is changed. The principal difficulty to be overcome in the development and use of devices of this type is to insure that the indication will be received on the moving train, and when received will not be improperly changed before the next contact point is reached. These systems, as far as developed, do not fully meet requirements Nos. 1, 2, 3, 4, 7 and 11.

Inductive—Alternating Current Type.

The committee is not aware that apparatus of this type has been tried. As described, the system is quite similar to the intermittent contact rail scheme, except that the operating impulse is conveyed to the moving train by induction, a coil of wire attached to the track acting on a suitably arranged coil placed on the train. The arrangement can be made to keep within the clearance lines, and seems to be capable of successful development, provided the necessary alternating current is available at the many points where same will be required. Requirements Nos. 1 and 2 do not appear to be complied with by systems of this type of which the committee has knowledge.

Inductive-Hertzian Wave Type.

This type of apparatus makes use of a generating device placed on a train or at a fixed point from which the Hertzian waves are sent out, preferably in the direction in which it is desired to give the indication. A collector of suitable form and arrangement is placed on the train or point at which an indication is to be received, and the proper Hertzian waves are supposed to be collected and actuate the apparatus to give an indication. The principal difficulty with apparatus of this type is in selecting the particular train or fixed point which is to receive the intended indication and to provide protection for a train when there is a failure of the wave generating apparatus. It is understood by the committee that these systems do not comply with the following requirements for safe and reliable working: Nos. 1, 2, 3 and 6.

Recommendations.

Up to the present time descriptions and drawings of automatic stop and cab signal devices referred to this committee have not included those which seem to be the best and the most practicable. Your committee is not in a position to, and does not think it advisable. to recommend for trial any type of cab signal or automatic stop device with which they are familiar, believing that demonstrations of the practical workings of these systems should be made by the patentee, the manufacturer, or under the auspices of the Block Signal and Train Control Board of the Interstate Commerce Commission. That those interested in the design and manufacture of automatic stop and cab signal devices for use on surface railroads may know of the operating conditions under which these systems will be used, and the requirements as to safe and reliable working which must be met in order that these devices may have the approval of this Association, your committee submits for adoption the following requisites of installation to which automatic stop and cab signal systems must conform. to be considered safe and reliable in operation :-

Requisites of Installation.

1. Apparatus and circuits so constructed that a failure of any essential part will cause the display of a stop signal indication, and also the working of the automatic stopping device. The apparatus shall if possible, be so arranged that the stop shall not be operative or effective at speeds less than five miles per hour.

Note.—To comply with this requirement, it is practically necessary that circuits be arranged with power supply at one end and controlled relay or operating device at the other end of each circuit.

2. The train control feature must be applicable for use with the absolute or the permissive block system.

With either system the release of the stopping device must be within the control of the engineman or trainman, but only after the speed of the train has been reduced to five miles per hour or less.

3. The automatic stopping device must be operative only in the direction of traffic, except in connection with signals governing reverse movements. 4. The system must be operative under all weather conditions and at any speed in excess of five miles per hour.5. The system must be adaptable for use with a block system using track circuits.

6. The system where track circuits are used must give protection against a broken rail, the ends of which have separated, or where a rail or section of a rail has been removed from the track.

7. The parts on the moving train must not extend beyond the maximum clearance lines and the parts on the ground must not extend within the maximum clearance lines, except for a space of two (2) feet above the top of the rail, within which distance the parts must clear the maximum equipment line.

8. An overlap equal to the breaking distance for the maximum permissible speed must be provided for an automatic stopping device.

9. Emergency application of the brakes should be made only when a home or dwarf signal has been run by, when indicating stop. If the system is arranged to cause an application of the brakes when a train passes a distant signal that is indicating caution, the application of the brakes must not occur if the home signal is indicating proceed, or if the speed of the train is under such control that the train will be stopped before passing the home signal.

10. The circuits must be arranged to allow two or more engines to be used with one train or to allow one train to push another train without having the automatic stop applied at each home signal, or to require the speed to be reduced to five miles per hour when passing a home signal that is indicating proceed.

11. The automatic stop must be adaptable for use with electric traction systems, using direct or alternating current for train operation.

12. The automatic stop and cab signal should be considered only as adjuncts to a fixed signal system.

Note.—This is on account of the impossibility of properly checking the work of the engineman if a cab signal or automatic stop is used without a fixed signal, and also from the necessity of informing the engineman of the exact commencement of the block and the point at which the indication received in the cab shall become effective.

All of these methods are old, and in developing a cab signal for the Simmen system the intermittent contact rail has been adopted. I will now enter into a general description of the Simmen system :--

As heretofore outlined, signalling may be divided into two distinct groups: one for the general control of train movements over an entire division, the other a local control. Heretofore all signal developments have been principally along the line of automatic local control, and the Simmen system makes a radical departure from this in that it consolidates the general control over a division and the local control from block to block into one system. In all signal developments of the local control type the old telegraph train order system must still be retained, and, therefore, no expense is eliminated by the introduction of the automatic block signal. By reason of this consolidation the telegraph operator, now essential for any system, is entirely eliminated, thus bringing about an initial saving which goes far towards paying the fixed charges, depreciation and maintenance expenses of the new system.

In general outline the Simmen system proposes to accomplish the following results :---

I. The telegraph operator, to-day the most prolific cause of accidents, is entirely dispensed with by the new system.

2. Each train as it passes over the road automatically makes a record (in graphic form) on a sheet in the despatcher's office of the exact time it enters and leaves a block, thus informing the despatcher of the exact location of trains at all times.

3. Signals along the road are under the direct control of the despatcher, who can signal to any engineer direct to stop or to proceed. The signal may be a fixed semaphore signal, a cab signal, or any type of signal now in use. A new cab signal, however, is being developed by the company