'GOOD NIGHT, BABY.'—From Drawing by Robert Barnes, A.R.

RAILWAY BLOCK SIGNALS.

On the common highway the driver always looks out for his own safety. On the railway he cannot do this. A capable teamster avoids other teams without aid or advice from any one; but railway trains run so fast that the engine-driver needs to be told of any obstacle in his way some time before he reaches it.

To run at high speed around hills, or even on straight lines, in foggy weather, he must be made confident that, if there is any slow train ahead of him, he will be notified of the fact at the distance of several thousand feet, so that he may put on the brakes in season. Therefore, when a train is delayed, one of the brakemen must at once go back on foot to warn any following train. The rules requiring this have come to be among the most imperative in the railway service.

But in spite of this, collisions do occur through negligence of various kinds: and where trains have to be run very frequently, as in the neighborhood of large cities, the brakeman has no time to give an adequate warning however vigilant he may be. Therefore the block system is resorted to.

Under the block system there are signals, generally semaphore signals, fixed along the railway at convenient intervals, say from one-quarter of a mile to three or four miles apart. No train passes one of these signals until the driver knows that the last preceding train has passed beyond the next forward signal. There is thus no danger of a collision, however fast the train may run.

The necessary information is conveyed by telegraph. An operator is commonly stationed at each signal, though there are also automatic signals working without operators.

The block system has been in use on some of the crowded railways of England for thirty years, and on some important American roads for several years. This year the New York Central & Hudson River Company has equipped its road from New York to Buffalo, four hundred and forty miles, with signals and apparatus which provide unusually thorough protection. It is of this system that I wish to tell.

To form a clear idea of the block system, we must conceive of a railway track, on which trains run always in the same direction, divided into 'block sections.'

The peculiarity of the New York Central signals is that they are locked, by locks which are electrically connected from one station to another. This arrangement is intended to give the advantages of the man-operated and of the automatic signals combined, and has never before been used except on a few short roads.

The specific object of the lock is to prevent the operator, say at B, from carelessly sending a train to the next station C before C has notified him that the previous train has arrived and gone beyond the C signal.

The essential feature of the lock is an electromagnet—by which an electric current sent over a wire from C to B can, by opening and closing the circuit, be made to raise or lower an armature, which, in this case, fulfils the same function as the bolt of an ordinary lock on a door or a chest.

The details of the operation are very simple, though the instruments have a complicated look, and there are some accessories which I will omit for the sake of clearness.

Each semaphore consists of a post, with a movable arm fixed to it near the top. When this arm stands out horizontally it signifies that a train must not pass it; when it hangs down, nearly in a perpendicular position, it indicated that a train may go on.

The arm is moved from one position to the other by a lever in the signalman's cabin, connected with the arm by iron rods. The arm, as it moves up, carries a red glass to a position in front of the light on the post, whereby signals are given at night.

Now the lever in the cabin is locked by an electromagnet under certain conditions, and the controlling of these conditions is the essential part of the ingenious invention which distinguishes the New York Central signals.

When a train is ready to go from B to C, the operator at B pulls the lever, thereby pulling his signal arm down or 'off,' and the engineman puts on steam. As soon as the train has passed, the man puts the lever back, pulling the signal up or 'on,' and the lever becomes locked in that position.

Then the signal cannot be pulled off for another train until C closes an electric current, actuating the electromagnet to release the lock on B's lever; and C will not do this until the train has arrived and passed into the section beyond.

As the train proceeds, the men of C and D, at D and E, and so on, go through the same operations. The signalmen communicate to each other by electric bells, or by the ordinary telegraph, two rings of the bell meaning 'all right;' three mean, 'Is block section clear?' four mean, 'Train has entered the section,' and so on. It will be seen that the combination I have described makes it impossible for a signalman carelessly to admit a second train to a section, when there is danger of running into a preceding train, unless the man at the outgoing end of the section also blunders at the same time.

But there is still another safeguard provided, in the shape of an electric lock fixed to the 'plunger' or handle by which C unlocks B's lever. This lock on the plunger can be released only by the action of the wheels of the train, so that if C tries to authorize B to admit a second train while the first is still in the section, he finds his plunger unmovable.

The plunger lock is a common electromagnet, held closed by an electric circuit which passes through the track. It flows from the battery, through about sixty feet of one rail of the track just beyond C's cabin, to the magnet, back to the opposite rail of the same piece of track, and thence to the battery again.

When a train passes over this place, no matter how quickly, the current instantly 'takes the shortest route home.' That is, nearly all of it flows from one rail to the other, through the wheels and axle of the engine or car, which are good conductors of electricity—and thus leaves the electromagnet 'dead,' so that the lock flies open. The rails to be electrified are insulated from the rest of the track by thick sheets of non-conducting material placed at their ends.

These simple safeguards constitute the essential features of the 'Sykes lock,' which enjoys such a high reputation among railway men. The inventor did a little thing, but his idea has vast importance. B cannot give a wrong signal because C checks him, and C cannot fail to check him because, if he forgets to watch for the

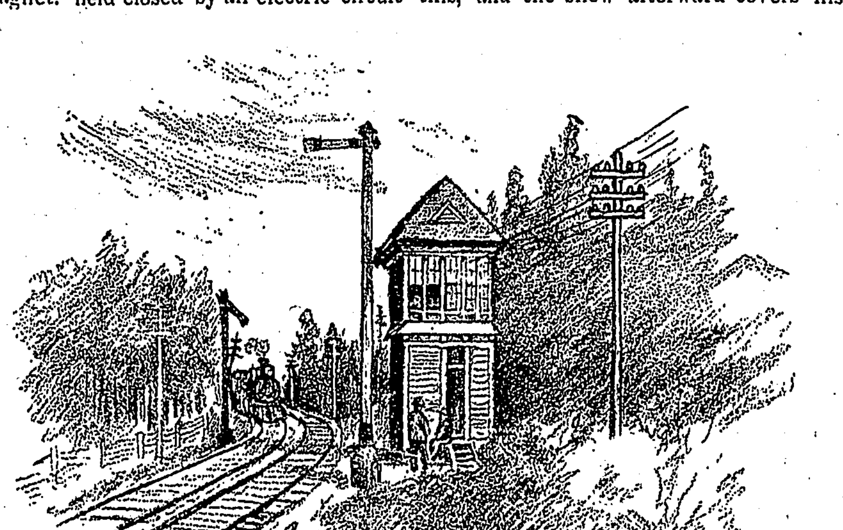
train, or goes to sleep and assumes that it has passed when it has not, the electromagnet, more conscientious than some human beings, will stay his careless hand.

To realize the great value of an elaborate safeguard like this, we must get some idea of the perplexities experienced by railway managers who have to do without it.

The superintendent who sends out a number of passenger trains over a five-hundred-mile road on dark and stormy nights has ground for a hundred fears. The brakeman on a delayed train may think the delay will not be very long, and decide that he need not go back around the curve to signal the following train. Another brakeman may go back, but go too short a distance, and the following train will not have time to slacken its speed.

In windy weather the brakeman's lantern may be blown out, and when there is ice on the ties he may fall through a bridge.

In a 'blizzard,' the man may be overwhelmed in the snow; for brakemen have been known to succumb to extreme cold; and give themselves up to the sleep that ends in death. If the brakeman does this, and the snow afterward covers his



SIGNAL STATION.