A Plan
of Apparatus
Interlocking Switches and Signals
at
Ayer Junction
Mass.

Charles F. Hammond

Ayer Junction is situated on the Fitchburg Railroad thirty six (36) miles east of Boston. A branch leaves the main line here and runs a distance of twenty four (24) miles to Greenville. This branch is known as the Peterboro and Shirley Branch. Here the Fitchburg Railroad has connections with the Worcester, Nashua, and Portland Division of the Boston and Maine Railroad, which Division crosses the Fitchburg's main line and the Shirley Branch close to the station. Its other connection is the Stony Brook Branch of the Boston and Lowell System and terminates at Ayer Junction.

The importance of this sta-

tion with its crossing and branches seems to indicate that in time, for the securing of safety, for the more rapid handling of traffic, and for a reduction in its maintenance expenses, it would be advisable to establish a complete system of interlocking switches and signals.

Although not as complicated as many others, Ayer Junction possesses sufficient essential features to combine in a less intricate way, the principles sought to be developed.

This yard is, at present, operated by hand switching and every train in whatever direction must come to a com-

plete stops. This item of bringing trains to a complete stop might in time be of sufficient amount to pay the interest on such a system as is proposed. Laying aside any economic discussion of the question, which no doubt would strongly favor the adoption of a change, we will proceed to lay out a system of interlocking, limited only in the amount of traffic that may be handled by the present arrangement of tracks.

Reference will frequently be made to the plan accompanying this description.

A few general rules, which are here enumerated, are followed

throughout the plan. Viz.: the normal position of all signals indicates danger, thereby bringing the train governed by that signal to a stop. The normal position of switches is as shown on the plan. The form of signal adopted is the semaphore. When two or more blades appear on the same post, the upper one refers to the right-hand tracks. Those tracks which are under the control of the signalman are numbered from one (1) to sixteen (16). Switches, facing point locks, and signals have each a distinct number, but not necessarily corresponding to the number of lever which

controls them. The directions in which trains may move are indicated by arrows. The table number one (I) tabulates the numbered levers, which operate the various switches, locks, and signals that have numbers. Table number two (II) gives the scheme of locking in the several directions in which trains may run.

The signal tower located as shown commands a view of all the tracks and the working of each signal can be distinctly seen from it; with the exceptions of the distant signals one (1), four (4), seven (7) which are hidden from view by the curvature of the tracks.

These signals are connected by electric circuits with the tower. Immediately in front of the signalman are electro-magnets forming part of the circuit. These magnets indicate, by actuating a diminutive semaphore, the true position of the signals; thus assuring the signalman that he has accomplished the movement desired.

Levers are numbered from right to left, from one (1) to forty four (44); there being thirty eight (38) working levers and six (6) spare levers. Twenty (20) levers operate twenty eight (28) signals, seventeen (17) indicators and thirteen (13) facing point locks.

Eighteen (18) levers operate nineteen (19) switches.

To more fully illustrate the manipulations of this system, we will assume a train approaching Ayer Junction from Boston and which desires to pass at speed. The object sought is to give the approaching train a clear and safe passage. In order to do so all conflicting signals and switches on that route must be locked in their proper position, which is successfully accomplished by the locking mechanism of the machine.

It must be remembered that all signals and switches are in their normal position

The first movement of the signal man is to clear signal number two (2), this he does by reversing lever number three (3), which locks levers fourteen (14) and twenty six (26) governing signals three (3) and three prime (3') respectively. This prevents a train approaching from Worcester or Nashua from crossing the main line. Lever three (3) reversed locks in their normal position levers one (1) and two (2) and in their reversed position levers four (4) and five (5), governing switches nineteen (19) and seventeen (17) and signals thirteen (13) and twelve (12) respectively, and releases lever six (6) which operates signal one (1). Signal one (1) bring the distant

signal, when it is cleared indicates to the engineer that he may pass the Junction at speed with safety. This last movement is a very important one. The locking arrangements are so placed that signal one (1) cannot be put to a clear position without following through the steps just indicated.

It ought to be observed that the levers, which were operated to provide for this movement are located in the right hand end of the tower, close to one another. This arrangement is for convenience and facility. The machine also provides for shunting (Signaling) on any of the

tracks as long as the home signals are kept in their normal positions, that is, at danger. The underlined figures in table I one refer to signals, and the small number above gives the number of indications on each signal. Facing point locks are designated by (L). The remaining numbers are switches.

In table II the figures in circles indicate that they are reversed. This table is a more concise way of expressing the movement of trains, than that just described in allowing a train to pass, approaching from Boston.

To make this perfectly clear we will assume another train

approaching from Worcester.
From table II we see first,
that lever fourteen (14) is re-
versed, which locks levers three
(3), twenty seven (27), and thirty
six (36) and releases eighteen 18,
and twenty one (21). Twenty one
(21) is then reversed which locks
in their normal position levers
eighteen (18), nineteen (19), and twenty
(20) and releases lever (22). Lever
twenty two (22) is then reversed
which locks in its reversed posi-
tion lever twenty one (21). We
see from this that all the levers
are locked one with another, as-
suring the engineer of a safe pas-
sage.

Table I.

Lever	Operates	Lever	Operates
1	19	20	49
2	17	21	6[2] 50L
3	2	22	5
4	13[2] 20L	23	43
5	12[2] 18L	24	52 42L
6	1	25	37
7	21	26	3'
8	14[3] 22L	27	33
9	23	28	9[2] 34L
10	15[4] 24L	29	4
11	55	30	10
12	38 56L	31	25
13	16	32	27
14	3	33	29
15	39	34	11[4], 26L, 28L, 30L
16	41	35	31
17	47	36	8[2] 32L
18	45	37	7
19	51[6] 46L	38	35

Table II

Lever	Locks	Releases
	From Boston	
(3)	26-14-1-2-(4)(5)	6
(6)	(3)-1-2(4)(5)-14-26	
	From Fitchburg	
(8)	7 9	3
(3)	(8) 14 26 28	13
(13)	(3) 12	
	From Worcester	
(14)	27 3 36	18 21
(21)	18 19 20	22
(22)	(21)	
	From Nashua	
(26)	3 20-24-25-36	27
(27)	(26)	28
(28)	(27)	29
(29)	(28)	
	From or to Greeville	
(31)	14 28 30	32 33 34
(34)	(31) or (32) or (33)	

33	35	36
32	35	36
36	35 or 35	37
37	36	
	From or to Lowell	
34	31 36	30
30	34	