

The practice on different roads in connection with interlocked semaphores at points where a number of routes are to be indicated has also varied, a number of the older lines having a home signal blade for each route, placed one above the other on a single mast, and other roads for similar situations having only two, the upper for the main high speed route and the lower for diverging routes.

Figure or letter indicators combined with the lower blades under the two-blade system have been tried but were discarded as of no value corresponding to the complication or cost due to their use.

The consolidation of different railway properties under one management has brought together lines having both systems in use, and the necessity for unifying the practice over the whole of such a consolidated line and doing it in such a way as would provide for the future as well as the present requirements, led to a very prolonged and exhaustive investigation by committees appointed by the larger lines interested in the question, and later by committees of the Railway Signal Association and Maintenance of Way Association. The result of these investigations was the statement of a series of fundamental principles and of the rules which should govern any applications under those principles.

(1) The first and most radical departure was the use of the upper right-hand quadrant for giving signal indications, in this respect following the German practice. (2) The giving of three indications by one signal blade (in a horizontal position and pointing to the right, pointing upward at an angle of  $45^\circ$ , and pointing in a vertical direction upward). (3) The use of a second blade below the first, which in turn gives three indications by similar positions to those of the first or upper blade. (4) The distinguishing of interlocked semaphore signals from automatic semaphore signals by having the ends of the interlocked signal blades (when the blades were in a horizontal position, in the same vertical line, and by having the ends of the automatic semaphore signals (when the blades were in a horizontal position) so arranged that the upper blade projected further to the right than the lower blade. The night signal lights were correspondingly arranged, one being vertically above the other for interlocked signals and for automatic signals the lower light being located diagonally below and to the left of the upper light.

The above combinations of three positions for two signals permitted of giving a considerable number of indications which were thought necessary for giving information to direct the movement at the high speeds at present required for through limited and special service trains.

It is generally admitted that the night indications should be given by lights of distinctive color, and the difficulty in giving so many combinations as above required has been solved by the use of green, yellow and red lights for the three positions of vertical,  $45^\circ$ , and horizontal. It appears to the writer that by far the most logical solution would have been (1) green, (2) red-and-green, and (3) red for the corresponding positions, the red and green from one source of light having been proved by years of use on one or two of the largest systems in the country to be absolutely distinct and reliable.

Up to the point where two blades have been decided on for giving indications in combination, there has been a fair degree of unanimity in the ideas of those responsible for the system, but some divergence of opinion has developed as to the system by which the combinations shall be made, and the great danger appears to be that greater confusion may result as between the practice of different roads in this respect than has existed under the systems which have been in use heretofore.

### Simplicity of Signals; A Single-Blade System

It is the writer's opinion, that simplicity should never be sacrificed in so grave a matter as giving indications for governing the runner of high-speed trains, in order to give modifying instructions for slower speed movements. The time for correct action by the runner of a high-speed train is so short that the message to be conveyed by signals must be so simple that its interpretation is intuitive and not the result of reasoning. The message, therefore, must be limited to that which can be instantly comprehended by anyone who can be expected to reach the position of runner and not by the highest, or even the average mental development to be found in runners as a class.

It is the firm conviction of the writer that, taking into consideration all of the conditions surrounding the men whose duty it is to run an engine, the care of the machinery, the looking out for train order, block, and interlocking signals, the graduation of power for grades and curves, taking water at speed, station stops, and a great many other exacting requirements, the placing upon them of the responsibility of correctly interpreting a combination of signal indications which takes a variety of mental operations, is a long step away from safe practice. It would seem much safer to give the indications by one blade, which, if need be, can have four positions with corresponding night indications, four appearing to cover all present requirements, the blade pointing to the right of the signal mast as seen by an approaching train whose movement is to be governed by it:—

(1) Horizontal position, red light at night; (2) vertical position upward, green light at night; (3) inclined upward at  $45^\circ$ , a red and green light at night; (4) inclined downward at  $45^\circ$ , a yellow light at night.

The corresponding indications would then be as follows: (1) "Stop" signal; (2) Clear signal: "Proceed," next signal is also in position to be passed, being either clear or at caution; (3) Caution signal: "Proceed at such speed as will admit of stopping at next signal, which may be at stop or at caution"; (4) Caution signal: "Proceed at such limited speed as is safe to take a diverging route from the main line from this junction or cross-over."

As discriminating between semaphores for interlocking and those for automatic block signals, there can be placed upon the mast a bracket projecting to the left, whose outer end shall have the same relation to the mast that the outer end of the semaphore casting has to the left of the mast for interlocked signals, and on the outer end of which a white light can be placed at night as a marker. For automatic block semaphores this bracket can be projected further to the left so that its outer end will appear to be materially further from the mast than is the semaphore casting upon that side and on the outer end of which a white light can be placed at night as a marker.

It is believed that such an arrangement of signals as this can be made to cover all of the necessary moves in territory where high speed is permitted and that in terminals or other points where the speed is necessarily limited, as compared with that on the open road, a dwarf signal indication can be given on the ground at the foot of or below the high speed signal to meet any additional requirements as to movements of trains at such points.

It will be seen from the above that the mental operations which the high speed runner would be obliged to carry out are limited to not more than four at the instant that he observes the signal, his rule being: (1) stop if a red light or a horizontal blade is displayed; (2) proceed if a green light or vertical blade is displayed; (3) reduce speed as is necessary if a red and green light is displayed, or the blade is