DIRECTOR OF S & T ENGINEERING.
WEST MIDLANDS PROJECTS GROUP.

The Automatic Warning System (AWS) is a safeguard against drivers' errors

AUTOMATIC WARNING SYSTEM

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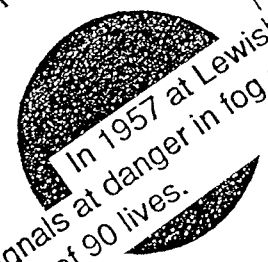
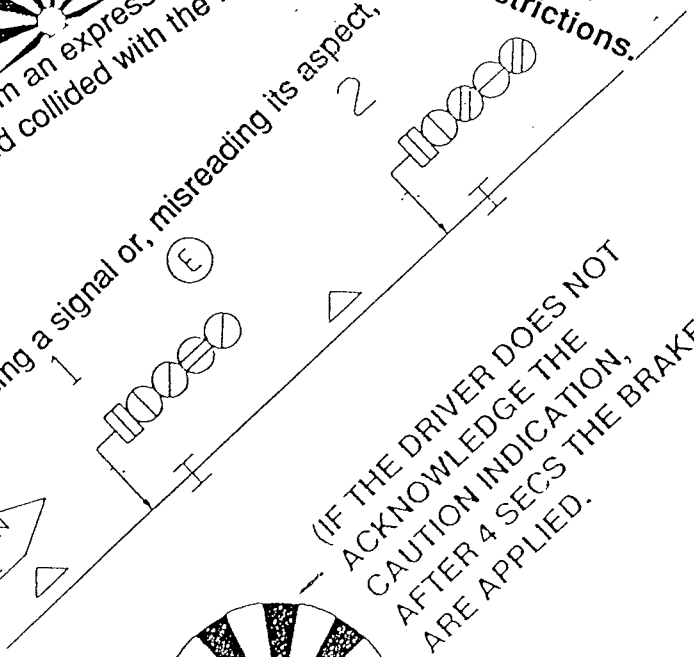
nnon Street to Ramsgate
MU (Electric Multiple Unit)

DRIVERS AWS CAB INDICATOR FACEPLATE.

In 1957 at Lewisham an express train from
ran past signals at danger in fog and collided with the rear of
with the loss of 90 lives.



AWS is a safeguard against a driver missing a signal or, misreading its aspect,



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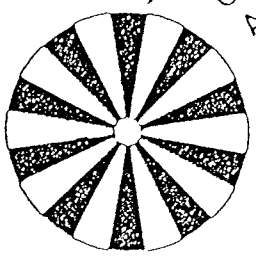


INTRODUCTION

It is a fundamental of railway signalling that there should be a signal showing danger, protecting each train or shunt of vehicles on the running line and that there should be another signal, the Distant signal, giving a braking distance warning of a stop signal which is showing danger.

In addition, it is fundamental that a driver observes and obeys the indication of the signals.

The Automatic Warning System (AWS) is a safeguard against drivers' errors in this respect.

AWS is a safeguard against a driver missing a signal or, misreading its aspect, and in the case of a Distant signal being "ON", his failing to acknowledge that he understands what it means. It must be stressed that it states in:-

"the Rule Book, Appendix No. 8,
Automatic Warning System

1. Principle

1.1 The Automatic Warning System (AWS) is an aid to the Driver. It does not relieve him of his responsibility for observing signals and speed restrictions."

continued

HISTORY

The idea of repeating signal indications in the drivers cab and applying the brake automatically if necessary, originated many years ago.

About the turn of the century many railways experimented with various types of equipment. The first permanent installation was that of the Great Western Railways (GWR).

This electro-mechanical system, known as Automatic Train Control (ATC) was introduced in 1906 as an audible cab signalling system, and a year or two later automatic application of the brake was added.

By 1939, this system had been installed throughout the main routes of the GWR. The system consisted of an insulated steel bar mounted between the running rails in the form of a ramp at 440 yards in rear of each Distant Signal. This bar made contact with a spring loaded shoe on the locomotive and so raised it. When the signal stood at clear the bar became electrified, and the current passing through the shoe, rang a bell in the drivers cab. If, on the other hand, the signal was at caution the ramp remained "dead" with the result that when the locomotive shoe was raised it broke an electric circuit on the engine and caused an alarm whistle to sound.

Unfortunately the other railway companies did not follow suit and install such a system. A pioneer Hudd electro-magnetic automatic warning system evolved in the 1930's designed to give drivers audible indications in the cab at distant signals.

This system was installed on the London Tilbury and Southend line. The Chief Inspecting Officer of Railways continually pressed the railway companies to install some form of warning system. However, nothing was done until two serious accidents occurred after railway nationalisation. In 1952 at Harrow & Wealdstone an Up sleeping-car express train ran past signals at danger in fog and ran into the wreckage of the first two trains with the loss of 122 lives. In 1957 at Lewisham an express train from Cannon Street to Ramsgate ran past signals at danger in fog and collided with the rear of an EMU (Electric Multiple Unit) with the loss of 90 lives.

In his report on Lewisham, Brigadier C.A.Langley stressed that this disaster, like the one at Harrow, would have been prevented by some form of ATC or Automatic Warning System. Soon after the Lewisham accident BR standardised on an intermittent automatic warning system (AWS) which supervises the driver's reaction to caution aspects and indicates to him the passing of a clear aspect.

continued

PRINCIPLE OF OPERATION

The British Railways' Automatic Warning System is advisory and leaves the regulation of the train speed in the hands of the driver for the most part, but causes a brake application to be made automatically if he fails to react when approaching a restrictive aspect.

The system operates by magnetic induction between static equipment fixed in the track and a receiver mounted on the motive power unit.

The caution indication, that is when the signal is displaying any aspect other than Green, is given by a continuous note from a horn, and a clear (Green aspect) by a one second ring on a trembler bell.

If a driver fails to acknowledge a caution indication a progressive brake application is initiated, which can be cancelled by the driver. If the driver acknowledges the caution indication, and so cancels the brake application, a visual indication is presented to him as a reminder that he has taken control of the train.

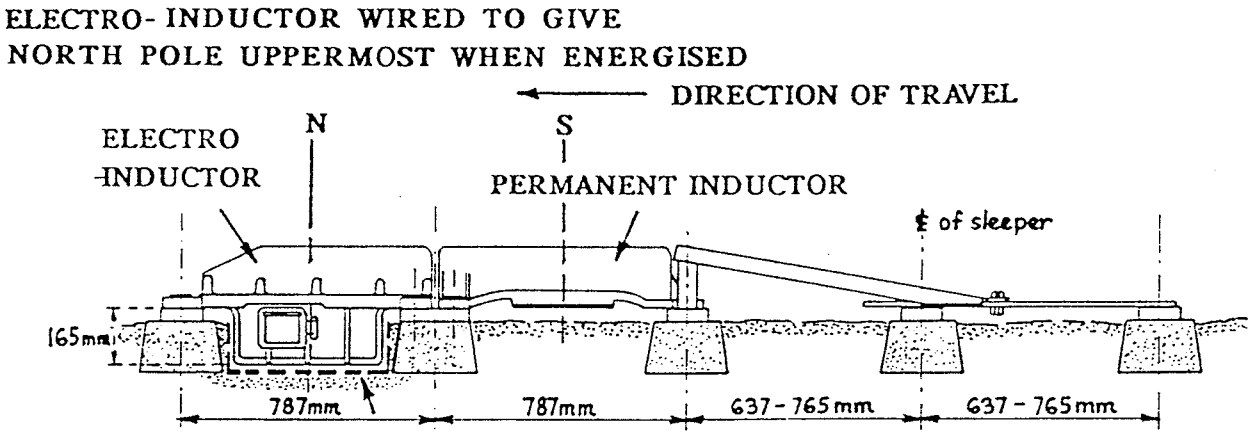
The visual indication will remain until the train passes over another AWS installation, that is until the AWS is again operative.

continued

AUTOMATIC WARNING SYSTEM EQUIPMENT

ON TRACK

The diagram below shows the track equipment which is mounted in the centre of the "four-foot" on the approach side of the signal. It consists of two magnets with their centres 787 mm (31 in.) apart. The magnets are vertical so that only one pole on each influences the receiving equipment on the train. The first magnet in the direction of travel is of the permanent type with its south pole at the top.



The second unit is an electro-magnet, energised only when the signal is displaying a Green aspect. The electro-magnet has its North pole uppermost.

The top of the aluminium magnet housing is at rail level and a robust ramp is fitted on the approach side of the installation to minimise damage from trailing brake gear, etc. on trains.

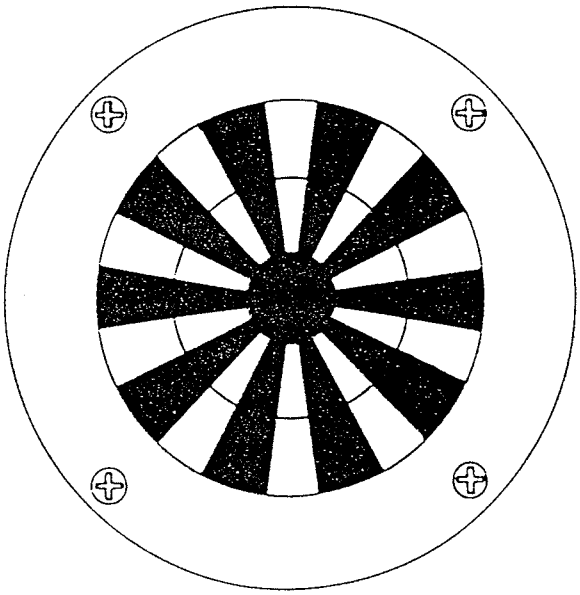
continued

ON MOTIVE POWER UNITS

This comprises a receiver, fixed at a nominal height of 165 mm (6-1/2 in.) above the rail level, the horn, bell, an apparatus case and the driver's control unit. The operative part of the receiver is a small centrally pivoted magnet mounted in line with the track. It can pivot in the vertical plane , the direction being dependant on the polarity of the track magnet which it is passing over.

The bell is of the circular, trembler type. The horn can be operated by vacuum or compressed air depending on the type of vehicle to which it is fitted. It produces a penetrating tone clearly distinguishable above the ambient noises in the driving cab.

In the driver's cab there is an acknowledgement/resetting plunger conveniently mounted on the driving console, and an indicator also on the console where it can be clearly seen by the driver. The diagram below shows an example of the indicator faceplate



The circular face of the indicator is black and has ten radial tapering slots. Behind the faceplate is a disc which is divided into twenty segments coloured alternately Yellow and Black.

The disc can be rotated magnetically through 18 degrees. When the equipment is in the running position an all-Black appearance is presented to the driver. If the disc has been rotated the all-Black indication changes to a striking pattern of alternate yellow and Black segments.

continued

INDICATIONS TO THE DRIVER

NORMAL

If the last signal passed was displaying a clear aspect, the AWS indicator will be all black.

APPROACHING A CLEAR SIGNAL

In this situation the electro-magnet will be energised during the period that the Green aspect is displayed. The train equipment will be activated as the receiver passes over the permanent magnet. The receiver will return to its normal position when it passes through the field created by the electro-magnet. As a result the bell will sound for one second, after which the equipment will again be quiescent.

APPROACHING A SIGNAL DISPLAYING ANY ASPECT OTHER THAN GREEN

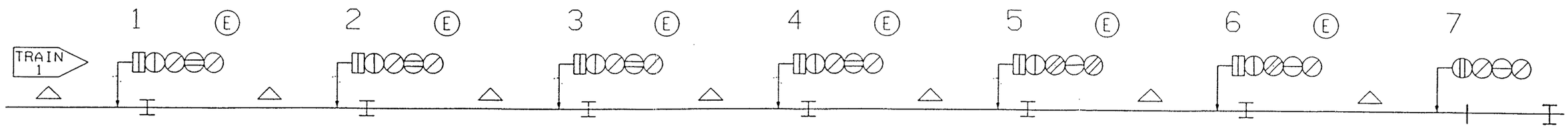
The permanent magnet will again activate the equipment on the train but due to the absence of any field from the electro-magnet, the receiver will not be restored and the horn will sound continuously until some action is taken by the driver. If the driver takes no action, a slow release relay in the apparatus case will de-energise and institute a brake application.

The degree to which the brakes are applied is pre-set so as to bring the train to a stand before it reaches the next signal displaying a stop aspect.

If after hearing the horn, the driver presses his resetting plunger, the brake application will be cancelled and the indicator will change to the Black-Yellow pattern. The driver now has the full responsibility for controlling his train as required by the signal aspects presented to him. When the next signal is reached the permanent magnet will restore the AWS indicator to the all Black and a bell indicator will be given if the signal is at Green. If the signal is at caution, a horn indication will be given and the indication will revert to Black-Yellow on acknowledgement.

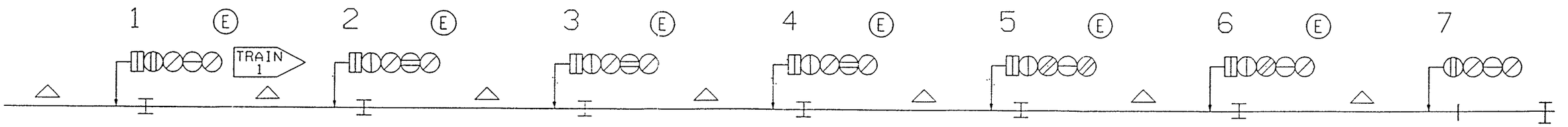
Figures 1a to 1g show what indications are given to the driver as he progress' through a series of automatic signals up to a controlled signal.

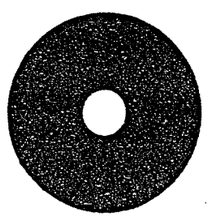
continued



BELL FOR 1 SEC.

FIGURE 1A.





BELL FOR 1 SEC.

FIGURE 1B.

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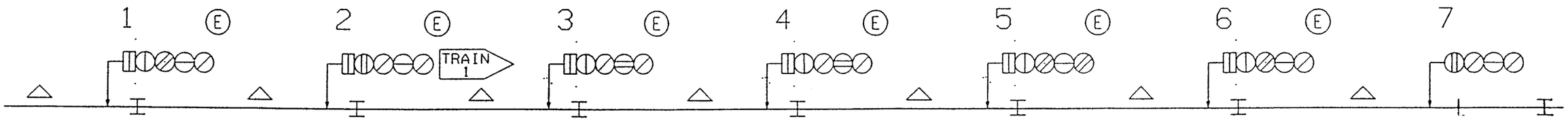
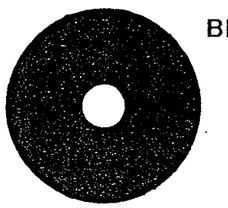
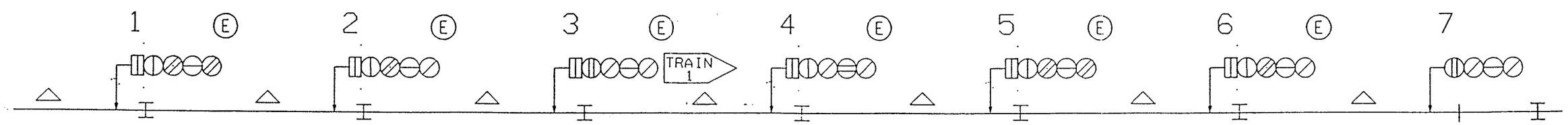


DRIVERS AWS CAB INDICATOR
FACEPLATE.

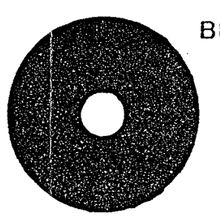


BELL FOR 1 SEC.

FIGURE 1C.



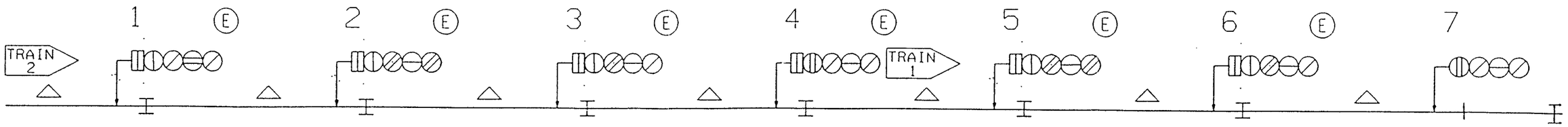
DRIVERS AWS CAB INDICATOR
FACEPLATE.



BELL FOR 1 SEC.

FIGURE 1D.

continued

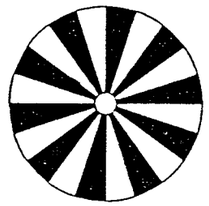


DRIVERS AWS CAB INDICATOR FACEPLATE

BELL FOR 1 SEC.

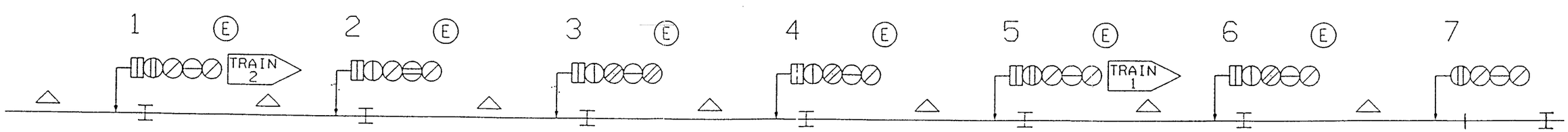
HORN AFTER 1 SEC IF THE DRIVER ACKNOWLEDGES THE INDICATION BY PRESSING HIS RESETTING PLUNGER THE BRAKE APPLICATION WILL BE CANCELLED AND THE INDICATOR WILL CHANGE TO THE BLACK-YELLOW PATTERN, AS SHOWN.

DRIVERS AWS CAB INDICATOR FACEPLATE.

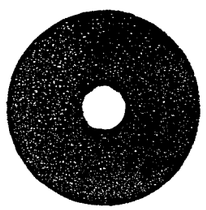


(IF THE DRIVER DOES NOT ACKNOWLEDGE THE CAUTION INDICATION, AFTER 4 SECS THE BRAKES ARE APPLIED. THE DEGREE TO WHICH THE BRAKES ARE APPLIED IS PRE-SET SO AS TO BRING THE TRAIN TO A STAND BEFORE IT REACHES THE NEXT SIGNAL DISPLAYING A STOP ASPECT. IN THIS CASE SIGNAL 7.)

FIGURE 1E.



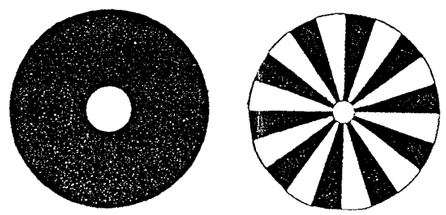
DRIVERS AWS CAB INDICATOR FACEPLATE



BELL FOR 1 SEC.

WHEN THE DRIVER REACHES THE PERMANENT MAGNET OF SIGNAL 6 IT RESTORES THE AWS INDICATOR IN THE DRIVERS CAB TO ALL BLACK.

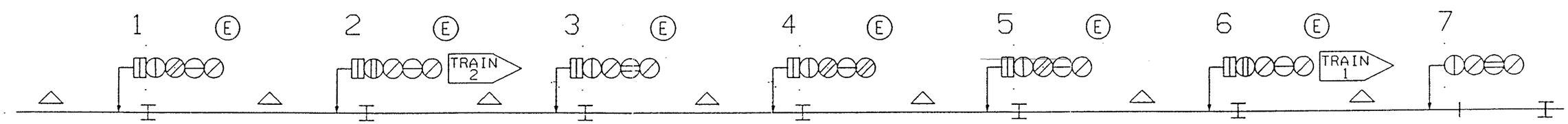
DRIVERS AWS CAB INDICATOR FACEPLATE.



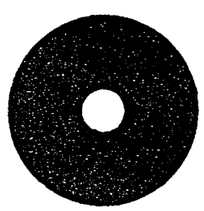
HORN AFTER 1 SEC IF THE DRIVER ACKNOWLEDGES THE INDICATION BY PRESSING HIS RESETTING PLUNGER THE BRAKE APPLICATION WILL BE CANCELLED AND THE INDICATOR WILL CHANGE TO THE BLACK-YELLOW PATTERN, AS SHOWN.

FIGURE 1F.

continued

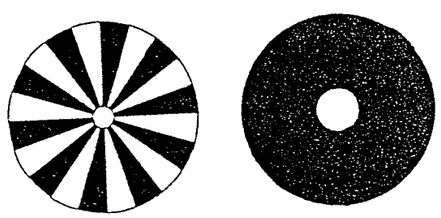


DRIVERS AWS CAB INDICATOR FACEPLATE.



BELL FOR 1 SEC.

DRIVERS AWS CAB INDICATOR FACEPLATE.



BELL FOR 1 SEC.
AS TRAIN 1 PASSED SIGNAL 6 THE SIGNALMAN HAD THE CORRECT CONDITIONS TO "PULL OFF" SIGNAL 7, AND IT HAS "COME OFF" TO DISPLAY A GREEN ASPECT.
WHEN THE DRIVER REACHES THE PERMANENT MAGNET OF SIGNAL 7 IT RESTORES THE AWS INDICATOR IN THE DRIVERS CAB TO ALL BLACK.

FIGURE 1G.

continued

PROVISION OF AWS

Lines to be equipped with AWS are those which meet the criteria set out in Appendix A of Standard Signalling Principle No. 43. The principles of positioning AWS magnets are fully covered in Signalling Principle No. 43 to which the trainee should refer to for further detailed information.

Two things are important at this stage for you to remember:-

> **"3. AWS track equipment is to be provided at every semaphore distant signal and every colour light signal capable of displaying a single or double yellow aspect.**
>
> **4. The standard position for track inductors will be within sighting distance of the signals to which they apply and normally 200 yards on the approach side of the signal."**

For further information on the AWS you should refer to the following documents:-

BR Standard Signalling Principle No. 43.

BR Rule Book Appendix No. 8.

Railway Signalling, Edited by O.S Nock.

Railway Control Systems, Edited by M. Leach.

General Instructions to Signal & Telecommunications Staff.

end