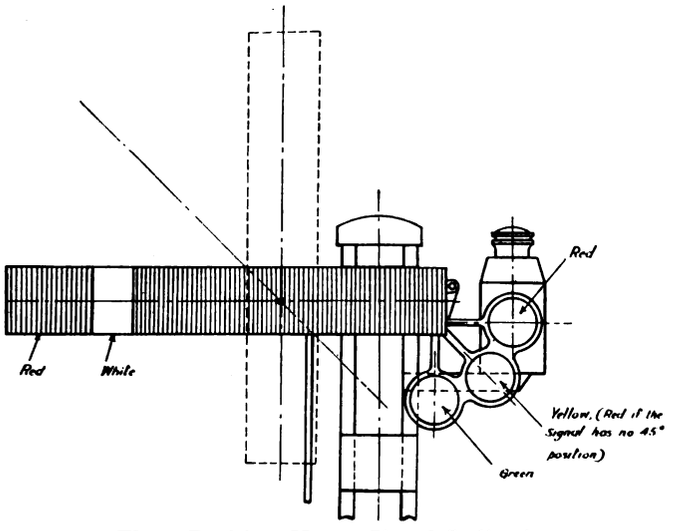
Weissenbruch Three-Position Signal System as Used in Belgium

Four Indications Given, Clear, Caution, Attention or Stop

By T. S. Lascelles

London, England.

UNTIL comparatively recently there has not been in Europe any extensive use of three-position signaling and such installations as there have been follow closely the American practice and have not involved any novel features. This condition has now been altered by the extended adoption on the Belgian State Railways of a three-position system involving several interesting and novel features worthy of attention.



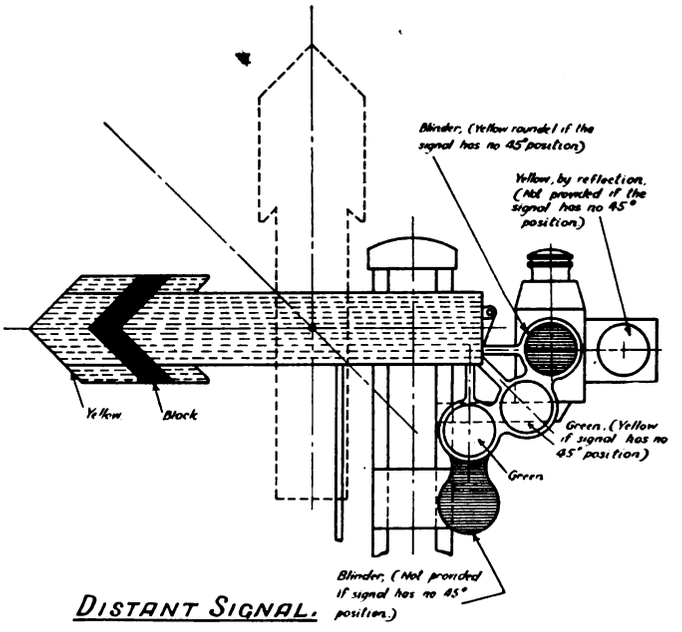
Three-Position Home Signal Indication

This system, which was conceived and put into service by the late Monsieur L. Weissenbruch, whose lamented death has prevented him from following out his ideas still further, is now in regular operation on extended stretches of main track, including the main route from Brussels to Antwerp, where the traffic is heavy and varied in character.

Automatic signaling is not in use in Belgium because the frequency with which stations, junctions and level crossings occur renders the employment of a large number of signal towers necessary, and it is thought that in such circumstances manual operation is at least as good and for some reasons perhaps it is better than automatic signals. The standard method is the controlled manual block, using the Siemen's alternating current apparatus, which is an efficient and reliable system. This type, or apparatus at all events that is very like it, is to be found almost everywhere in Germany, Holland, Scandinavia and Switzerland. The general conditions of operation resemble those in England and the pre-war Belgian signaling was similar to English practices, except that upper-quadrant semaphores were employed and a *yellow* light was used for the distant "caution" indication, whereas *red* is still in general use in England for this purpose. The Belgian pre-war system was two-position.

So much of the signaling having to be reconstructed owing to the destruction of the railways by the enemy in the war, Monsieur Weissenbruch determined to introduce the three-position principle and simplify the signaling layouts in consequence. With his accustomed independence of mind, however, he did not simply copy other people's systems, with all of which he was acquainted, but endeavored to see first what the conditions were in Belgium which had to be met and to make a set of signal aspects to suit those conditions. The new indications have now been in service for some time and have given every satisfaction. The writer brings them to the notice of readers of the *Railway Signal Engineer* because he considers they form one of the most complete and logical sets of signal aspects ever put forward, particularly when the simplicity of the night indications is considered.

Moreover, it has been my opinion for some time that the simple three-position system of "Stop," "Caution" and "Proceed" does not meet all the requirements of practice any more than the "Home" and "Distant" system does, without special modifications, if, at the same time, the ideal is to be attained that a given aspect should never have more than one unalterable meaning. This ideal is attained in the Weissenbruch system. It is understood



Complete Distant Signal Indication with Special Lamp

that this has been recognized on the Pennsylvania and certain other railways in the United States, but their signal systems use two arms on almost every signal and always two lights at night, which will likely never meet with approval in Europe.

In this article the question of *aspects* only is considered. The new Belgian signaling is mechanically operated by double wire connection with automatic compensation, used for some years now in Belgium. This is one of

its most ingenious features, completely disposing of the idea believed in England that 3-position signals must be either power-operated or worked by rods, as in America. For details of the working the writer refers the readers to the Bulletin of the International Railway Association,

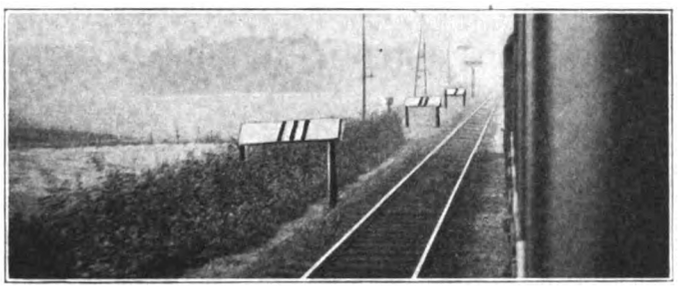


Fig. 3. Barrier Markers to Show Distance from the Signal

where Monsieur J. Verdeyen, engineer in charge of signals, Belgian State Railways, will in the near future publish a description of this equipment.

The semaphore signals are rather different from those usually employed in three-position signaling and are illustrated in Fig. 1 and 2. The arm is balanced almost in the center and the spectacle is worked on another spindle and placed on the opposite side of the mast, there being a shaft connection between it and the semaphore.

So far as stop signals are concerned an ordinary lantern is used, the roundels being arranged according to the notes on the diagram, yellow being replaced by red in a signal having no 45 deg. position. Distant signals, when giving only the horizontal and vertical indications, also have an ordinary lantern, but when working to three positions on 0 deg. to 45 deg. they are equipped with a reflecting lantern so as to produce at 45 deg. two lights side by side. The arrowheaded arm has been employed for some time now in Belgium as a distant signal, the usual notched arm being at one time in use there for another purpose. Trains run left-handed in Belgium.

The photograph in Fig. 3 shows a distant signal in Belgium, showing some of the "barriers," as they are called, which are used to assist the enginemen in locating signals in foggy weather. These consist of white boards (whitewashed or of enameled iron) carried on posts and set at an angle of 45 deg. to the track in such a way as to catch the runner's eye readily and be easily illuminated by the headlights at night. Each distant signal is preceded by five "barriers" placed at 50 meters apart, the first one met with having five black stripes on it, the next four, and so on. (See article by L. Weissenbruch in the April, 1920, International Railway Association Bulletin.)

Referring now to Fig. 4, where the whole of the aspects employed are shown, the first point to note is that distant signals are retained and in addition stop signals they can give three indications, "Caution," "Attention" and "Proceed." The "Attention" sign is the new feature, meaning "Pass next signal at reduced speed," and the night indication is a green light beside a yellow light obtained from a lantern similar to E. C. Carter's lamp used on the Chicago & North-Western. The indication corresponds to the Pennsylvania signal where the top arm is at 45 degrees and the lower at 90 degrees, although this has always seemed to the writer a most contradictory looking sign. If my memory is correct, Mr. Rudd himself once said it was "unsatisfactory but the best he could get." Stop signals indicate as in ordinary three-position working distant signals as just mentioned, and at certain places combined signals are used which are capable of showing all the four signs, "Stop," "Caution," "Attention" and "Proceed." Only one lantern is required, the lower arm not having one. Many of the signals do not require to show "Attention" and in that case are equipped with an ordinary and not the special lamp. Careful consideration will show that there are only four chief indications to remember and also in the combined signals, that the arms do not contradict each other, as in the Pennsylvania signal.

Switching signals are shown on the diagram, but switching is worked so differently in Belgium as compared with England and America that the indications need scarcely be considered by readers of this paper. It is to be particularly observed that the indication "Caution" invariably means "next signal is at Stop" and nothing else. In fact, no indication in the system has a *double meaning.*

In order to explain the applications of these aspects Figs. 5 and 6 have been prepared from information kindly supplied by Monsieur J. Verdeyen. Case *1* illustrates a simple block tower, of which there are a great number in Belgium. It has a home signal with corresponding distant signal placed 800 meters in the rear. (All distances given in this article are those for level track, and variations are made to suit change of grade.) Both these

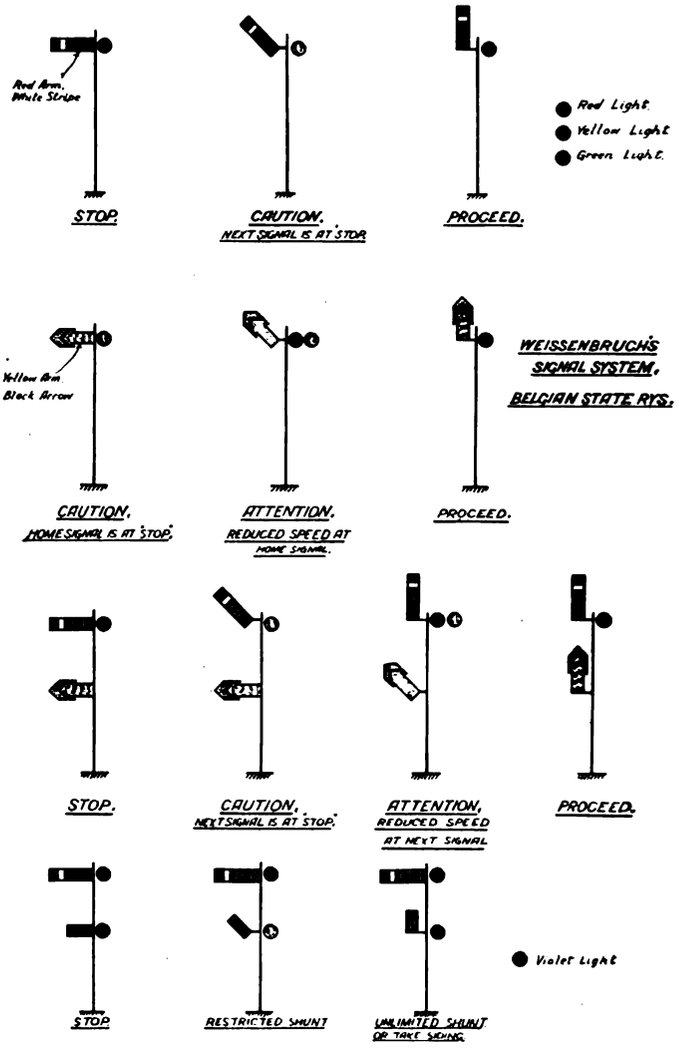


Fig. 4. Comparison of Signal Aspects

signals work as shown to two positions, horizontal and 90 deg., and the indications are self-explanatory. When two consecutive block towers are at a distance of more than 1,000 meters apart, each one is treated as in Case *1*, but if this distance is not more than 1,000 nor less than 800 meters the arrangement shown in Case *2* is employed.

Tower *B* has then no distant signal, but the home signal for Tower *A* is made a three-position signal to act as distant for Tower *B*, the distant for Tower *A* acting as in Case *1*. When two towers are less than 800 meters apart signal to signal or when a tower has both home and advance block signals, which is, of course, practically the same thing, signals are arranged as shown in Case *3*.

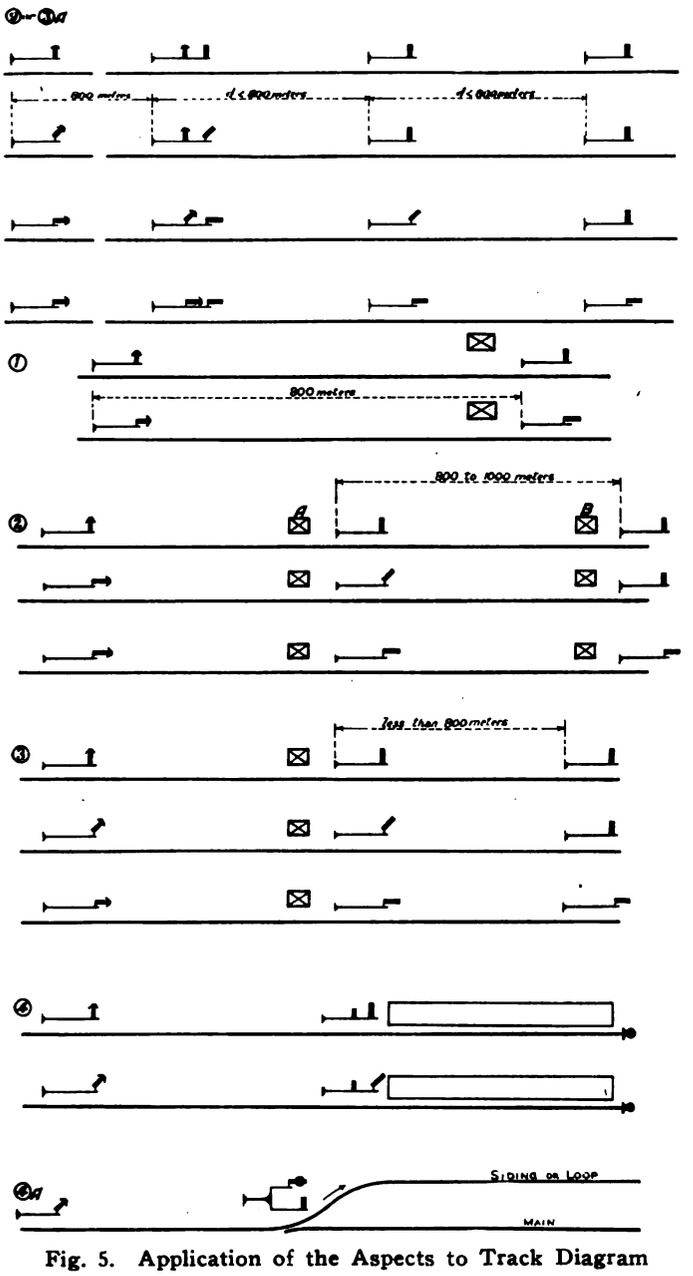


Fig. 5. Application of the Aspects to Track Diagram

The caution indication of the home signal being too close to the advance, the distant signal shows "Attention" (i. e., "Pass home signal at reduced speed"), enabling the engineman to control his train properly and stop in due course at the advance signal. The advantage of the three-position distant signal is well seen in this case. With a train standing at the advance signal and the home signal therefore at "Stop," the distant signal stands at "Caution" and gives positive indication of the real position of the home. As a "Caution" signal always means "Next signal is at Stop" and nothing else an engineman never has any temptation given him to put a less restrictive construction on the "Caution" sign as he has when it is used for several other purposes, such as showing that a diverging route is set at interlocking plant.

Case *4* shows the indications used for entering a terminal the home signals indicating "Caution," since the red light at the bumping-post is a permanent "Stop" indication, the distant signal showing "Attention" and having no "Proceed" position. This is a more logical method than having the distant permanently at "Caution," as is done by some systems.

(Actually in Belgium the home signal works from 0 to 90 degrees, the runner being trusted to enter a terminal cautiously, but case *4* is shown in accordance with American and English ideas on this point.)

Case *4A* indicates a signal set to enter a running siding or loop, the semaphore having a ringed arm on the home signal and the distant signal displaying "Attention," the loop having to be entered at reduced speed.

We now come to consider junction signaling where the "Attention" indication is most useful. Case *5* is the simplest, in which both diverging lines may be taken at full speed, the radii being greater than 500 meters. Only one distant signal is provided which can occupy either the horizontal or vertical position. It will be observed that the junction signals are placed on a bracket, Monsieur Weissenbruch having adopted English practice in this

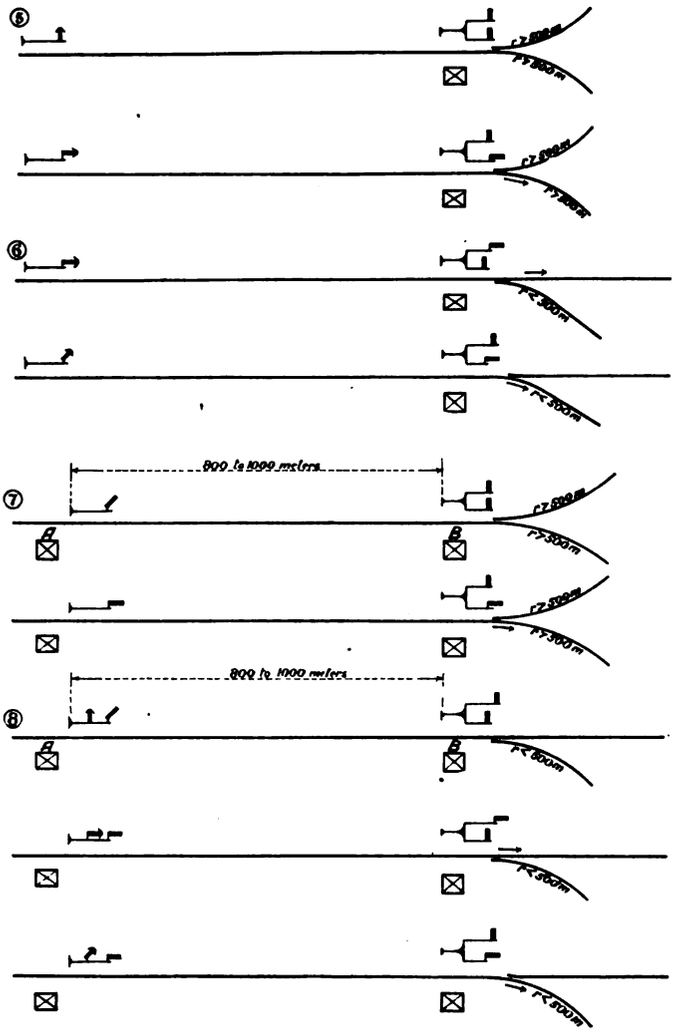


Fig. 6. Signal Aspects Approaching a Junction

respect, which the writer regards as the most logical method of junction signaling. When a large number of routes is concerned this system becomes cumbersome, it is true, but this can readily be overcome by a combination of the bracket system with route indicators. Moreover, one seldom meets with any great number of routes except at terminal or large stations where extra caution is observed in running. If in Case *5* both routes were suit-

able only for reduced speed the distant signal would have no vertical position, but would work from horizontal to 45 deg. only. No figure is required to illustrate this, it being only a development from Case *6*, where both the normal and reduced speed routes are shown, the distant signal then taking all three positions according to the circumstances. In such a case the arms of the junction home signals are placed at different levels, the lower arm being for the reduced speed line. These elementary cases will enable anyone to see how the system would be applied to more complicated arrangements of tracks.

So far no mention has been made of the uses of combined signals, but the principles governing their use are very simple and are derived from what has been said above. If in Case *2*, tower *B*, were a junction interlocking tower governing the junction shown in Case *5*, we should have the situation shown in Case *7*, the home signal for tower *A* acting as the distant signal for tower *B* and being three-position. The same situation applied to Case *6* produces Case *8*. Here it is necessary for the home signal at *A* to give all the four signs, "Stop," "Caution," "Attention" and "Proceed," and as one arm will not do this, resort is had to the combined signal as shown. This signal has always to be employed when this necessity arises, but a little thought will soon show without further examples how these cases can occur.

For example, where three stop signals succeed one another at a less distance than 800 meters, the first one would be a combined signal as shown in Case *9* or *3A*, and the different indications would be as shown. The purpose of each one will be readily grasped from the explanations of previous cases.

In conclusion, it is well to emphasize the fact that each aspect in this system has one meaning and no more, that "Caution" invariably indicates that the next signal is at "Stop," while only one lamp is used to give the four signs of the system. No unnecessary multiplication of signal arms has been introduced in the effort to introduce the "Attention" sign, a valuable indication lending itself to several applications. Having seen the new Belgian signals in operation I am able to testify to their excellent working and to the ease with which their aspects can be grasped. My most sincere thanks are due to Monsieur J. Verdeyen not only for showing the signals themselves, but for supplying the information on which this article is founded.

Train Control Test on Raritan River

"M-V All Weather" Induction Apparatus With Limited Speed Control Exhibited Near South Amboy, N. J.

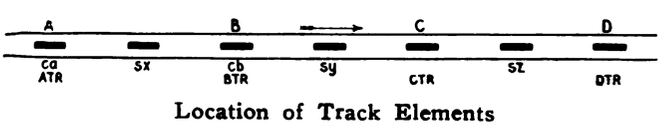
NEAR Parlin, N. J., four miles west of South Amboy, on the Raritan River Railroad, on December 15, the "M-V All Weather" Train Controller Company of Newark, N. J., gave an exhibition of its automatic train control before four or five hundred spectators, the party having been taken to Parlin in a special train over the Central of New Jersey and the Raritan River. A locomotive and five coaches were used and five tests were carried out satisfactorily.

This device is of the induction type with no contact between the locomotive apparatus and the roadway, and no moving parts in the roadway member. The valves controlling the setting of the brakes of the train are automatically opened at the approach to each block section, and the brakes are set, unless the valves are held closed, at that point, by what is equivalent to a proceed indication conveyed by induction from the roadway element. This periodical operation of the brake apparatus is accomplished by means of a cam, which is revolved slowly by gearing actuated through a suitable connection to one of the front truck wheels of the locomotive. The scheme involves the division of the line of road into block sections of equal length, the gearing connecting the truck wheels and the cam or cams being so proportioned that the cam, in its revolution, will have reached its brake-setting position when the locomotive has reached the point on the road where it is desired that the brakes should be applied. If there is no reason for stopping, or for slackening speed, the cam, by the influence of a magnet controlled from the roadway, is released, and before causing a brake application is reset at its starting point, to begin a new revolution, preparatory to causing a stop (if a stop shall be required) at the next point.

The air valves, controlling magnets and centrifugal governor (by which latter the speed of the train is made to control the setting of the brakes) are contained in a box fixed on the front of the locomotive and the photographic illustration is a front view of these parts, the front cover of the box being off.

The collecting coil on the train is hung about 9 in. above the level of the top of the rails, being supported on a longitudinal beam beneath the center of the tender. The track magnet is placed midway between the running rails, and the top of the box containing it is flush with the tops of the ties. The arrangement of the magnets of successive sections is shown below.

The scheme contemplates the use of blocks of a length which (including a suitable margin of safety) will correspond to the braking distance for the fastest trains; and the brakes of such trains, for stopping at the entrance of block B C, will be applied at A (see diagram). Assuming the presence of a train in section B C, the track relay at



Location of Track Elements

B, being open, holds open the wire circuit which energizes the track magnets at sx and at ca. A following train, if moving at more than 30 miles an hour, has its brakes applied at A; and at sx, if block B C is still occupied, another application of the brakes is made, to bring the train to a stop before it reaches B. The second brake-applying point (sx) is fixed at a sufficient braking distance short of B to stop trains traveling at restricted speed (30 miles an hour). Further details are not made public at this time; but Dr. Charles W. Burrows, consulting engineer of the controller company, has favored us with the description, given below, of the valve-actuating apparatus by means of which the train brakes are set.

The track equipment, taking, for example, block B C, consists of the caution magnet ca, the stop magnet sx,