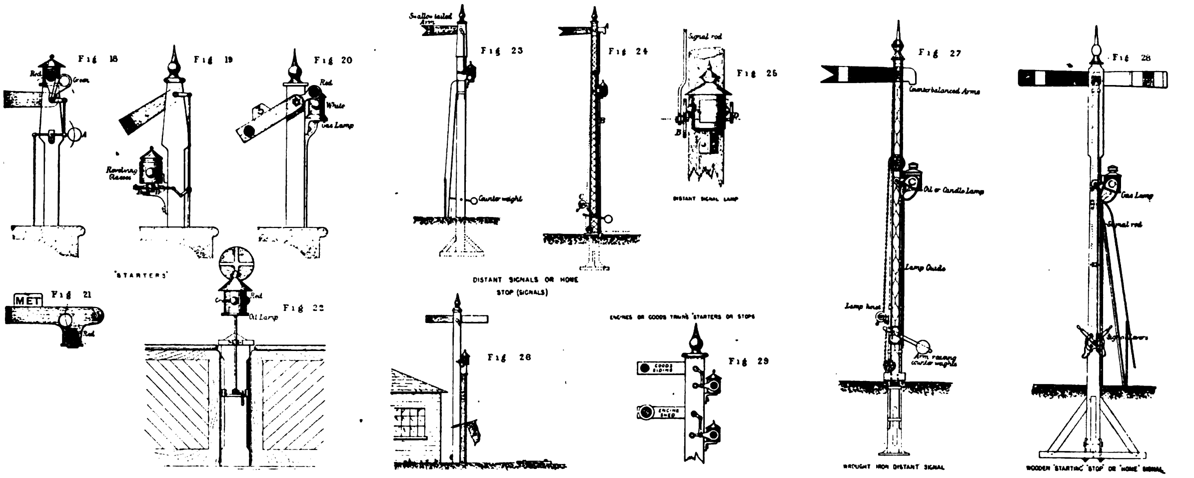
Washington, Ohio & Western.
Piedmont.
Statesville & Western.
Oxford & Henderson.

And we understand that some half dozen minor sales and as many more conveyances of other kinds are now in progress in order to perfect the minor details of the work.

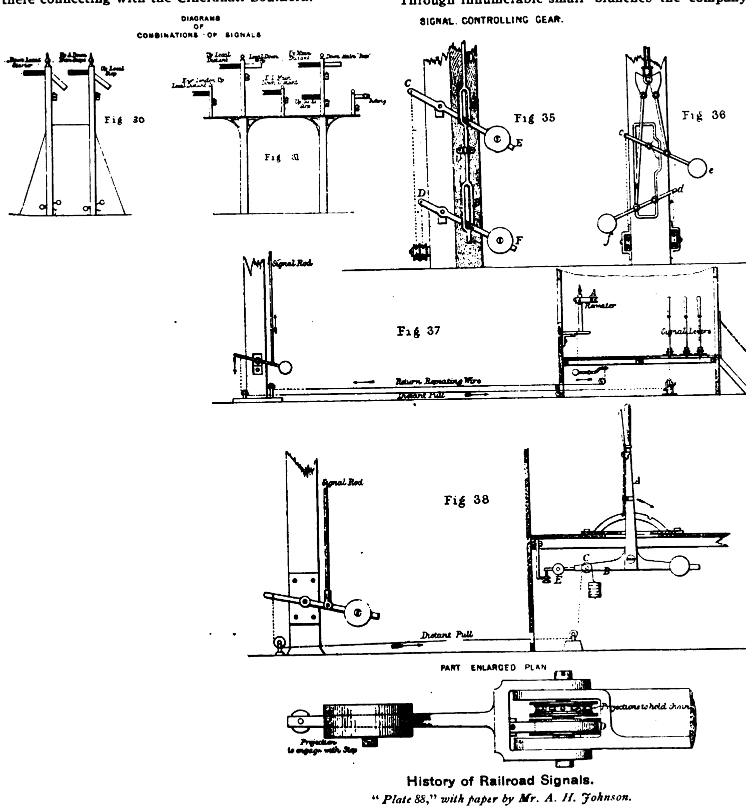
Prior to the reorganization, the properties now merged into the Southern Railway Co. were covered by about 70 separate mortgages. About 40 of these mortgages have been eliminated in one way or another.



History of Railroad Signals.

"Plate 82," with paper by Mr. A. H. Johnson.

Decribed briefly, and ignoring many small branch lines, the Southern Railway Co. extends from Washington, or, more properly, from Alexandria, Va., and from West Point and Richmond, Va., via Salisbury, N. C., to Augusta and Atlanta, Ga.; and thence to the Mississippi River at Greenville. At Salisbury another main line crosses the State of North Carolina by way of Asheville; thence over to Knoxville and Chattanooga, Tenn., and from there to Rome, Ga., where it divides, one line going to Brunswick and the other to Meridian, Miss. Another line runs from Louisville to Lexington and Burgin, Ky., there connecting with the Cincinnati Southern.



History of Railroad Signals.

"Plate 88," with paper by Mr. A. H. Johnson.

The Cincinnati Southern and the Memphis & Charleston were included in the plan of reorganization as originally promulgated, but were dropped from the amended plan, as the security holders failed to accept the terms offered. They have not bettered their condition by their refusal, and the general impression is that, sooner or later, these lines will be acquired. The Southern Co. is also expected to control the Central of Georgia when reorganized.

Among the most important cities reached by the Southern Railway are Washington, D. C., Alexandria, Va., Charlottesville, Va., Richmond, Va., Lynchburg, Va., Danville, Va., Raleigh, N. C., Durham, N. C., Greensboro, N. C., Statesville, N. C., Asheville, N. C., Salem-Winston, N. C., Charlotte, N. C., Columbia, N. C., Spartanburg, S. C., Greenville, S. C., Augusta, Ga., Atlanta, Ga., Macon, Ga., Brunswick, Ga., Bristol, Tenn., Louisville, Ky., Lexington, Ky., Knoxville, Tenn., Chattanooga, Tenn., Rome, Ga., Birmingham, Ala., Anniston, Ala., Columbus, Miss., and Selma, Ala.

The lines of the company, located as they are, reach and serve all of the diversified intersts of the South. In the way of mineral, they penetrate its two great coal fields, viz., the Kentucky and Tennessee coal fields on the north and the Alabama coal field on the South, and from these are able to supply all the States traversed by them. They also reach the great iron industries of the South at Knoxville, Cleveland, Chattanooga, Anniston, Birmingham, and intermediate points. Iron is made cheaper at Birmingham than at any other place in the United States, or, for that matter, in the world. On the Western division of the system there are over 30 iron furnaces. Through innumerable small branches the company goes into the very heart of the lumber territory in the States through which it runs. It is able, of course, to draw cotton from every direction, not only on its own lines, but from its connections, and it penetrates, the sections of North and South Carolina and Georgia which are occupied by cotton mills. The growth of cotton mills along the line is, perhaps, one of its most remarkable features. Right through the hard times new mills have been going up, especially in North Carolina. Its lines in Kentucky enables it to control its full share of the tobacco business at Louisville, and, in addition to this, it penetrates in every direction the country in which tobacco is grown, especially in the neighborhood of Oxford and Durham, in North Carolina, and along almost the entire length of the former Western North Carolina Railroad, which is now a part of its system. By way of Augusta and its connections to Florida it does a very large share of the garden truck business in the Southeastern States. It is the most direct passenger line from Washington to Atlanta and all the intermediate points, and also as short as any line to Florida. The Old Piedmont Air Line, which is part of the system, has long been famous.

The properties embraced in the reorganization had bonded and floating debts of about $135,000,000. This is now reduced to a bonded debt of $94,000,000, including sufficient bonds (which are reserved), to take up all underlying bonds and all the bonds and stocks of the 491 miles of leased railroad. The company will also issue about $6,000,000 more bonds during the next two years, to purchase additional equipment and improve the properties, which will make the total bonded debt of all kinds $100,000,000. The plan of reorganization wisely provides that $20,000,000 of bonds additional (to be strung out through a series of years) may be issued hereafter only for the further development of the property. The interest charges before the reorganization were about $7,500,000 per annum, and sinking funds were about $600,000 to $700,000 per annum additional. The new company's charges are $4,100,000, for 1894, $4,700,000 for 1895, and $5,400,000 for 1896.

The old company was always in such dire financial straits and had such large fixed charges that it could not afford to spend a cent on the property where such expenditures could possibly be avoided, and in this way it really lost business. Furthermore, its financial necessities led it to litigate all claims of shippers for lost or damaged goods, such litigation in nine cases out of ten having for its object simply to procrastinate and delay payment. The new company, organized as it now is, can, of course, follow a different policy, and by fair treatment of shippers is sure to enlarge its business.

Another interesting feature is that, notwithstanding the nominal control of the former East Tennessee, Virginia & Georgia and Richmond & Danville systems by the now defunct Terminal Co., there was no actual control, and the two companies did not co-operate even in the ordinary interchange of business. The jealousy between the two was so great that they preferred to turn business over to some outside connection rather than give it to each other. Another feature is the consolidation of the business organizations and the reduction of expenses at junction points where the Danville and East Tennessee have each maintained separate organizations heretofore.

In several of the Southern States, legislation has been bitterly hostile, and it must be admitted that the way these companies were conducted provoked such legislation. As a result of the reorganization there is already a much better feeling in this respect, and it is certain to grow as the community is better served.—*New York Sun.*

A Historical Sketch of Railroad Signaling.*

[Continued from page 561.]

In looking over these old records, one is impressed by the number of devices which we recognize in the many signal patents taken out from time to time by inexperienced inventors. It would take a long time to briefly describe the great number of different devices that have been proposed for signaling, but I will not dismiss the subject without mentioning a signal proposed about 1845, which revolved quickly to indicate a clear track, slowly to indicate caution and was stopped to indicate danger or stop. Hand signals for use in starting, stopping, backing, etc., were introduced at an early day and have changed very little in principle as used to-day.

Detonators or torpedo signals were introduced about 1841 as auxiliary audible signals for use in foggy weather.

In England, where there is much fog, the trackmen have standing orders to report for duty as fog-signal men in case of fog. Each man has his alloted position at a home or distant signal. He takes a supply of detonators and places two of them on the rail or removes them in accordance with the indications of the fixed signal which he serves. Many attempts have been made during the past fifty years to do this fog signalling by automatic machines, working in conjunction with the fixed signals. No such machine has been widely introduced, owing partly to its being a bad principle to depend upon the action of mechanism which is only called into practical use under exceptional conditions, except when, like fire engines,

*From a lecture by Mr. Arthur H. Johnson delivered before Lawrence Scientific School, Harvard University, Cambridge, May, 1894.

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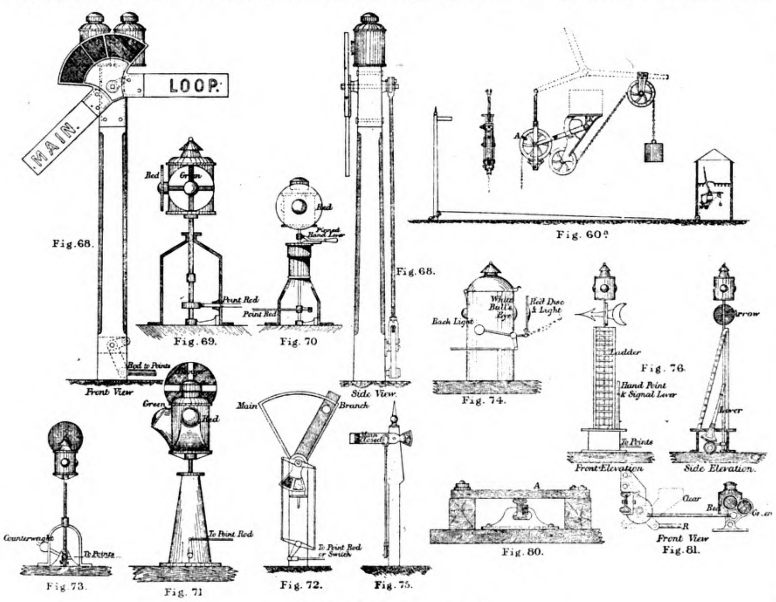
the machine can have constant supervision. As before explained, experience proved that the best signal by day is afforded by position and form, rather than by color. Color signals, however, are still used by day in connection with flagging, red meaning stop, green, proceed with caution, and white, all clear or go ahead. Color signals are also used in connection with switch stands to indicate whether the switch is set for the main track or for the diverging track, but there is also usually some distinguishing shape. Color by itself has probably been condemned as a day signal, owing to the prevalence of many other colors in the background, but at night, when there is a dark sombre background, colors have proved to be the most distinguishable. In fact, a strong red light has no equal as a stop signal. It has for many years been the general practice to use the following night signals, viz.: Red for danger, green for caution, and white for all clear. But some roads have used green for the all-clear signal, having in view the possible breakage of a red glass, and thus obviating the danger arising from such breakage.

Plate 82 illustrates several forms of semaphoric signals of some of the earlier types, but the signal of to-day varies very little in general design from these. Fig. 18 was used by the Southeastern Company. There are red and green spectacles to be placed in front of the lamp on top of the post. Fig. 19 was used by the London, Brighton & South Coast. The special feature is the revolving colored glasses inside the lamp introduced by Mr. Saxby, with the idea that the glasses would be the better protected. Fig. 20 was used by the London, Chatham & Dover. It will be noticed that the spectacle is attached to the arm, and it will be well to note in passing that this is the form that has survived all the others. Fig. 21 is used on the Metropolitan Underground. It is designed to be hung on the side of the tunnel. Fig. 22 shows a signal fixed to the platform gate post at a terminus, for the use by the man who starts the trains. In this country a small semaphore mounted on the gate post, has been used for this purpose.

It has come to be one of the first principles of signaling that the normal position of all signals must be the danger position, and should any part of the mechanism fail, the signal should at once fly to the danger position. Although the reason for this rule now appears to be obvious, yet the earlier signals were so constructed that the



History of Railroad Signals.

"Plate 101," with paper by Mr. A. H. Johnson.

arm would fall to the clear position in the case of a rupture of connections. Signals 18, 19, 21, 23 and 28 are so constructed, while it will be noticed that the signal arms of 23 and 24 are counterbalanced so as to fly to the danger position when disconnected.

Fixed signals are divided into two principal classes, viz.: Home or stop signals, and distant or warning signals. Home signals have square ended arms, as at 20 and 28, and distant signals have swallow-tailed arms, as at 23 and 27. Their principal distinction, however, is in their relative locations. I can best illustrate this by a diagram. Fig. 1. Signals 2, 7 and 5 are home signals, located at

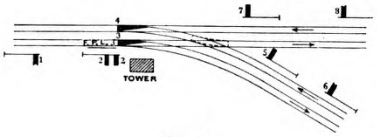


Fig. 1.

the points at which it is desired that trains shall stop when required. Signals 1, 6 and 8 are distant signals, placed 1,000 to 5,000 feet from the home signals, which they serve; the distance being regulated by speeds and grades. Signal 8 is the "distant" which serves home signal 7. The office of the distant signal is to give advance information with reference to the position of the home signal, and its use is made necessary simply by the high speeds at which some trains run. Under some conditions it is impossible for an engineman to see his home signal until his engine is within a short distance of it, and he would therefore be obliged to approach such a signal very slowly. The distant signal enables him to know whether he is to stop at the home signal, or whether that signal stands at "all clear," and he may proceed at speed. It is made mechanically impossible to place the distant signal at "all clear" until the home signal has been placed in that position.

Again referring to Plate 82, signal 27 is fitted with a lamp hoist for raising the lamp to a position opposite the colored spectacle glasses. Lamp hoists have been discarded for many years, as it was found that the men failed sometimes to raise the lamps high enough, and thus the lamps showed a continuous white light. The present general practice is to use wrought iron ladders, as shown by Fig. 28. Fig. 26 shows a simple arrangement of home signals at a plain telegraph block station. The green flag is used in certain contingencies to permit trains to enter a block section that is already occupied, under the permissive system. I shall refer to this matter later, when expaining the Block System.

It is the practice on some lines to use distinguishing marks on the home signal arms. Fig. 29 shows an arm fitted with a ring. This particular signal is used at a terminus for backing out road engines to the round-house or turn-table. It will be noticed in the illustrations that the arms extend to the left of the signal posts, as read by the enginemen. This is common practice in Great Britain where all trains run on the left-hand track, but in this country the arms extend to the right, with a few exceptions, such as the Old Colony and Boston & Albany.

In the best practice the signal posts are painted white, and the front side of the signal arm red with a white transverse stripe. It must be distinctly understood that the color of semaphore signals has nothing to do with their indications. They should be so painted as to make them easy to pick out by the runners of fast trains. On Plate 88, Figs. 30 and 31 show two examples of the arrangement of signals, where it is necessary to have a group at one point. Fig. 31 is termed a bracket signal. On railways having four main tracks signals are sometimes arranged on bridges spanning the tracks each signal being located over the track, which it governs, otherwise they are usually placed on the engineman's side of the track.

In order to secure safety it often becomes necessary that a signal arm shall be under the control of two or more signal men located at different points, and it must take the combined action of two or more men to place the signal at safety, but any one man, by reversing his lever, must be able to place the signal at danger. This is accomplished by what is called a "slot," this term having arisen from the construction of the first apparatus for accomplishing this purpose, shown at Fig. 35. B is a rod attached to the signal arm, and through slots in which pass balance levers E and F, operated by two separate signalmen. It will be readily seen that both balance levers E and F must be raised before the rod B attached to the signal arm, can rise, and that the return of either lever will restore the signal to danger. This was a primitive construction, and the signal arm had to be weighted to the clear position. Fig. 36 shows Saxby & Farmer's scissors slot which was designed to operate an arm properly counterbalanced to danger. Signals are sometimes controlled mechanically by a local man, and electrically by another man at a distance, by what is known as an electric slot.

It is very important that signals should, when possible, be placed so that they may be seen from the signal cabin; but it is sometimes impossible to arrange this, and then it becomes most advisable to repeat their action to the signal cabin, in order that the signalman may assure himself as to the proper action of such signals. The early repeaters were operated by a return wire, a shown by Fig. 37. A is the miniature repeater of the line signal, and it is operated by the return wire as shown. This method proved to be very inefficient and gave place many years ago to repeaters actuated by electricity. Contacts are arranged on the signal arms, and the miniature repeating signal in the cabin is made to correspond with the action of the line signal by the influence of electro-magnets. A bell is made to ring in case the signal fails to correspond with the operating lever.

Owing to the expansion and contraction of wire connections to signals at a long distance from the signal cabin, it has been found advisable to insert temperature compensators, as in practice the men cannot be relied upon to continually adjust the connections by means of the usual turn-buckles. Hundreds of patents have been taken out for signal-wire compensators, but their general principle is illustrated by Fig. 38. A is the operating lever, and C is a pulley over which the signal connection passes, and to the end of which is attached a weight sufficient to pull the wire taut. It is, of course, necessary to grip the connection before the signal can be moved by the lever A, and this is accomplished by the ratchet trip E, which locks the pulley as soon as the small lever is lifted from the stop.

An ingenious compensator was invented by Mr. Henry Johnson about fifteen years ago. It consisted of an iron tube, containing non-freezeable liquid. A plunger is inserted through a stuffing box into this tube. The coefficient of expansion of the liquid being ascertained, enough of it was put in the tube to expel the plunger the proper distance by its expansion when a rise of temperature took place, and thus take up the expansion of the signal wire. Thousands of these compensators have been used in France, England and America, and they were perfect as long as they did not leak, but this point proved to be too delicate for ordinary railroad repair men, and the scheme was abandoned.

The difficulty with weight compensators, as applied to a one-wire connection, is that the varying friction in a long wire, owing to the difference between wet and dry weather, makes the effect of the compensating weight variable, but this has been lately overcome to a great extent by the use of two-wire connections. Fig. 60a, Plate 101, shows another form of weight compensator.

We have thus far considered only signals which inform the engineman whether he may proceed or must stop. We now pass to signals which are placed at switches to inform the trainmen whether they will take the main or the divergent track.

There are a great many different patterns of switch indicators, and Plate 101 will show us some of them. Fig. 68 represents a switch indicator of the semaphore pattern. The two arms and the green and red spectacles are mounted on a common center pin, and connected to the switch by cranks and rods.

When the arms are in the position shown, they indicate that the switch is set for the left-hand track, and that it is set for the right-hand track when the arms are in the reverse position.

There are two lamps to give the night indications. In the position shown there is a green light on the left and a red light on the right, and it will be readily seen that when the switch is reversed the green and red lights will be transposed. Fig. 69 is a revolvable disk indicator, and it makes a quarter turn by being connected to the switch by a rod. Fig. 70 shows a simple form of switch stand. The lever handle for throwing the switch is mounted on the same shaft as the signal.

Fig. 76 shows a similar switch stand, but the switch throwing lever is mounted to swing vertically, and the signal disks are carried high so as to be better seen by fast trains.

The lenses of the indicator shown at Fig. 71 are inclined upward at about 45 degrees, in order that the light may be better seen from yard engines at short range, while at the same time being obscure to the runners of fast trains, to whom these signals do not apply. Fig. 72 shows a switch indicator which will explain itself. It is similar in design to the semaphore indicator, Fig. 68. There is, however, only one arm and one lantern, and the night signal is white for the main track, and green for the siding. At Fig. 73, the signal is connected to the switch by a wire, the signal being moved back to its normal position by a counter-weight.

In Fig. 74 the lamp case is stationary, and the indications are given by a red disk carrying a red glass. The disk is pivotted to the frame, and is made to cover or uncover the white face of the lamp case by being swung like a box lid.

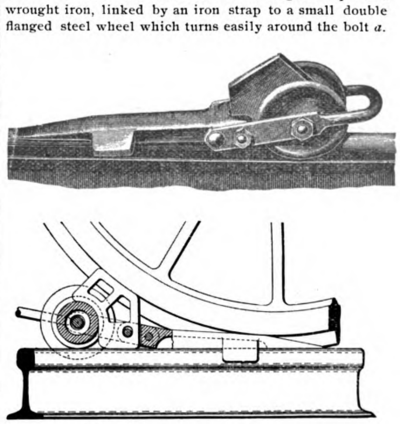
Figs. 80 and 81 show two forms of Scotch blocks. These blocks are some times used to prevent cars from being accidentally kicked or blown out of a siding on to the main line. Fig. 80 is made of oak and is moved by hand. Fig. 81 is of iron, and is operated by rod connections from a signal cabin. It has an indicator connected to it, to show at night, when the Scotch blocks are clear of the rail.

I will next pass to a brief desciption of the introduction of the inter-locking system.

(TO BE CONTINUED.)

The Koppel Stop-Block.

The illustrations represent a stop block patented and manufactured by Arthur Koppel, of Bochurn, Germany. It is in successful use on several German and Luxembourg railroads. The device consists of a tongue of pressed wrought iron, linked by an iron strap to a small double flanged steel wheel which turns easily around the bolt *a*.



The Koppel Stop-Block.

Between tongue and strap a wrought iron brake shoe is placed, turning on a bolt *b*. When a car wheel mounts the tongue it pushes against the shoe which gradually brakes the running wheel. The stop-block is carried along by the car for a short distance, bringing it to a halt without injurious shocks.

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