## RAILWAY SIGNALLING APPLIANCES AT THE CRYSTAL PALACE ELECTRIC EXHIBITION.

Recent railway accidents which have exposed the defects of some of the existing methods of signalling have naturally made the appliances exhibited at the Palace Exhibition objects of much attention, and as nearly every really useful system is shown in working order (that is, when not disarranged by the carelessness of experimenters), the public have an opportunity, not often afforded, of becoming acquainted with the signalling arrangements commonly adopted on railways. Besides the standard systems, as they may be called, there are, however, several novelties which are more or less adapted to remedy defects which are inherent in or appertain to the well-known devices, and these we shall endeavour to describe as minutely as possible. The London, Brighton, and South Coast Railway Company exhibit the methods adopted on their line at various periods, including Saxby and Farmer's union of "lock" and "block," while the London and South-Western show Preece's system in working order for a block section, with three signal-repeaters to indicate to the signalman in the boxes the position of the semaphore arms. Mr. Spagnoletti's arrangements as employed on the Great Western are also shown, and as we have previously mentioned, Mr. C. V. Walker, the electrical engineer of the South Eastern, exhibits a unique and chronologically arranged collection of instruments used for signalling purposes. All of these are tolerably familiar to those interested in the subject, as they are fully described in text-books; but in the exhibit of W. R. Sykes, shown in very large scale model, we have perhaps the most advanced and most perfect combination of the electric lock and block. This system has been in use for some years on the London, Chatham, and Dover, and the Metropolitan District, and is probably as near perfection as it is possible to go. It is shown as working between three signalling points, and those who are sceptical can try for themselves how far it is possible to break it down, and set signals so as to cause an "accident." The system is based on the mechanical union between the lock and block, and every signal given requires the attention of at least two signalmen. Thus, suppose we designate two signal boxes as A and B, A cannot lower his semaphore until B releases his lever, and per contra, B cannot lower his semaphore for a train in the opposite direction until A has released the lever by electrically removing a pin from the stop in the lever. Suppose a train to be approaching A's box, and travelling towards B's, A sends the call to B, and receiving "line clear," sends another signal which releases the lever in B's box, and enables the latter to pull off his signal, which he can put on again, but "off" until he gives "line clear" a second time. Thus two trains cannot be in one block-section at the same time, except by consent of two signalmen. Similarly, by combinations of electrical and mechanical arrangements, it is impossible to pass trains by signal while a siding is open for shunting, as the fact that the points are open for the siding effectually locks the main-line signals. On the other hand, points for sidings cannot be opened if a "line clear" signal has been given to a main-line train, until that train has passed out of the section. Thus, unless two signalmen at different boxes make the same blunder, it is impossible for an accident to occur, provided the drivers of the trains pay attention to the signals. It will be readily understood that such a system would have prevented the Canonbury "accident," which may be taken as an extreme case of railway blundering that would have been simply impossible if the signalling arrangements had been on the plan just described.

All the systems we have mentioned are, however, thrown out of use by dense fogs, and by occasional defects, and attempts have been made by enthusiastic inventors to persuade the railway companies to employ what may be termed automatic systems, not that they are really automatic, dispensing with the services of signalmen, but as complementary signals appealing more directly to the driver than the semaphores, for which it may be said he has to look out. Even in the case of fog, however, the Sykes' system has been found to answer remarkably well, for the simple reason that a signalman cannot allow a train to leave until the signalman in advance has released the lever.

Still, fogs are not unknown in London, so dense that the driver cannot see even the post, let alone the semaphore, and in such cases fog-men are employed—introducing yet another element of human fallibility. To provide for such conditions as these, several devices in the shape of electric gongs working in connection with the signals have been invented, and one of the simplest of these is Sullivan's electric fog and night signal, shown in a working model in the Eastern Gallery at the Palace. This arrangement is simple, not likely to get out of order, and certainly more trustworthy than the average fogman. It consists simply of a small bar placed parallel with the rail, and projecting slightly above its surface when the signal-arm is "on," or at danger. The wheel of a passing engine depresses this bar, and rings a powerful gong in a box near the post; while, should the signal be "off," the bar is drawn below the level of the rail, and the gong is not sounded. The signal is entirely under the control of the signalman, and can be worked either electrically or mechanically in connection with or separate from the semaphore. It is, in fact, a type of a useful class of signals, which can be so arranged as to supplement the ordinary semapheres in clear weather, and to act as substitutes in the event of fog or derangement of the apparatus.

The British and Irish Telephone Co. exhibit a working model of Redcliffe's fog-signal, which differs so far from that just mentioned, that the "signal" itself is given on the engine. In this arrangement we have the usual magnet and armature, the latter carrying a projection, which rubs against a long lever carried alongside the engine, in about a line with the centres of the driving wheels. This lever actuates a small semaphore placed on a level with the driver's eyes, and also sounds the whistle,—a crude idea, which does not commend itself by the finish of the model. Several better devices have been described in our back volumes, and so long ago as Feb. 5, 1875, we gave an account of Sir D. Salomons' system, which was so far complete in details as not only to call the driver's attention, but actually to shut off steam and apply the brake for him. That system (See p. 516, Vol. XX.) necessitated a central insulated rail, which was so connected to the engine that on the latter entering a block section already occupied, a bell would be rung, or, as before explained, the steam might be automatically shut off. A practically identical system was patented last year by a Mr. Putman, of New York, and in the Concert-room Gallery, Messrs. Apps exhibit a nicely-finished working model of the system invented by Mr. T. T. Powell, of Harrogate. In this we have the insulated centre rail or wire in contact with the train by means of light wheels and rods, a couple of signal-boxes, and bells, &c. Levers at the side of the rails are depressed by the passage of the train and give notice in the signal-boxes, while tapper-keys on the engine and guard's-van enable either driver or guard to communicate with the signalmen, and the latter can, of course, communicate with them. The model is sufficient to show that a railway worked on this system would form an electric circuit, or combination of circuits, by which not only would signalmen be able to communicate with trains approaching their boxes, but the manager could, by means of an indicator, locate the position of any train at any given time; further, platelayers could inform signalmen promptly of any defect in the road, and passengers could communicate with the driver or guard. The difficulty is the centre insulated rail, which would cost something, and the insulation, we are afraid, would be a source of trouble. In some respects, Mr. Powel's system is more complete than that of Sir D. Salomon's, for the latter breaks his centre-insulated rail into "block sections"; but we do not think that either plan is likely to be adopted for some time.

A really useful invention is shown in the Eastern Gallery in the shape of King's patent electric railway signal, which is specially adapted for use on single lines in sparsely-populated countries, or where the amount of traffic will not allow of a competent and ample staff of signalmen. In the model we have a simple line with a branch to a siding and three posts, one of which contains a clock capable of indicating time up to 15 minutes, and a semaphore put "on" by mechanical means as the train passes over a lever treadle level with the rails. This semaphore is put to "off" by means of electricity when the train reaches the next post, where, at the same time, it puts the second signal at danger. The use of the clock is not quite apparent, for the inventor can scarcely expect his system to be adopted in crowded districts, but for certain purposes it will be employed in the following way:—The clock, say, is at post A: a driver approaching and finding the signal "off" will see by the clock how many minutes have elapsed since the previous train passed into that block section, and as his engine passes that post it will, as explained above, put the semaphore at danger and the clock-hand back to zero. When the engine passes post B, it again runs over a treadle, which puts the semaphore at B to danger and clears the block section in the rear by lowering the semaphore at A, where the clock-