



**STANDARD
RAILROAD
SIGNALS**

PART ONE

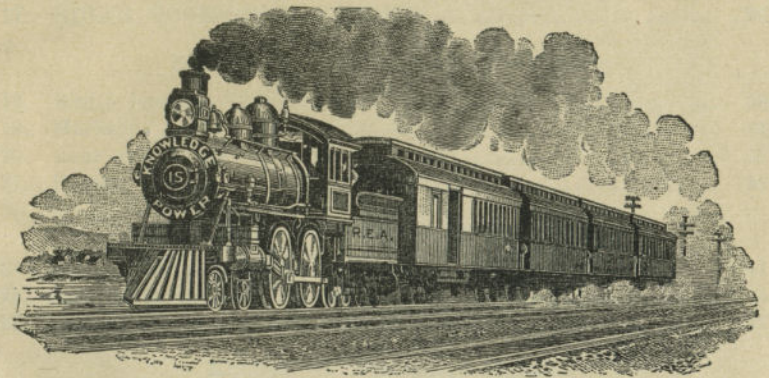
RAILWAY EDUCATIONAL ASSOCIATION

Standard Railroad Signals

Fireman's and Brakeman's
Preparatory Instruction

PART ONE

By GEORGE H. BAKER

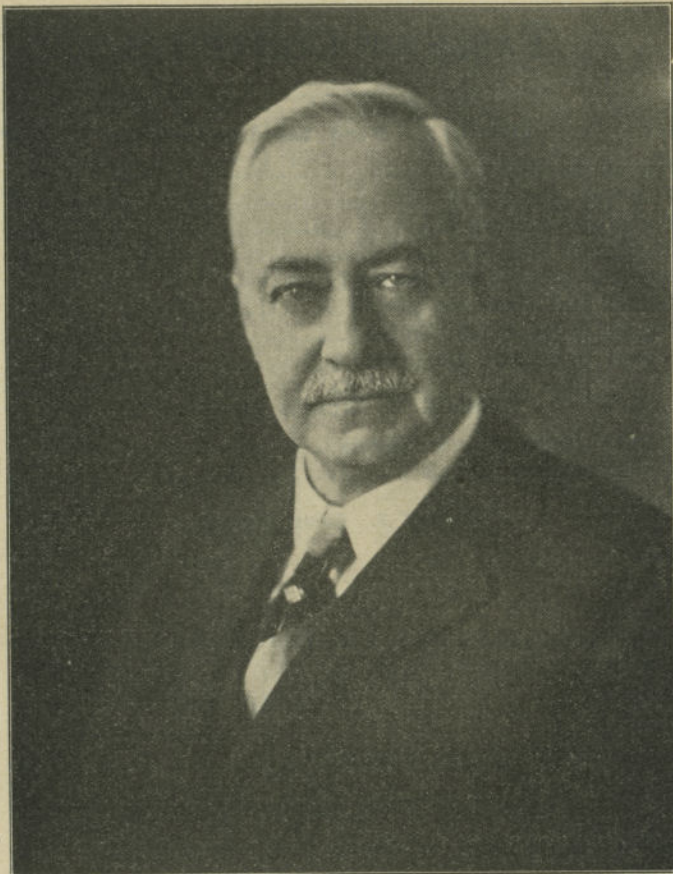


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STANDARD RAILROAD SIGNALS

LESSON 1.

HAND AND LAMP SIGNALS

Signal to Stop. Modified Stop Signal. Signal to Proceed.
Signal to Back. Modified Proceed and Back Signals.
Signal that Train Has Parted. Signal to Apply
Air Brakes. Signal to Release Air Brakes.

The signals described and illustrated herein are the principal signals used to govern the movements of engines and trains. Various other signals are, or may be, used for special purposes.

All signals must be made exactly in accordance with the Rules. Those carelessly made may not be understood, and accident and loss of life and destruction of property may result.

Employees whose duties may require them to give signals must provide themselves with the proper appliances, keep them in good order and always ready for immediate use.

Flags of the prescribed color must be used by day, and lamps of the prescribed color at night.

Night signals must be displayed from sunset to sunrise. When weather or other conditions obscure day signals, night signals must be used in addition.

Following are descriptions of the hand and lamp signals. They are illustrated as given with a lamp at night, but the hand or a flag moved in the same way in daylight gives the same signal:

STOP SIGNALS

1—Signal to Stop.

Because it works for safety, the signal to stop is most important. A flag, the hand or a lamp swung crosswise of the track—or across the track—is the regulation signal to STOP, as shown in Figure 1.

Any object waved violently by any one on or near the track is a signal to stop.

Also any signal imperfectly displayed, or the absence of a signal where one is usually shown, must be regarded as a stop signal.

In a conflict of signals, such as a signal to stop and another to proceed—preference must always be given the STOP signal.

2—Modified Stop Signal.

In switching, there are frequent starts and stops, and necessary variations of speed. As the cars being handled often obstruct the view of the engine-men, they must depend upon the signals of the men in charge of the car movements. So modifications of the stop signal are necessary.

The "steady" signal is given when an engine or cars are in motion, and means—a little slower—get speed under control. This signal is given by holding a lamp at night, or one or both arms in daylight—out straight from the shoulder sideways.

The "slower" signal is given by slight—short movements like the stop signal.

3—Signal to Proceed.

The hand or a lamp raised and lowered vertically—up and down—as shown in Figure 2, is the signal to PROCEED, or go-ahead—in the direction the engine is headed.

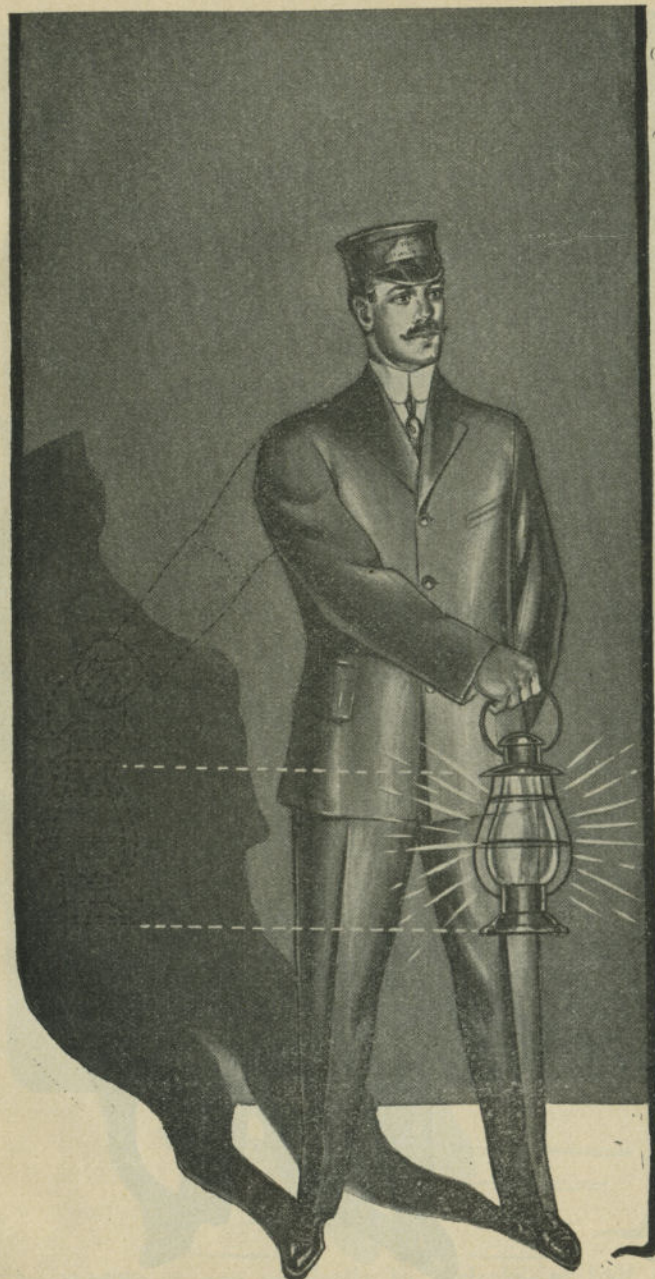


Fig. 1. STOP—Swung across the track.

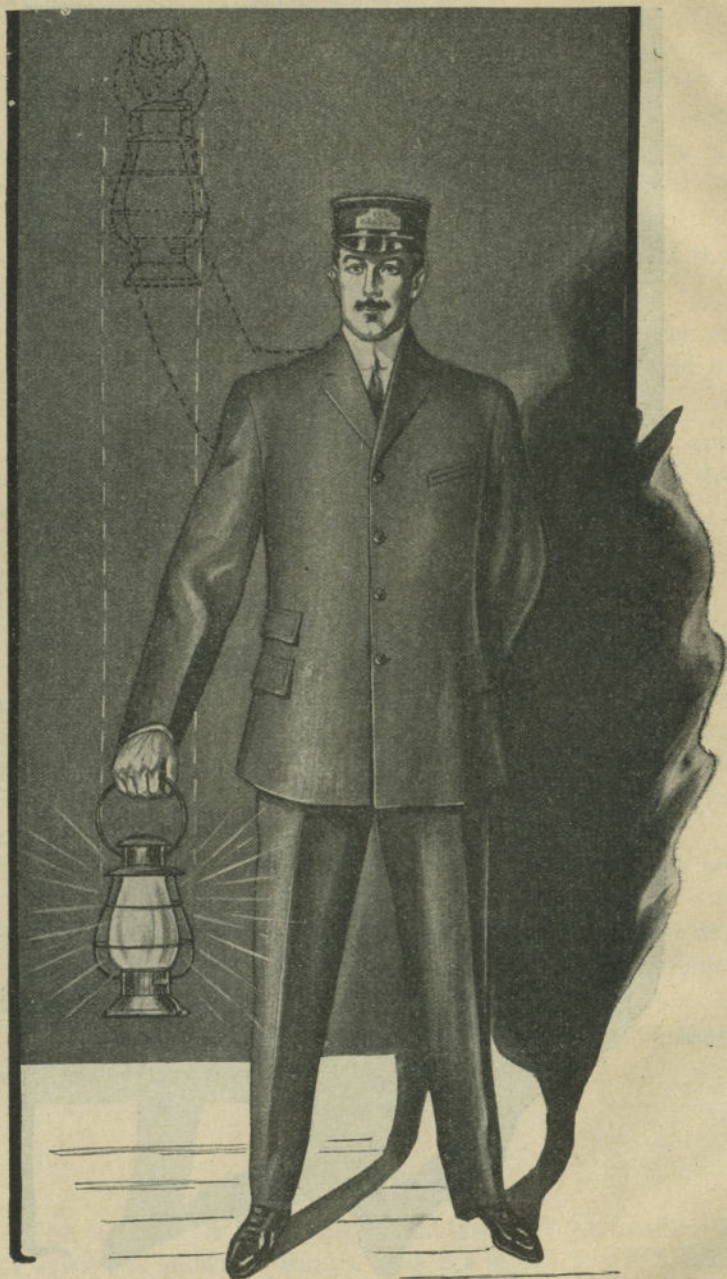


Fig. 2. PROCEED—Raised and lowered vertically



Fig. 3. BACK—Swung vertically in a circle—at half arm's length—when the train is standing or backing.

4—Signal to Back.

The hand or a lamp swung vertically—up and down—in a CIRCLE crosswise of the track—or across the track—when the train is standing or backing, is the signal to BACK, or back-up. See Figure 3.

Those who give signals to PROCEED and to BACK must always remember that these signals say practically these words to the enginemen. So it is very important in switching to bear in mind the DIRECTION in which the engine IS HEADED—and to give signals accordingly.

5—Modified Proceed and Back Signals.

In switching, and in some movements of trains controlled by hand and lamp signals—modifications of the proceed and back signals are also used as necessary. For instance—it would not do to give the engineer the full proceed signal if it is desired to move ahead a few inches or feet. A modified, or slight approximation to this signal is then given—a little go-ahead signal. This is interpreted on the engine as—"go-ahead a little"—or "a little ahead."

Likewise in signaling to back a short distance—probably gently to make a coupling—a similar modification of the back-up signal must be used. This is interpreted on the engine as "back-up a little"—or "a little back."

These hand and lamp signals really constitute a language by which those in charge of the car and train movements taking place can communicate full information and directions to each other, or to the enginemen. Through nearly a century of use this brief "language" has become capable of a wide range of expressions—nicely fitting the necessities of every ordinary occurrence and condition of train and switching work. To learn this "language" well, and use it always correctly, carefully and with good judgment, is one of the principal duties of every man in engine, train and switching service.

6—Signal that Train has Parted.

The hand or a lamp swung in a vertical circle—at full arm's length—across the track or top of train—while the train is running—is the signal that the train has parted, or broken-in-two—or more pieces. This signal is shown in Figure 4.

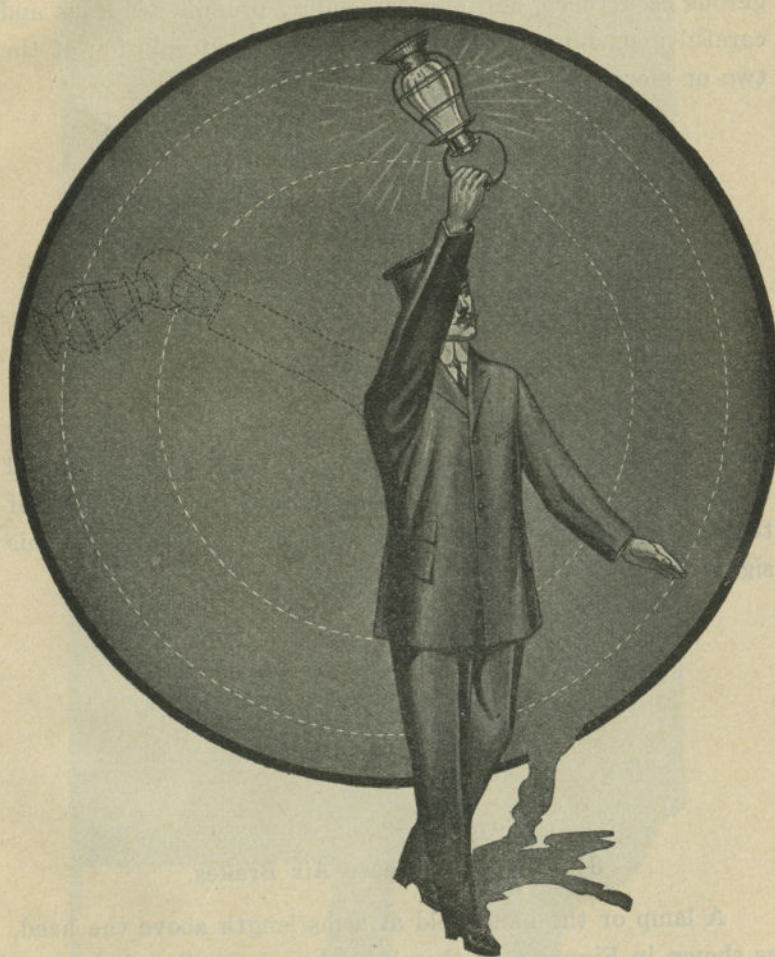


Fig. 4. TRAIN HAS PARTED—Swung vertically in a circle at arm's length across the track—when the train is running.

TRAIN HAS PARTED SIGNAL

This signal is similar to the BACK signal, Figure 3, only given on a much larger scale, and when the train is running. The signal is given for the information of all concerned—the enginemen and other trainmen—and should be given as soon as the break in the train is discovered. It announces a dangerous occurrence, and one demanding prompt, vigorous and careful management by all hands to prevent collision of the two or more parts of the train.

7—Signal to Apply Air Brakes.

A lamp or the hand swung from right to left above the head—horizontally—while the train is standing, is the signal to the enginemen to apply the air brakes for the purpose of testing them to see if they apply properly on each car. This signal is shown in Figure 5.

8—Signal to Release Air Brakes.

A lamp or the hand held at arms length above the head, as shown in Figure 6, is the signal to release the air brakes, after they have been applied in the test, to ascertain if they release properly.

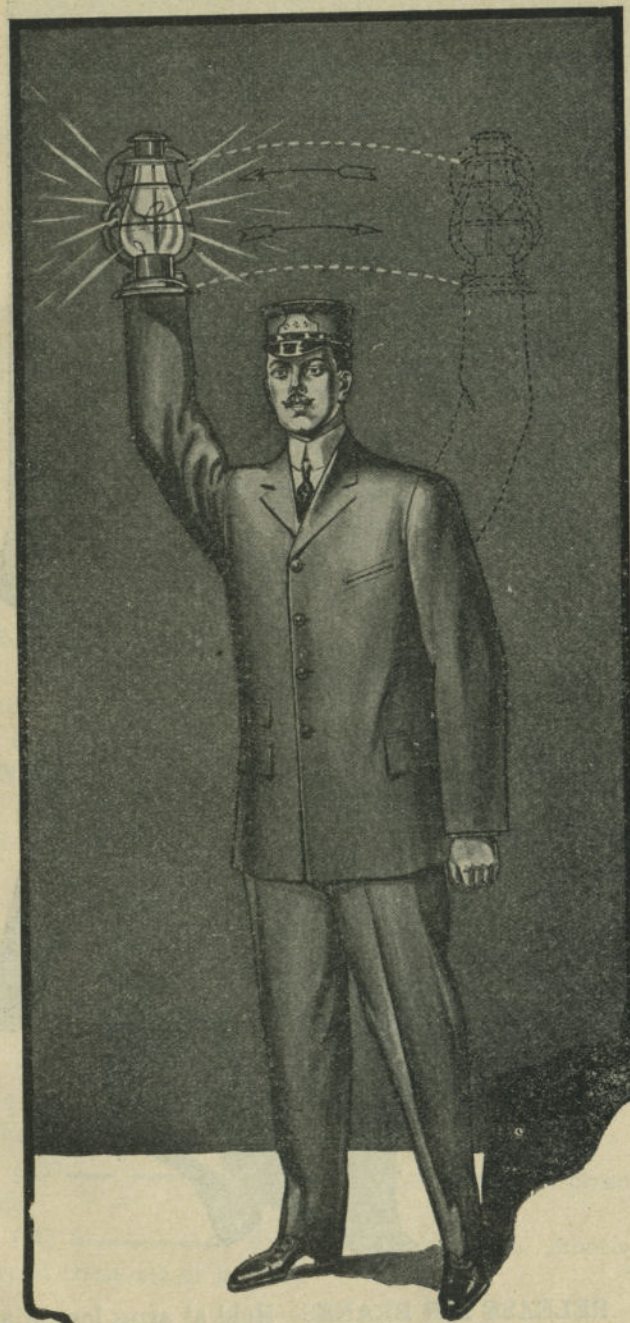


Fig. 5. APPLY AIR BRAKES—Swung horizontally above the head—when the train is standing.

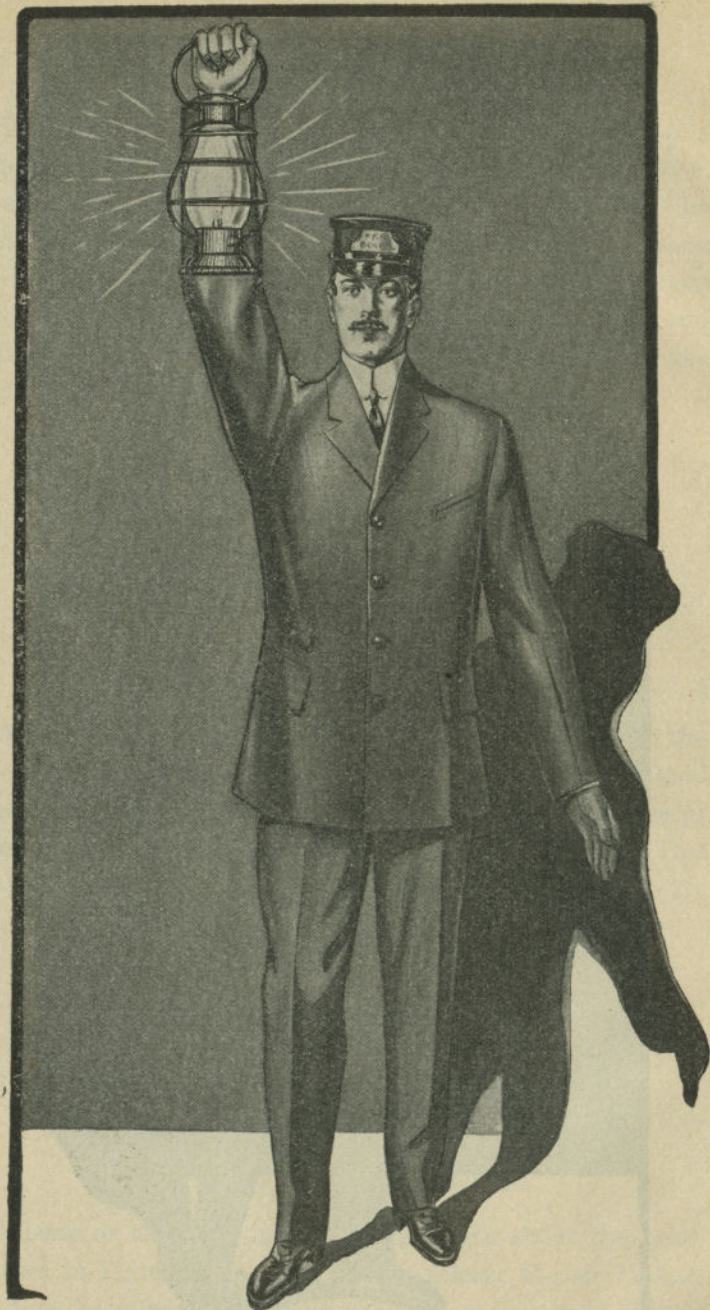


Fig. 6. RELEASE AIR BRAKES—Held at arms length above the head—when the train is standing.

LESSON 2.

WHISTLE SIGNALS.

Engine Whistle Signals. Communicating Signals.

9—Engine Steam Whistle Signals

Every locomotive is equipped with a whistle that may be sounded loudly as a notice of approach to stations and other stopping places, to sound a warning or alarm in case of danger, and to give and answer necessary signals.

The steam whistle signals authorized by the Rules are given below. Short blasts are shown by the character o. Long blasts which should sound for two seconds each, with one second intervals—are shown by dashes, thus—.

INDICATIONS

- (A) — stop. Apply brakes.
- (B) — — Release brakes.
- (C) — o o o Flagman go back and protect rear of train.
- (D) — — — — Flagman return from West or South.
- (E) — — — — — Flagman return from East or North.
- (F) — — — (when train is running.) Train has parted. Answer to hand or lamp signal that train has parted.
- (G) o o Answer to any signal not otherwise provided for.
- (H) o o o (when train is standing.) Back. Answer to signal to back.
- (J) o o o o CALL for signals.
- (K) — o o To call the attention of yard engines, extra trains, or trains of the same or inferior class or right—to SIGNALS displayed for a following section.
- (L) — — o o Approaching public road crossings at grade.
- (M) — — — — — Approaching stations, junctions and railroad crossings at grade.

- (O) ——— o Approaching meeting points,
 (O) o ——— Inspect air brake train line for leak.

A succession of short sounds of the whistle is an alarm for persons or cattle on the track.

Signal A—One Long Blast—STOP—APPLY BRAKES

This signal is a call for brakes, and when it is given its demand is to be complied with immediately, with alacrity, and without waiting to learn if brakes are necessary, or if the engineer's judgment is correct. Stop first, and find out afterward.

Signal B—Two Long Blasts—RELEASE BRAKES.

The definition is clear, but trainmen must exercise judgment in obeying this signal. If given when the train is running—they must consider the situation, the grade, and whether all brakes should be released or only a few. Certainly brakes should not be left set to "drag" a train up to a stopping place, or to force the unnecessary use of steam—and therefore waste of fuel—over ground that the train should run by its own momentum.

**Signal C—One Long Followed by Three Short Blasts
 —FLAGMAN GO BACK.**

This signal commands the flagman (rear brakeman) of a train to immediately and rapidly go back along the track with stop signals—red flag or lamp and torpedoes—a sufficient distance to surely protect his train from being run into by a following train.

But whenever a train needs protection—the flagman must promptly proceed to flag—and must not wait for orders from his conductor or this whistle signal from the engine. Many towns have ordinances which impose fines for sounding the whistle within their limits.

**Signal D—Four Long Blasts—FLAGMAN RETURN from
 WEST or SOUTH**

**Signal E—Five Long Blasts—FLAGMAN RETURN from
 EAST or NORTH**

Signal F—Three Long Blasts—TRAIN HAS PARTED

Given when running, it signals to the trainmen that the train has parted; and is to be repeated until it is answered by them with the regular train-parted signal, given by hand or lamp. Signal F is also the answer to the train-parted signal when this is given by trainmen.

Signal G—Two Short Blasts—ANSWER to Signals Generally

This signal is the acknowledgment given by engineers that they observe and understand any signal being given to them; except such signals as the Rules require shall be answered differently.

**Signal H—Three Short Blasts, Given when Train is Standing
 —BACK**

This signal may be a notice that the train is to be backed. If all is right for such a movement the signal should be answered by the trainman at the rear, with the regular hand or lamp signal to back. Or this whistle signal may be an answer to the trainman's signal to back, if such has been given.

Signal J—Four Short Blasts—CALL for Signals

This is an engineer's call for whatever signal is due to be given him, and it is to be answered by the man whose duty it is, under the circumstances, to give that signal—if it can then properly be given.

The call may be for a switch to be changed—and in this case the man who undertakes to comply with it must first set and secure the switch before he answers the call with any signal. Many derailments have been caused by neglect of this precaution—such as, by a hasty or careless switchman first signalling the engineer to proceed, and then failing in some way to get the switch set and secured before the engine was upon him.

Signal K—One Long Followed by Two Short Blasts—Calls

ATTENTION to SIGNALS DISPLAYED

for a Following Section

This signal is sounded by trains running on single track to notify all trains they meet or pass—of the same or inferior class, inferior right, or extras—that signals are displayed for a following section having the same timetable rights and schedule. When Signal K is sounded for this purpose it must be answered by Signal G (two short blasts) by the train so notified—otherwise the train displaying signals **MUST STOP** until this answer is given.

Trains running on double track use Signal K only when **PASSING** trains bound in the same direction.

Signal L—Two Long Followed by Two Short Blasts—

ROAD CROSSING WARNING

Sounded as a warning when approaching highway crossings at grade. It is required by the laws of all States, and is very necessary for the safety of the public.

Numerous fatal accidents on grade crossings prove the necessity of this warning signal. Many careless people, often engrossed in conversation and thoughtless of danger, drive automobiles and other vehicles onto railroad crossings right in front of rapidly approaching trains—with fatal consequences. The sounding of this signal should always be followed by ringing the engine's bell until the road crossing is passed.

Signal M—One Extra Long Blast—**STATION WHISTLE.**

Sounded as notice of the train's approach to stations, junctions and railroad crossings.

Signal N—Two Long Followed by One Short Blast.

This signal is used only on single track railroads—not on double track. It is sounded at least one mile before reaching a station at which the train must meet or wait for an opposite bound train. It is an engineer's notice to his conductor that he is aware of the necessary meeting

point, and that he will control the train accordingly. Should the engineer not sound this signal—the conductor must "take immediate action to stop the train"—to avoid the possibility of a collision.

Signal O—One Short and One Long Blast.

Engineer's signal to the train "crew"—conductor and brakemen—to search for a suspected leak of AIR in the pipes and couplings between the cars—called the "train line"—through which the compressed air passes for operating the air brakes.

10—Communicating Signals.

Each locomotive used in passenger train service is equipped with a small air whistle in the cab to enable the conductor to communicate signals to the engineer regarding desired movements of the train, and its operation.

These signals, as authorized, are described as follows:

SOUNDS.	INDICATIONS.
TWO.....	When the train is standing— START.
TWO.....	When train is running— STOP AT ONCE.
THREE	When train is standing— BACK.
THREE	When train is running— STOP AT NEXT STATION.
FOUR	When train is standing— APPLY or RELEASE AIR BRAKES.
FOUR.....	When train is running— REDUCE SPEED.
FIVE.....	When train is standing— CALL IN FLAGMAN.
FIVE.....	When train is running— INCREASE SPEED.

Any of these signals are to be answered by the engineer with Signal G (two short blasts); except the signals to back—stop at next station—or call in flagman—either of which must be answered by the proper signal in each case—H to back or stop at next station, and either D or E for flagman, according to the Rules.

LESSON 3.

COLOR SIGNALS.

Red. Yellow. Green. Blue. Purple. Green and White.
Use of Torpedoes. Use of Fusees.

In the code of COLOR signals used—each color has a permanent meaning or indication, whether stationary or in motion, and whether displayed as a flag in daylight, or as a light at night.

COLORS.	MEANINGS.
RED	DANGER—STOP
YELLOW	PROCEED WITH CAUTION
GREEN	CLEAR—PROCEED
GREEN and WHITE combined....	STATION FLAG—STOP
BLUE	DON'T MOVE CAR—WORKMEN UNDERNEATH
PURPLE	STOP—Night Indication for Dwarf Signals

11—Red.

RED is the DANGER color, and means STOP. It is used as a semaphore "HOME" signal to stop trains at railroad crossings, junctions, drawbridges and other dangerous places; also at telegraph stations to stop trains for orders.

Red flags by day and red lamps at night are used to flag and stop trains between stations to prevent collision, or because of some obstruction on or defect in the track.

12—Yellow.

YELLOW is the CAUTION color, and means to REDUCE SPEED and bring the train under control, ready to stop on short notice. It is used as a warning semaphore signal placed some distance (about half a mile) from a stop semaphore, and is called the "DISTANT" signal.

Yellow signals are also used by bridgemen and trackmen to warn approaching trains to run CAUTIOUSLY over bridges, and sections of the track which are in imperfect condition. Yellow signals are usually stationary.

13—Green.

GREEN is the SAFETY color, and means CLEAR—PROCEED. It is used as a light at night on semaphores at railroad crossings, junctions, drawbridges and other places—indicating PROCEED. It is used as a light at night telegraph offices to indicate no orders are awaiting trains; and as a switch light at night, showing that switches are set for the main track.

14—Green and White.

GREEN and WHITE combined, swung as a stop signal, is the station agent's signal to stop passenger trains at regular flag stations.

15—Blue.

BLUE is the signal to PROTECT WORKMEN who may be repairing a car or engine standing on tracks outside of shops. A blue flag by day, or a blue light at night, displayed at one or both ends of an engine, car or train, indicates that workmen are under or about it. When thus protected it must not be coupled to or moved.

Workmen will display the blue signals, and the same workmen are alone authorized to remove them. Other cars must not be placed on the same track so as to obstruct the view of the blue signals, without first notifying the workmen.

It is very important to faithfully observe this Rule, as loss of life may result from its disobedience.

15A—Purple

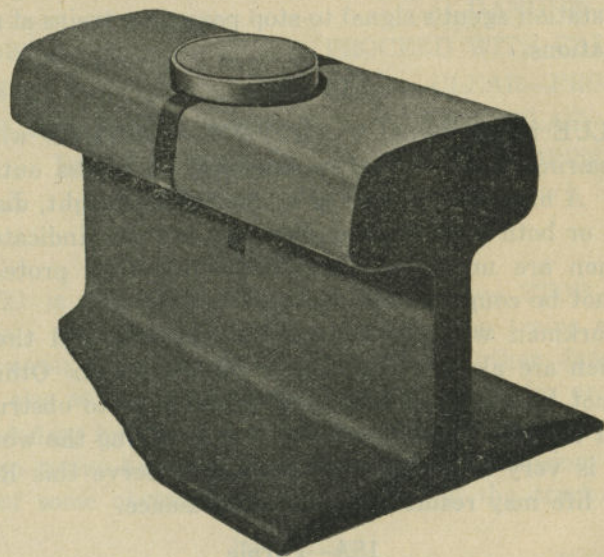
PURPLE is used to signal STOP on the small or "DWARF" semaphores which indicate the positions of switches in yards. See Subject 27.

16—Torpedoes.

TORPEDOES are used in connection with red flags or lamps in FLAGGING TRAINS to prevent collision or derailment. They are provided with soft metal clamps to attach them on top of rails, as shown in the accompanying illustration.

Brakemen, firemen and others who may have to flag trains must ALWAYS have several torpedoes attached to their red flags and lamps. They are to be used IN ADDITION to the regular red stop signal when necessary.

In all cases of flagging—TWO torpedoes must be placed on the rail on the engineer's side of the track. Their explosions are signals to the engineer to REDUCE SPEED and look out for danger or an obstruction ahead. The explosion of ONE torpedo gives the same signal—but the Rules require that TWO torpedoes shall be used.



A TORPEDO IN PLACE ON A RAIL.

To be Exploded when crushed by the wheel of a Locomotive.
If it is of metal—stand away from it to avoid injury
by flying pieces.

If a flagman is RECALLED by the whistle of his engine before the arrival of the train he was prepared to flag—he must leave the torpedoes on the rail, when for any reason it is best to give this CAUTION signal to the following train.

Torpedoes must not be placed near stations, or road crossings, where persons may be injured by flying pieces of shell when they explode—nor close in front of switches.

THE TORPEDO is a vitally important necessity in flagging. **TWO** should be clamped on the rail **AS A FIRST MOVE** in every case of flagging—especially at night, or in a fog, or in stormy weather. Flag or lamp signals appeal to an engineer's **VISION** and may not be seen sometimes—for various reasons—but the loud **EXPLOSION** of a **TORPEDO** under an engine **FORCEFULLY** appeals to the **HEARING** of both engineer and fireman and **INSURES** prompt action toward stopping the train.

17. RULES GOVERNING FIREMEN.

The Instructions in this Subject are for Firemen and
NOT for Brakemen Students.

When you are employed as a fireman you will be given the Book of Rules of the Railroad you go to work on. As soon as you get this book—study all the Rules—not only those relating to firemen—but also those relating to other employees and the safe movement of trains.

When you are called to go out on an engine you will sign your name and state the time in a book carried by the caller. Should you be asleep when you are called—don't trust yourself to take another nap, but get up at once and prepare to go on duty.

The Rules require that you shall always ring the engine's bell—when the engine is about to move in either direction, and while it is running through the limits of any yard, station or town, and on approaching all public road crossings.

Firemen on duty are under the direct supervision of their engineers. The engineer is the "Captain" of the engine and is responsible for its performance and the work of his fireman.

A fireman must report for duty (be on hand) at least 30 minutes before the time set for the departure of his train, and assist the engineer in any needed way in preparing the engine for its trip. It is very important that PROMPTNESS and DISPATCH govern a fireman's movements while getting his engine ready. A good railroad man is ALWAYS ON TIME.

A fireman must remain on duty until the end of the trip, unless properly relieved. He must examine the bulletin boards at terminals, which announce all special instructions; and provide himself with a copy of the Timetable in force. If a new Timetable is to take effect during the trip, he must provide himself with a copy. When his other duties permit he must keep a careful watch upon the track, and instantly warn the engineer of any obstruction or signals he sees.

When approaching and leaving a station he must observe the "MARKERS" or green flags or lamps on the rear car of the train, and watch for signals from trainmen or station employees. When a train is running and rounding a curve to the LEFT, the fireman should look back along the train for the MARKERS and to see if all is right with the train.

In the absence of the engineer the fireman will have charge of the engine, and must not permit any unauthorized person to be upon it. It is the duty of the engineer to handle the engine at all times, but the fireman may do so with the permission of and in the presence of the engineer, who will be responsible for the proper handling of the engine.

Flagging Trains.

A Fireman may sometimes have to act as a flagman in cases of delays or accidents. Then, on the engineer's order, he must go forward IN ADVANCE of his engine and train, with a red flag by day, or a red and white lantern at night—always with THREE TORPEDOES attached to either his flag handle or his red lantern—to signal and warn any approaching train to STOP and avoid a collision. This is a

rare but a very important duty for which you must always be prepared.

A fireman must see that he has always three torpedoes clamped to the handle of his red flag; and that the flag is where he can get it quickly. Also, while running after dark, he must have (where it cannot be seen by passing trains), a red lamp burning brightly with three torpedoes attached to its wire guard, ready for IMMEDIATE USE.

The Rule of every Railroad describing the duties of flagmen is always No. 99 in its Book of Rules. This Rule varies on different roads—but it is always No. 99. Make yourself familiar with it as soon as you are employed—and if an occasion arises wherein you must act as a flagman, remember that the safety of many lives and thousands of dollars worth of railroad property depend in that emergency upon your promptness and faithfulness in the discharge of this important duty.

LESSON 4.

COLOR SIGNALS—Continued.

White Leading Lights. Markers. Rear Red Lights. The Use of Fusees.

18—White Leading Lights.

A white light must be displayed at night on the front of every engine, train or car in motion.

Engines in switching or other service, where they run backward as much as forward, are provided with front and rear headlights. When a yard engine has no rear headlight—it must then display two white lights on the rear of the tender.

A road engine running backward at night—having no rear headlight—must display one white light on the rear of the tender, as shown in Fig. 7.

On a passenger car, or train, being pushed by an engine at night, a man with a white light must be stationed on the front of the leading car, as shown in Fig. 8.

On a freight car, or train, being pushed by an engine at night, a man with a white light must be stationed on the front of the leading car, as shown in Fig. 9.

When a train on single track takes a siding to meet an opposite bound train, its headlight must be **covered or concealed** when the train is fully in on the siding, or **IN TO CLEAR** the main track. All locomotives in road service are provided with means for **concealing** their headlights.

The headlight must not be concealed before the train is **in to clear**, nor when there are more trains at the meeting point than the siding will hold.

The engineer of an oncoming opposite bound train, seeing a headlight on the siding, will consider it an indication that the train, or trains are not yet in to clear, and will govern his train accordingly.

The headlight must be concealed on trains waiting to meet trains at junctions, or at the end of a double track.

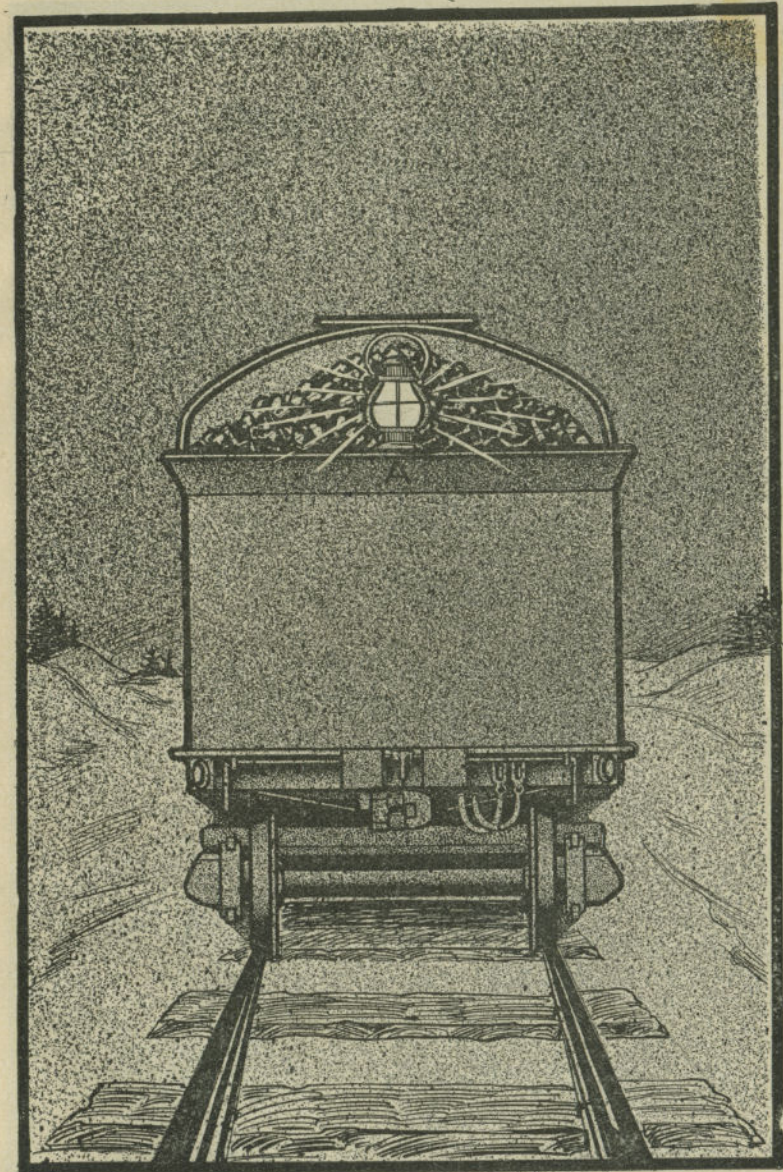


Fig. 7. ENGINE RUNNING BACKWARD AT NIGHT—without cars, or at the front of a train pulling cars. White light at A.

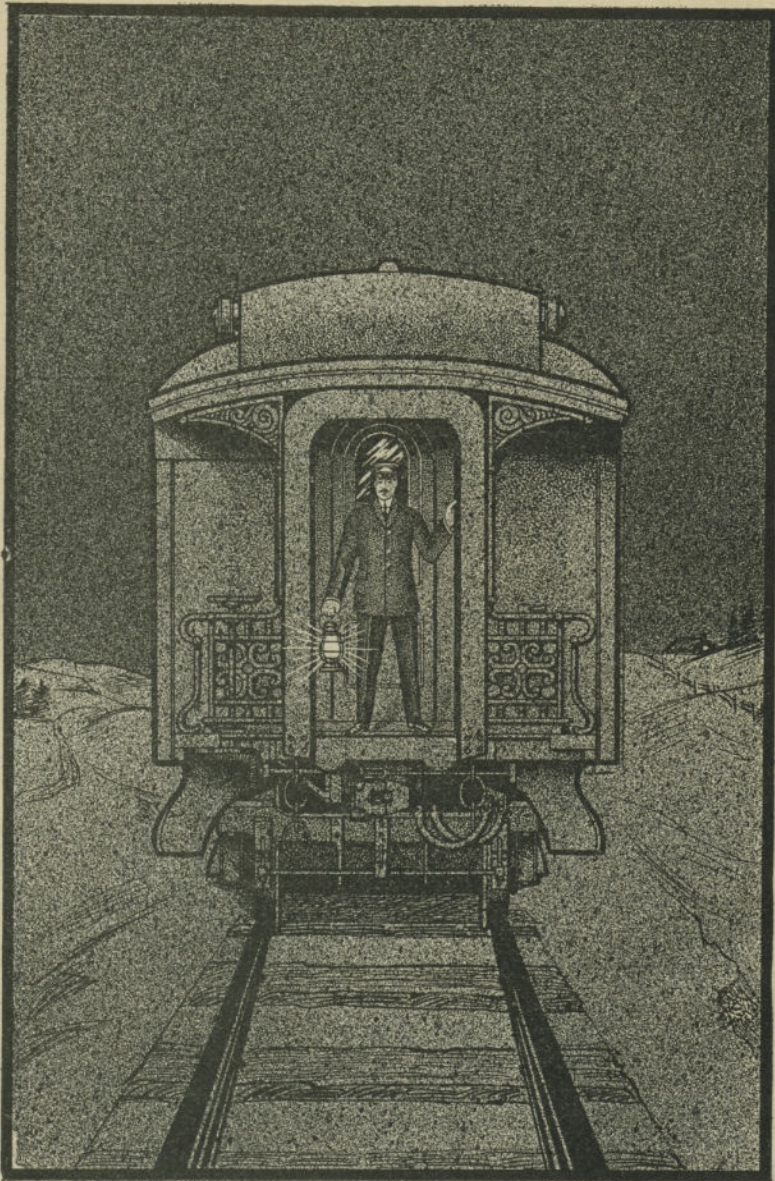


Fig. 8. PASSENGER CARS BEING PUSHED by an engine
AT NIGHT.
White light on front of leading car.

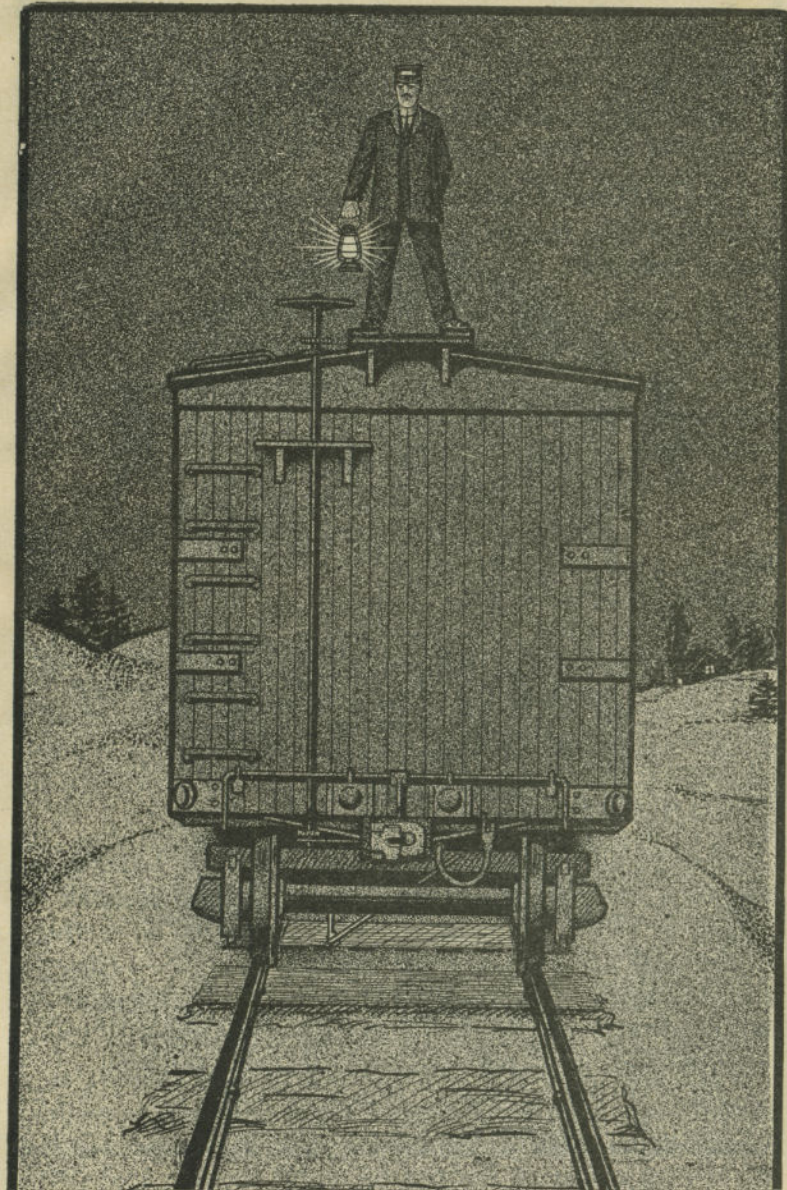


Fig. 9. FREIGHT CARS BEING PUSHED by an engine AT NIGHT.
White light on front of leading car.

19—Markers.

Two green flags displayed by day, and two green lights at night—one on each side of the rear car of a train—mark the rear of the train, and are called "MARKERS."

The authorized definition of a train is: An engine, or more than one engine coupled, with or without cars, displaying markers.

An engine running alone, and displaying markers, is considered as much a train as if it had fifty cars between the tender and the markers. Fig. 10 shows the position of markers on the rear of the tender of an engine running forward by day without cars; or when the engine is at the rear of a train pushing cars.

Fig. 11 shows the position of these signals on the rear car of a train by day. Green lights must occupy the same positions at night on either the rear of the tender, or the rear of the last car.

Markers serve the double purpose of showing to the enginemen while running that the train is intact, or altogether; and also of showing to others, who may need to know, that when the MARKERS pass—THE LAST CAR OF THE TRAIN HAS PASSED.

For instance, while running, the engineer and fireman look back along the side of the train to see if it is all together, as they frequently should—but seeing no markers, or seeing them at a great distance they may know that the train is parted—(has become uncoupled or broken apart)—and be governed accordingly.

Again a train on a siding awaits another it must meet at that station. The expected train comes, with everything appearing all right on the head end, but in passing NO MARKERS appear on the last car—thus showing that ONLY A PART of the train has passed, and that the detached part is left behind somewhere.

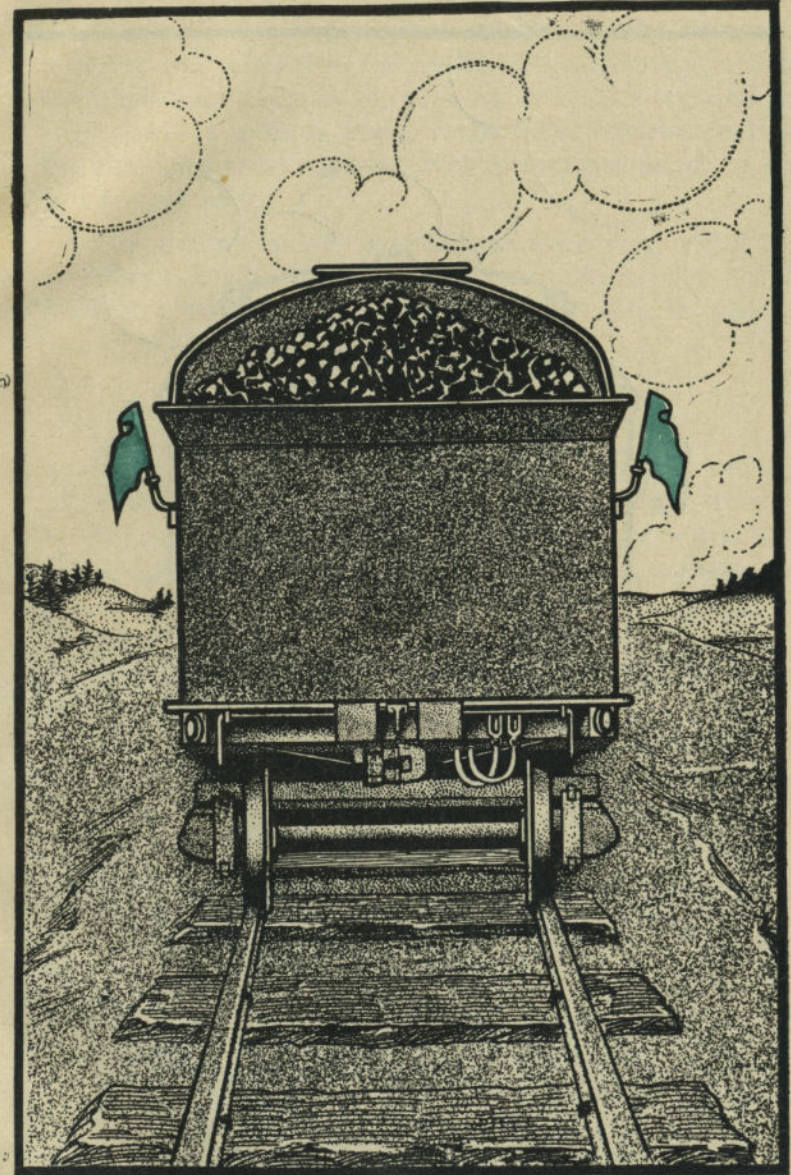


Fig. 10. ENGINE RUNNING FORWARD BY DAY—without cars, or at the rear of a train pushing Cars.
Green flags, as Markers.

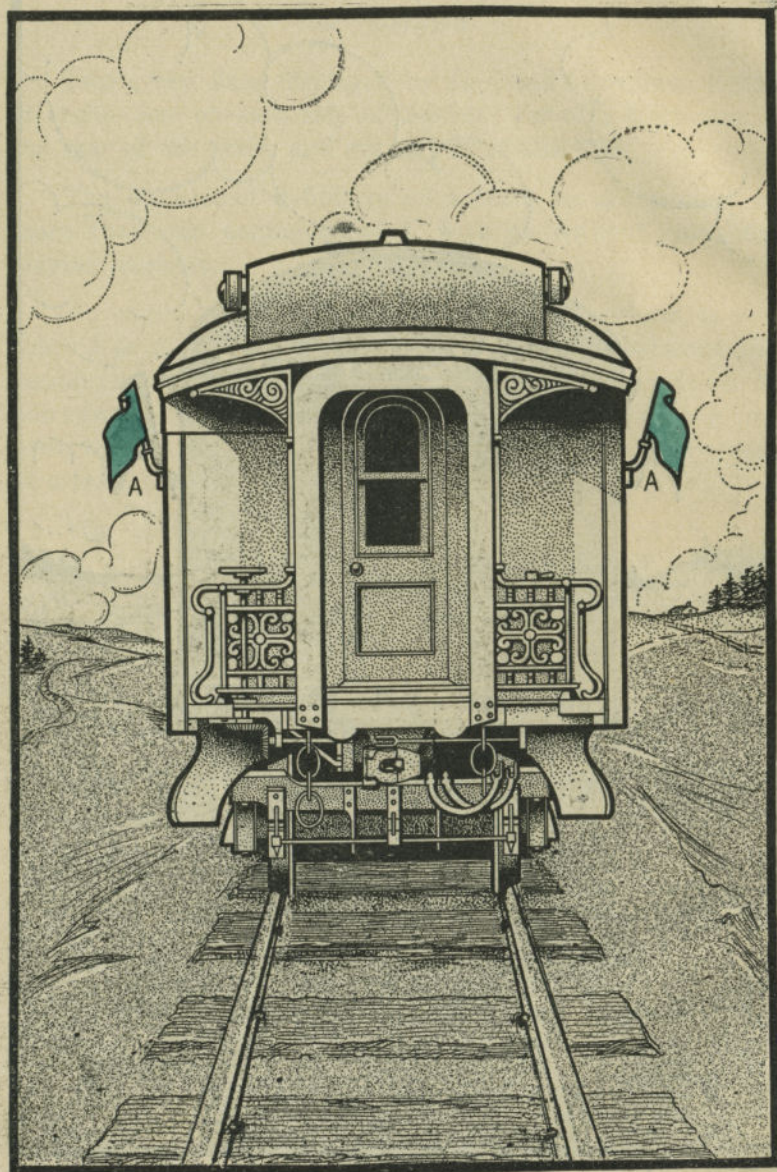


Fig. 11 REAR OF TRAIN BY DAY.
Green flags at A A, as Markers.

Should the crew of the train waiting on the siding fail to notice this ABSENCE OF MARKERS and, supposing that the whole train had passed—proceed with their train on the main track—a collision might result. The detached part of the uncoupled train might be rapidly approaching, or be run into further along.

The markers on the rear of trains are very useful and important signals; and every man in train service should SCHOOL himself to be ALWAYS on the lookout for them—both on his own and other trains.

20—Rear Red Lights.

Each train running after sunset must display two red lights at the rear, visible only from the rear of the train.

Lamps are used for this purpose, each having ONE RED and THREE GREEN lenses, and these produce both the required red lights, and the green marker lights. They are illustrated in position in Fig. 12, as on an engine running forward at night without cars; and again in Fig. 13, as on the rear car of a train running forward at night.

RED being always a danger signal, the purpose of these rear red lights is to signal DANGER to any train following in the rear at night. In the darkness they indicate the location and position of the train.

These lights are displayed in this way on each train at night except when it enters a siding to meet or be passed by another train. In this case, when the train is fully in to clear the main track, the rear lamps are TURNED so they will show green to the front, side and rear; and the red light is concealed, as shown in Fig. 14.

Passenger trains display at night a third red light in the center of the platform of the rear car—a large red “bull’s eye”—and freight trains a similar red light in the cupola of the caboose. These “bull’s eyes” are concealed when the train takes a side track to meet or be passed by another train.

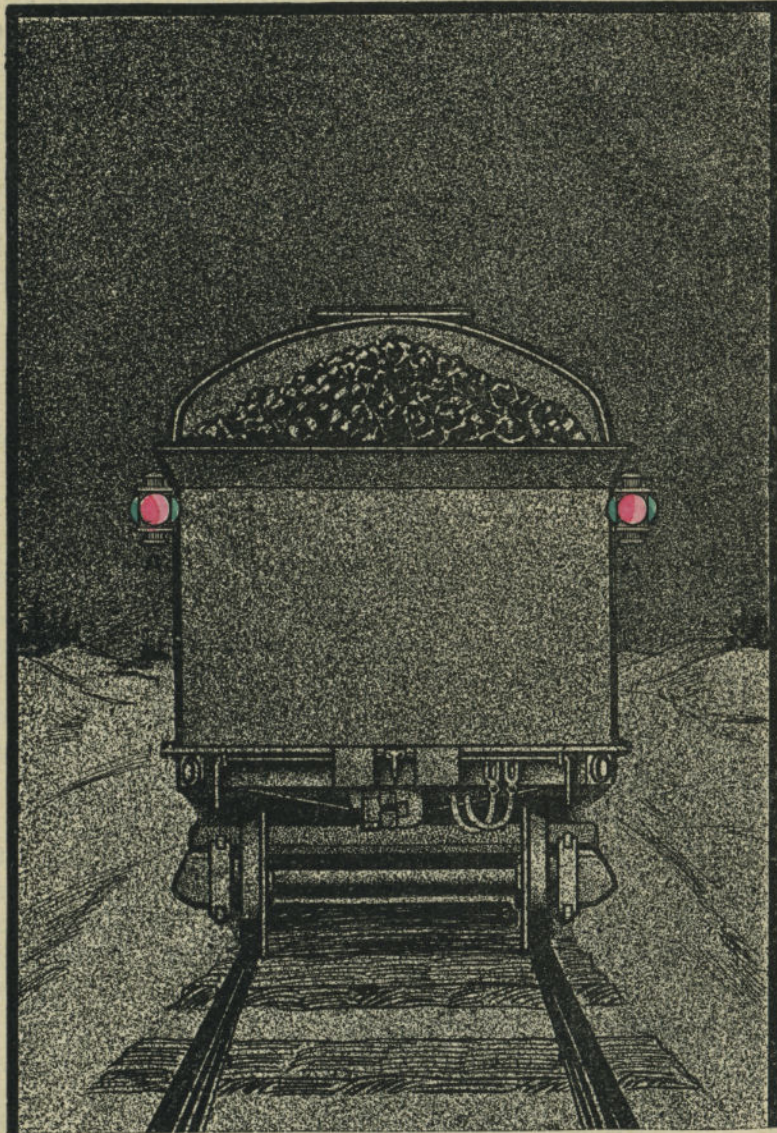


Fig. 12. ENGINE RUNNING FORWARD AT NIGHT—without cars, or at the rear of a train pushing cars. Lights at A A, as Markers, showing GREEN to the front and side, and RED to the rear.



Fig. 13. REAR OF A TRAIN AT NIGHT WHILE RUNNING. Lights at A A, as Markers, showing GREEN toward the engine, and side, and RED to the rear.

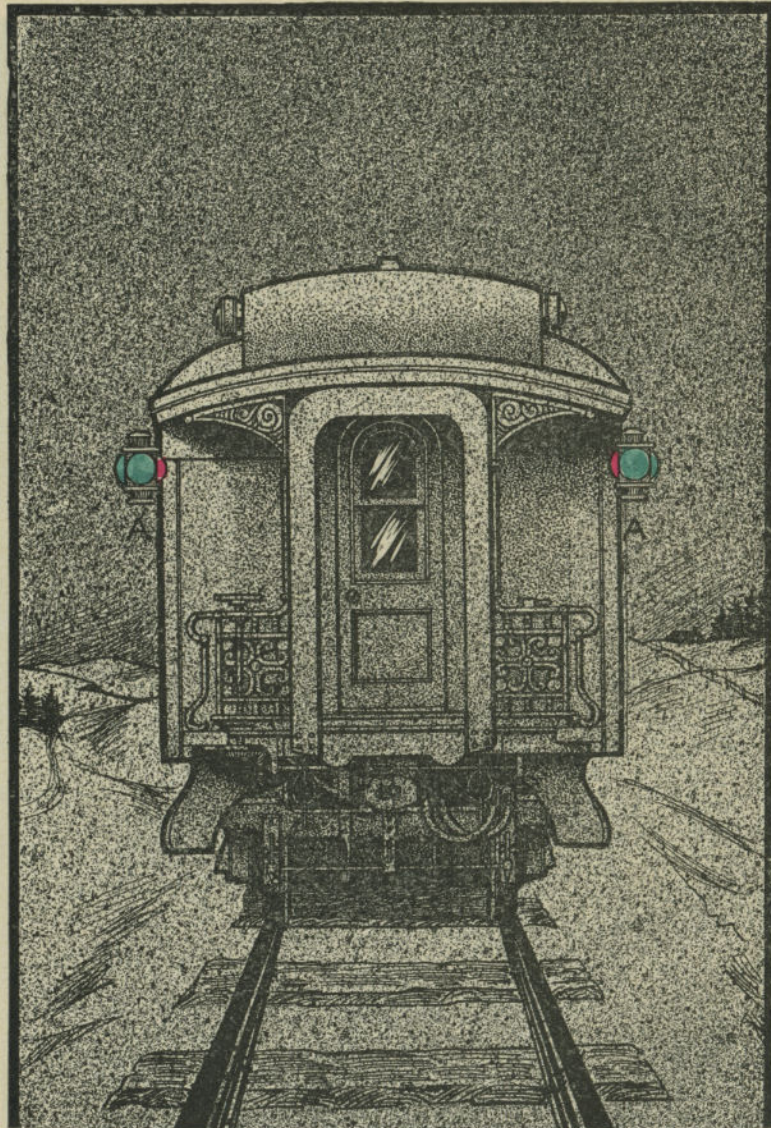


Fig. 14. REAR OF A TRAIN AT NIGHT—when on a siding to be met or passed by another train.
Lights at A A, as Markers, showing GREEN toward the engine, the side and to the rear.

21—Fusees.

FUSEES are an extra danger signal to be lighted and placed on or near the track by day or night, in cases where their use is a necessary precaution. Some burn with a RED flame to give a DANGER signal; and some burn with a YELLOW flame to give a CAUTION signal. They are placed on the track, lighted, by the flagmen of trains that are delayed by slow running or unusual stops, to warn any following train. They burn from 10 to 20 minutes. A fusee burning RED must not be passed until burnt out; but one burning YELLOW may be passed, with the train proceeding CAUTIOUSLY.



A FUSEE



RED FUSEE IN ACTION

Note the sharp spike on the base. This holds the fusee erect when stuck in a tie. To light a fusee use the lighting cap on the top. Never light one at the caboose stove or the engine furnace. Hold it near the base, and point the top or lighting end away from you.



FUSEE PROTECTING A SLOW RUNNING TRAIN

NEVER plant fusees burning yellow between the rails, but always OUTSIDE the rails so they shall be of the least possible danger to cars passing over them that may be loaded with explosive or inflammable substances. Keep torpedoes and fusees in a cool, dry place, never near heat. Do not throw them around, or let them chafe among tools in train or tender boxes.

LESSON 5.

COLOR SIGNALS ON LOCOMOTIVES.

Signals for a Following Section. Signals to indicate an Extra.
Signals on Locomotives Running Backward.

21A—Signals for a Following Section

A code of colored flag and lamp signals of the utmost importance is provided for display on the fronts of locomotives to announce important conditions.

A regular train is:—A train represented on the time table. It may consist of sections.

That is, when there are more cars to go on any train than it is proper for local or other reasons to include in one train—then two or more trains are run—SEPARATELY—as SECTIONS of the same train; each having the same rights and time table schedule.

A SECTION is:—One of two or more trains running on the same schedule, displaying signals, or for which signals are displayed.

Signals for a following section consist of two green flags by day; and, in addition, two green lights at night, carried in the places provided for them on the front of the engine, as shown in Figs. 15 and 16.

These signals must be displayed by the engines of each section of the train, except the last. These are the signals to which the attention of trains of the same or inferior class, or right, must be called by whistle-signal K; and answered by whistle-signal G.

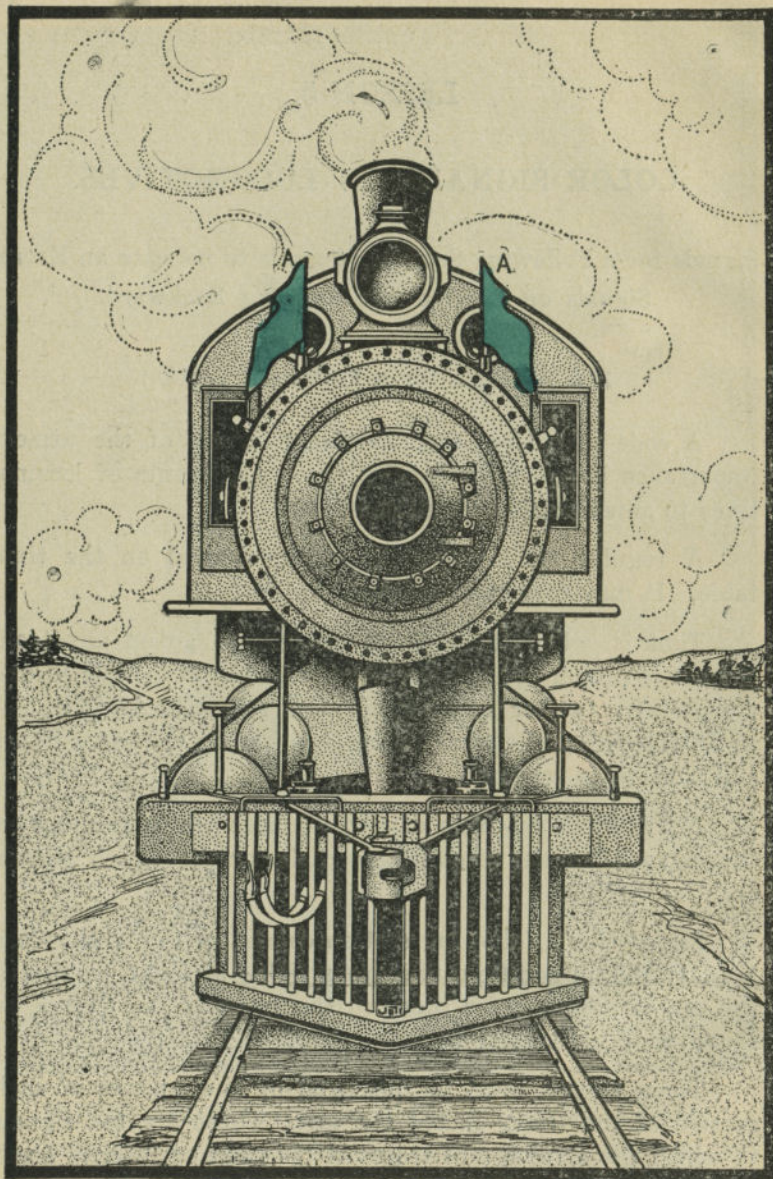


Fig. 15. ENGINE RUNNING FORWARD BY DAY—DISPLAYING SIGNALS for a following section.
Green flags at A. A.

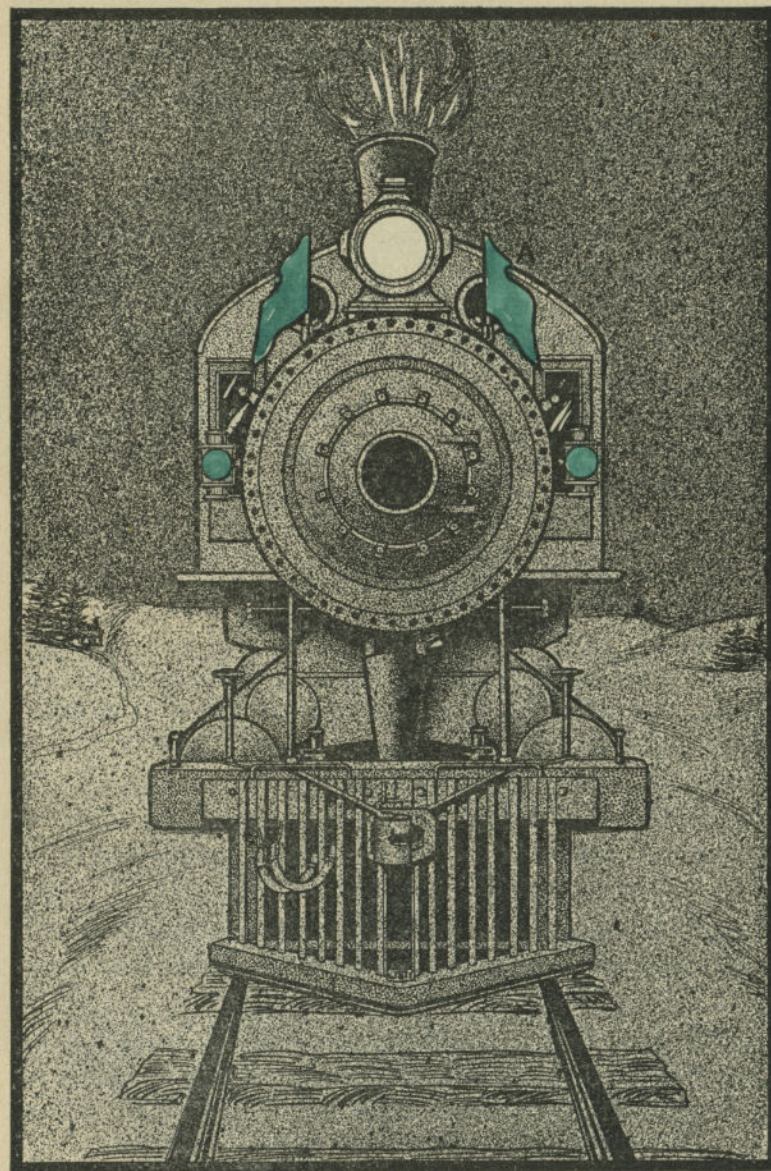


Fig. 16. ENGINE RUNNING FORWARD AT NIGHT—DISPLAYING SIGNALS for a following section.
Green lights and green flags at A. A.

The vital importance of these green signals can be understood when it is known that they announce that the train displaying them is only A PART of the whole train—that there is another PART or SECTION of the train coming, and having the SAME RIGHTS TO THE ROAD.

Should these signals not be noticed by the crew of a train having inferior rights, and should this train then proceed on the main track without authority against the oncoming section of the superior train—all the conditions tending toward a head-end collision would be in operation.

This is why the Rules require that whistle signal K, calling attention to these signals, shall be acknowledged—or the train displaying them MUST STOP until the signal K is acknowledged.

22—Signals to Indicate an Extra.

Necessity often requires that trains shall be run which have no time table schedule. Such a train is called an EXTRA, and its right to run is conferred by special train orders.

To declare its character, an extra train must display two white flags by day, and in addition, two white lights at night, in the places provided for them on the front of the engine as shown in Figs. 17 and 18.

This is necessary in order that other trains shall not mistake the extra for some regular train which they must meet.

ONE green signal, instead of two displayed for a following section, or ONE white signal instead of two displayed to denote an extra, will indicate the same as the two proper signals; but the proper display of all signals is required.

When two engines are coupled to a train—BOTH engines will display green signals for a following section—or white signals denoting an extra.

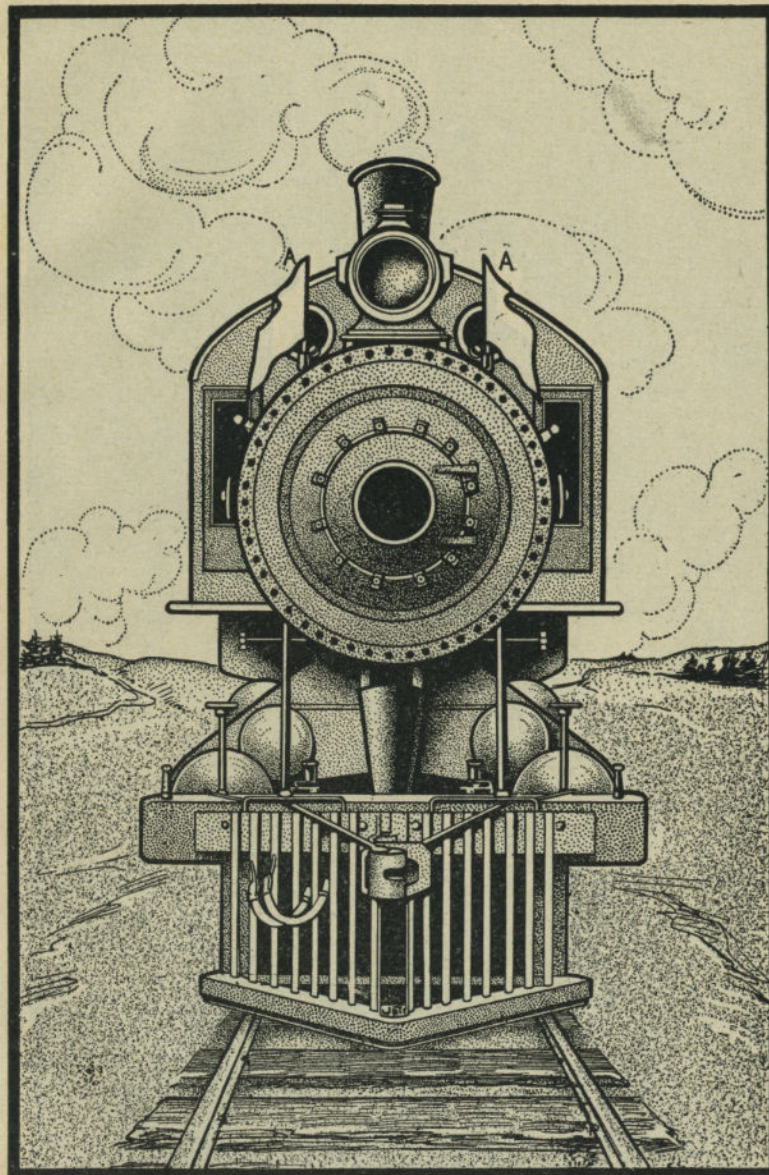


Fig. 17. ENGINE RUNNING FORWARD BY DAY—as an EXTRA TRAIN.
White flags at A A.

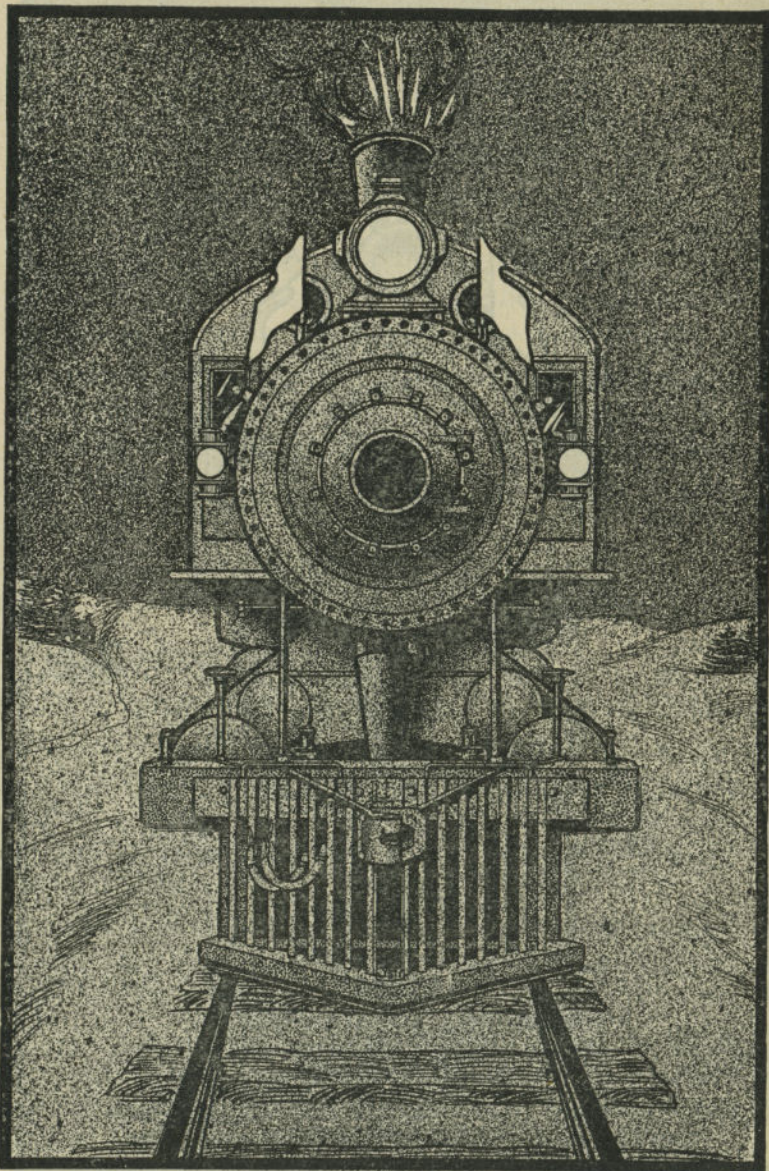


Fig. 18. ENGINE RUNNING FORWARD AT NIGHT—as an
EXTRA TRAIN.

White lights and white flags at A A.

23—Signals on Locomotives Running Backward.

It is sometimes necessary for engines to run backward, either without cars—or at the rear of a train PUSHING cars. In all such cases they must display regulation green flags by day and green lights at night as markers, and rear red lights at night, to indicate their location to following trains—in the SAME WAY as these signals are displayed on the rear car of every train.

In these cases it is considered that the front of the backing engine has become the rear of the train; and therefore regular rear signals must be displayed on it with as little change as possible.

Fig. 19 shows the proper display of white signal flags and green markers on an engine running backward by day, as an extra train without cars, or at the rear of an extra train, pushing it.

Fig. 20 shows an engine running in the same way at night, properly displaying white signal flags and lights; also green marker lights, and rear red lights.

Fig. 21 shows the proper display of green signals for a following train, and green markers, on an engine running backward by day without cars, or at the rear of a train, pushing it.

Fig. 22 shows an engine running in the same way at night, and properly displaying green signal flags and lights, for a following section—and green marker lights and red rear lights.

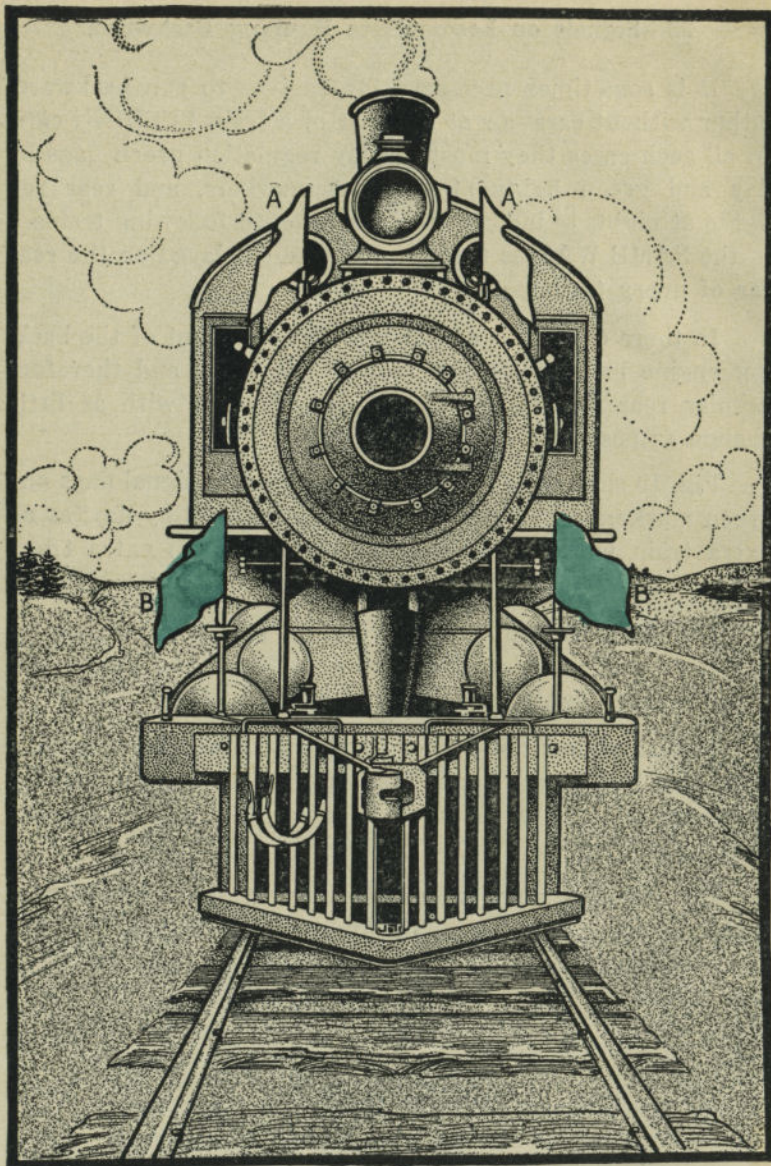


Fig. 19. ENGINE RUNNING BACKWARD BY DAY—as an EXTRA TRAIN—without cars, or at the rear of a train pushing cars.

White flags at A A. Green flags at B B, as Markers.

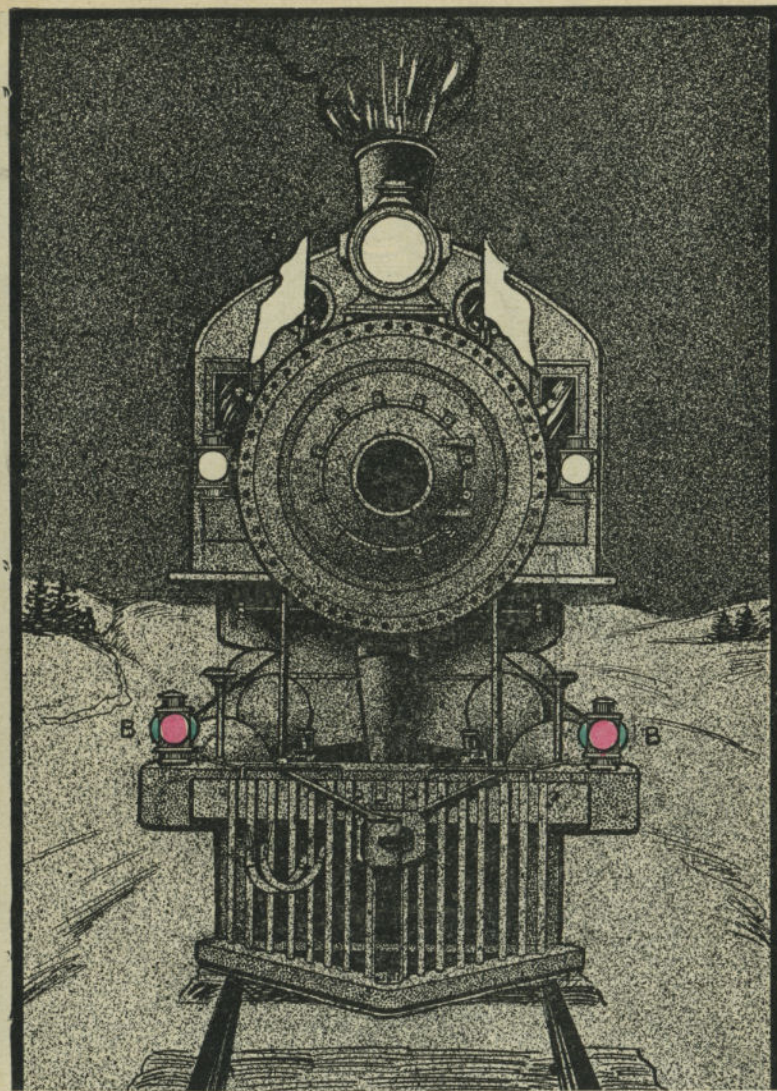


Fig. 20. ENGINE RUNNING BACKWARD AT NIGHT—as an EXTRA TRAIN—without cars, or at the rear of a train pushing cars.

White lights and white flags at A A. Lights at B B, as Markers, showing GREEN at the side and in direction engine is moving, and RED in opposite direction.

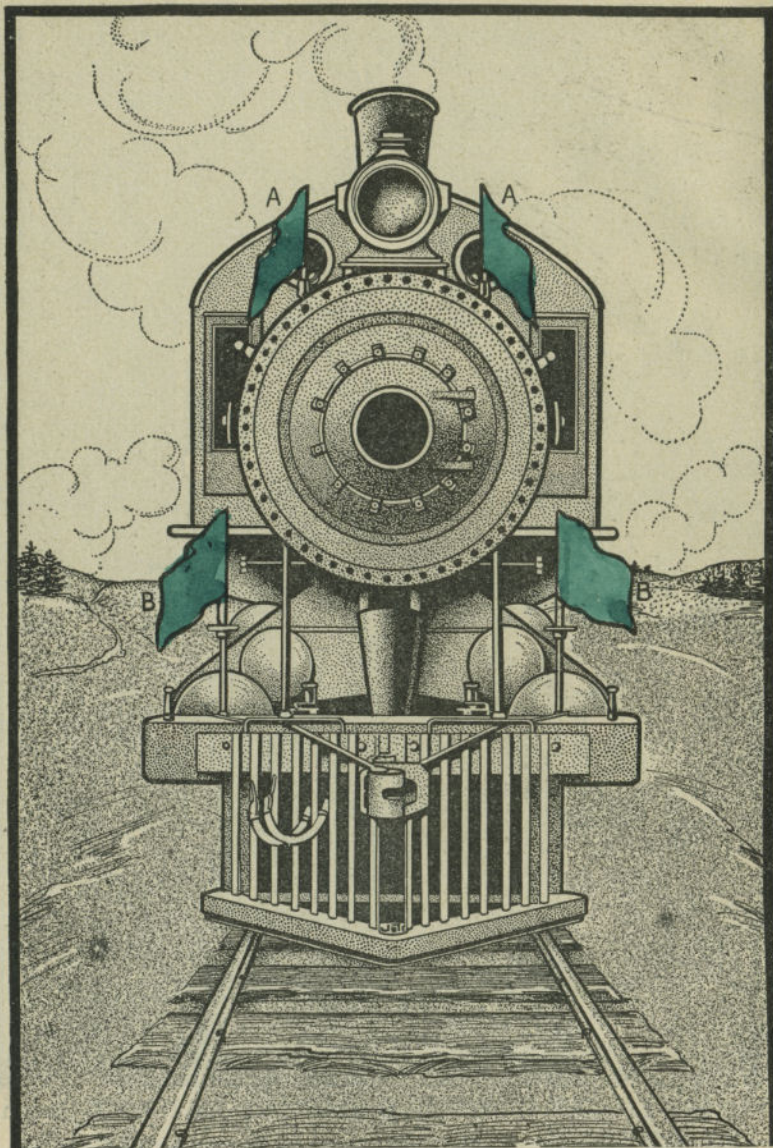


Fig. 21. ENGINE RUNNING BACKWARD BY DAY—without cars or at the rear of a train pushing cars, and—
DISPLAYING SIGNALS for a following section. —
Green flags at A A. Green flags at B B, as Markers.

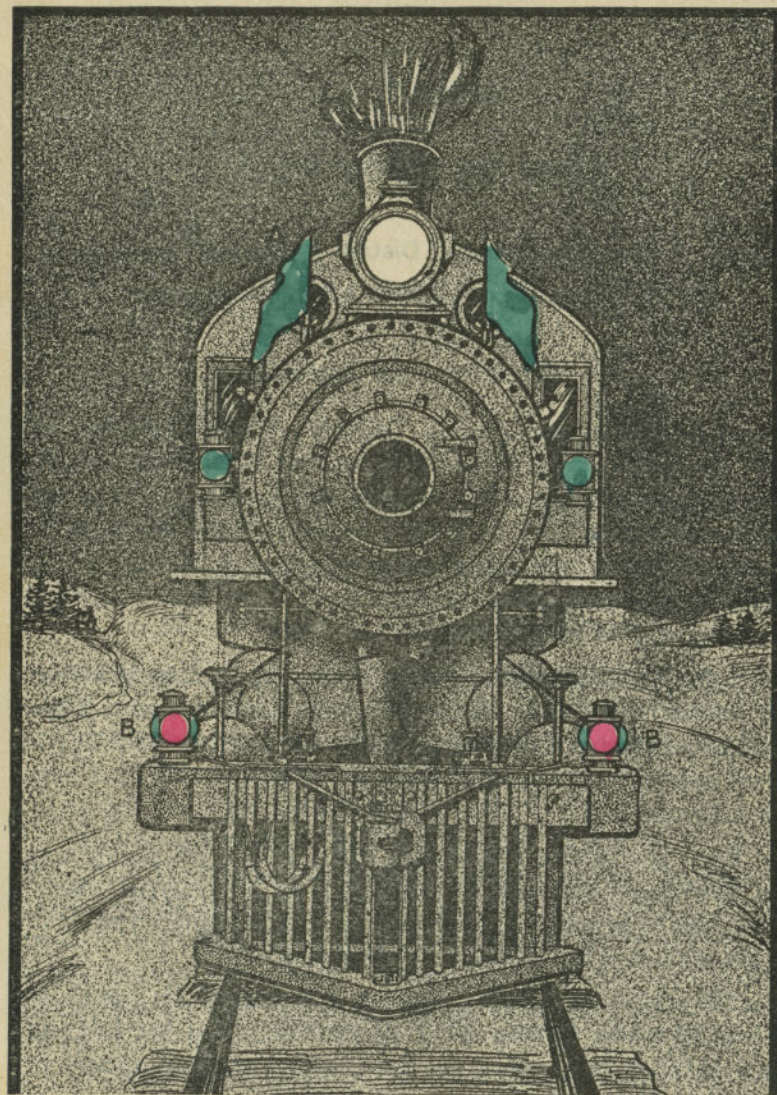


Fig. 22. ENGINE RUNNING BACKWARD AT NIGHT—without cars or at the rear of a train pushing cars—and DISPLAYING SIGNALS for a following section. Green lights and green flags at A A. Lights at B B, as markers, showing green at side and in direction engine is moving, and red in opposite direction.

LESSON 6.

SEMAPHORE SIGNALS.

"Home" or Stop Semaphores. Distant or Caution Semaphores.
Dwarf Semaphores. Train Order Semaphores.

24—"Home" or Stop Semaphores.

Large semaphores—called "HOME" signals—mounted on high masts and with their arms painted RED—are used to govern the movements of trains in approaching and passing dangerous places, such as draw bridges, railroad crossings at grade, junctions, and other places where it is necessary for trains to approach and pass with their speed under control, ready to stop if required.

A home semaphore is placed at the top of a mast standing at the RIGHT side of the track, its arm extending horizontally—outward and away from the track to signal STOP to an approaching train, as shown in Fig. 23. The red arm has a square end.

Each semaphore is provided with a lamp at night, and the mechanism operates so that when an arm signals stop—a red lens is brought to cover the lamp and show a red light in the direction the signal is to show, Fig. 23.

The extended arm by day, or a red light at night, requires all trains to stop AT THE SIGNAL—and not proceed until the arm is dropped to the inclined position shown in Fig. 24—which is the signal to PROCEED.

This semaphore is a STOP signal, and its position is at or near the dangerous place that it protects. When the arm is lowered as in Fig. 24, the lamp is uncovered by the red lens, and shows at night a green light to proceed.

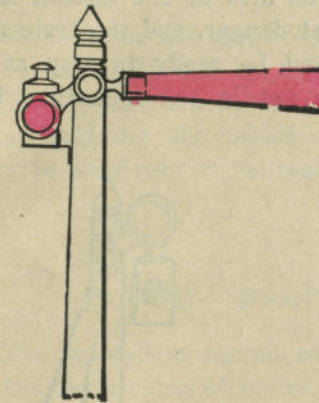


Fig. 23. STOP.

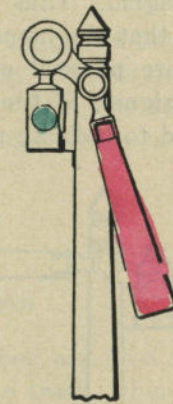


Fig. 24. PROCEED.

HOME SEMAPHORE SIGNAL.

25—"Distant" or Caution Semaphores.

To give fast running trains additional warning, and TIME to prepare for stopping at the home signal, another semaphore equally large and high is usually placed about half a mile from the home signal in the direction from which trains governed by the signal approach.

This is called the "DISTANT" signal, and it is shown in Fig. 25. The arm of the distant signal is painted the caution color—YELLOW; and is forked at the end. When it is extended, as in Fig. 25, it signals PROCEED WITH CAUTION to an approaching train. Seeing it the engineer slackens speed—passes this signal and prepares to stop at the home signal.

At night an attachment to the extended arm of the distant signal covers the lamp with a yellow lens, so that it shows the yellow caution light. When the arm is down, as in Fig. 26, the signal is to proceed. At night the lamp is then uncovered by the yellow lens, and shows a green light to proceed.

The distant signal is an indication of the position of the home signal. Thus the extended arm of the distant signal means that the home signal is at danger, and the train must therefore proceed cautiously and be ready to stop at the home signal, if the latter has not in the meantime been lowered to indicate proceed.

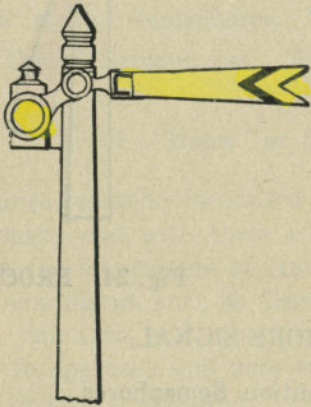


Fig. 25. CAUTION.



Fig. 26. PROCEED.

DISTANT SEMAPHORE SIGNAL.

On the other hand, the inclined position of the arm of the distant signal means that the arm of the home signal is also lowered. The distant signal is therefore a preliminary signal to notify an engineer of the condition of the home signal before he reaches it.

Where semaphore arms governing trains moving in opposite directions are mounted on the same post, the one on the right hand side of the post as viewed from an approaching train governs that train.

26—"Blocks," and Block Signals.

On many railroads some sections of track, a mile or more in length—in running trains over which SPECIAL CARE is necessary to avoid accident or collision—are called "BLOCKS,"

and are protected at each end by semaphore signals. Such signals when so used are also called "BLOCK" signals.

By this practice generally NO TWO trains are permitted in the same BLOCK at the same time. One train must PASS OUT before another even similarly bound is admitted—thus avoiding the possibility of collisions—the most destructive accidents on railroads.

27—"Dwarf" Semaphores

The semaphore signals so far described are used to control the movements of trains on the main track, where large and high signals are necessary to give proper warning to trains at considerable distances away, so they may have TIME AND SPACE to enable them to stop.

Other semaphores are needed to guide trains during movements about stations and yards. As such movements are slow—small and low semaphores are sufficient.

Such small signals are called "DWARF" semaphores, and are shown in Figs. 28 and 29. The meanings of the positions of their arms by day are the same as the larger semaphores—but at night the color of the light each shows to signal STOP—is PURPLE instead of red.

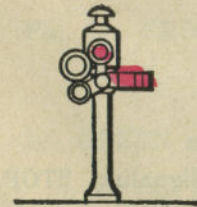


Fig. 28. STOP.

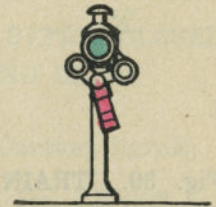


Fig. 29. PROCEED.

DWARF SEMAPHORES.

28—Train Order Semaphores.

A train-order semaphore is shown in Fig. 30. It is displayed at telegraph offices to stop trains for orders awaiting them; or to "block" them until preceding trains have passed beyond the station a certain number of minutes, or passed the next telegraph station, as the Rules may require.

As this semaphore is a stop and danger signal, its two arms are painted red. They are both attached to the same mast, but on opposite sides, and they extend in opposite directions, so as to signal opposite bound trains independently.

Thus the arm extending to the RIGHT of the mast, as seen from an approaching train, is a signal for that train. The arm is no signal for a train coming from the opposite direction.

In Fig. 31, the arm facing the reader indicates PROCEED, but the opposite arm, indicated by dotted lines, is shown in position to signal STOP to a train coming from the opposite direction.

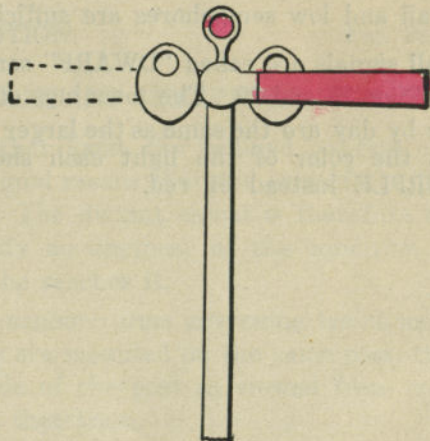


Fig. 30. TRAIN ORDER SEMAPHORE—Signaling STOP.

When a train-order signal is displayed at a telegraph station as shown in the manner described—no train bound in the direction the signal governs may pass that station with-

out a train-order, or a "clearance card"—stating that there are no orders for that particular train, and naming the train for which orders are waiting.

These semaphores also have lamps at night to indicate the positions of their arms. When the semaphore signals STOP at night, a red lens covers the lamp and shows a red light. Likewise if there are no orders, and the signal indicates PROCEED—a green light is shown, Fig. 31.

Should the train-order semaphore at a night telegraph office show neither a green nor a red light, then any passing train must STOP and ascertain the cause of the signal's absence.

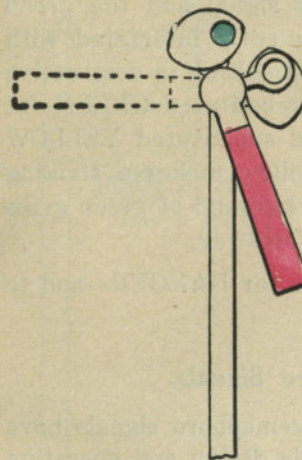


Fig. 31. PROCEED.

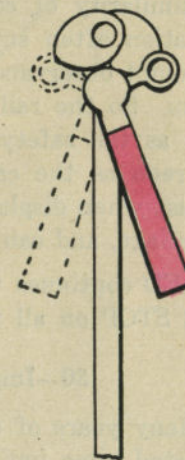


Fig. 32. OFFICE CLOSED
—NO LIGHT.

29—GREEN as Safety and YELLOW as Caution Signals.

In all the signals we have studied so far, GREEN has indicated SAFETY, and YELLOW—CAUTION. Because nearly all large railroads use these colors for these indications we have considered them exclusively up to now.

Formerly all railroads used **WHITE** for safety and **GREEN** for caution. But many objections were found to the use of white as a safety signal, because white lights are so common about towns and stations at night that sometimes lights that were not signals at all were mistaken for safety signals.

So most of the larger railroads have adopted **GREEN** as their safety signal—because green, being an uncommon light at night, is easily distinguished from other lights that are not signals.

Also there is this other objection to green as a caution signal: In Summer it was usually displayed by trackmen close to the green grass and green foliage of bushes and trees. The similarity of color between this signal and the green vegetation often surrounding it frequently interfered with its prompt observance by engineers—resulting in destructive wrecks. So the railroads that have substituted **GREEN** for white as the safety signal, have also substituted **YELLOW** for green as the caution signal. Yellow makes a striking contrast when displayed against a background of green grass and foliage, and can be plainly seen far away.

RED continues the standard color for **DANGER**—and to signal **STOP** on all railroads.

30—Improved Semaphore Signals.

Many years of experience with semaphore signals have suggested some improvements in their design and operation—and these are shown in the following illustrations. In all the semaphores so far described and shown in this Lesson—the **LOWERED** arm signals—**PROCEED**. The objection to this arrangement is that a **BREAK** in the mechanism that lifts the arm to the **EXTENDED** position—to signal **STOP** or **CAUTION**—might let the arm **FALL** to the **LOWERED** position and signal **SAFETY**—**PROCEED**.

To avoid accidents from this defect the latest improved signals now in use on most of the larger railroads are so constructed that their arms are lifted to the **ERECT** po-

sition to signal **CLEAR**—and **PROCEED**. In case of any break or failure in the mechanism controlling one of these semaphores—the arm would **FALL** by gravity to the **EXTENDED** position—and signal **STOP**—or **CAUTION**—accordingly as it may be a “home” or “distant” semaphore.

Also each of these semaphores provides **THREE** positions for its arms—the **ERECT** position to indicate **PROCEED**—the upper **MIDWAY** position to indicate **CAUTION**—

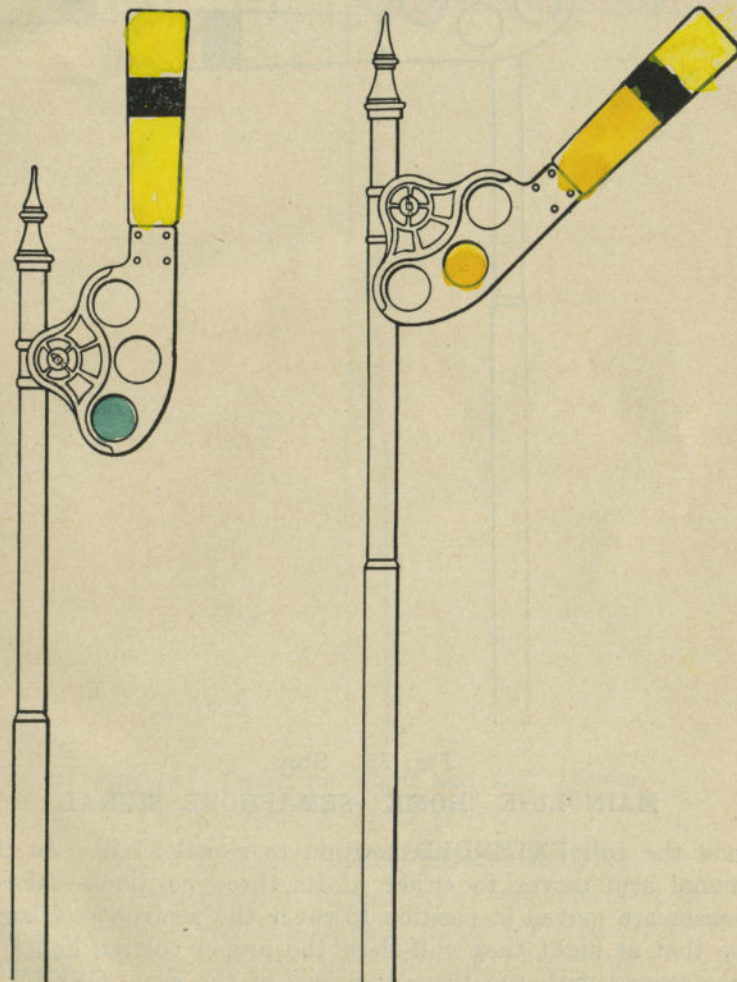


Fig. 33. Clear—Proceed. Fig. 34. Proceed with Caution.

MAIN LINE SEMAPHORE SIGNALS.

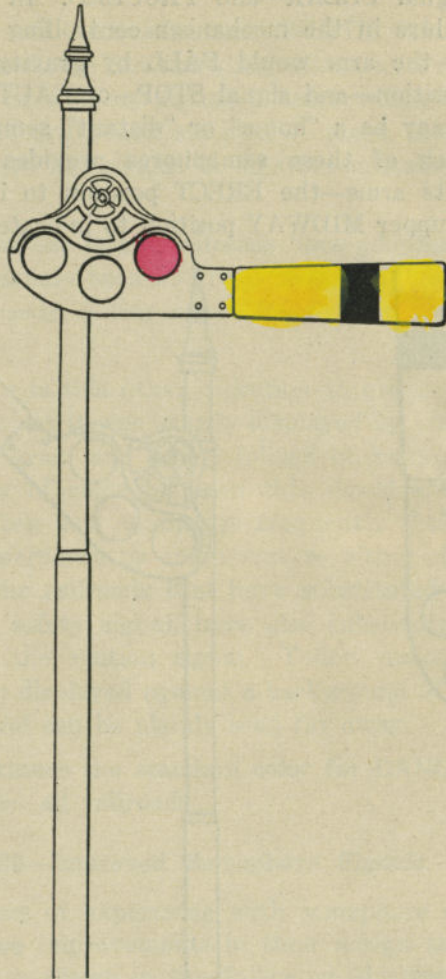
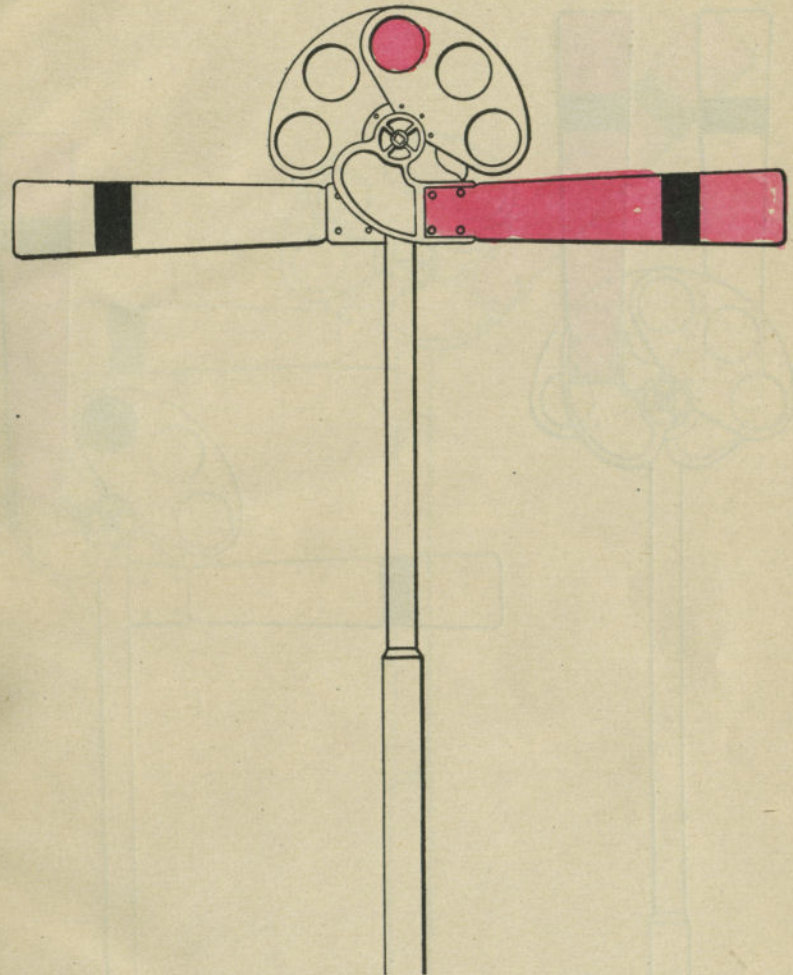


Fig. 35. Stop.

MAIN LINE "HOME" SEMAPHORE SIGNAL.

and the full EXTENDED position to signal STOP. As the signal arm moves to either of its three positions—colored lenses are moved in position to cover the semaphore's lamp, so that at night they will show the proper colored lights to correspond with the three positions of the arm—GREEN to PROCEED—YELLOW for CAUTION—and RED to STOP.

Fig. 36. Trains on Right and Left Tracks
—Stop for Train Orders.**TRAIN ORDER SEMAPHORE SIGNAL.**

In the three-position "train order" semaphore shown—the EXTENDED red arm signals "STOP for train orders"—the ERECT position signals "PROCEED, no orders"—and the upper MIDWAY position signals "TAKE SIDING."

See Fig. 39.

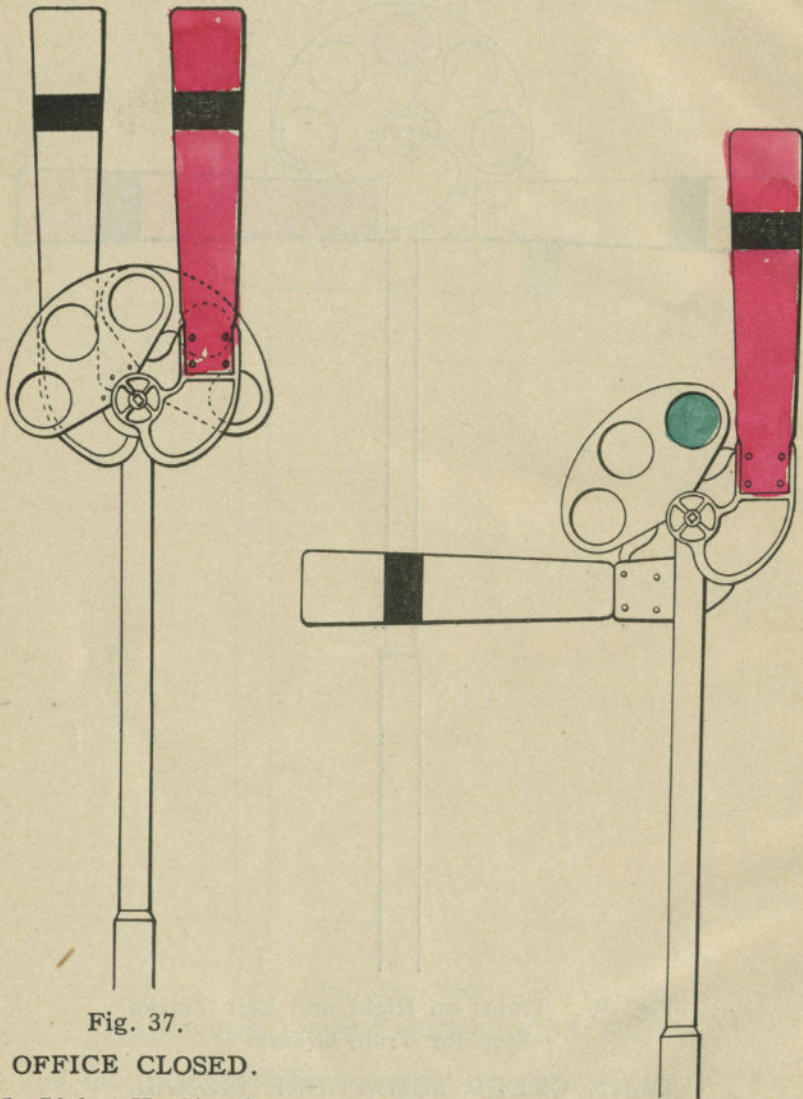


Fig. 37.

OFFICE CLOSED.

No Light—No Signal.

Fig. 38. Train on Right Track—PROCEED. Train on Left Track—STOP.

TRAIN ORDER SEMAPHORE SIGNALS.

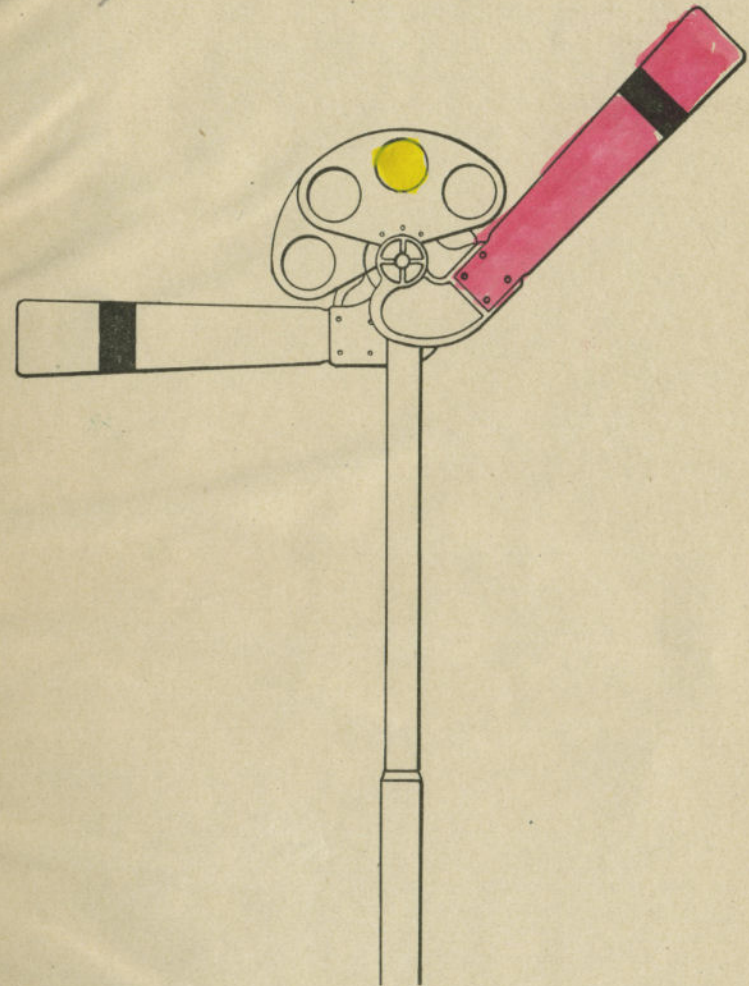


Fig. 39. Train on left track—STOP. Train on right track—TAKE SIDING.

TRAIN ORDER SEMAPHORE SIGNAL.

The illustrations of the Improved Semaphore Signals appearing herewith are reproduced from original drawings very kindly provided for this purpose by the Union Switch and Signal Company.