In 1860 the system of locking, which consisted of slide bars with hooks or locks, was moved to & fro by the action of the levers themselves. It was then found that when the parts became worn a lever which was supposed to be locked could be moved part way. To overcome this difficulty, the spring catch handles which were used to keep the lever in its vertical or back position, similar to that attached to the reversing lever of a locomotive, were utilized in order to set in motion the locking gear, so that before a lever could be moved the spring catch must be lifted, thus locking other levers, &, when fully moved over & the spring catch lowered into notch, releasing other levers. This improvement was made in 1867. It also had the advantage of making the locking much less cumbersome, an arrangement which was found to be of increasing advantage as the number of levers multiplied.

At the present time as many as 280 levers have been placed in one cabin at the London Bridge terminus on the London, Brighton & South Coast Ry. We have in Toronto yard one cabin containing 66 levers, which will give some idea of the growth of the interlocking system.

I will now pass on to the switches & their connections. Switches are worked by means of rods, bellcranks, &c., connected to the levers fixed in the signal cabins. In 1870 it was found that in many cases where switches were worked from the signal cabins accidents were liable to happen, owing to the signalman moving the switches whilst trains were passing over them, thus causing what is commonly known as the splitting of trains. It then became evident that the switches must be held perfectly closed & firm until the whole train had passed over them. This led to the invention of what is commonly called "the facing point lock." This apparatus not only effectually prevents the possibility of the points being moved while the train is passing over them, but also, by means of the bolt lock connected to & worked with the detector bar, ensures the switch being completely closed before the signal to pass over it could be given. The detector bar is made about 3 ft. longer than the longest wheel base of a car in use on the particular railway. On the G.T.R., for instance, the length of the bar is 45 ft. This bar has to be lifted to the top of the rail, so that it is absolutely impossible for the signalman to move his lever without lifting the train, & he must move this lever before he can alter the position of the switch.

As the speed of the modern express trains increased it became at once seen of what vital importance it was that the switches over which the trains ran should be perfectly closed & securely locked in position before the signal could be lowered, & also to notify the signalman in the event of any of the rodding or other gear connected with the switches becoming broken or out of order. For instance, suppose the switches are set for the main line & the signalman wishes to reverse them so as to set them for a branch line. To do this he would pull over the lever connected to the switch. Should the rods to the switch be broken, the switch would remain set for the main line. The signalman, thinking he has set the switch for the branch line, proceeds to lower the branch signal, thereby endangering the safety of the train. To overcome this difficulty a contrivance was invented called a signal detector. The form of detector most generally adopted is as follows: A rod connected to the switch tongue passes through a cast-iron box placed in line with the signal wires. In this rod a notch is cut, & in the signal wire a slide is inserted which will pass through the notch in the rod if the switch point is perfectly close. If on the other hand the switch tongue is the least way open the notch in the rod will not be opposite the slide in the signal wire & the signal cannot possibly be lowered. This was called the detector because it detects whether or not the switch is properly set.

To reduce the cost of the interlocking plants a device was invented by which the switch & detector bar were worked by one & the same lever. This is known as the economical facing point lock, & is greatly in favor in the U.S., although in England a separate lever-facing point lock is preferred.

Another contrivance for reducing the expense of an interlocker is an invention called the selector, by means of which 2 conflicting signals are worked by 1 lever. The action of the setting of the switches selecting which signal shall be lowered, of course only 1 signal can be lowered at a time. This effects a saving, not only of a lever in the cabin, but also one line of connection from the cabin to the signal. The action of the switch moving to either position sets the mechanism in the selector, so that the slide working the signal for that route is free to be pulled, while the slide working the conflicting signal is locked.

Owing to the switches being at considerable distance from the signal cabins, the levers were found very hard to work. To reduce as far as possible the friction on the rods working these switches, anti-friction rollers were brought into use. These not only revolve on their own axis, but are also suspended in curved links. These are specially adapted for the working of the rods on curved lines.

In order to facilitate the working of these long distance switches so as to retain the control of the yard in the hands of 1 man instead of having 2 or 3 cabins, Geo. Westinghouse, Jr., invented his pneumatic, interlocking machine, thus giving the signalman much greater power. To this, later on, he added the electric attachment, & we now have the electro-pneumatic system, very fine installations of which are in operation at the Boston & Maine depot in Boston, & at St. Louis Union Terminal Station.

In addition to the working of switches & signals, gates or barriers are often worked from the signal tower, & interlocked with the signals, so as to ensure the gates being against street traffic before the signal can be lowered for a train to pass.

Another system for working long distance switches is the hydraulic system which is largely in use in Europe, but has not as yet been introduced in this country. The principal hindrance to the working of the hydraulic system in this country is the liability of the freezing up of the liquid. This has been overcome by the mixture of glycerine with the water, which has been found to withstand the extreme cold of Russia.

I now come to the block systems, of which there are two kinds, the manual block & automatic block. The manual block differs from the automatic in that the former depends entirely upon the vigilance of the operator, & is worked in the following manner. The line is divided into sections of various lengths, one train not being allowed to enter the section until the preceding one is reported by telegraph as having reached the block station ahead. In order to check the vigilance of the operator a scheme was devised by means of which the train on entering the section passed over a treadle which put the signal to danger behind it, locking it in that position until the train was clear of the other end of the section, when it passed over another treadle, which released the signal behind it so that the operator was permitted to lower it to admit another train into that section. This was found to work allright in sections where trains were not liable to break in two, but was a source of danger in the event of a train breaking loose & the front portion getting clear of the section & passing over the releasing treadle while the rear part of the train was still left in the section, in which case the operator could lower the signal for a following train owing to the fact of the first part of the train having released his instrument.

The automatic block, which has been successfully operated in the U.S., is worked by means of an insulated rail or track circuit. The train on entering the circuit puts the signal to danger behind it & locks it in that position until every wheel of that train is clear of the circuit, when the signal returns to the all-right position. In the same way in the event of an open switch or a broken rail the signal goes to danger & remains in that position until the line is again secure.

I will now pass on to the various means of communication between the different signal towers. The simplest system is by means of telephones, which are very handy, but are not altogether reliable. The system which I now describe to you is for recording the departure & arrival of trains at the various cabins. For example, we will call the right-hand instrument A, & the left hand B. A wishes to send a train to B, & to notify B of this fact he places the little peg or pin in the hole opposite the section on which is recorded a description of the train he wishes to send. The dials on B's instrument are similar to those of A's. Having placed the peg in the required hole A pulls out the knob which sets the machinery of the instrument in motion, when the same indication is repeated on B's instrument by means of electricity. B then acknowledges receipt of the message by placing the pin of his instrument in the hole opposite the section on which the corresponding description is written. When both pegs are removed from the instruments they return to their normal position & are ready for another message to be sent. Another means of communication is by the ordinary telegraph instrument.

Before leaving this subject I would say that electricity is of great use in controlling the action of the signalmen by means of electric locks operated by the trains themselves.

Grand Trunk History.

The most important feature of the 4th of July festivities at Portland, Me., was the celebration of the semi-centennial of the G.T.R., the original Atlantic & St. Lawrence Ry. from Portland to Yarmouth, Me., having been opened for traffic just 50 years ago. The G.T.R. was represented by General Traffic Manager G. B. Reeve, who, in the course of his speech, said:

The Grand Trunk was the pioneer in the railway field in Canada, & the line between Portland & Montreal was opened in 1853, having taken about 6 years in building, the openings of the several portions taking place as follows:—Longueuil to St. Hyacinthe, in the spring of 1847; Longueuil to Richmond, in the autumn of 1850; Longueuil to Sherbrooke, in Aug. of 1852; Longueuil to Island Pond, in July, 1853.

From the Portland end of the line the building of the road was also in operation, & the several sections were inaugurated as follows:—Portland to Yarmouth, July, 1848; Portland to Danville Junction, Dec., 1849; Portland to Mechanic Falls, Feb., 1849; Portland to South Paris, Jan., 1850; Portland to Bethel, Mar., 1851; Portland to Gorham, July, 1851; Portland to Northumberland (Groveton), July, 1852; Portland to Island Pond, Feb., 1853; thus connecting the two portions joining Longueuil & Portland with railway facilities. Longueuil was then the western terminus of the system. Owing to this fact, there were consequently many inconveniences, trouble & expenses incurred in reaching the Canadian metropolis, as the river is 2 miles across at this point, & freight & passengers had to be transferred by boat in summer & by teams across the ice in winter. These difficulties, however, were soon overcome by the