signal had not been bulletined as out of order that engineman would have 'obeyed that impulse' to reduce speed and get his train under control when he passed the caution aspect.

"The small and isolated plants are the ones on which we should spend some additional money to make them fool-proof. In the larger plants, handling congested traffic, we have a better class of men. The night men in these places are too busy to get much sleep, and, on account of their work being exacting, they get the proper rest when off duty. These men never let their minds stray very far from their work, so, for this reason, I do not install any more 'frills' (pardon the word) than I consider absolutely necessary. On the other hand, 20 out of the 71 plants on our system are small, handling only a straight crossing, or some other simple layout, with few levers. These night signalmen have a superannuated cinch as far as work is concerned, and they can curl up on any convenient flat surface and go to sleep any moment. They are the fellows who always wake up rattled, and in their eagerness to prevent further delay to some train standing at the home signal, they are apt to knock down a route in front of a rapidly approaching train which has already passed a clear distant signal on the other line. This is the reason why I equip all plants of this kind with electric locking, a slow-speed mechanical hand release, and annunciators in all directions. I believe in helping these men hold their jobs. The handling of these small isolated plants was the prime argument that led up to our present rulings, covering interlocking plants out of service."

"That all sounds good," said the general manager. "I don't see where we are taking any chances if these rules are followed out by all the men. One other thing: Tell me a little about distant signals. How many types are there of this signal, who was first responsible for connecting them to every interlocking plant in the country, and do you think they are really necessary?"

"The distant signal," answered the signal engineer, "is a sort of necessary evil that must be attached to all plants that are not in automatic territory. It was an English idea, although in that country they put a red light on it and really have two home signals. When the first interlocking was imported from England, the distant signal came along with it. In the early days about all interlocking plants were installed under contract, the cost being figured out at so much per lever. Distant signals, being wire-connected, were easy to install, and because they represented easy money the contractor got them in on every possible route controlled by the machine. About this time the speed mania began to attract the American traveling public, and schedules were consequently shortened. Then the work of the distant signal became a necessary and specific function.

"That placed the signal engineer in a predicament where he never felt as though he stood on solid ground. He could never fully satisfy himself as to whether he was putting in a wire-connected distant signal as a landmark so an engineman would know he was approaching a home signal, or whether he was installing an adjunct that would facilitate speed. If it was the former, there was no use in making the arm operative; if the latter, he had no confidence in its operation. For years the old wire-connected distant signal was looked on as a necessary evil. The signal companies developed compensators of all kinds that employed oil, springs, and weights; they got out disengaging levers and other things that increased the factor of safety, but still the distant signal was the weak link in the whole scheme of interlocking.

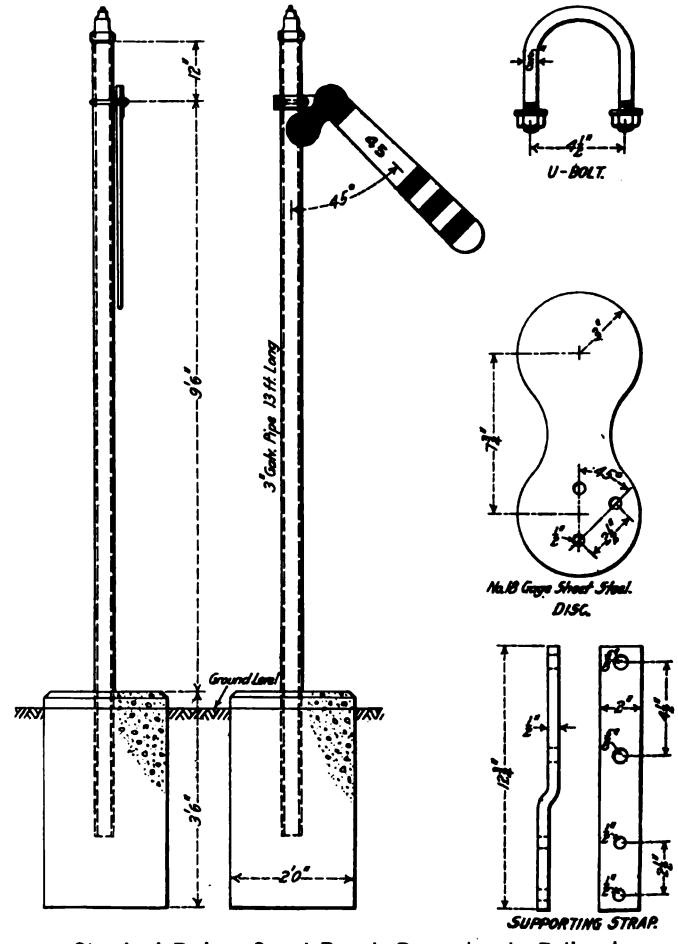
"The enginemen never felt sure of its indication, and no signal engineer would ever be rash enough to guarantee to them that if the distant signal was clear they would find the home signal in the same position. We could only operate them about 1,600 ft. from the lever, and then the wire line had to be as straight as possible in order to get any assurance regarding the proper travel of the arm. The engineman could see the home signal, if on straight track, about as soon as he could the distant signal, so in ordinary climatic conditions it gave no material assistance to speed. If local conditions forced it to be located around a curve, we hooked it up, shut our eyes, and hoped for the best. In the winter time the arms would wiggle about 25 deg., and usually dropped about 10 deg., with the lever normal. The wise signalman left this lever normal at all times during bad weather.

"Through a slow process of evolution I have superseded the old wire-connected distant signals with either power-operated signals or fixed arms, until there are only a few of them left. These I hope to eliminate soon. The fixed arm acts as a landmark on branch lines or other unimportant routes. The power-operated distant signal can be placed far enough from the home signal to offer some real assistance to an engineman who is trying to make up some time. I can truthfully tell him he can depend on its indication where I have also installed electric locking and placed an electric back lock on the distant signal lever."

"I agree with you," said the general manager. "You are working along the right lines, and I am getting considerable inside information that I should have had a long time ago. Quite reluctantly I am forced to tell you that I must postpone further discussion of these subjects at the present and get busy on some work. I am glad to note that you are beginning to thaw out and do not allow me to do all the talking when you are in my office. Good day, sir."

PENNSYLVANIA SPEED LIMIT POST.

Speed limit posts are to be set up at curves along the Pennsylvania Railroad throughout the length of the main line from New York to Pittsburgh. Each curve over which the limit of speed is 45 miles an hour or less will have a signal at the entrance of the curve indicating caution, and another indicating



Standard Reduce Speed Board; Pennsylvania Railroad.

"proceed" at the point beyond the curve where regular speed may be resumed. The signal to be used is of the semaphore type, like that which has been used for the same purpose on the Pennsylvania Lines west of Pittsburgh for some years past, and its style is shown in the illustration. It is familiarly called the "coon tail" signal, the transverse stripes on the blade being

alternately black and yellow. The main body of the blade is yellow. On both signals the arm is fixed and motionless; at 45 deg. from the horizontal for caution, and straight down for proceed. There is no light for a night indication.

The drawing herewith shows the caution signal, the parts for both signals being identical. The post is 13 ft. long, 3 in. in diameter, and made of galvanized iron pipe. The concrete foundation, 2 ft. square, is usually 3 ft. 6 in. in depth. The metal disk, to which the wooden arm is fastened, is made of No. 18 gage sheet steel, and the supporting strap is of wrought iron, ¼ in. thick, 2 in. wide and 12¾ in. long. The strap is fastened to the post by a U bolt. The wooden blade is 3 ft. 7 in. long, and its back side is painted black.

MR. BELNAP'S REPORT ON THE WESTERN SPRINGS COLLISION.

H. W. Belnap, chief inspector of safety appliances for the Interstate Commerce Commission, has made a report of his investigation of the rear-end collision on the Chicago, Burlington & Quincy at Western Springs, Ill., on July 14, 1912. The circumstances of the disaster, the results of the coroner's inquests, and the report of the Illinois Railroad and Warehouse Commission, following its investigation, were mentioned at length in *The Signal Engineer* for August, 1912.

Mr. Belnap summarizes fully and carefully the testimony of all of the important witnesses at the investigations and describes the Burlington's method of operating between Chicago and Aurora. He then concludes that "this accident was caused primarily by the failure of flagman Woodworth properly to protect the rear end of train No. 2. Trains No. 2 and No. 8 passed both West Hinsdale and Western Springs approximately nine minutes apart, giving the flagman ample time to go back far enough properly to protect his train. He was well aware that fast mail train No. 8 was following his train and, in view of the dense fog prevailing, he should have taken extraordinary precautions in the performance of his duty as flagman. * * * After the accident, a test was made for the purpose of ascertaining how far back the flagman could have gone in the time at his disposal. In this test a man at a brisk walk covered a distance of 2,277 ft. in six minutes. It was thus conclusively proved that the flagman did not go back as far as he might have gone had he sufficiently regarded the responsibility resting upon him. He also displayed exceedingly poor judgment in applying two torpedoes to the rail, thus arranging for a caution signal, instead of putting down only one torpedo, which would have given the stop signal."

Mr. Belnap calls attention to the lack of definiteness in the rules of this and many other railways covering flagging instructions to employees. The simple requirement that the flagman must go back a sufficient distance to insure full protection leaves the matter of distance to the judgment of the flagman to such an extent that an error of judgment may prove disastrous, as in this case. Many railways, by their rules, fix a minimum distance which the flagman is required to go back. Mr. Belnap thinks this is the safer practice, but does not specify distance.

The failure of engineman Brownson of train No. 8 properly to control the speed of his train and to obey the indications of the fixed signals is given as a contributing cause of the disaster. "If he had approached Western Springs with his train under control, so that he could have come to a stop before passing the block signal, as required by the rules, the collision would not have occurred." The report states that the signals on the division of the Burlington on which the accident happened were inadequate, especially during foggy or stormy weather. Credit is given the road on account of the fact that distant signals were being installed at the time of the accident, and the report continues: "But where trains are operated at high speed when the weather is so foggy or stormy that signals can be seen a distance of only a few feet, no system of fixed signals can provide that measure of protection to which the traveling public is entitled, and for this reason positive and definite instructions should be given prohibiting the running of trains at high speed during foggy or stormy weather." Mr. Belnap thinks that Mrs. Wilcox, the operator at Western Springs, notwithstanding the fact that she violated no rule in releasing No. 8 at West Hinsdale, nevertheless exercised poor judgment in doing this while she was so uncertain as to the position of No. 2. Regarding the speed at which the trains were running, Mr. Belnap says as follows: "It was particularly dangerous in view of the dense fog which prevailed on the morning of the accident. As the train schedules in many cases are fast for clear weather, it is apparent that in fog enginemen must run at high speed between signals, or not reduce speed as they approach signals, or fail to make schedule time, since in foggy weather signals can be distinguished at a comparatively short distance. Either of the first two conditions may be dangerous; and yet, notwithstanding the rule which requires enginemen to approach signals with their trains under control prepared to stop, the desire to maintain schedule speed and make a good showing by bringing their trains in on time will impel enginemen to take chances against the dictates of good judgment. * * * * * There is a limit to the speed at which trains can safely be operated. This limit is variable, depending upon numerous local conditions. In several derailments which have been investigated it was evident that speed was above the limit of safety, in view of the condition of track and equipment. In a number of collisions also, notably those at Kinmundy, Ill., on the Illinois Central Railroad, and Corning, N. Y., on the Delaware, Lackawanna & Western Railroad, speed was too high for safety. While these accidents were caused by a disregard of signals or rules, there can be no question that the attempt to make up time or to maintain schedule time led to high speed, which no doubt caused the employees involved to take dangerous chances, in the absence of which the accidents might have been avoided, or at least their severity greatly mitigated."

Following this, Mr. Belnap calls attention to the testimony of F. C. Rice, general inspector of transportation of the Burlington, to the effect that excessive speed is the cause of about 75 to 80 per cent of the catastrophes of the last few years. Mr. Rice is quoted as saying also that many of the block systems now in use were put in when the speed of trains was less and when neither the railroad people nor the public had reached the present craze for high speed, which would make some of these installations, adequate originally, now inadequate. Mr. Rice considered the public responsible "because they ride on the railroad that has the fastest train and the road that doesn't make that fast time is not patronized."

Mr. Belnap's report continues: "It is believed that Mr. Rice has not properly placed the responsibility for high speed. It is true that the public patronizes the railroad that makes the fastest time. But did the public have knowledge that any railroad was operating its trains at such high speed as to make travel upon that road unsafe, its patronage would quickly be withdrawn. The great majority of people who ride on railroads desire to travel quickly, if it can be done with safety, but their first consideration is safety. They rely upon the judgment of railroad managers, knowing that they are the only ones who have full knowledge of conditions existing upon their roads, and the assumption always is that the road operating high-speed trains will bring them safely, as well as quickly, to their journey's end. It is apparent, therefore, that if trains are run at such a high rate of speed as to sacrifice safety the railroads themselves must bear the responsibility. Moreover, in view of Mr. Rice's statement that 'excessive speed is the cause of about 75 to 80 per cent of the catastrophes in the last few years,' a double responsibility rests upon the managers of railroads. If Mr. Rice's statement is correct, it lies wholly within the power of the railroad managers virtually to put an end to from 75 to 80 per cent of these harrowing railway disasters, and in this one feature of railway operation alone lies an opportunity for railroad managers to introduce an entirely practicable reform which will be of vast benefit to the public and meet with commendation on every hand."