR
WRRPR —Relay repeating WRR or reverse position of WR
WPR —Relay repeating position of switch
NWPR —Relay repeating normal position of switch or normal position of WPR
RWPR —Relay repeating reverse position of switch or reverse position of WPR
WK —Indicator indicating the positions of a switch
WL —Switch lock operating mechanism on a switch
NWLPR —Relay repeating normal position of switch lock
NJPR —Relay repeating normal position of dual-control lever
RJPR —Relay repeating reverse position of dual-control lever
NWK —Indicator indicating the normal position of a switch
RWK —Indicator indicating the reverse position of a switch
WAK —Indicator indicating the condition approaching a switch
RWLPR —Relay repeating reverse position of switch lock
WCR —Switch correspondence relay

Wires Relating to Switches

NW —Normal control of switch operating mechanism
RW —Reverse control of switch operating mechanism
N10W —Individual return wire to 10 switch operating mechanism
WR —Positive control of WR
N10WR —Negative control of 10WR
WNR —Positive control of WNR
WRR —Positive control of WRR
WRP —Positive control of WRPR
WNRP —Positive control of WNRPR
WRRP —Positive control of WRRPR
WP —Positive control of WPR

N10WP —Negative control of 10WPR
NWP —Positive control of NWPR
RWP —Positive control of RWPR
NWLP —Positive control of NWLPR
WK —Positive control of WK
N10WK —Negative control of 10WK
NWK —Positive control of NWK
RWK —Positive control of RWK
WA —Positive control of WAK
WL —Positive control of WL
RWLP —Positive control of RWLPR
WC —Positive control of WCR
NJP —Positive control of NJPR
RJP —Positive control of RJPR

Operating Units Relating to Signals

HR —Relay controlling approach indication of a three-position signal or the proceed indication of a two-position signal in one-arm signaling
DR —Relay controlling proceed indication of a signal
HDR —Relay controlling approach and proceed indication of a signal
HPR —Relay repeating HR or approach indication position of HDR
HSR —Home stick relay controlling the approach indication of a signal
DPR —Relay repeating DR or proceed indication position of HDR
RGPR —Relay repeating signal mechanism at stop
HGPR —Relay repeating signal mechanism at approach
RHGPR —Relay repeating signal mechanism at approach and stop
DGPR —Relay repeating signal mechanism at proceed
RGK —Indicator indicating signal mechanism at stop
HGK —Indicator indicating signal mechanism at approach
DGK —Indicator indicating signal mechanism at proceed
ETOHR —East train order HR, likewise west, north and south
ETOHDR —East train order HDR, likewise west, north and south
ETOPHR —East train order repeater HR, likewise west, north and south
ETOPDR —East train order repeater DR, likewise west, north and south
HDGPR —Relay repeating signal mechanism in the approach and proceed position
HDGK —Indicator indicating signal mechanism in the approach and proceed position
HY —Hold clear or retaining mechanism of the approach indication of a signal
DY —Hold clear or retaining mechanism of the proceed indication of a signal
HG —Approach indication operating mechanism of a signal
DG —Proceed indication operating mechanism of a signal
RG —Stop indication operating mechanism of a signal

Wires Relating to Signals

H —Positive control of HR
D —Positive control of DR
HD —Positive control of HDR

N10HD —Negative control of 10HDR
HP —Positive control of HPR
HS —Positive control of HSR
DP —Positive control of DPR
RGP —Positive control of RGPR
HGP —Positive control of HGPR
DGP —Positive control of DGPR
ETOH —Positive control of ETOHR
ETOHD —Positive control of ETOHDR
ETOPH —Positive control of ETOPHR
ETOPD —Positive control of ETOPDR
HDGP —Positive control of HDGPR
HDGK —Positive control of HDGK
RGK —Positive control of RGK
HGK —Positive control of HGK
DGK —Positive control of DGK
HG —Positive control of HG
DG —Positive control of DG
RG —Positive control of RG
N10HG —Negative control of 10HG
HY —Positive control of HY
DY —Positive control of DY
RHGP —Positive control of RHGPR

Stick, Traffic and Directional Operated Units

SR —Stick relay
ESR —East stick relay, likewise north, south and west
LSR —Locking stick relay
EASR —East approach stick relay, likewise north, south and west
ASR —Approach stick relay
FL —Traffic lock preventing initial movement of a traffic lever from normal or reverse
FLM —Traffic lock preventing initial movement of a traffic lever from normal or reverse and also preventing final or indicating movement of same lever
FR —Traffic relay
FLR —Traffic lock relay controlling FL
FLMR —Traffic lock relay controlling FLM
FLK —Traffic lock indicator
FSR —Traffic stick relay
EFSR —East traffic stick relay, likewise north, south and west

Wires Relating to Stick, Traffic and Directional Units

S —Positive control of SR
ES —Positive control of ESR
LS —Positive control of LSR
EAS —Positive control of EASR
AS —Positive control of ASR
FL —Positive control of FL
FLM —Positive control of FLM
F —Positive control of FR

FLR —Positive control of FLR
FLMR —Positive control of FLMR
FLK —Positive control of FLK
FS —Positive control of FSR
EFS —Positive control of EFSR

Operated Units Relating to Indicators, Locks, Indication Magnets, and Relays Used for Locking Purposes

M —Lock preventing the final movement of a lever
L —Lock preventing the initial movement of a controlled function or lever
NK —Normal indicator indicating normal position of a unit
RK —Reverse indicator indicating reverse position of a unit
TER —Time element relay
NM —Lock preventing the final movement of a lever to the normal position
RM —Lock preventing the final movement of a lever to the reverse position
NL —Lock preventing the movement of a lever or a controlled function from its normal position
RL —Lock preventing the movement of a lever or a controlled function from its reverse position
LR —Relay controlling L lock
LPR —Repeater of L lock relay
MR —Relay controlling M lock
MPR —Repeater of M lock relay
TE —Time element
TESR —Time element stick relay
LK —Lock indicator repeating electric locking
TEPR —Relay repeating energized position of TE
TECPR —Relay repeating checking contact of TE

Wires Relating to Locks, Indication Magnets and Relays for Locking Purposes

M —Positive control of M
L —Positive control of L
NK —Positive control of NK
RK —Positive control of RK
TE —Positive control of TER
NM —Positive control of NM
RM —Positive control of RM
NL —Positive control of NL
RL —Positive control of RL
LR —Positive control of LR
LP —Positive control of LPR
MR —Positive control of MR
MPR —Positive control of MPR
TES —Positive control of TESR
LK —Positive control of LK
TEP —Positive control of TEPR
TECP —Positive control of TEPCR

Operated Units Relating to Highway Crossing Signals

XX —Crossing bell
EXR —Eastward interlocking or crossing relay, likewise north, south and west
XG —Wig-wag mechanism—Crossing gate mechanism
XY —Slot for wig-wag mechanism—Crossing gate mechanism
EOR —Electric light operating relay (flasher relay)
XSR —Directional relay to hold crossing signal clear as train recedes from crossing

Wires Relating to Highway Crossing Signals

XG —Positive control of XG
RXG —Reverse control of XG (drive down mechanism)
E1 —Positive wire to No. 1 unit of flashing light signal (to be designated by letter N, E, S and W)
E2 —Positive wire to No. 2 unit of flashing light signal (to be designated by letter N, E, S and W)
XS —Positive control of XSR
EX —Positive control of EXR
EO —Positive control of EOR

Operated Units Relating to Approach and Annunciating of Trains

AX —Annunciator indicating approach traffic
EAX —Eastward annunciator indicating approach of eastward traffic, likewise north, south and west
AER —Relay used for approach lighting

Wires Relating to Approach and Annunciating of Trains

AX —Positive control of AX
EA —Positive control of EA
E —Positive control of ER

Miscellaneous Operated Units

AK —Approach indicator
AR —Approach relay
PCR —Pole changing relay
NLPR —Relay repeating the normal position of a lever
RLPR —Relay repeating the reverse position of a lever
E —Electric light
TO —Train order
WTO —West train order signal governing westward traffic, likewise north, south and east
RR —Route relay
VR —Train stop relay
VSR —Train stop stick relay
VPR —Train stop repeater relay
VY —Train stop retaining mechanism
XR —Interlocking relay

TOR —Train order relay
POR —Power off relay
LOR —Light out relay
ME Marker light
OR Overload relay
GDR —Ground detector relay
CT —Code transmitter
DU —Decoding unit
RLNPR —Rail lock normal repeating relay
RLRPR —Rail lock reverse repeating relay
DEDR —Dragging equipment detector
FCOR —Frequency change-over relay

Wires Relating to Miscellaneous Operated Units

AK —Positive control of AK
A —Positive control of AR
PC —Positive control of PCR
NLP —Positive control of NLPR
RLP —Positive control of RLPR
R —Positive control of RR
V —Positive control of VR
VS —Positive control of VSR
VP —Positive control of VPR
VY —Positive control of VY
X —Positive control of XR
TO —Positive control of TOR
PO —Positive control of POR
LO —Positive control of LOR
ME —Positive control of ME
O —Positive control of OR
GD —Positive control of GDR
CT —Positive control of CT
DU —Positive control of DU
RLNP —Positive control of RLNPR
RLRP —Positive control of RLRPR
DED —Positive control of DEDR
FCO —Positive control of FCOR

GRAPHICAL SYMBOLS

See Figs. 1 to 10, inclusive, and 12 to 25, inclusive.

SIGNAL ASPECTS AND INDICATIONS

Signal aspect is defined by the Standard Code, A.A.R. as: The appearance of a fixed signal conveying an indication as viewed from the direction of an approaching train; the appearance of a cab signal conveying an indication as viewed by an observer in the cab.

Signal indication is defined by the Standard Code as: The information conveyed by the aspect of a signal.

In other words, "aspect" is the picture conveyed to the mind by the eye, and "indication" is the meaning this picture or aspect has for the engineman and upon which he should act.

The following definitions are taken from the current Standard Code of the A.A.R.:

Limited Speed.—A speed not exceeding ___*___ miles per hour.

Medium Speed.—A speed not exceeding ___*___ miles per hour.

Slow Speed.—A speed not exceeding ___*___ miles per hour.

Restricted Speed.—Proceed prepared to stop short of train, obstruction, or switch not properly lined and to look out for broken rail, not exceeding ___*___ miles per hour.

Reduced Speed.—Proceed prepared to stop short of train or obstruction.

Yard Speed.—A speed that will permit stopping within one-half the range of vision.

**Note to Definition of Speed.*—Railroads may insert in definitions where asterisk is shown, suitable speed in miles per hour, not exceeding 20 miles per hour for Restricted Speed and/or Slow Speed, 40 miles per hour for Medium Speed, and 60 miles per hour for Limited Speed.

Aspects and indications.

The Standard Code sets forth signal aspects and indications for use with the Block Signal and Interlocking Rules, as shown on pages 42-51.

The aspects and indications, as approved, are designed to cover the requirements of all American railroads and, consequently, show many more aspects than are necessary on any one railroad: for instance, aspects and indications are given for the one-arm scheme of signaling as well as those for the two and three-arm schemes. A name is given to each set of aspects having the same indication.

Many roads use other aspects: for instance, the round-end blade used by some roads to mark distinctively their manual block signals, and the fishtail blade used by some roads as approach or distance signals outside automatic block system territory. The same thing may be accomplished at night by a different combination of lights.

In Rule 281 are shown the various aspects of signals indicating "proceed." Rule 281A shows the aspects of signals indicating "proceed approaching second signal at medium speed." This aspect can only be displayed on two or three-arm signals.

(Continued on page 52)

FIXED SIGNALS

Rules 281 to 292, inclusive.

Aspects may be shown by the position of semaphore arms, color of lights, position of lights, flashing of lights, or a combination of color, position, and flashing of lights.

Day and night aspects for color light signals shall have the same colors as the night aspects of the semaphore signals.

Day and night aspects for position light signals shall have the same positions as the day aspects of the semaphore signals.

Aspects shown are typical. Each road should show the aspects and colors of lights it uses.

Note.—In the following illustrations of typical signal aspects, Rules 281 to 292, inclusive,

R = Red
Y = Yellow
G = Green

Note.—When the color "Lunar" is used,

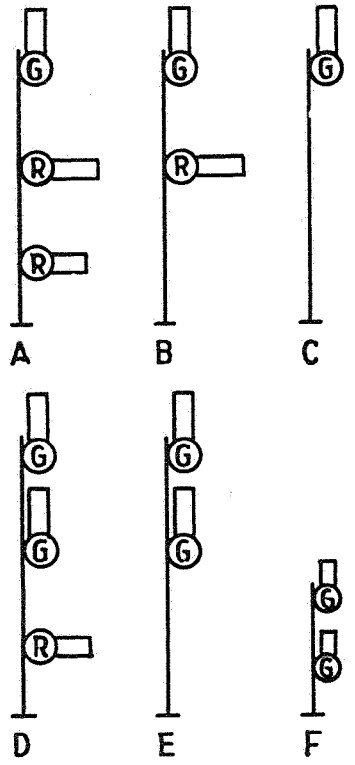
L = Lunar

(This Note adopted 7-27-1951)

Note.—When flashing color lights are used, they shall be indicated as follows:

FR = Flashing Red
FY = Flashing Yellow
FG = Flashing Green

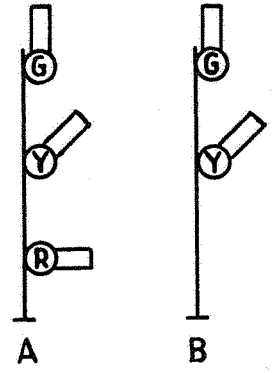
RULE 281



Indication — Proceed.

Name: Clear.

RULE 281 A



Indication — Proceed approaching second signal at medium speed.

Name: Advance approach medium.

RULE 281B

Indication — Proceed approaching next signal at limited speed.

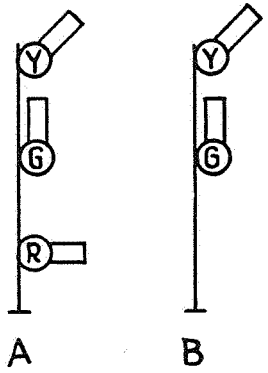
Name: Approach limited.

RULE 281C

Indication — Proceed; limited speed within interlocking limits.

Name: Limited — clear.

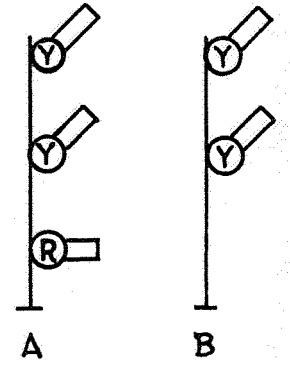
RULE 282



Indication — Proceed approaching next signal at medium speed.

Name: Approach medium.

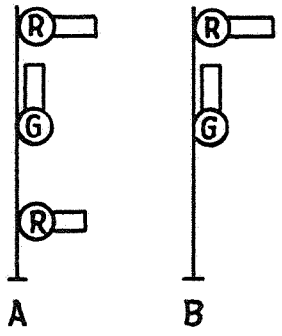
RULE 282A



Indication — Proceed preparing to stop at second signal.

Name: Advance approach.

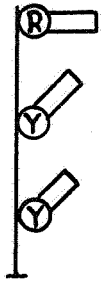
RULE 283



Indication — Proceed; medium speed within interlocking limits.

Name: Medium-clear.

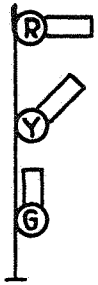
RULE 283A



Indication — Proceed preparing to stop at second signal; medium speed within interlocking limits.

Name: Medium — advance approach.

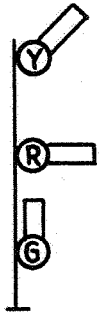
RULE 283 B



Indication – Proceed at medium speed approaching next signal at slow speed.

Name: Medium – approach slow.

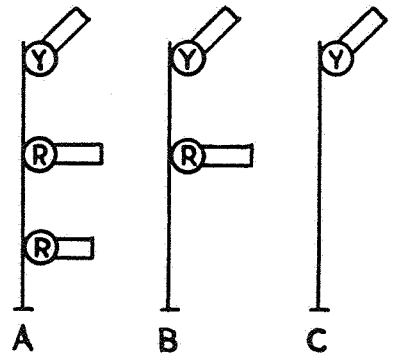
RULE 284



Indication – Proceed approaching next signal at slow speed. Train exceeding medium speed must at once reduce to that speed.

Name: Approach slow.

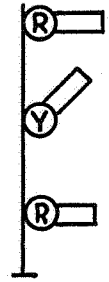
RULE 285



Indication – Proceed preparing to stop at next signal. Train exceeding medium speed must at once reduce to that speed.

Name: Approach.

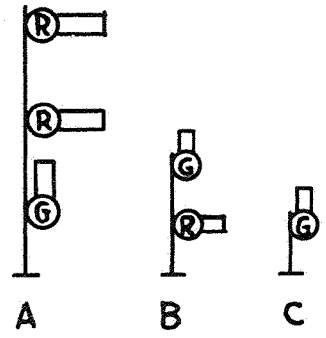
RULE 286



Indication – Proceed at medium speed preparing to stop at next signal.

Name: Medium – approach.

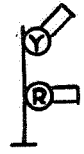
RULE 287



Indication — Proceed; slow speed within interlocking limits.

Name: Slow – clear.

RULE 288



Indication – Proceed preparing to stop at next signal; slow speed within interlocking limits.

Name: Slow – approach.

RULE 289

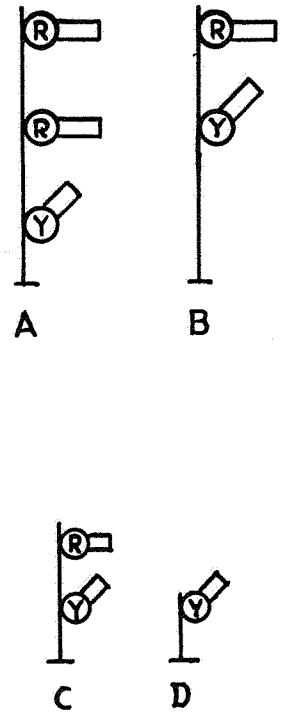
Designate by

1 - Letter plate
or
2 - Marker light
or
3 - Shape of arm
or
4 - Combination of these distinguishing features.

Indication—Manual Block occupied; proceed prepared to stop short of train or obstruction, but not exceeding 15 miles per hour.

Name: Permissive.

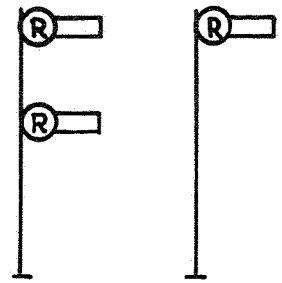
RULE 290



Indication — Proceed at restricted speed.

Name: Restricting.

RULE 291



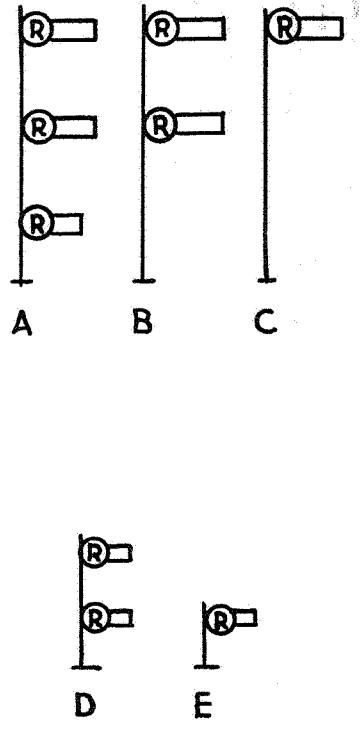
Designate by: 1-Number plate
or
2-Marker light
or
3-Pointed blade
or
4-Combination of these distinguishing features.

Indication – Stop; then proceed at restricted speed.

Name: Stop and proceed.

NOTE–Railroads desiring to avoid stopping trains may arrange accordingly.

RULE 292



Indication – Stop.

Name: Stop.

Rule 281B shows the "approach limited" aspect which is displayed only where three-arm signals are used.

Rule 281C indicates the "limited-clear" aspect which is likewise displayed only where three-arm signals are used.

The "approach medium" signal is shown in Rule 282 and requires at least two arms or lights. It will also be noted this aspect is shown with a two-arm dwarf signal.

The aspects and indications are used to give approach information where medium speed is required at the next signal. It indicates that a block or route governed by a signal displaying this indication is clear, but next signal limits the speed at that point. The next signal may be displayed for a movement over a turnout, crossover or other medium speed route. This indication is also used with what is known as three-block indication. Three-block indication may be used in automatic block system territory where there is less than stopping distance between signals, in which case the aspects displayed behind a train are shown in Fig. 27. Thus it will be seen that a train receiving Proceed indication has three clear blocks. This subject is treated fully in Chapter XV—Block Signal Systems.

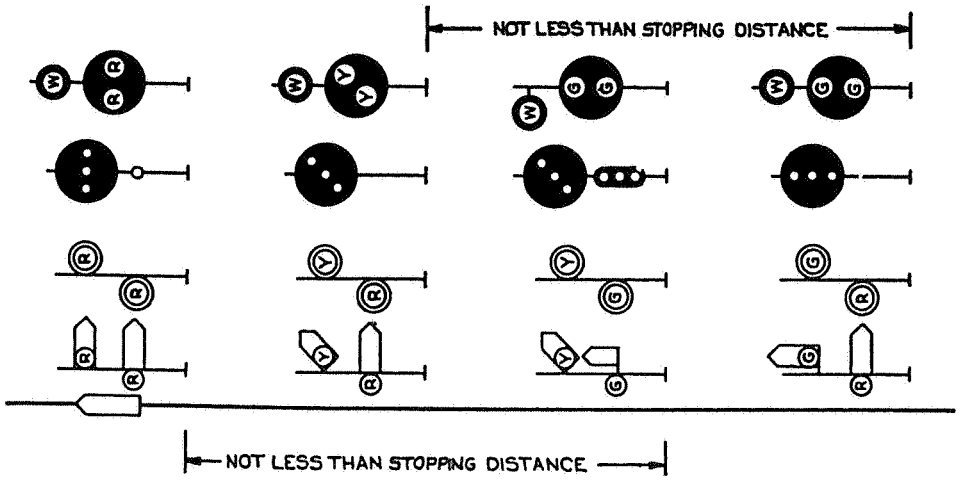


Fig. 27.

Aspect known as "advance approach" is shown in Rule 282A, this aspect being more restrictive than "approach medium."

The "medium-clear" signal shown in Rule 283 which also requires at least two arms or lights to display this aspect, indicates the block or route is clear, the movement is over a medium speed route, but that medium speed is required only within interlocking limits.

The next restrictive aspect, known as "medium-advance approach," is shown in Rule 283A and is only displayed where three-arm signaling is in effect.

Rule 283B illustrates the "medium-approach slow" aspect and is likewise only displayed with three-arm signaling.

The "approach slow" signal shown in Rule 284 is only given on a three-arm signal and indicates that the block or route governed by a signal displaying

this indication is clear, but that slow speed restriction will be effective at the next signal.

The "approach" aspect is necessary to govern the approach of a train to a signal indicating Stop. The aspects and indication requiring a train to be prepared to stop at the next signal are shown in Rule 285. These aspects indicate the block in advance is clear but train must be prepared to stop at the next signal. Formerly, this was the only requirement, thus permitting the engineman to use his own judgment as to the speed. However, experience has demonstrated that it is desirable for the engineman to take some immediate action on receiving such an indication and the requirement for a train to have its speed reduced to not exceeding medium speed has been added. This indication may be given by signals of the "stop and stay" type as well as by those of the "stop and proceed" type.

The "medium-approach" signal shown in Rule 286 is only given on a three-arm signal and indicates a medium speed route is clear but that the engineman must be prepared to stop at next signal.

As shown in Rule 287, the "proceed; slow speed within interlocking limits" indication may be given on three-arm signals, or on dwarf signals. The "slow-clear" signal indicates slow speed must be observed within interlocking limits after which normal speed may be resumed.

The "slow-approach" signal shown in Rule 288 is used by some roads mostly in terminal territory where the signal indications are given by dwarf signals. It may be used for other slow speed purposes.

The "permissive" signal shown in Rule 289 is used in manual block system territory where a train is admitted to an occupied block by a fixed signal. This aspect is also used in one-arm signaling at interlockings where it is desired to display a more favorable indication than Stop, or Stop and Proceed but less than Proceed. Thus, in one-arm signaling this indication means that the route or block may be occupied, or a switch open, or next signal at Stop, or any condition requiring caution.

Where used as a permissive signal in manual block it is used to admit other than a passenger train to a block occupied by other than a passenger train.

The indication "proceed at restricted speed," Rule 290, is displayed on a two-arm, three-arm or dwarf signal. This indication is used at interlockings for routes where restricted speed is required and on automatic block signals for movements of trains by such signals without stopping. Restricted speed signals may be used to advance a train to the block or interlocking station for orders or may be used to admit a train to a main track or other route that is occupied.

In Rule 291 is shown a signal giving the "stop and proceed" indication. While the aspect may be designated by the schemes indicated in the Standard Code, the most generally used schemes are:

Where semaphore signal is used—pointed blade and staggered lights.
Where color light signal is used—staggered lights.
Where position light signal is used—marker light.
Where color position light signal is used—white marker light.

Various aspects of signals indicating "stop" are shown in Rule 292. Trains receiving Stop indication must stop and stay until a more favorable indication

is received or until authorized to pass the stop signal by train order, clearance form or other method in effect on the railroad involved. Where two or more lights are used on semaphore and color light stop signals, they are arranged vertically. Purple in lieu of red is used by some roads on dwarf signals to indicate Stop.

"Stop and proceed" indication, Rule 291, is closely allied with the "stop" indication shown in Rule 292. The indications given by each rule require the train to stop, those in Rule 292 requiring the train to stay until a more favorable indication is displayed or authority received to pass it, while those in Rule 291 permit the train to proceed after having stopped, expecting to find a train in the block, obstruction, or switch not properly lined, and to look out for broken rail.

The signal aspects in Rule 292 are those ordinarily used at interlockings and block stations, or other points where it is desired to hold trains. The signal aspects in Rule 291 are those used as automatic block signals where stop and stay until authorized to proceed is not required. Where two lights are used they are generally diagonally arranged, or staggered.

On some roads automatic block signals are equipped with number plates, and on some of these roads the number plate is also used on a signal whose most restrictive indication is more favorable than Stop. For example, some roads use a square-end blade on all semaphore signals and apply the number plate on Stop and Proceed signals only.

There are in service a number of other aspects displayed by signals for which there may be no specific Standard Code rule, but the same general principles as laid down in the Code are followed.

Grade signals.

The grade or tonnage signal is used, on some roads, in automatic block system territory where for various reasons it is not desired to arrange the signal system to display Permissive or Slow Speed. It is used primarily to permit heavy tonnage freight trains, on ascending grades, to proceed at restricted speed by a signal displaying Stop and Proceed without stopping. However, on some roads all freight trains may pass these signals without stopping, while on other roads all trains may do so.

All roads permitting trains to pass Stop and Proceed signals without stopping, provide some sort of distinctive aspect for the purpose. Some of the aspects employed are as follows:

1. Short semaphore arm 45 degrees, pointed arm, night aspect yellow; arm located below block signal arm on same mast. The arm with a light shining on it is also used for the night aspect.

2. A yellow disc, displaying the letter G, mounted on the signal mast is the aspect on several large roads. On some roads the "G" is illuminated for the night aspect; a yellow instead of a red marker light is also used as a night aspect.

3. On some roads where the block signals have red arms, a yellow arm is substituted for the day aspect, and a yellow light in place of the usual red light for the night aspect.

Semaphore signals.

Semaphore signals are still in use on American railroads today but light signals are generally superseding them.

The aspects for semaphore signals shown in Rules 281 to 292, inclusive, are those for upper-quadrant signals, which is the type most generally in service. Three-position lower-quadrant signals give the same indications for corresponding positions as upper-quadrant signals.

Two-position lower-quadrant signals were in use many years before the three-position signals were developed. This type of signal requires two arms to give the three indications which may be given with one three-position signal arm, but as the lower-quadrant signal is now generally obsolete the aspects and indications will not be elaborated on.

Color light signals.

As previously stated, the aspects of light signals are the same both day and night, using the same colors as the night aspects of the semaphore signal.

While the practice thus far in America has been to follow the night aspects of semaphore signals with color light signals, in England, a system known as "four-aspect color light signals" is being used by some railroads. This system is based on the same principles as three-block indication which is illustrated in Fig. 27. In this system, one red light is used for Stop; one yellow light, Caution—be prepared to stop at next signal; two yellow lights, Attention—run at medium speed; one green light, Proceed. In automatic block system territory this scheme would agree with the principles and practice of the American roads, but at interlockings where more than one route is involved, complications arise. An attempt is made to so signal the routes that it will not be necessary for a train to pass a red light; this, however, cannot be done except by the use of route indicators and other auxiliary devices used in connection with the four-aspect signal. The system generally uses one four-aspect signal, regardless of the number of routes, and an indicator to designate the route to be taken.

As the aspects and indications of color light signals are mostly in conformity with those shown in the foregoing rules, no special aspects will be listed. Each railroad may use additional aspects to meet their individual requirements.

Position light signals.

The aspects and indications of this type of signal are given by positions day and night. The positions are given by rows of lights (all the same color), the high signals having three lights per row and the dwarf signals two lights per row. The position light signal is more flexible than the semaphore or color light signal in that four positions may be secured from each arm while three positions or colors are the maximum with the semaphore and color light signals, except by use of color combinations, as, for instance, the "four-aspect color light signal" being used in England.

Position light signal aspects, indications and names, as generally used, are shown in Fig. 28. By referring to this figure, it may be seen that it is the practice in using position light signals to display only the various arms, or rows of lights, as necessary: for instance, the stop signal displays only one horizontal row of lights as it is unnecessary to light additional arms to indicate Stop.

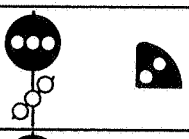
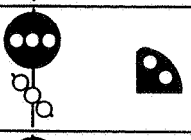
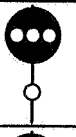
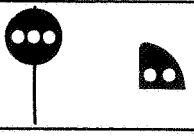
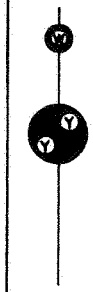
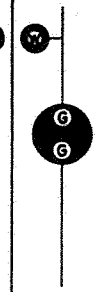
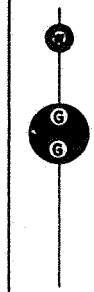
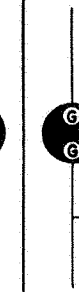
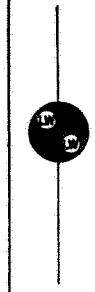
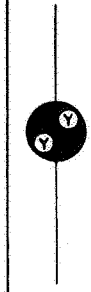
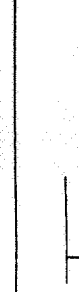
INDICATION	NAME	ASPECT
PROCEED; MANUAL BLOCK CLEAR.	CLEAR-BLOCK	
PROCEED	CLEAR	
PROCEED APPROACHING NEXT SIGNAL AT MEDIUM SPEED.	APPROACH-MEDIUM	
PROCEED; MEDIUM SPEED WITHIN INTERLOCKING LIMITS.	MEDIUM-CLEAR	
PROCEED PREPARED TO STOP AT NEXT SIGNAL. TRAIN EXCEEDING MEDIUM SPEED MUST AT ONCE REDUCE TO THAT SPEED.	APPROACH	
TRAIN EXCEEDING MEDIUM SPEED MUST AT ONCE REDUCE TO THAT SPEED. WHERE A FACING SWITCH IS CONNECTED WITH THE SIGNAL, APPROACH THAT SWITCH PREPARED TO STOP. APPROACH NEXT SIGNAL PREPARED TO STOP.	CAUTION	
PROCEED; SLOW SPEED WITHIN INTERLOCKING LIMITS.	SLOW-CLEAR	
PROCEED PREPARED TO STOP AT NEXT SIGNAL. SLOW SPEED WITHIN INTERLOCKING LIMITS.	SLOW-APPROACH	
BLOCK OCCUPIED; FOR PASSENGER TRAINS, STOP; FOR TRAINS OTHER THAN PASSENGER TRAINS, PROCEED AT REDUCED SPEED BUT NOT EXCEEDING 15 MILES PER HOUR.	PERMISSIVE-BLOCK	
PROCEED AT RESTRICTED SPEED.	RESTRICTING	
STOP; THEN PROCEED AT RESTRICTED SPEED.	STOP-AND-PROCEED	
STOP	STOP-SIGNAL	

Fig. 28.
Position Light Signals.

ROUTES		NORMAL ROUTE							MEDIUM ROUTE						SLOW ROUTE			
ASPECT																		
INDICATION	STOP	STOP, THEN PROCEED AT RESTRICTED SPEED UNTIL ENTIRE TRAIN PASSES NEXT SIGNAL	TONNAGE TRAIN PROCEED AT RESTRICTED SPEED UNTIL ENTIRE TRAIN PASSES NEXT SIGNAL. OTHER TRAINS STOP, THEN PROCEED AT RESTRICTED SPEED UNTIL ENTIRE TRAIN PASSES NEXT SIGNAL.	BLOCK OCCUPIED. PROCEED PREPARED TO STOP SHORT OF TRAIN AHEAD. IN AUTOMATIC BLOCK TERRITORY, PROCEED AT RESTRICTED SPEED UNTIL ENTIRE TRAIN PASSES NEXT SIGNAL.	PROCEED, PREPARING TO STOP AT NEXT SIGNAL AND BE GOVERNED BY INDICATION DISPLAYED BY THAT SIGNAL. TRAIN EXCEEDING MEDIUM SPEED MUST AT ONCE REDUCE TO THAT SPEED.	PROCEED, APPROACHING NEXT SIGNAL AT SLOW SPEED. TRAIN EXCEEDING MEDIUM SPEED MUST AT ONCE REDUCE TO THAT SPEED.	PROCEED, APPROACHING NEXT SIGNAL AT MEDIUM SPEED.	PROCEED	STOP, THEN PROCEED AT RESTRICTED SPEED UNTIL ENTIRE TRAIN PASSES NEXT SIGNAL	BLOCK OCCUPIED. PROCEED PREPARED TO STOP SHORT OF TRAIN AHEAD. IN AUTOMATIC BLOCK TERRITORY, PROCEED AT RESTRICTED SPEED UNTIL ENTIRE TRAIN PASSES NEXT SIGNAL.	PROCEED AT MEDIUM SPEED, PREPARING TO STOP AT NEXT SIGNAL AND BE GOVERNED BY INDICATION DISPLAYED BY THAT SIGNAL.	PROCEED AT MEDIUM SPEED APPROACHING NEXT SIGNAL AT SLOW SPEED.	PROCEED AT MEDIUM SPEED APPROACHING NEXT SIGNAL AT MEDIUM SPEED.	PROCEED; MEDIUM SPEED WITHIN INTERLOCKING LIMITS OR THROUGH NON-INTERLOCKED SWITCHES IMMEDIATELY BEYOND THE SIGNAL. BLOCK CLEAR.	PROCEED AT RESTRICTED SPEED UNTIL ENTIRE TRAIN PASSES NEXT SIGNAL.	PROCEED AT SLOW SPEED, PREPARING TO STOP AT NEXT SIGNAL AND BE GOVERNED BY INDICATION DISPLAYED BY THAT SIGNAL.	PROCEED AT SLOW SPEED UNTIL ENTIRE TRAIN PASSES THROUGH SWITCHES APPROACHING NEXT SIGNAL AT SLOW SPEED AND BE GOVERNED BY INDICATION DISPLAYED BY THAT SIGNAL.	TAKE SIDING
NAME	STOP	STOP AND PROCEED	TONNAGE	PERMISSIVE	APPROACH	APPROACH SLOW	APPROACH MEDIUM	CLEAR	STOP AND PROCEED	MEDIUM PERMISSIVE	MEDIUM APPROACH	MEDIUM APPROACH SLOW	MEDIUM APPROACH MEDIUM	MEDIUM CLEAR	RESTRICTING	SLOW APPROACH	SLOW CLEAR	TAKE SIDING INDICATOR

W = white
LW = lunar-white

Fig. 29.
Color Position Light Signals.

Color position light signals.

The aspects and indications of this type of signal are given both by colors and positions, day and night. The positions are given by two lights in a row on both high and dwarf signals, each row having a distinctive color. There is but one arm used and its positions are the same as those used with the position light signal. Red, yellow and green as used with semaphore signals are used as is also lunar white; red being used in the stop row, yellow in the approach row, green in the clear row and lunar white in the lower-quadrant row. The different speeds or routes are indicated by a white marker light above or below the arm or the absence of a marker light. The white marker above the arm indicates authorized speed or main route; below the arm, medium speed route, and no marker lights, slow speed route. The marker light is located in line with the mast or center of signal to the left or right of mast, depending on aspect displayed.

The aspects, indications and names for color position light signals are shown in Fig. 29, and with the explanations of the aspects and indications given above, no further detailed explanation is necessary.

The system as now used is based on three-arm scheme of signaling, and, like the position light signal, the indications can be given with fewer aspects than with semaphores.

Dwarf signals are not shown in this figure as they are the same as the high signals, except for height and size.

The indications of color position light signals are given by positions and in addition by the colors generally used with semaphore and color light signals for three aspects and lunar white for the fourth or permissive; the marker light is white.

General.

Reference is made in some of the indications to limited, medium, slow or restricted speed. Where no speed is mentioned, authorized speed for that portion of the road being used is permitted.

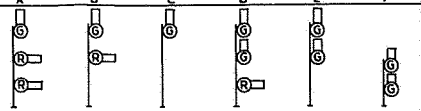
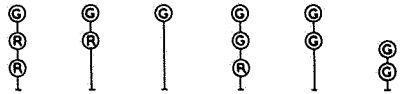
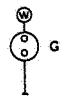
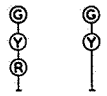
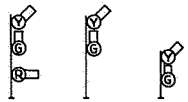
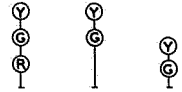
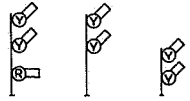
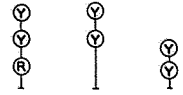
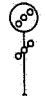
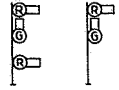
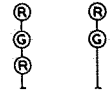
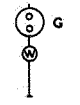
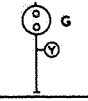
Until the Railway Signal Association (now the Signal Section, Association of American Railroads) adopted its principles of signaling (1912) there was a great variety of aspects and indications. These have been reduced to scientific basis as brought out in the foregoing. There are 41 aspects shown in the various Standard Code rules, and these cover the three schemes of signaling: namely, one, two and three-arm.

Figure 30, sheets 1 and 2, shows a composite of semaphore, color light, position light and color position light signals arranged in accordance with Standard Code fixed signal aspects and indications.

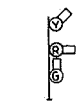
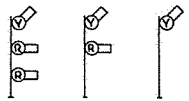
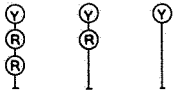
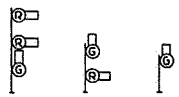
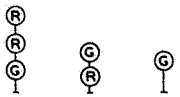
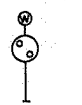
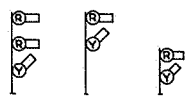
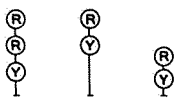
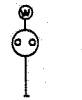
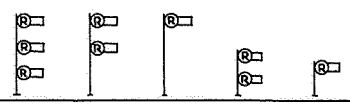
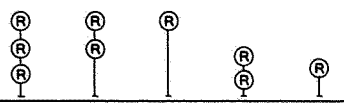
There are two basic principles in the use of aspects and indications which should never be overlooked: first, the undesirability of using one aspect to give two or more indications, and second, the undesirability of providing a multiplicity of aspects which would be confusing to the engineman. The picture received by the mind should have only one meaning and thus avoid the possibility of confusion arising in the engineman's mind which may cause hesitation when prompt action should be taken, or the taking of wrong action.

The principles involved in the determination of the various aspects and indications are covered in Chapter III—Principles and Economics of Signal-

AAR STANDARD CODE EQUIVALENT INDICATIONS FOR SEMAPHORE, COLORLIGHT, POSITION LIGHT AND COLOR POSITION LIGHT SIGNALS.

RULE	NAME	INDICATION	SEMAPHORE SIGNAL ASPECTS A B C D E F	COLORLIGHT SIGNAL ASPECTS A B C D E F	POSITION LIGHT SIGNAL ASPECTS A B	COLOR POSITION LIGHT SIGNAL ASPECTS A B
281	CLEAR	PROCEED				
281 A	ADVANCE APPROACH MEDIUM	PROCEED APPROACHING SECOND SIGNAL AT MEDIUM SPEED.				
281 B	APPROACH LIMITED	PROCEED APPROACHING NEXT SIGNAL AT LIMITED SPEED.				
281 C	LIMITED-CLEAR	PROCEED; LIMITED SPEED WITHIN INTERLOCKING LIMITS.				
282	APPROACH MEDIUM	PROCEED APPROACHING NEXT SIGNAL AT MEDIUM SPEED.				
282 A	ADVANCE APPROACH	PROCEED PREPARING TO STOP AT SECOND SIGNAL.				
283	MEDIUM-CLEAR	PROCEED; MEDIUM SPEED WITHIN INTERLOCKING LIMITS.				
283 A	MEDIUM-ADVANCE APPROACH	PROCEED PREPARING TO STOP AT SECOND SIGNAL; MEDIUM SPEED WITHIN INTERLOCKING LIMITS.				
283 B	MEDIUM-APPROACH SLOW	PROCEED AT MEDIUM SPEED APPROACHING NEXT SIGNAL AT SLOW SPEED.				

AAR STANDARD CODE EQUIVALENT INDICATIONS FOR SEMAPHORE, COLORLIGHT, POSITION LIGHT AND COLOR POSITION LIGHT SIGNALS

RULE	NAME	INDICATION	SEMAPHORE SIGNAL ASPECTS A B C D E F	COLORLIGHT SIGNAL ASPECTS A B C D E F	POSITION LIGHT SIGNAL ASPECTS A B	COLOR POSITION LIGHT SIGNAL ASPECTS A B
284	APPROACH SLOW	PROCEED APPROACHING NEXT SIGNAL AT SLOW SPEED. TRAIN EXCEEDING MEDIUM SPEED MUST AT ONCE REDUCE TO THAT SPEED.				 G
285	APPROACH	PROCEED PREPARING TO STOP AT NEXT SIGNAL. TRAIN EXCEEDING MEDIUM SPEED MUST AT ONCE REDUCE TO THAT SPEED.				 Y
286	MEDIUM-APPROACH	PROCEED AT MEDIUM SPEED PREPARING TO STOP AT NEXT SIGNAL.				 Y
287	SLOW-CLEAR	PROCEED; SLOW SPEED WITHIN INTERLOCKING LIMITS.				 G
288	SLOW-APPROACH	PROCEED PREPARING TO STOP AT NEXT SIGNAL; SLOW SPEED WITHIN INTERLOCKING LIMITS.				 Y
289	PERMISSIVE	BLOCK OCCUPIED; PROCEED PREPARED TO STOP SHORT OF TRAIN AHEAD.	 DESIGNATE BY: 1-LETTER PLATE OR 2-MARKER LIGHT OR 3-SHAPE OF ARM OR 4-COMBINATION OF THESE DISTINGUISHING FEATURES.	 DESIGNATE BY: 1-LETTER PLATE OR 2-MARKER LIGHT OR 3-SHAPE OF ARM OR 4-COMBINATION OF THESE DISTINGUISHING FEATURES.		 LW
290	RESTRICTING	PROCEED AT RESTRICTED SPEED.				 LW
291	STOP AND PROCEED	STOP; THEN PROCEED AT RESTRICTED SPEED.	 DESIGNATE BY: 1-NUMBER PLATE OR 2-MARKER LIGHT OR 3-POINTED BLADE OR 4-COMBINATION OF THESE DISTINGUISHING FEATURES.	 DESIGNATE BY: 1-NUMBER PLATE OR 2-MARKER LIGHT OR 3-POINTED BLADE OR 4-COMBINATION OF THESE DISTINGUISHING FEATURES.		 R
292	STOP	STOP				 R

ing, while the details of the various kinds of signals are covered in Chapters XII—Semaphore Signals, and XIII—Light Signals and Light Signal Lamps.

Cab signals and indicators.

Cab indicators of the audible type were used in Europe as early as 1880, some of which were placed in service on the Northern Railway of France in that year. Other roads in the European countries have used similar cab indicators. Trial installations of visual cab indicators also have been made. However, most of these installations made use of the cab indicator only in connection with approach signals, and this primarily on account of dense fogs experienced.

On the American Continent cab signals and cab indicators did not receive serious consideration until the era of automatic train stop and automatic train control in the United States. Both audible and visual signals are now in use.

With the intermittent automatic train stop the cab indicator is usually an audible one produced by an air horn, a gong, or both. In some systems the horn or gong indicates that the receiver on the locomotive has passed over an open inductor, providing the acknowledging lever is manipulated, while in other installations, the horn is used for the above purpose and the gong acts as a check on the proper functioning of the wayside inductor. When an engineman acknowledges prior to passing a restrictive signal indication, the gong sounds when the receiver passes over an open inductor. If an engineman acknowledges the indication and the gong fails to sound, he knows there is something wrong either with the engine equipment or inductor. In addition to this, on one road there is in use an indicator in the cab with a white light displayed when the train-stop apparatus is in working order and cut-in. On another road a red light is displayed in the cab at the instant an automatic application is received; this in addition to the audible signal. When the locomotive circuits are set up for free running, no light is shown and no audible signal is sounded.

With the continuous automatic cab signal, train stop or speed control, a cab signal (designated by one road, "visual indicator") is used; however, the practice on various roads differs. One road utilizes a gong, horns and a visual indicator, described in the following:

> A single-stroke gong is mounted on the inside back wall of the cab on the engineer's side. When this gong sounds it indicates that the low speed restriction is removed.
>
> A warning speed horn having a soft tone is mounted in the cab. When this horn is sounded it indicates that the speed of the train is within the warning speed limits. This horn will stop sounding as soon as the speed has been properly reduced.
>
> An acknowledging horn having a sharp tone is also mounted in the cab. When this horn sounds the engineman should immediately acknowledge it by means of the acknowledging lever. When properly acknowledged, this horn will immediately stop sounding.
>
> A visual indicator containing two lights is mounted on the inside front wall of the cab on the engineer's side. The aspects displayed are: GREEN —indicating Proceed; YELLOW—indicating Proceed at Slow Speed Prepared to Stop. The change from green light to yellow light will pre-

cede the warning speed horn indications by 2 seconds. Acknowledgment should not be made until the acknowledging horn sounds but if done it should be repeated after the acknowledging horn sounds. The change from yellow light to green light will be accompanied by a single stroke of the gong.

When passing over short sections of track where current may not be picked up for a distance of less than 175 feet such as staggered joints at the end of a track circuit, a test section or at a railroad crossing, the light may flash from green to yellow and back to green without the horn or gong sounding. No attention need be paid to these flashes.

When either indication light is lighted, it indicates that the current on the engine is cut-in for train control operation and the cut-out cock or actuator can then be cut-in.

The train control should not be cut-out on account of a failure of either or both lights if the equipment is otherwise operating properly as this may only be due to failure of a light bulb.

Some roads use two-aspect cab signals, while others use three or four aspects. On some roads, where continuous automatic stop or speed control is in service, all wayside signals except Stop signals at points where trains may be held are eliminated. On one road all wayside signals, except Stop signals at points where trains may be held, are eliminated where continuous cab signals are in use.

Figure 31 shows the aspects and indications for continuous automatic cab signals of the two, three and four-indication types, with corresponding Standard Code rules which apply.

Audible horn signals are frequently used with visual cab signals, although single-stroke gongs have been used in lieu thereof. The horn or gong sounds to advise the engineman of a change of his visual cab signal to a more restrictive indication and, in case of the horn, sounds continuously from the time the aspect changes until an automatic application of air occurs or until the engineman takes proper action.

In the application of cab signals, the general principles which apply for wayside signals have been followed as far as practicable.

This chapter deals only with aspects, indications, etc.; the details of construction, control, etc., are covered in other chapters.

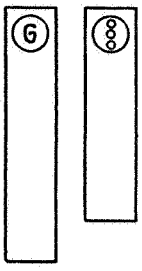
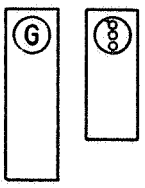
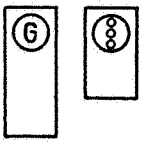
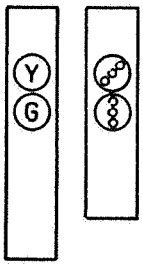
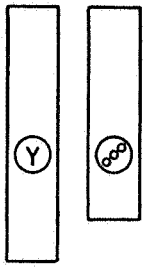
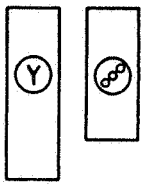
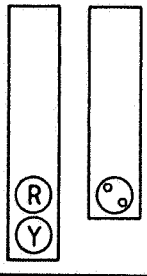
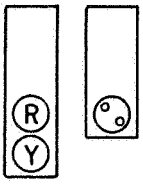
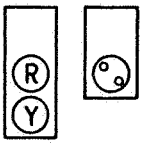
NAME	INDICATION	ASPECT		
		4 INDICATION	3 INDICATION	2 INDICATION
CLEAR	PROCEED (STANDARD CODE RULE 281.)			
APPROACH MEDIUM	PROCEED APPROACHING NEXT SIGNAL AT MEDIUM SPEED. (STANDARD CODE RULE 282.)			
APPROACH	PROCEED PREPARING TO STOP AT NEXT SIGNAL. TRAIN EXCEEDING MEDIUM SPEED MUST AT ONCE REDUCE TO THAT SPEED. (STANDARD CODE RULE 285.)			
RESTRICTING	PROCEED AT RESTRICTED SPEED. (STANDARD CODE RULE 290.)			
G = GREEN	Y = YELLOW	R = RED		

Fig. 31.

American Railway Signaling Principles and Practices

QUESTIONS ON

CHAPTER II

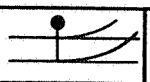
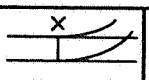
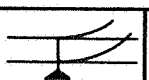
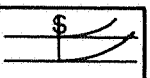
Symbols, Aspects and Indications

1. Mark an "X" in the appropriate box.

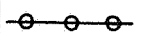
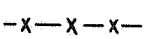
WAYSIDE SIGNAL OPERATING CHARACTERISTICS				
Non-automatic				
Semi-automatic, stick				
Semi-automatic, non-stick				
Automatic				

2. Underline the correct answer.
   Track is drawn with red dash lines to indicate:
   (a) track to be taken up
   (b) proposed track
   (c) track to remain
   (d) foreign track
   (e) none of these

3. Mark an "X" in the appropriate box.

SWITCH FIXTURES				
Spring switch				
Electric switch lock				
Switch stand				
Switch circuit controller				

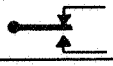
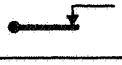
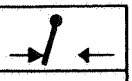
4. Mark "X" in the appropriate box.

RUNS OF CONNECTIONS				
Underground or aerial cable (not in duct)				
Wire duct				
Compressed air				
Pipe (mechanical)				

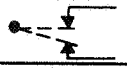
5. Mark an "X" in the appropriate box.

RELAYS					
Magnetic stick					
Slow drop-away					
Slow pick-up					
Retained					
Biased					

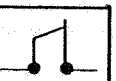
6. Mark an "X" in the appropriate box.

RELAY CONTACTS				
Polar dependent				
Neutral dependent				
Neutral independent				
Polar independent				

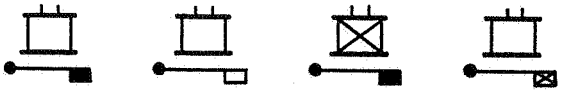
7. Mark an "X" in the appropriate box.

RELAY CONTACTS				
Flashing				
Coding 2-position neutral				
Coding 2-position polar-reverse				
Magnetic blowout				

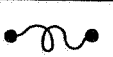
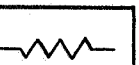
8. Mark an "X" in the appropriate box.

MISC. CIRCUIT CONTROLLER CONTACTS				
Door contact				
Lever latch				
Electric lock armature				
Train stop trip type				

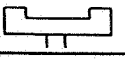
9. Draw a circle around the symbol for an electric lock used with alternating current.



10. Mark an "X" in the appropriate box.

CIRCUIT APPURTENANCES				
Fuse				
Resistor				
Thermal circuit breaker				
Ground connection				

11. Mark an "X" in the appropriate box.

CIRCUIT APPURTENANCES				
Lightning arrestor				
Auto. train stop inductor				
A.C. generator				
D.C. generator				

12. Mark an "X" in the appropriate box.

ENERGY WIRES	FC	N	CL	B	NX	CX	C	EB
Negative A.C. energy								
Common traffic locking								
Positive energy east								
Common D.C.								
Common A.C.								
Common of split battery								
Positive D.C. energy								
Negative D.C. energy								

13. Mark an "X" in the appropriate box.

OPERATED UNITS RELATING TO TRACK CIRCUITS	TPSR	TR	T	TSR	TPR	BK
Block indicator						
Track section						
Track stick relay						
Track relay						
Relay repeating track relay						
Stick relay repeating track relay						

14. Mark an "X" in the appropriate box.

WIRES RELATING TO TRACK CIRCUITS	WN	RB	TB	TPP	TN	RN
Positive energy to rail						
Wire from positive rail to relay						
Negative energy from rail						
Positive control of TPPR						
Negative rail to switch circuit controller						
Wire from negative rail to relay						

15. Write number of each of the operated units relating to switches in List A opposite correct letter combination in List B.

List A	List B	Number
1. - Switch operating mechanism	WRPR	_____
2. - Relay, controller or contactor controlling the normal operation of a switch	NWPR	_____
	WPR	_____
3. - Relay repeating WR	WRRPR	_____
4. - Relay repeating WRR or reverse position of WR	W	_____
5. - Relay repeating position of switch	WNR	_____
6. - Relay repeating normal position of switch	WCR	_____
7. - Indicator indicating the positions of a switch	RWK	_____
8. - Indicator indicating the reverse position of a switch	WK	_____
9. - Switch correspondence relay		

16. Mark an "X" in the appropriate box.

WIRES RELATING TO SWITCHES	RWK	WRP	WRRP	WNR	WC	NW
Normal control of switch operating mechanism						
Positive control of WNR						
Positive control of WRPR						
Positive control of WRRPR						
Positive control of RWK						
Positive control of WCR						

17. Write number of each of the operating units relating to signals in List A opposite correct letter combination in List B.

List A	List B	Number
1. - Relay controlling approach indication of a three-position signal	HGK	_____
2. - Relay repeating HR	HR	_____
3. - Relay controlling proceed indication of a signal	ETOHR. . .	_____
4. - East train order HR	HPR	_____
5. - Relay repeating DR	RGPR . . .	_____
6. - Relay repeating signal mechanism at stop	DPR	_____
7. - Relay repeating signal mechanism at proceed	DR	_____
8. - Indicator indicating signal mechanism at approach	DG	_____
9. - Proceed indication operating mechanism of signal	DGPR . . .	_____

18. Mark an "X" in the appropriate box.

STICK,TRAFFIC AND DIRECTIONAL OPERATED UNITS	FLK	SR	FSR	FR	ASR	LSR
Locking stick relay						
Stick relay						
Approach stick relay						
Traffic relay						
Traffic lock indicator						
Traffic stick relay						

19. Underline the correct answer.

The letter "XX" are used to symbolize a

(a) wig-wag mechanism.
(b) slot for wig-wag mechanism.
(c) flasher relay.
(d) crossing bell.
(e) none of these.

20. Write number of each of the miscellaneous operated units in List A opposite correct letter combination in List B.

List A	List B	Number
1. - Code transmitter	DU	_____
2. - Decoding unit	ME	_____
3. - Route relay	LOR	_____
4. - Approach relay	POR	_____
5. - Approach indicator	XR	_____
6. - Interlocking relay	RR	_____
7. - Power off relay	OR	_____
8. - Light out relay	CT	_____
9. - Overload relay	E	_____
10. - Marker light	AK	_____
11. - Electric light	AR	_____

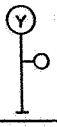
21. True or false. A signal aspect is defined as the information conveyed by the indication of a signal. If false, give true definition of "aspect".

22. Underline the correct answer.

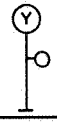
A speed that will permit stopping within one-half the range of vision is called

(a) limited speed.
(b) slow speed.
(c) restricted speed.
(d) yard speed.
(e) reduced speed.

23. Mark an "X" in the appropriate box.

NAME						
Clear						
Advance approach						
Approach						
Permissive						
Restricting						
Stop						

24. Mark an "X" in the appropriate box.

INDICATION						
Stop						
Proceed at restricted speed						
Manual block occupied, proceed prepared to stop short of train ahead						
Proceed preparing to stop at next signal						
Proceed preparing to stop at second signal						
Proceed						

25. True or false. Visual cab signal indicators are generally used together with an audible signal.
If true, what does the audible signal indicate?