THE NATIONAL RAILWAY EXPOSITION.[1] — II.

The numerous accidents that have occurred owing to the signals showing 'clear' when the switches were set for a side-track led to the invention of 'interlocking,' which is now used extensively in England, and is being introduced into this country. The term 'interlocking' applies to a system where the switches and signals can be so worked by levers concentrated at one point, that no safety-signal can be given for any track until the switches are properly set for the safe passage of the train; and, when the signal is set to safety, none of the switches can be moved until the signal is again made to indicate danger. The advantages of this system are, that one man can operate a large number of switches and signals, and the interlocking apparatus acts as a check upon him, and renders it impossible for him to commit a mistake and move a wrong lever; and the mechanism is so arranged that a certain definite routine must be gone through in making a safe course for a train. The signals standing at their normal position of 'danger,' the switches are first moved, then they are locked firmly in position: then only can the danger-signal be changed to safety for the passage of the train when all possible conflicting signals or switches are locked, so that they cannot be operated. When a certain track has been prepared for the safe passage of a train, the necessary alteration of switches and signals is begun at the point farthest from the train, and ended at the signal nearest to it, this signal being locked to indicate danger until the track is ready for the train; and the setting of this signal to safety shall lock to danger all conflicting signals not already locked.

The amount of safety secured by the adoption of interlocking apparatus is thus laid down by an English author: "If a man were to go blindfold into a signal-box with an interlocking apparatus, he might, as far as accordance between points and signals is concerned, be allowed with safety to pull over any lever at random. He might doubtless delay the traffic, because he would not know which signal to lower for a particular train; but he could not lower such a signal, nor produce such a combination of position of points (switches) and signals, as would, if the signals were obeyed, produce a collision."

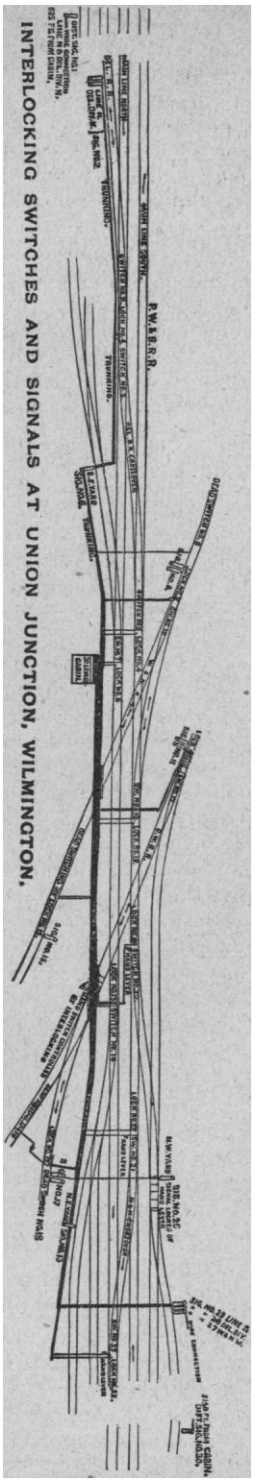
Interlocking has been very generally adopted in England, but hitherto little attention has been paid to the subject in this country; though in some crowded depots, such as Lowell, Wilmington (Del.), and Boston (Boston and Albany railroad), it has recently been introduced with great success.

The two principal exhibits of interlocking and signalling apparatus at the Chicago exposition are those of the Pennsylvania steel company and the Union switch and signal company; Mr. George Westinghouse, so well known as the inventor of the break bearing his name, being the president of the latter company. The Union switch and signal company exhibits several distinct methods of working switches and signals controlled by interlocking apparatus. First, the Saxby and Farmer method, which is very generally used in England, and in some station-yards on the continent; Brussels, for example. In this the whole work of moving the signals and switches is effected by the manual power of the signalman. But as this involves considerable physical exertion in places where the levers are numerous, and some of the signals are a considerable distance away, Mr. Westinghouse has introduced a system whereby the signalman only moves valves admitting either compressed air, or a mixture of water and wood, or methylated spirits of wine, to cylinders, the pistons of which perform the actual hard work of shifting the switches and signals. The Pennsylvania steel company shows an American invention, which proceeds on similar lines to the Saxby and Farmer apparatus, attaining, however, the same end by the use of fewer levers. As, therefore, these two systems are very similar, except as regards mechanical details, into which we need not enter here, the following description of the general methods and purposes of interlocking mechanism will apply to both exhibits. The whole question is novel on this side of the water, and will well repay a careful study by all those who are interested in the progress of railroads.

One of the points that has been equipped with interlocking apparatus by the Pennsylvania steel company is shown in the accompanying plan of tracks at the Union Junction of the Philadelphia, Wilmington, and Baltimore railroad, at Wilmington, Del. This junction is one mile west of the passenger-station, at the crossing (at grade) of the Wilmington and northern railroad and of the Delaware western railroad, where the Delaware railroad branches from the main line of the Philadelphia, Wilmington, and Baltimore railroad. Through trains pass this junction at lightning express speed. The main line is protected from crossing roads by dead

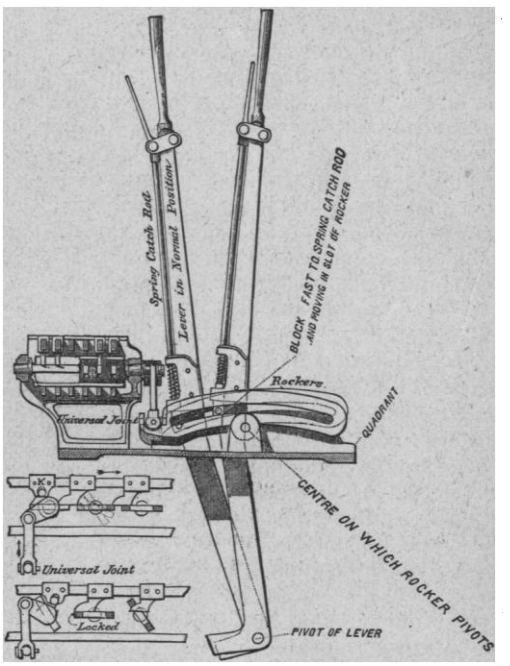
[1] Continued from No. 22.

switches on the crossing roads, so that crossing trains running against signals will be turned into a side-track, and cannot, therefore, cross or foul the main line. There are, in all, fifteen switches handled and controlled, and three other switches not handled (owing to the infrequent use, or being required only for hand-drilling), which are also perfectly controlled. Twelve facing point locks and seventeen signals are employed, some of them 2,150 feet from the signal-tower. To operate the above, twenty-eight interlocking levers are used, with two spare levers in the frame for future improvements. At this writing, the apparatus at Union Junction has been in use over one year with perfect success, and it will probably repay any railroad manager to visit it, and study its workings.



In arranging a yard on the interlocking system, it is important to concentrate the switches so that they can be worked by one man from one machine, where as many as fifty levers operating switches and signals can be conveniently arranged. Provided that the yard is well laid out, it is possible not only to gain greater safety and security in switching and drilling, but a saving in time and labor is effected, as one man who is always on the same spot can perform the work of several men scattered about a yard, and having continually to move from one spot to another. The levers should be placed in a house constructed so as to shelter the signalman from the weather, and enable him to have a good view of the whole yard; and the latter object is generally best attained by placing him at some distance above the ground-level, so that his view is not obstructed by passing engines and cars.

The levers, which resemble the reverse lever of a locomotive, are mounted close together in a line, and a name or number plate on each lever shows its use and purpose; and,



to further distinguish the levers, all those operating switches may be painted one color, locking levers another color, and so on. Each hand-lever carries a spring-catch, which secures the lever at either end of the stroke; and the detent, forced down by the spring, and pulled up by the action of the signalman's hand in grasping the handle-end of the lever and its catch, instead of engaging in a notched rack, as on a locomotive, slides in a curved slot in a pivoted bar. This bar, or 'rocker,' is therefore moved about its pivot by the very action of the signalman grasping the lever. Interlocking virtually consists of mechanism attached to this pivoted bar, which renders it immovable under certain circumstances. These controlling circumstances are the posi-

tions of certain of the other levers in the frame. To exemplify this, we will take three levers, A, B, and C. If A and B be in such position that a signal given by the movement of lever C will be dangerous or misleading to a train, the pivoted bar connected to lever C is locked, and cannot be moved by any exertion of strength on the part of the signalman; and therefore he cannot even begin to move lever C, and the possibility of giving a wrong signal is put beyond doubt. Similarly, nothing is effected unless the lever completes its stroke. The pivoted bar or 'rocker,' through which the whole work of interlocking is done, moves only at the extreme ends of the stroke of the levers, and then is only moved by the rising or falling of the spring detent. This invention, simple as it seems, is the result of many years' experience, accidents having often occurred through a lazy signalman pulling his lever through part only of the stroke, and thus only partially effecting the locking. This is now impossible; and the *intention* of a switchman to move a lever, expressed by his grasping the lever and so moving the spring-catch, independently of his putting the intention into force, actuates all the necessary locking.

The details of locking-apparatus are somewhat complicated, but the principle is simple. Certain bars carrying lugs or projections are made to slide or move by the movements of the rockers. Certain other bars, which are also moved by the action of one or more rockers, are slotted or pierced with holes, so that, in certain positions, the lugs in the first set of bars can enter the holes in the second set of bars, and, in other positions, the lugs strike against the bars, and cannot be moved. It is, of course, obvious that the arrangement is such as to prevent unsafe or contradictory signals being given, and permit only of safe or harmonious signals; and, by a careful arrangement of the locking-apparatus, it is sometimes possible to make a few movements effect important changes of the switches and signals with a minimum of levers and complication.

It is obvious, that, when switches are worked from a distance, there is a chance of the switch being incompletely closed, owing either to dirt, or a stone, or ice, choking the switch itself, or the switch-rods working it. There is also a danger that the switch-rod might break or become disconnected, and that, though the signalman moved all his levers, and all the locking and unlocking was properly performed in his cabin, yet the switch itself might remain unshifted, or be left half open. To obviate this, the facing point lock was invented. This is a bolt which can only be shot into a crossbar connecting the two rails of the switch when the switch is either properly closed, or wide open. A failure of the switch connections, or an obstruction in the switch, will render it impossible for the bolt to enter the opening to lock the switch; and, as the signalman's lever actuating this lock interlocks with the signal levers, no train can be signalled to approach until the switch is either closed, or wide open, as the case may be, and firmly locked in its proper position. But another danger has to be guarded against: signalmen, to save time, will generally throw a signal again to danger directly the engine of an approaching train has passed; his other levers are then set free, and he can unlock his switch, and actually change the switch, before the whole train has passed, thus probably throwing the rear vehicles off the track, and causing a serious accident. To guard against this, a locking or detector bar is used, which lies near the rail, but clear of a wheel, when the switch is either shut or full open; but directly the switch is moved from either of these positions, the bar moves close to the tread of the rail, and takes such a position that it must come in contact with any wheel approaching the switch. As the bar is made longer than the distance between any two trucks, it follows, that, as long as a train is passing over the switch, one or more wheels of the train must prevent this bar being moved, and, as the switch-lock and the bar are arranged to move together, it follows that the switch cannot be unlocked until the last truck of the last car of a train has passed. The Union switch and signal company adheres to Saxby and Farmer's arrangement of this bar where it moves vertically. The Pennsylvania steel company shifts it laterally. The latter movement is more easily performed, and the bar can serve as a guard-rail; but its movement seems somewhat liable to be impeded by snow falling between the rail and bar.

(*To be continued.*)

THE WEATHER IN MAY, 1883.

There have been two periods of very severe storms, and at many places of tornadoes. The first of these accompanied a 'low,' first noted in Colorado[1] on the 13th. This moved with considerable energy over Colorado and Nebraska. On the 14th, increasing in energy,

[1] It has been found necessary, owing to the smallness of the appropriation, to give up all telegraphing reports west of the Rocky Mountains: hence the charts are made up only to the east.