Acetylene Signal Lights on the Boston & Maine

Describing the Apparatus and Showing How It Is Applied to 228 Miles of Automatic Block Signaling

The Boston & Maine a few years ago began the installation of 1,000 acetylene signal lighting equipments. A little more than one-third of these are now in service. On account of the scheme of signaling which is standard on this road and which requires two signal arms on each mast, each lighting equipment has two lights.

The gas apparatus for each signal consists of a tank, the necessary piping to conduct the gas to the signal lamps, and a regulating valve and a pressure gauge. The tank is a 12-in. by 44-in. cylinder, and contains enough gas to run one light continuously for 112 days, or two lights continuously for 56 days, with a margin of about 10 per cent on the side of safety. The tanks are attached to the signal mast, as shown in Fig. 4. They are all of exactly the same size, and the bottoms are concave, so that they can be dropped over the vertical hook, which holds the bottoms in place up against the mechanism case, while the

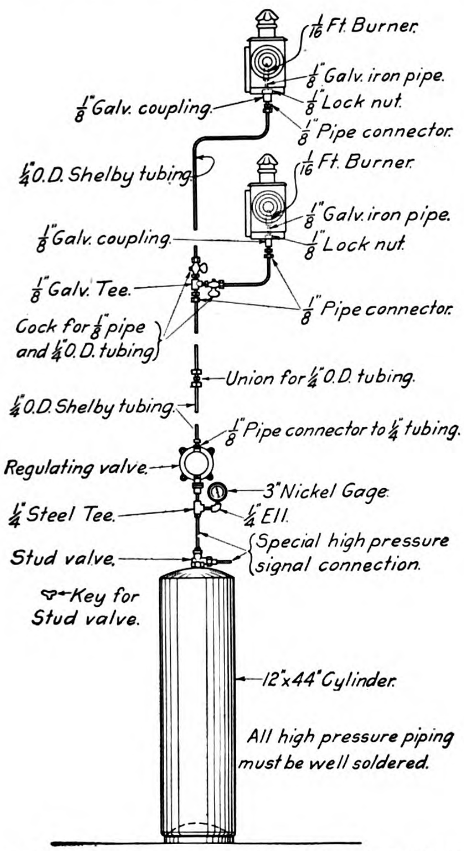

Fig. 1. Details of the Acetylene Lighting Equipment.

tops are held by a bail, which is forced down over the upper edge of the cylinder. The method of attachment is thus very simple, the complete operation of changing a tank requiring only disconnecting the valves, which is done by unscrewing a union, knocking up the bail and throwing the tank to one side. The new tank is put on by the simple operation of dropping it over the hook, pushing down the bail, and screwing up the union.

The maintainers change the tanks according to a predetermined schedule, copies of which are given to the sectionmen. Since the lights are guaranteed for 56 days' continuous burning, the schedules are so arranged that the changes are made at 56-day intervals without regard to how much gas may be left in any one of the cylinders. This remaining gas, however, is not wasted, as, if any is left, there is that much less to put in when refilling the tank. The schedules for changing are made up in the office, and each maintainer is given a copy showing him on which day his cylinders will be received, how many of them there will be, and also the day on which the 56-day period ends, and the day on which the cylinders must be returned to the delivery station. The arrangement is such that each maintainer changes out about one-fourth of his cylinders at a time, and he is given 25 per cent extra tanks, so that he can make the changes as may be most convenient. Five days

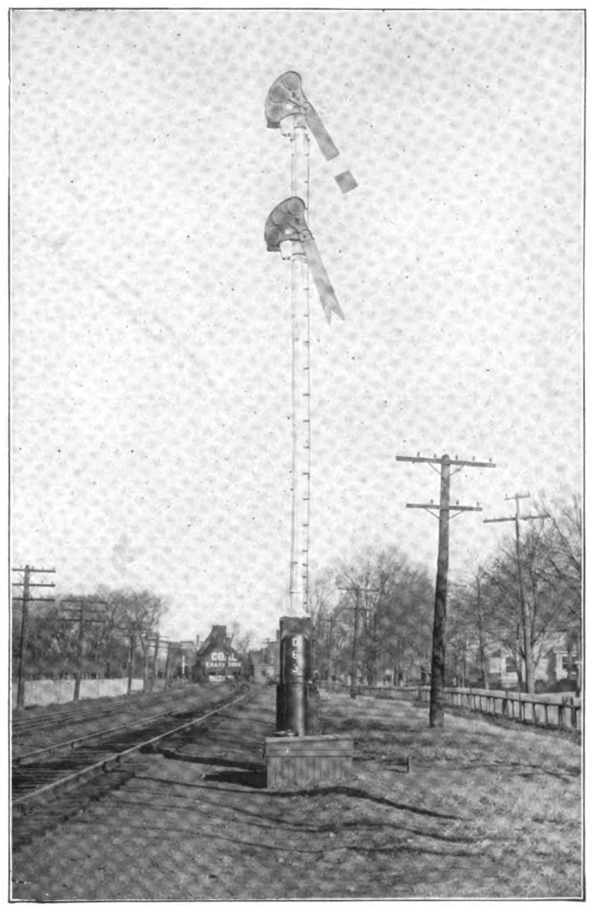

Fig. 2. The Equipment in Place.

are allowed between the sending out of the tank from the freight house and its return to that point.

The empty tanks are all sent to the central station at East Deerfield, where acetylene gas is manufactured for the various uses to which it is put on the road, among these being the headlight and car lighting equipments in addition to the signal lighting. The central station belongs to and is operated by the Commercial Acetylene Company, which furnished the signal lighting equipments. A "gas car" makes regular trips to East Deerfield, carrying the gas tanks for the signals and other utilities. In the charging of the tanks, whatever gas remains in any of them is left there and added to until the tank is filled to the predetermined quantity sufficient to supply the lights for the given time.

After the tanks have been filled the "gas car" carries them to the distributing point for each district, and from this point the local freight takes them out to the freight houses at the stations named in the schedule and deposits them as called for on the schedule. For example, on June 13 there were received at Edgeworth, Mass., 11 cylinders. Within the next day or two after the tanks are received at the freight houses the sectionmen are required to carry them out, as they go to work in the morning, and place them on the ground near the signal to which they belong. Each tank has a number, so that its identification is an easy matter. The cost of distributing the tanks is not considered a charge against the signal department, as it is done by the sectionmen with practically no loss of time on their part, since they would have to pass the signals anyway in order to get to the scene of their day's work. The operation of putting a few tanks on their car and dropping them off again at the proper point is not considered as requiring enough of their time to be worth accounting for.

SCHEDULE OF DISTRIBUTION OF ACETYLENE CYLINDERS—PORTLAND VIA. DOVER ROUTE (MAIN LINE).

	To Be Received.	End of 56-day Period.	Return to Station.	Number of Cylinders.	Stations.	Signal Numbers.
Lot No. 1	June 13	June 17	June 18	(11	Edgeworth, Mass.	W29, M35-40-43-49-50-D30-35-38-41-44
				2)	Reading, Mass.	D130-(133)
				6)	North Wilmington, Mass.	D138-143-146-151-154-161
				(7	South Lawrence, Mass.	D257-258-260-263-266-267-268
				3)	Madbury, N. H.	D637-644 647
Note—Cylinder for signal D133 to be handled by the Reading section.				5)	Dover, N. H.	D654-655-661-662-669
				(6	North Berwick, Me.	D779-791-794-803-808-817
				(4	Wells Beach, Me.	D820-831-834-845
Lot No. 2	June 27	July 1	July 2	(5	Oak Grove, Mass.	D47-50-53-56-59
				(5	Melrose, Mass.	D60-63-66-69-(73)
Note—Cylinders for signal D73 to be left at Melrose for the Wakefield section.				7)	North Wilmington, Mass.	D162-169-168-177-178-186-187
				(6	North Andover, Mass.	D257-278-283-286-291-296
Note—Cylinders for signals D863-868 to be left at Wells Beach and delivered by Wells Beach crew to Kennebunk crew.				(2	Ward Hill, Mass.	D301-304
				8)	Dover, N. H.	D670-673-677-678-682-685-690-693
				(5	Wells Beach, Me.	D848-853-854-(863-868)
				(6	Kennebunk, Me.	D875-880-887-890-895-899
Lot No. 3	July 11	July 15	July 16	(4	Melrose, Mass.	D74-77-81-82
				(6	Wakefield, Mass.	D85-88-91-92-95-98
				7)	Ballardvale, Mass.	D194-197-202-207-210-215-218
				2)	Andover, Mass.	D223-226
				(2	Ward Hill, Mass.	D309-314
				(3	Bradford, Mass.	D319-320-327
				(2	Haverhill, Mass.	D328-331
Note—Cylinders for signals D74-77-81-82 to be left at Melrose for the Wakefield section.				5)	Salmon Falls, N. H.	D698-701-706-709-710
				2)	Cummings, Me.	D717-718
				(11	Kennebunk, Me.	D902-907-910-915-920-923-928-933-936-943-946
Lot No. 4	July 25	July 29	July 30	(3	Wakefield, Mass.	D101-105-106
				(7	Reading, Mass.	D111-112-117-118-119-122-125
				4)	Andover, Mass.	D232-233-240-243
				4)	South Lawrence, Mass.	D247-248-253-254
				(6	Haverhill, Mass.	D334-335-338-341-348-349
				(2	Atkinson, N. H.	D358-359
				3)	Cummings, Me.	D734-735-738
Note—Cylinders for signals D101-105-106 to be left at Wakefield for the Reading section.				5)	North Berwick, Me.	D747-752-759-764-774
				(2	Kennebunk, Me.	D951-952
				(8	Biddeford, Me.	D961-962-969-970-977-980-987-988

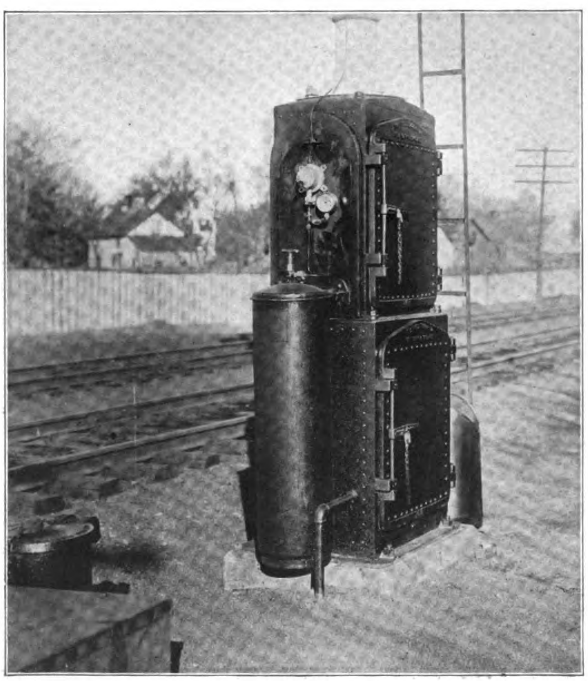

Fig. 3. Showing the Regulating Apparatus.

The signal maintainer's duty is to remove the old tanks and put the new ones in place. This must be done at the end of the 56-day period, the date of which is always given on the schedule. Soon after the empty tanks have been taken off the

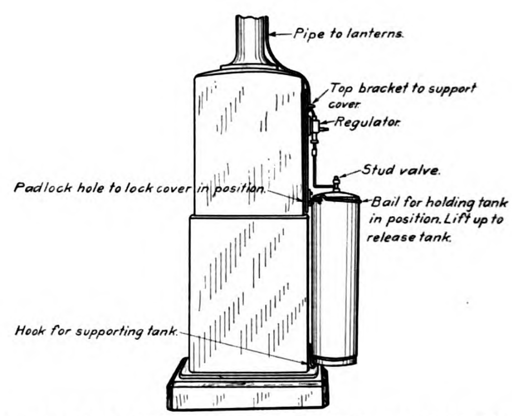

Fig. 4. Details of Method of Attaching a Tank to a Signal Mechanism Case.

signals, the sectionmen pick them up and take them back to the freight house, and from there they are shipped to the central station at which they are refilled and from which they are brought back on the gas car. The maintainers keep a record of the pressure of each tank when it is taken off and when it is put on.

The equipments cost about $110, complete, applied to the signal, and the cost of operation is 2½ cents per day per lamp.

Lamps made by Peter Gray & Sons are used. During two winters through which these lights have been in service not a single instance of a light having blown out has been recorded.

The installations have been completed between Boston and Atkinson; between Madbury and Biddeford, and on the Medford Branch, Western route, between Boston and Rigby, Eastern route, Portland division, and between South Ashburnham and Bellows Falls on the Fitchburg division,—a total of 228 miles.

THE LESSON OF THREE COLLISIONS.*

The collision at Western Springs, on the Burlington, on July 14, was the third bad one on the railways of the United States within two weeks. The three were alike in their main features, but they occurred under widely different condition—a combination of circumstances affording an unusual opportunity to study the causes of such disasters.

In the collision at Wilpen, Pa., on the Ligonier Valley, a passenger car was crushed between the engine which was pushing it and two engines which were pulling a freight train. The immediate cause was either the failure of the dispatcher to deliver, or of the conductor to understand or obey, an order. The road on which the disaster occurred had no block signal system of any kind, kept no record of train orders, maintained no train register, had no printed rules governing train operation, and used a system of dispatching which provided for verbal orders to be given to the conductor, and by him transmitted to the other members of the crew.

At Western Springs three passenger trains in succession ran past a stop signal in a fog; and the third, a fast mail train, ran into the second, the flagman of which did not get back far enough "to insure full protection." The Burlington has ranked very high among the railways of this country for safe operation, good equipment, and the maintenance of a high standard of obedience among its employes. Officers of the railway say there has been no collision on its lines east of Burlington, operated under the manual block system, in 22 years. No fusees are used on the Burlington; and one point regarding its equipment which has not escaped attention is that there was no distant signal for the home signal at Western Springs. Distant signals are now being installed for all manual home signals, which seems to amount to an admission of their need.

Near Corning, N. Y., on the Delaware, Lackawanna & Western, the engineer of a regular train, in a dense fog, ran past in succession a distant automatic signal at caution, a flagman, and a home automatic signal at stop, and collided with a passenger train which had been stopped by a stalled freight ahead of it. The flagman had a fusee but had neglected to take any torpedoes. This road, according to a statement of its general passenger agent, had carried 250,000,000 passengers in the 12 years preceding with a loss of only two lives. The foregoing statements regarding the wreck indicate the high character of its equipment.

The fact of the three collisions so similar occurring on three roads where the conditions as to physical equipment were so very dissimilar raises a strong logical presumption that some cause not connected with the physical equipment was operating in each case, and in fact was the essential cause—in other words the cause without which probably not one of these collisions would have occurred, and without which possibly most collisions would not occur. Let us carefully examine and see if the preponderance of the evidence supports this presumption.

Nearly any circumstance surrounding a collision may be a contributing cause. At Wilpen the method of handling train orders, the placing of the car ahead of the engine, the conductor's loss of memory or carelessness in not being sure he knew what his orders meant, all contributed to the disaster. At Western Springs the fog, the misunderstanding of the signal operator, Mrs. Wilcox, as to whether No. 74 was to cross over at Congress Park, and her assumption that she had no reason to believe No. 8 would overrun the same signal that both No. 2 and No. 4 had just overrun, may be considered as contributing causes. So may the flagman's act in putting down, not one torpedo, but two, 10 ft. apart, the non-use of fusees on this road, and the absence of a distant signal which might have given a preliminary warning as to the indication of the home signal. And at Corning, the fog, the injector which seems to have distracted Engineman Schroeder's attention, the failure of the flagman to take any torpedoes with him, or to light his fusee soon enough, all may have helped to bring about the disaster.

The list of contributing causes in these accidents might be extended indefinitely It could even be made, in the Burlington case, to include the practice of the United States government in awarding mail-carrying contracts to the road that makes the best time, thus putting a premium on fast running. Or it could include the failure of the flagman at Western Springs, to obey the flagging rule, or of the enginemen at both that place and Corning to run cautiously in the fog.

The absence of any one of a number of such contributing causes might have prevented either of these collisions. For example, the flagman at Western Springs would have been out far enough at 1,100 or 1,200 ft., if the engineman on No. 8 had been running as cautiously as he should have been in the dense fog; and if the flagman had been out as far as he could possibly have gone he might have stopped No. 8. The same thing could be said of other incidents connected with the disaster. But none of these things, in the absence of which, perhaps, the wrecks would not have happened, was their real essential cause. These immediate causes each have a precedent cause, and it is that *cause of causes,* to which are traceable these collisions and most other collisions, which must be hunted out and exterminated.

Such reports and recommendations as have been made in the past, following bad wrecks, and will probably be made in the cases under discussion, are well enough in their way. But they do not go far enough. They aim to correct only conditions which are nothing more than contributing causes. For example, to recommend that distant signals be installed for all home signals. that rule 99 specify a minimum distance which a flagman shall go back under certain conditions, that the Burlington displace its few women operators with men, that fusees be used to supplement torpedoes at night and in fogs, or even that enginemen never exceed a certain speed in a fog, will not prevent collisions under the many possible conditions under which these things would not and could not be contributing causes. Even an automatic stop would not remove the possibility of collisions, for it would be only as reliable as the signal to which it was attached or the track circuit control of that signal. And if a train should be far enough past the entrance to a block to avoid being hit by a following train stopping after an automatic device had acted, it could easily be far enough away to be hit pretty hard by that same train when it resumed its journey.

What, then, is this *cause of the causes* of accidents? Whatever else an investigation of one collision accident here and another there may disclose, there is one condition that every such investigation discloses, and that is the tendency of employes chronically and persistently to take risks, and the tendency of railway officers chronically and persistently to tolerate the taking of risks. In every investigation the fact comes out that the employes have taken risks. In every investigation the officers cite the book of rules to show that in doing so the employe violated the rules, and that the accident was a result of this. But why did they violate the rules in the particular instances when accidents occurred? The employes often reply that they did it to "make the time." But they are trying to "make the time" daily. Are they, therefore, violating the rules daily in order to do so? The evidence in about every case indicates that they are. The violations in the particular cases that result in accidents are, then, themselves, it would seem, a result of a *habit;* and all the violations that have taken place have helped to form that habit; and, therefore, indirectly every violation of a rule or order that has ever taken place, whatever its immediate

*An editorial in the "Railway Age Gazette" of July 26, 1912.