CHAPTER XV.

JUNCTION WORKING.

181. Junctions are a fruitful source of disaster. Void of electrical aid, it is to be feared they will largely continue so; but given a proper block system for the government of the traffic for a certain distance on either side of the junction, and it is not seen why—independent of such danger as there is attending all facing points—this should be. Properly worked, a junction, if not as safe as any straight road, should, at all events, be free from collisions.

182. The principle upon which all junctions should be worked is,

That each road about to be fouled by a coming train shall be regarded as one section, until such train is clear of the fouling point.

183. Let B, Fig. 89, be a junction of which ABC is the main line, and BD the branch. Now a down train from A, for C, will foul the *up branch road*, and therefore, before any such train is allowed to leave A, it is desirable any *up branch* train should be blocked back at D. In like manner as an up main, or an up branch train, must traverse the same road from B to A, it is clear there is

no advantage in allowing either one or the other to leave C or D until the other is free of the junction.

It will be observed that whereas a down main line train fouls the up branch road at B, it in no way interferes with the up main traffic; and in like manner that a down branch train in no way interferes with an up branch train. It is, therefore, desirable that the character of the train about to leave A for B—whether it be for C or for D—should be made known to B, and that a separate instrument for down branch trains should be

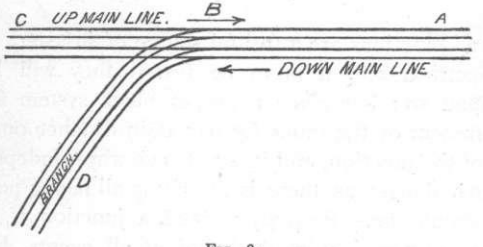

FIG. 89.

worked from B to A. Where the additional instrument is provided, all branch instruments should be kept at *danger*, and only the up and down main line instruments set at clear after the respective trains have passed out of the section. The additional instrument for down branch trains facilitates the traffic and affords greater security.

184. Following out the same principle with a triangular junction, Fig. 90, electric signals are necessary at A, B, C, and D, on the main line, and at E and F, on the branch. B, E, F we will take as E's main. Additional signals will therefore be required for down branch trains at A for the protection of junction B, at D for branch trains for the protection of junction C, and at F for branch trains,

proceeding towards C and D, for the protection of junction E. B and C will keep E constantly blocked for trains from that direction, removing the block only after having blocked the respective sections on either side from which approaching trains might foul the branch roads; and E will keep C constantly blocked for all trains from that direction, C being E's branch road.

185. It is highly desirable, to insure a due and faithful blocking of all the necessary roads, that the means by which the electrical block signals are worked from each of the junctions B, C, E, should interlock after the manner of the out-door signal locking frames. Thus: —

1. Before B can give the "clear" signal for a down

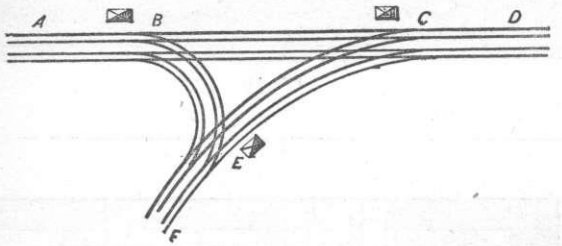

FIG 90.

branch train to A, it should be compulsory for him to block the up main road at C.

2. Before C can give the "clear" signal to E, for a train from that junction proceeding to D, it should be compulsory for him to block the up main at D, and the down main at B.

3. Before E can give the "clear" signal to F, for a train from F for C, it should be compulsory for him to block any down train from B.

Where the additional instrument for the respective branch traffic is not provided, the locking should apply to the ordinary signal instrument for the section affected,

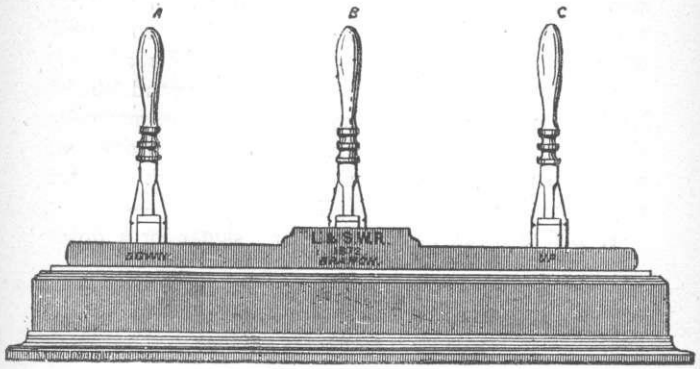

FIG. 91.

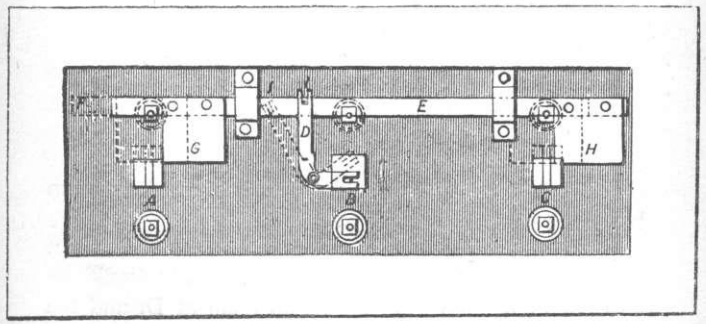

FIG. 92.

every approaching train being "warned" (§§ 157, 158) in due course.

The system of locking electric signals has, up to the present, been applied to but one form of instruments, viz., Preece's.

Fig. 91 represents, in front view, a junction-locking switch.

Fig. 92, the plan, as seen from underneath the base board.

Fig. 93, the end section.

In Fig. 92, the lower ends of the levers are shown at A, B, C.

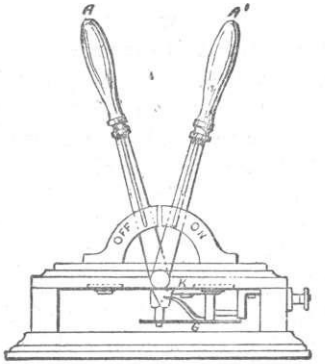

FIG. 93.

Lever B is fitted with a pin at its foot or lower end, which pin works in the fork of an angle or elbow-piece D, which is also forked at its other extremity.

E is a sliding bar, free to move towards F, carrying with it two locking plates G, H. To this sliding bar is fixed a small pin I, working within the other forked end of the angle-piece D. It will thus be seen that the angle-piece D is governed by the switch lever B, and that it controls the sliding bar E; that to move the

sliding bar, we must move the lever B, and unless the sliding bar E is free to move, the lever B cannot be moved.

Levers A and C are slotted at their extremity, as shown at K in Fig. 93.

The movement of the several portions of the apparatus is shown by the dotted lines, and is further indicated by the arrows.

The position of the levers as shown by the plan, Fig. 92, is ON: that is, all the signals worked by them are at danger. Any one of them may be drawn over to OFF so as to place the signal worked by it at "clear."—Let us assume that lever A is drawn over to this position. It will then be in the position shown at A, Fig. 92, and its lower portion will stand in front of the locking plate G. If now we try to move lever B we cannot do so, because the locking plate G, banks hard upon the lower portion of A, and the sliding bar having but one movement, as indicated by the arrow, is thus immovable. But lever C is free and it may be drawn over to the OFF, or clear position. Now lever A controls the down main, and lever C the up main. Neither of these lines conflict, and hence it is not necessary the signals by which they are governed should interlock. But B governs the branch, and trains from that direction must foul both lines, the locking being arranged for a junction as shown in Fig. 89.

Now let levers A and C be placed at ON, and let B be brought over to OFF for a branch train. The sliding bar E, is now moved forward, and the locking plates, G and H, pass in front of, and within, the slot K, Fig. 93, of both levers. A and C are now immovable, and the signals which they work at the distant signal stations cannot be lowered.

The drawing represents a switch for working but three instruments—the up and down main, and the branch; but any number of levers may be made to lock in a similar way, and the locking may be diversified as required, by the removal or otherwise of the locking-plates in connection with the sliding-bars.

These switches are applicable to the single or three-wire systems of the inventor, the former, however, requiring any movement of the lever to be confirmed by a pressure of the signalling-key, or plunger. They are, moreover, applicable to the "double needle" block, Spagnoletti's, Tyer's, and Walker's systems.

186. Where the block system is not in existence, and where, from reasons of economy or otherwise, its introduction for the protection of junctions cannot be entertained, additional security may be obtained by adopting the following arrangement.

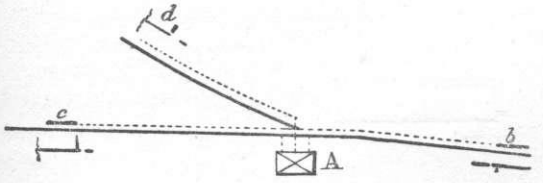

FIG. 94.

Let Fig. 94 represent a junction, of which A is the signal-box. Let the "stop" or junction signals, instead of being erected *at the junction points*, be placed some 300 yards away from it, as shown at *b*, *c*, and *d*. Trains will thus have a margin of 300 yards, ere they come foul of the points or cross-roads should the signal be against them, in which, should the driver be negligent or the metals slippery, the train may be brought to a stand and no damage ensue.

But occasions will arise, when, from fogs or other causes, the train may come to a stand at the stop-signal, and the signalman may not be able to see it, and may thus be unaware of its presence. If, however, a treadle, of such a length that two wheels of any coach, or the first and last wheel of any two vehicles shall rest upon it, be laid alongside the metal-rail for trains approaching the

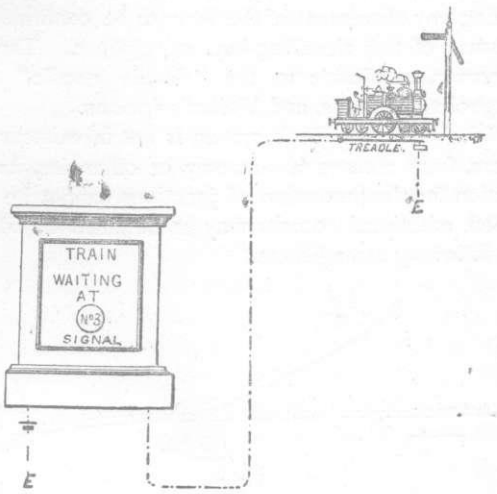

FIG. 95.

junction at *a point near* the signal-post, so as to be operated by the flange of every wheel; and this treadle be connected with an indicating instrument and a bell, fixed in the signal-box; and further, so arranged that on its depression, it shall put the line wire to "earth"; the signalman will have due notice, both by the ringing of the bell and the indication of the instrument, of the arrival of any train, and be able to take the necessary

steps in due course for its relief. Fig. 95 shows the electrical arrangement.

The distance at which the stop-signals are placed is, as regards this arrangement, immaterial, the object being to give as much margin as possible for careless driving, and to meet other circumstances under which a train may be so far past control, as to be brought to a stand before reaching the fouling, and consequently the danger point of the junction; but the distance at which these stop-signals are arranged must of course be, in a measure, controlled by the distance at which the "distant" signal is placed. The space between it and the "stop" signal should be sufficient to admit of a train being brought to a stand within it.

Siding Working.

187. All siding working at stations, or within view of the station signal-box, can, as a rule, be sufficiently provided for by the ordinary block-signals, that is by "obstructing" the stations on either side—without recourse to special appliances; but where the siding is situated at any distance from the sectional signal-box, it becomes necessary to make further provision for securing the safety of the traffic. In the mineral districts, junctions with local lines, sidings in connection with mines, manufactories, and collieries, become extremely numerous. They are, one and all, sources of danger unless necessary steps for regulating the traffic are taken.

Fig. 96 represents a section A B, with a mineral or accommodation siding C. Let it be assumed that a train arrives at A which has work to do at C. Now *safety* would be secured if on its passing A it were signalled to B in the ordinary way, so that A might be held blocked by

B until the train had arrived there; and if the down road were blocked by A (the train requiring to cross the down road at C) until the arrival of the train had been notified to A by B. But this would entail a complete stoppage of the traffic, for both up and down roads, during the entire time the train is in the section, including the time it is working at C. This is to be avoided by giving C communication with A and B. Such communication should consist of a bell between the siding-box and the station on either side, and two block instruments worked, the one from A,—governing trains proceeding from C to A,—and the other from B—governing trains proceeding

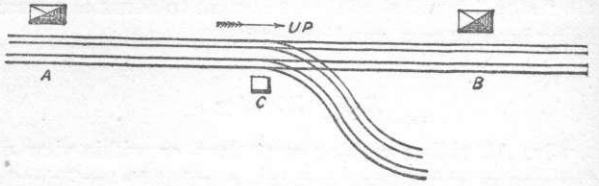

FIG. 96.

from C to B. The means by which these block-signals are worked should interlock as explained under the head of "Junction Working," so that A, when about to admit a train from C, may first be obliged to block B; and that B may be compelled to deal similarly with A, before allowing the siding train to foul the up road.

Let it be assumed that a train is about to leave A for B having work to do at C.

A man is detailed from A to accompany it and see to the crossing and signalling of it at C.

A signals it to B by a special "departure" signal, indicating "Up train left here having work to do at siding," and B blocks the up road at A in the usual manner.

Arrived at C, the detailed signalman does not permit the train to leave the up main metals, but, entering the signal-box, signals to A, "Train arrived and waiting to enter siding." A is aware that in order for it to reach the siding it must cross the down road. Before this is permitted, provided nothing has been signalled from B to A, he proceeds to block the down road at B by the usual "obstruction" (§§ 157, 158) signal, and when this has been acknowledged by B, and A is assured the electric signal for down trains is at danger at B, he places the siding block-signal worked by him at C at "all clear," which is the signal to the signalman waiting there that the train may be shunted across to the siding.

This "all clear" (§§ 157, 158) signal is acknowledged by C, but it will be observed that the block-signals at both A and B are still maintained at *danger*. The "all clear" signal received at C simply informs him that he may cross the train over, and he understands by it, that the up and down main roads are protected from any train advancing towards him.

The train is now, we will assume, crossed over, and when it is *clear of both roads, the up and the down*, the signal, "Train in siding, up and down main roads clear," is sent to A, and acknowledged. A now blocks the siding by placing his signal in connection with C at *danger*, and so long as it remains so *it is an indication to any train within the siding that it must not leave it or foul the main roads.*

A is now at liberty to clear the "obstruction" at B. The siding train has crossed the up and down roads, and he holds it within the siding by the electric danger signal worked by him at that point. Accordingly he does so, and again having signalled B, "Train in siding, clear up

road," B is at liberty to clear A from the block put on to protect the siding train when it passed A.

During the time the train is within the siding-signal the traffic between A and B may proceed in the usual manner.

But we now find the train at C has done its work, and is ready to proceed on towards B. The signalman therefore communicates to A, "Up-train waiting to come out of siding," which is acknowledged.

A has now again, provided no train has been signalled from B, to block the down road, and he accordingly "obstructs" (§§ 157, 158) B. He then signals the ordinary up-train "departure." This acknowledged, and assured that the down road is blocked at B, he is at liberty to give the *clear* signal to the siding. The train thereon crosses over to the up road and proceeds on its journey, the signalman detailed for that purpose communicating to A "Up-train left," when A again places his electric signal at C at danger, and relieves the "obstruction" at B. The signalman locks the *siding* points and the signal-box and returns to A.

A down train leaving B for C would be signalled to A in the ordinary way by a special bell code as "Down train left here, having work to do at siding." Arrived at C it would at once be shunted into the siding and the signal "Train in siding, down road clear," signalled to B. B would then signal to A "Train in siding, clear down road," and A would thereon be at liberty to do so.

Before the train can leave the siding, however, *it must obtain the clear signal from B*, in the same manner as has already been explained with reference to the up train.

It will be seen that with regard to down trains, as the up line is not fouled, no necessity exists for blocking it; consequently the signalling for down trains proceeding to a siding such as that indicated in the figure is more simple than is that for up trains.

On lines where siding working is general, the system by which they are worked should be *universal*. Clear and concise instructions as to the method of signalling, the bell codes, and the circumstances under which trains may cross the roads or leave the siding, should be drawn out, printed, and posted in every siding and signal-box. All those using the sidings, whether guards, breaks-men, or engine-drivers, should be furnished with copies, so that they may become acquainted with the system of working and be careful to observe it. Whenever a man cannot be detailed from either signal-box for the purpose of conducting the signalling, and taking charge of the crossing operation at the siding, the signalman should understand from the guard that he is conversant with what is required to be done. The signalman at A is the responsible agent for all siding trains proceeding from A to B, and B for all similar trains proceeding in the opposite direction.

It may of course happen that a train requires to proceed from A to C, and then to return to A. It is clear that in a case of this kind, after the train has entered the siding and A has blocked B for it to come out again, it will be necessary for the down road to be retained blocked at B till the train has arrived back at A. B would understand the reason why the block was thus kept on longer than usual, from the absence of the departure signal.

Similarly a train from B to C returning again to B, would, before leaving the siding, require the up road blocked at A and the block kept on there until the train had returned to B.

For single lines, inasmuch as the road is always blocked in front as well as in the rear of any train, the method of signalling would be more simple from there being no other roads to cross, and consequently none to obstruct. On the arrival of the train within the siding, the station from which it started would be advised of it and would clear the road. The train would not leave the siding until the station in front, as also that in the rear, had been blocked, and the requisite permission to do so had been obtained.