by smashboards are not warranted. Smashboards on one road only would afford a check in the case of overrunning signals, for in case of an accident, if the smashboard was broken the responsibility would be placed on the road having the smashboard, but if these boards were in the clear and unharmed it would be proof that the train on the other road had over-run the signal. The signal mechanism, smashboard and extra wiring, relays and other equipment for each smashboard cost between $700 and $900, depending on the class of apparatus and local conditions. Whether smashboards should be used or not is an important question that should be decided by the Signal section, A. R. A.

Looking at the question from one angle it might be said that once the signal is cleared for a route the same conditions exist as at any other interlocking without derails and, therefore, smashboards, in addition to the home signals, are an unnecessary complication not required in regular interlockings as now being installed. From the other viewpoint it might be argued that as there is no towerman to witness train operation the smashboards are worth while as a check on signal observance.

The idea of eliminating distant signals or substituting some sort of a special marker sign did not meet with much approval in the discussion on the convention floor on account of the fact that the engineman would be likely to come upon an absolute stop interlocking signal without a caution distant indication as provided for in the majority of rule books. Whether the distant signal is operative, whether it is to indicate in two positions, caution and clear, or in three indications, danger, caution and clear, should depend on the system of automatic signaling adjacent to the plant and on the volume of traffic.

The decided economy accomplished by these plants should be given comparative consideration when authorizing such equipment in order that everything justified for safe operation is included. About $5000 a year can be saved by using an automatic signaling interlocking in place of a mechanical plant where levermen are required for three tricks. Therefore, if this economy is to be extended to numerous crossings, the installation must be surrounded with sufficient safeguards to prevent train accidents, for one or two serious collisions on these automatic signaling interlockings might result in the refusal of state commissions to approve future installations.

Open Switch Protection in Train Control Installations

THE continuous train control and train stop system provides inherent protection after a train has passed a signal or a "phantom signal" location. This added protection includes that provided in the event that a switch is opened after an engineman accepts a signal. In some of the reports issued recently by the Interstate Commerce Commission, covering final inspections of continuous train control or train stop installations, attention has been directed to the ineffective shunting conditions which were noted in specific instances. The commission's interest is indicated in the following excerpt from a recent report:

"Further tests developed the fact that when the locomotive occupied the main track with no other train in advance in the block, a switch opened resulted in the display of a red cab signal until the locomotive was within a distance of from 962 to 330 ft. from the open switch, at which time the cab indication changed to green, this green indication being held until the receiver had passed the first lead joint, after which it changed to red. This condition was due to the relative capacities of the shunt imposed by the locomotive wheels and axles and that of the switch-box shunt. After adjustment and cleaning, the distances ranged from 264 ft. to 282 ft."

If the reader will refer to the discussion of this question of switch-box shunting as it affects train control or train stop installations, as published in the "What's the Answer" section of this issue, he will realize the fundamental difference existing between switch-box shunting of an ordinary a-c. track circuit and of train control current when a locomotive occupies the track circuit. The train control relay on the engine requires an alternating current in the rails between the exit end of the block and the locomotive, which is essentially different from the conditions existing in the ordinary a-c. or d-c. track circuit. Due to the lower shunting impedance of the wheels and the axles of a train, the a-c. train control current divides between the switch-box shunt (assuming an open switch) and the train in such an inverse ratio that current enough to cause a pick up of the engine relay may be encountered when within a few hundred feet of an open switch.

Does this constitute an operating hazard? The commission's attitude is perhaps best given in its own words as taken from the same report referred to previously: "The installation must be such at all times that an open switch will cause a red cab signal indication to be displayed, and initiate an automatic brake application at such distance from the switch as to insure protection, maintaining this red cab-signal indication to a point which will afford ample protection. Should this arrangement be found unsatisfactory or impracticable to maintain, other means of protection must be applied."

How far should a red cab signal be maintained to afford ample protection? From the opinions contained in the replies received to this question, the reader may wonder whether there is any room for argument, because the consensus of opinion is clearly that protection is provided for a train if it is within braking distance of a switch, which is all that can be expected of any automatic system for protecting trains. This is set forth clearly in the "What's the Answer" reply of A. H. McKeen, system signal engineer of the Union Pacific.

Not all installations of continuous systems for controlling trains are dependent upon the shunting of switch boxes for switch protection, some of the three-indication systems which employ a "loop" current as well as a "track" current breaking this "loop" current through all switch boxes in the section controlled, thus insuring a double protection inasmuch as the two-element relay cannot pick up with only single-phase current. However, it is certain that a great deal more attention is being given to the proper functioning of switch boxes at the present time than was formerly the case and owing to their importance in checking the position of switches in train control territory it is very likely that the inspection and maintenance of switch instruments will receive more recognition in the future as a factor of prime importance in all train control or train stop installations.

It is not at all impossible that, through efforts to reduce the shunting impedance of switch boxes and connections, together with more refined adjustments of engine relays, with respect to minimum values of pick up current, these distances from an open switch within which a so-called false pick up of an engine relay may occur, will be reduced to well under 100 ft. which should eliminate all basis for the criticisms now being made.