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# The STYLE "K" AUTOMATIC SIGNAL

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**THE HALL SIGNAL Co.**  
NEW YORK - CHICAGO



STYLE "K"

The STYLE "K"  
AUTOMATIC  
SIGNAL



THE HALL SIGNAL Co.  
NEW YORK - CHICAGO



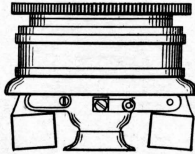
THE HALL SIGNAL CO.





STYLE "K"

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NEW YORK—CHICAGO

DESIGNED AND PRODUCED BY  
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## INTRODUCTION.

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**I**T is with a feeling of considerable satisfaction and pardonable pride that we present to our patrons and the signaling fraternity in general, this circular describing our style "K" Automatic Signal.

Most automatic signals now on the market will, with good maintenance, operate in a fairly satisfactory manner, provided that conditions as to weather, etc., are favorable, but what has long been sought is a mechanism which will be absolutely dependable at all times, regardless of inefficient attention or climatic conditions.

Such a signal we are pleased to announce is found in our style "K".

Experience has shown that this signal will stand an almost incredible amount of neglect and abuse and yet go right on, faithfully performing its work.

The fact that the door is carelessly left open and the case filled with snow, does not in the least affect the style "K", nor do extremes of heat, cold, or moisture.

Its easy and positive operation is due to two reasons: First, to the underlying principle of its construction, which is entirely original with this signal, and secondly, to the care taken in the design and manufacture of its various details.

A large number of the style "K" signals are now in service throughout various portions of the United States and extending from the interior of Canada down to southern Texas.

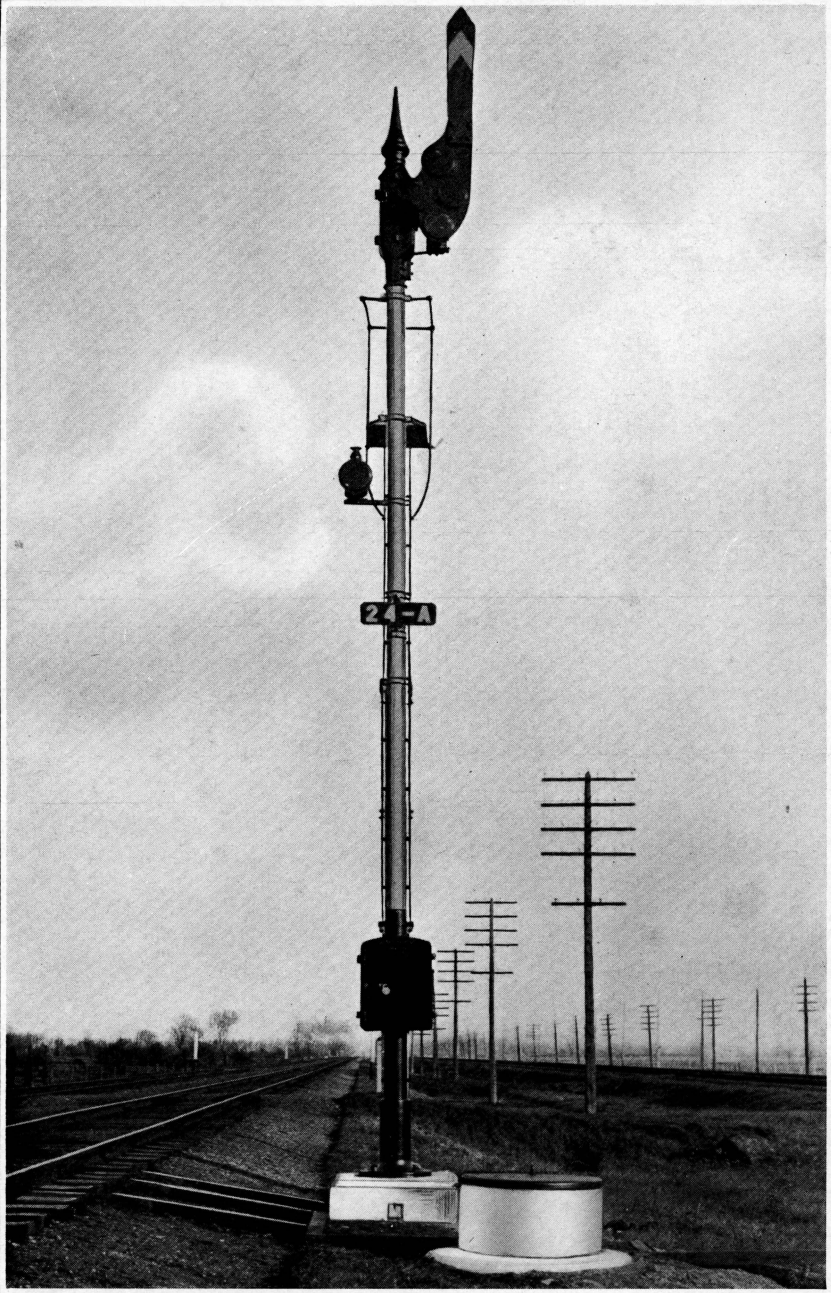
All these signals are operating with a degree of perfection unknown with any other mechanism and are establishing a record of which we are justly proud.

**THE HALL SIGNAL COMPANY.**





STYLE "K"



STYLE "K" THREE POSITION ELECTRIC MOTOR SIGNAL.  
Canadian Pacific Railway.



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## Style "K" Automatic Signal.

THE value of an automatic signal system as a means of protecting and facilitating the traffic of railroads is now known to all railroad managers in the United States, and manufacturers of Railway signals find it no longer necessary to present arguments for their installation, as it is probable that all managers in this country would prefer to operate their trains under a modern system of automatic signals, and would issue orders for the complete equipment of their respective lines if the necessary funds were available. As the mileage of roads thus protected is increasing rapidly, and as large sums are being expended annually for this equipment, the details of signal installations are becoming of increasing interest to all railroad men, and no railroad manager's education may be said to be complete without some knowledge of signal systems.

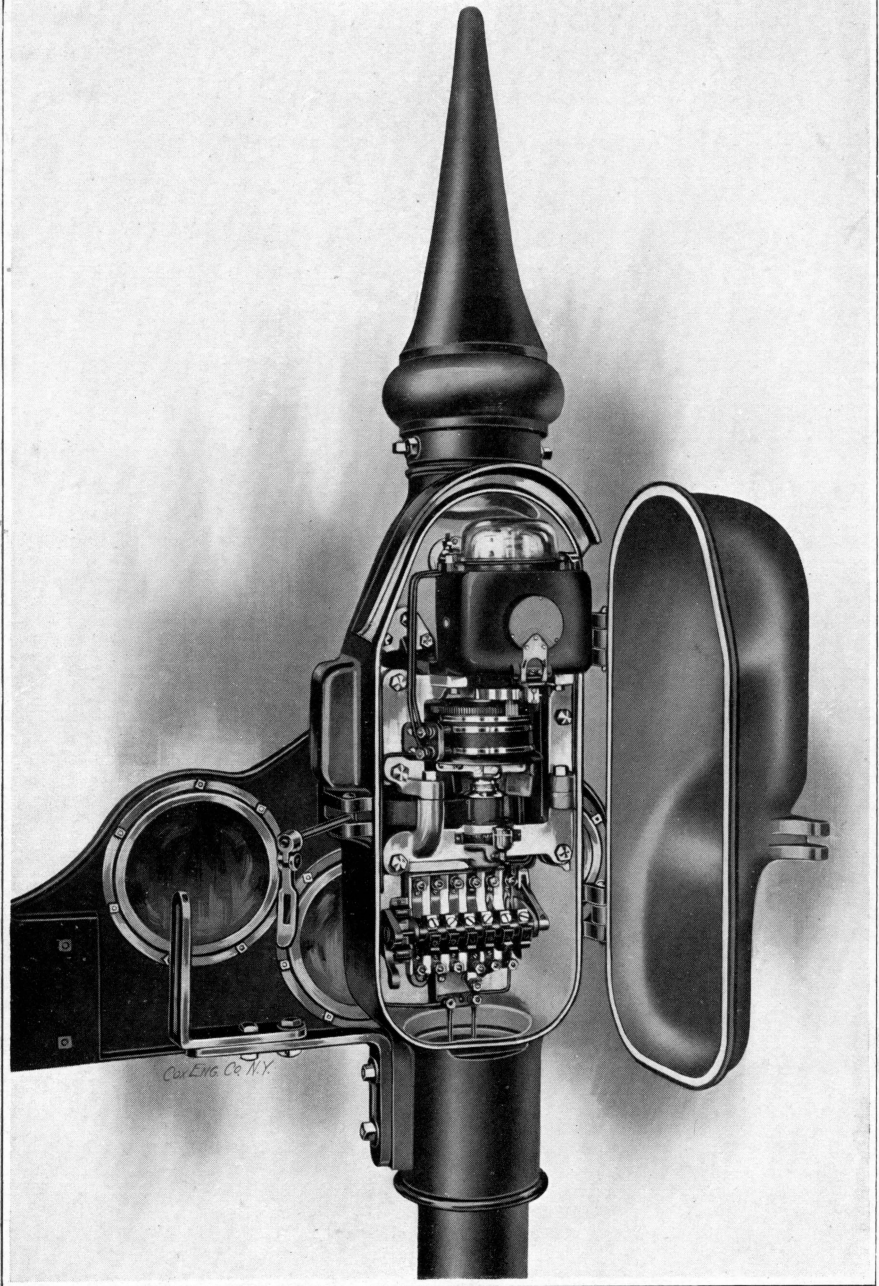
In a signal system, obviously the most important apparatus is the signal itself. This is true not only on account of the signal being the most prominent device used in the system, but because of the peculiar difficulties in meeting the requirements of moving an exposed signal arm through an arc of a quarter or a sixth of a circle, under all weather conditions, with a very limited amount of electrical energy, often times with insufficient and unintelligent attention, and with a small percentage of failures. In fact, the designer of an automatic signal must provide for conditions which it is probable the designer of no other machinery need consider, not because the majority of signal maintainers are less efficient or less intelligent than any other class of men, but because the consequences of the slightest carelessness or inattention of any one man in the large body of maintainers may be most dire, especially if the equipment is not designed and constructed in every detail to meet every possible contingency of improper maintenance or repairs.

The first automatic semaphore signal used in America was operated by compressed air, controlled by electric power. The expense





STYLE "K"



STYLE "K" SIGNAL MECHANISM.  
Three Position. Top Post Type. Direct Current.



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## STYLE "K"

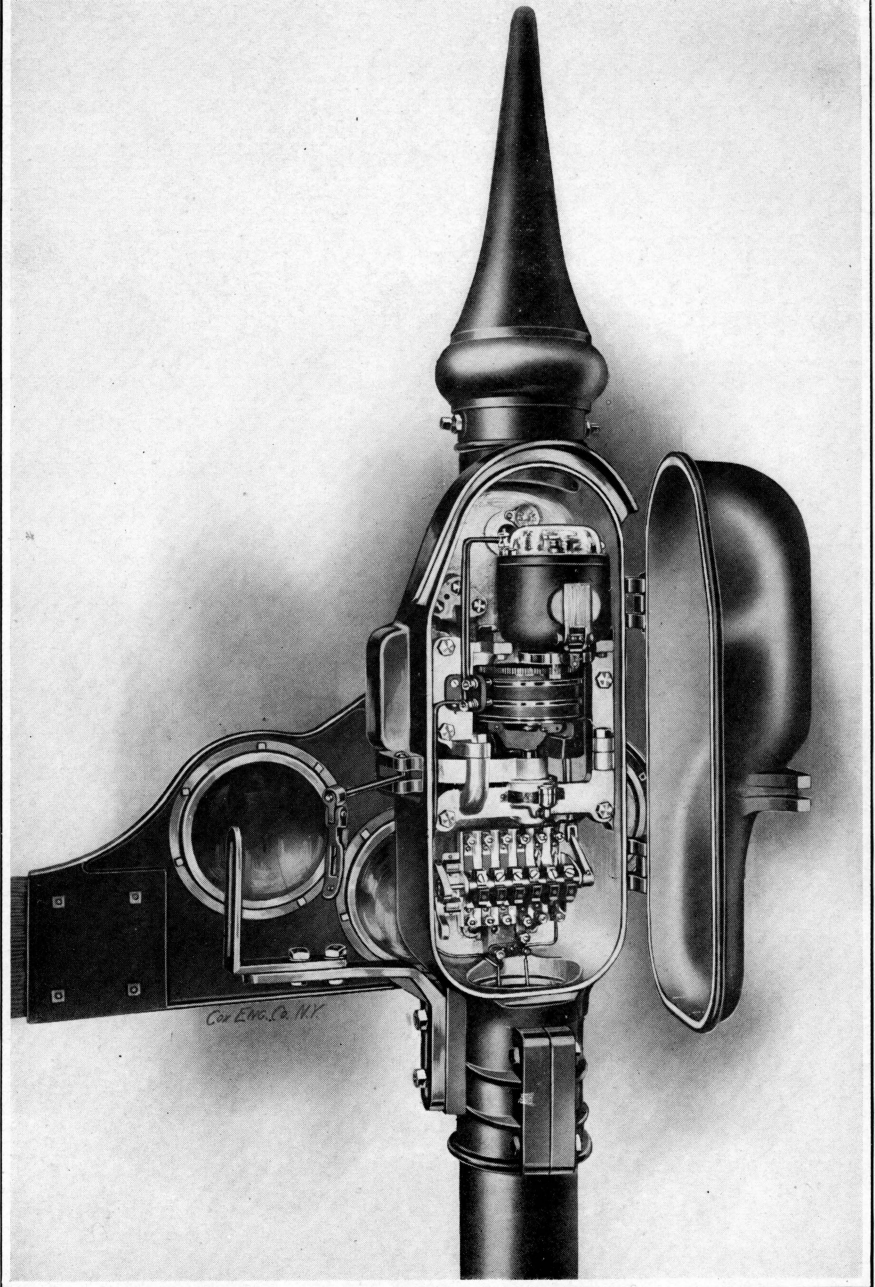
incident to an installation of this type of signal, involving as it did expensive air compressing plants at frequent intervals, and a continuous line of pipe along the right of way, as well as the expense of the operation of these plants, and the losses and annoyances caused by leakage of air, drew the attention of signal engineers to the necessity for a design of automatic signal of the unit power type, one that could be operated in a similar manner to the enclosed disc, which had at that period proved highly efficient and economical in operation.

In 1897 Mr. J. W. Lattig designed an electric semaphore signal of the top post type, which, considering the period of its inception and the lack of experience of all engineers on this subject, proved quite successful. In fact, a number of the Lattig signals were used with a certain success in some roads for more than ten years. This signal was of the type which provided for the retardation of the blade from the clear to the stop position by the reversal of the motor armature. The signal was equipped with a small high speed motor, and the motor armature made a great number of revolutions with each movement of the blade, consequently a very slight amount of unlooked for friction, such as extra tension on the brushes, was liable to cause the signal to fail to return to the danger position, with the controlling circuit open. This proved to be a very serious defect in the signal, and it was soon recognized that other means of retardation must be resorted to before a safe electric semaphore would be had.

The next step in the design of a signal was the dash pot type. There were two designs of dash pot made at about the same time—the oil type and the air buffet type. The oil dash pot was quickly abandoned, since little or no precaution was taken in the quality of the oil used, the dash pot was poorly designed, and as a result frequent dangerous failures accompanied the use of these signals. The air dash pot signal met with greater success. The designs of air dash pots were made on more scientific principles, the workmanship was better than in the first designs of oil dash pots, and comparatively good results



STYLE "K"



STYLE "K" SIGNAL MECHANISM.  
Three Position. Top Post Type. Alternating Current.



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## STYLE "K"

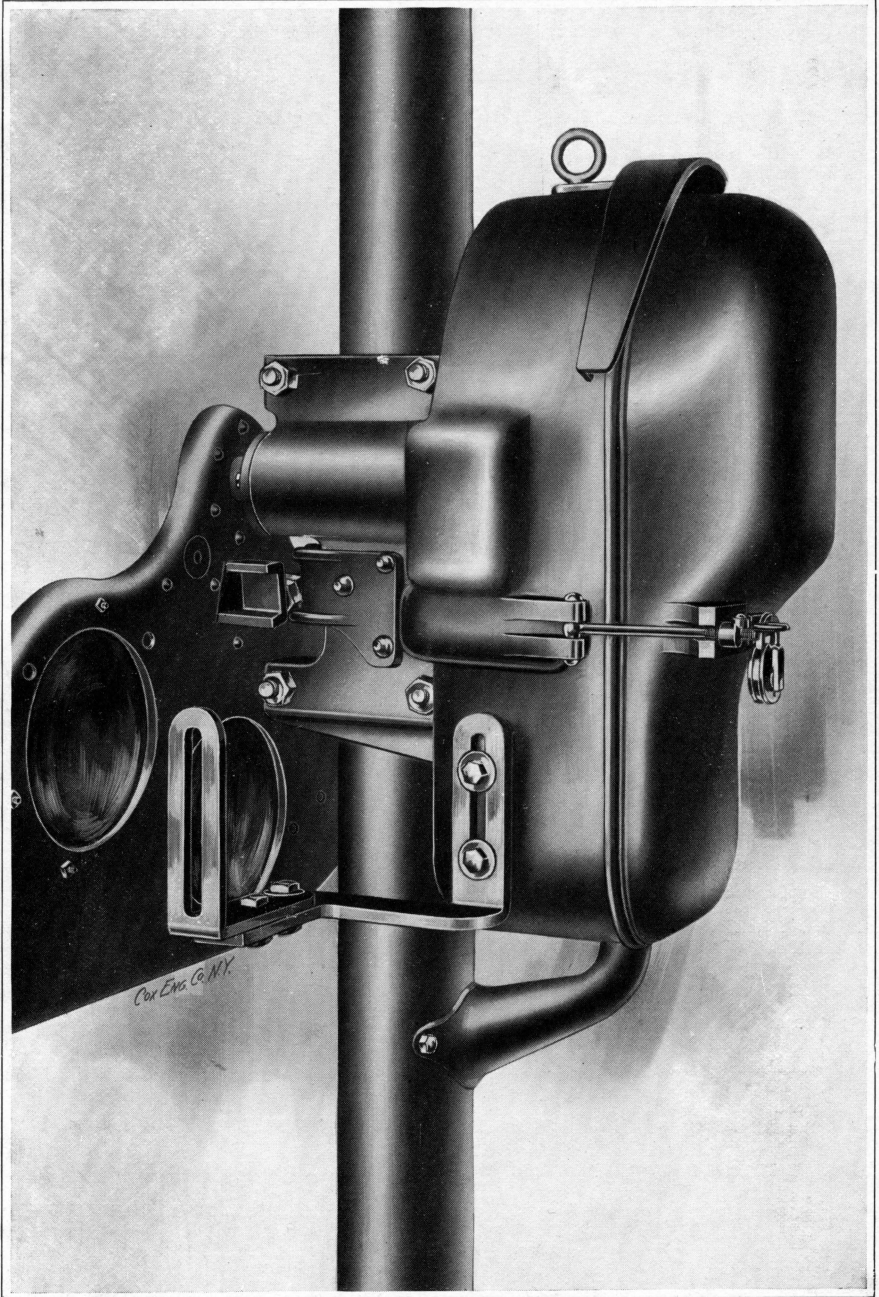
were obtained. As the number of automatic signals used on railroads increased, however, the deficiencies of the air dash pot became more apparent, and the conviction gradually settled upon Signal Engineers that, although comparatively good results were being obtained from signals using the air buffer, this design did not entirely meet the requirements. If the air dash pots were very accurately made, and if they were regularly cleaned and oiled, fairly good results were obtained; but if the signals using dash pots were not given proper attention regularly, very serious signal failures might result. There was only one remedy considered—the oil dash pot. Notwithstanding the previous experience with this type of retarding mechanism, two designs of signals were made about 1905, using an oil dash pot. These signals were made on more scientific principles and were a great improvement on the original design of oil dash; in fact, one of these designs may be said to have been an improvement on the air dash pot signals in use at that time. All the signals in use at this period, however, required the use of mechanical latches for holding the signal at clear, and the mechanisms were of a more or less complicated design.

A later type of signal mechanism reverted to the original principle of the Lattig signal. The retardation of the blade from the clear to the stop position was effected by the reversal of the motor armature. In this design many improvements over the original Lattig signals were embodied. The motor was of the low speed type, and the signal was designed on much better principles, with the result that it gave much better satisfaction than some of the older types of signal mechanisms.

The reversal of the motor armature, however, is known to be an unsafe method of operation, as the possibilities of holding the signal arm by improper adjustments of motor brushes, etc., are too apparent.

In 1908 The Hall Signal Company introduced its type "H" mechanism which used an oil dash both for retardation and for holding the signal clear, eliminating the use of latches for the latter function. This signal is designed on better principles than previous types using

STYLE "K"



STYLE "K" SIGNAL MECHANISM.  
Three Position. Top Post Type. Side Clamp Case.



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## STYLE "K"

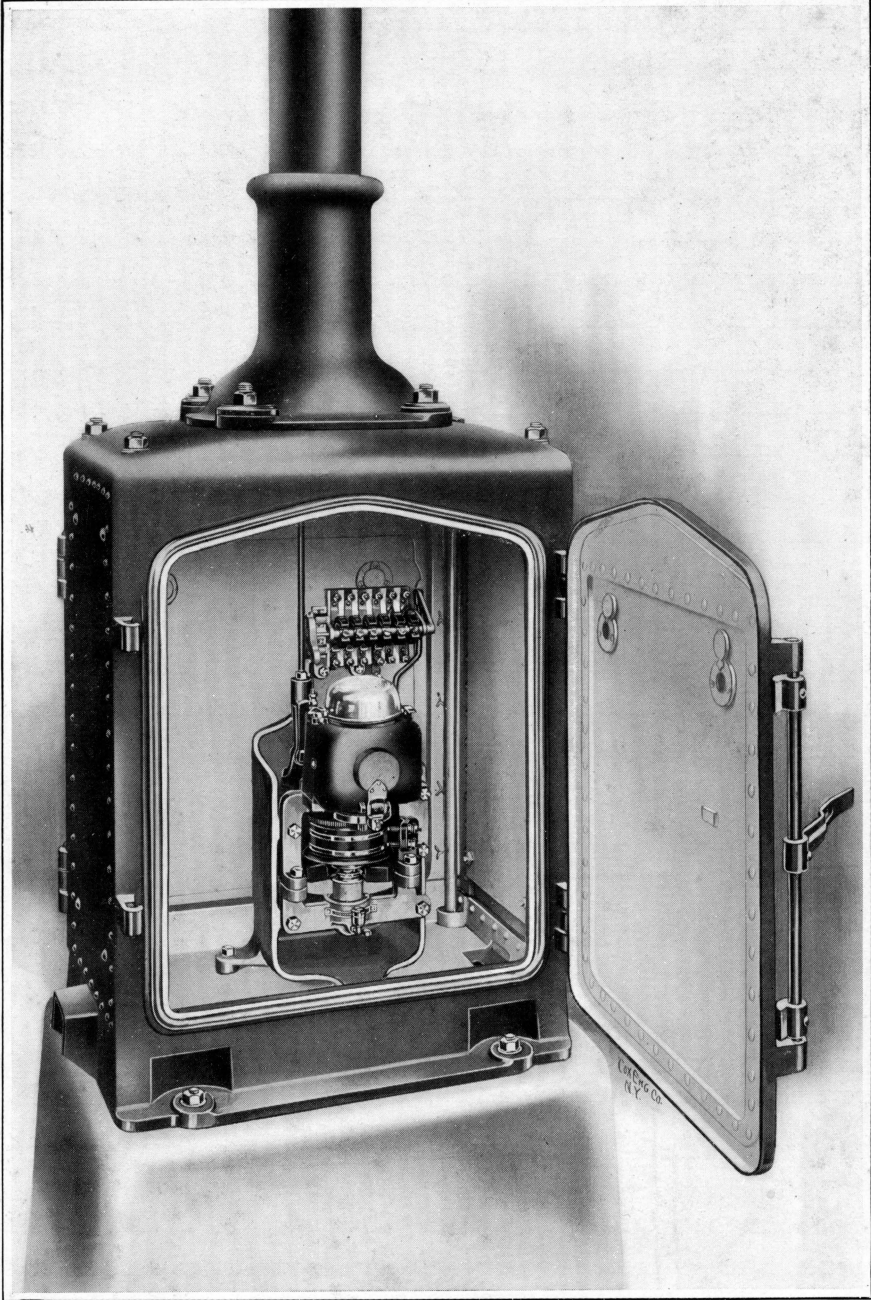
the oil dash pot; it is simple in construction and well made, and proved a decided innovation in signal design.

In the design of a mechanism for the operation of a signal blade there are, as has been previously stated, many difficulties to be overcome, and many points to be considered, but the most important consideration, the detail that has proven itself to be the most difficult, is the design of a proper method of retardation of the blade. Heretofore, there have been only two methods of retardation used—the dash pot, and the method involving the reversal of the motor armature. Both these methods, as used on the later types of signals, have given fairly good satisfaction, but it is well-known that neither method can be made perfect, and the demand for an entirely different method of retardation of signal blade has become very insistent.

The style "K" signal, of The Hall Signal Company, was designed to meet these requirements. No dash pot of any description is used in this signal, no mechanical latches are used, and the motor armature does not reverse. The retardation is effected by a pair of governors attached to the hold clear armature, which rub against the insulated portion of the hold clear magnet, and provide friction in proportion to speed. There is no friction provided by these governors with the blade at rest in the clear or stop positions, and the governors are effective only when in returning to the stop position, the speed of the blade reaches a predetermined rate. The friction of these governors increases proportionately to the speed of the blade returning to danger, so that the control is entirely automatic, and the friction of the governors is effective only when required. The principle of governor control being well-known and recognized by all mechanical designers, it would appear that on account of its simplicity and reliability, it would have been used in a signal design years ago. It is liable to be a weakness of designers of special apparatus, however, to use the most complicated methods of accomplishing results on first attempts, and the simpler methods are usually later conceptions. It is inconceivable that the governor method of retardation can be the cause of holding the



STYLE "K"



STYLE "K" ONE ARM SIGNAL MECHANISM IN CASE.  
Bottom Post Type.



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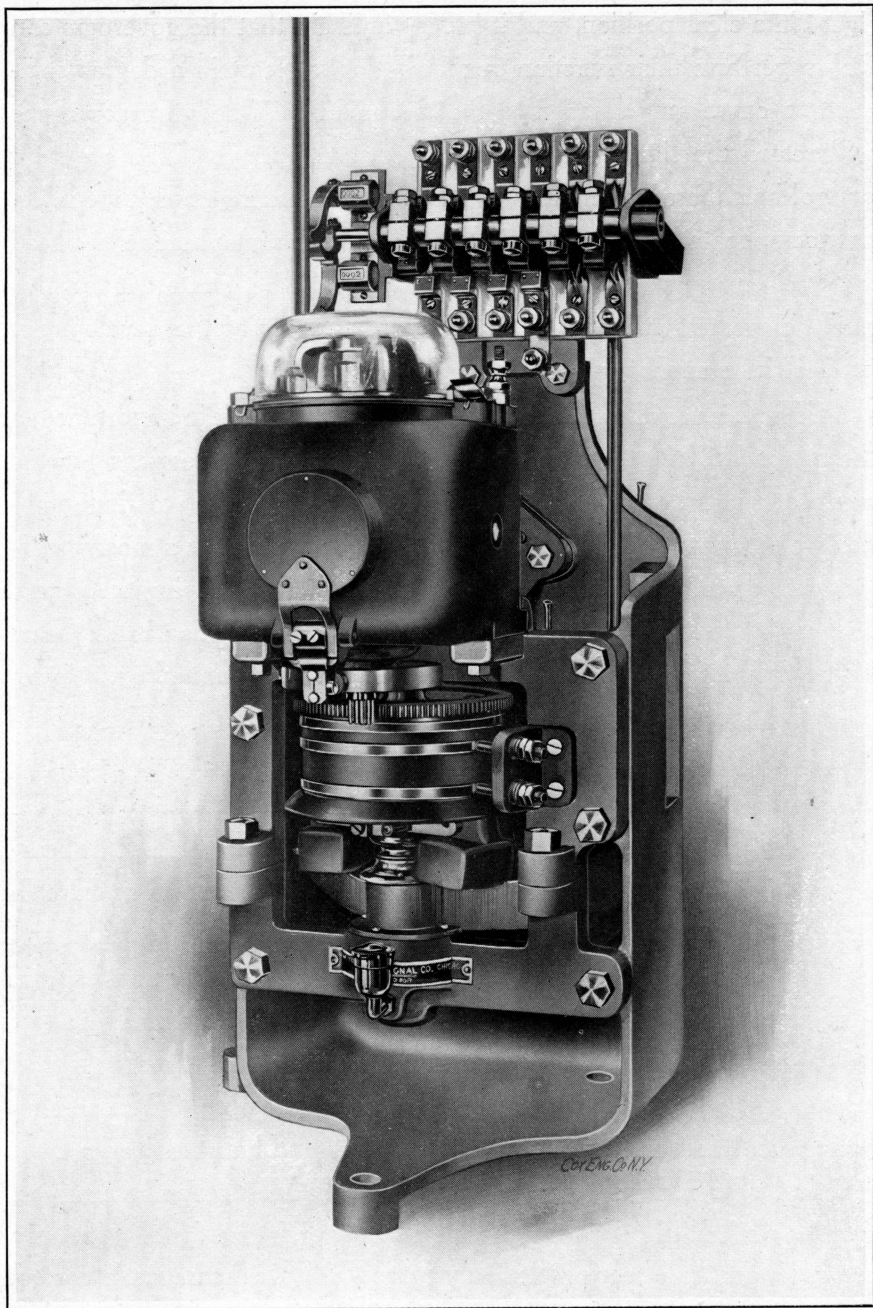


## STYLE "K"

signal in a clear position, and it is very unlikely that the governors can fail to perform their function of retardation, at least in a degree sufficient to cause any damage to the mechanism. One governor alone will retard the signal sufficiently to prevent damage. The governor control has, therefore, made what was the most dangerous, unreliable, and complicated detail of design of an electric semaphore, the safest, most reliable and most efficient feature. It is the greatest innovation and the greatest improvement made in the history of the development of electric semaphore signals.

The feature of signal design that is probably next in importance to the method of retardation is the construction of the bearings for the shafts and in the mechanism. Strength of bearings and wearing qualities are secondary considerations in a signal. Friction is a most important consideration, for the certainty of a signal blade moving by gravity to the stop position is dependent on the amount of friction in the bearings. If the friction of a solid bearing could be depended upon to remain constant under all service conditions, a properly designed and manufactured solid bearing, made of bronze or other good wearing metal, not susceptible to rust, would meet the requirements. But the friction of a bearing in an exposed signal, especially the blade shaft bearing, is likely to greatly increase under service conditions, such as extreme cold weather, especially with accumulated moisture in the bearings, and clear failures due to frozen or rusted bearings have not been an unusual occurrence where solid bearings are used. The reason a little frost or rust in a solid bearing may prevent free movement of the shaft, is on account of the relatively large surface of a solid bearing. The remedy is to reduce this surface to a minimum. Roller and ball bearings present practically no surface as these are respectively line and point bearings, and they offer little or no opportunity to rust or freeze fast. Not only are roller and ball bearings the only types which are theoretically correct for use in a blade shaft or in a signal mechanism, but experience has fully demonstrated that they are the only safe types for this work. All the bearings on the style "K" signal are either roller or ball bearings.

# STYLE "K"



STYLE "K" ONE ARM SIGNAL MECHANISM.  
Bottom Post Type.



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## STYLE "K"

The main shaft is supported on the blade end by an "S K F" ball bearing (Fig. 1) and on the inside end by a "Hyatt" Roller bearing (Fig. 2).

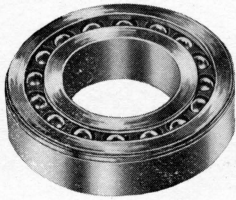


FIG. 1.

The "S K F" ball bearing is extremely well adapted for the locations in which it is used, and is considered the best type obtainable for the service required. It is constructed of a double row of balls fitted in a brass cage, with steel supporting rims inside and outside. It is self-aligning, withstands a thrust strain of 25 per cent of its radial capacity, and is very accurately manufactured. It may be floated in oil, yet very little oil is actually required to keep it in good condition. Exhaustive tests made with this bearing in a blade shaft, extending throughout an entire winter, have shown that these bearings may be operated almost indefinitely without oil. The "S K F" bearing is also used at all points in the mechanism where a thrust and radial bearing is required, as at "L" Fig. 7.

The Hyatt roller bearing (Fig. 2) has been used on the Hall style "H" mechanism for the past two years and has given perfect service. For the lesser requirements, where the shaft does not reverse, and where the strain is slight, as at "a" (Fig. 5) the bearing shown at Fig. 3 is used.

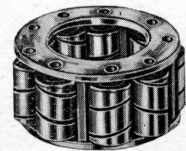


FIG. 2.

This is a roller bearing of substantial design, made of steel rollers and supports, and has proven a very satisfactory type of bearing for the requirements. The important question of bearings has been carefully studied in the type "K" signal, and that type has been selected which is best adapted for the requirements. Protection to the bearings and provision for oiling has also been given proper attention.

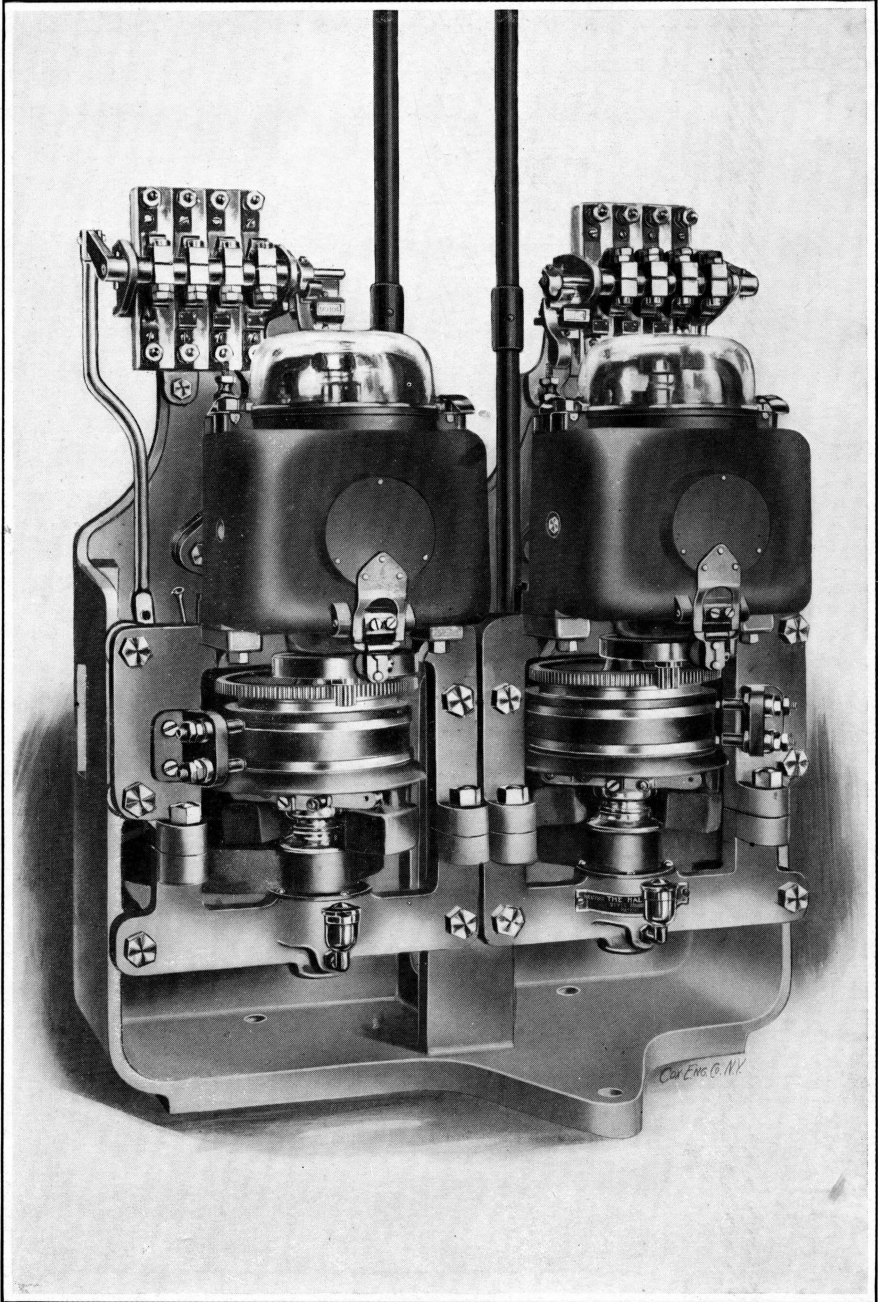


FIG. 3.

The ball bearing on the outer end of blade shaft is protected by a weather plate, with a soft gasket between it and the main casting. A substantial oil cup is provided on the shaft bearing and accessible oil cups and pipes are provided for all important bearings in the mechanism. The essential bearings are also provided with space so as to allow the bearings to



STYLE "K"



STYLE "K" TWO ARM SIGNAL MECHANISM.  
Bottom Post Type.



THE HALL SIGNAL CO.





## STYLE "K"

float in a continuous oil bath, which insures against rust, if proper maintenance is not given the signal.

The hold clear magnet in the style "K" signal is of the disc type, similar to the design used with such success in our electric slot. In the latter device the armature is nickel plated to provide an air gap equivalent, but in the style "K" signal in addition to the plating of the armature, an actual air gap is provided. A phosphor bronze outer ring is fastened to and made a part of the Norway iron armature, and when the magnet is energized, the bronze ring bears against a steel piece on the magnet, which provides the friction required to hold the signal clear. The torque of the blade and blade grip is very heavy on this armature, the frictional surface is small, the armature is well protected, and the entire design of magnet and armature is of known safety and reliability.

Steel pinions and bronze gears are used. Bronze gears are tougher than cast iron, less brittle, non-rustible, and altogether more suitable for a signal mechanism. The gears and pinions are placed in such a manner that the teeth are vertical, and the clearance between gear and pinion teeth is sufficient to prevent clogging by ordinary particles of dirt. Neat and effective guards protect the gears from dust and foreign matter, yet all the gears may be plainly observed during the operation of the signal.

The motor used in the style "K" signal is of an improved design, simple, efficient and durable. The motor brushes are made of a special carbon which offers practically no electrical resistance, does not wear rapidly, and does not cut the commutator. The motor will operate an upper quadrant blade, R. S. A. design, with R. S. A. blade grip, with an ordinary 10-volt battery, through an arc of 90 degrees, and using a maximum of  $2\frac{1}{2}$  amperes of current, in eight seconds.

The operation of the style "K" signal is as follows: Motor pinion A (Fig. 4) is geared to the blade shaft through gears and pinions, B, C, D, E and F. Gear wheel B, Fig. 5, is rigidly attached to hold clear



# STYLE "K"

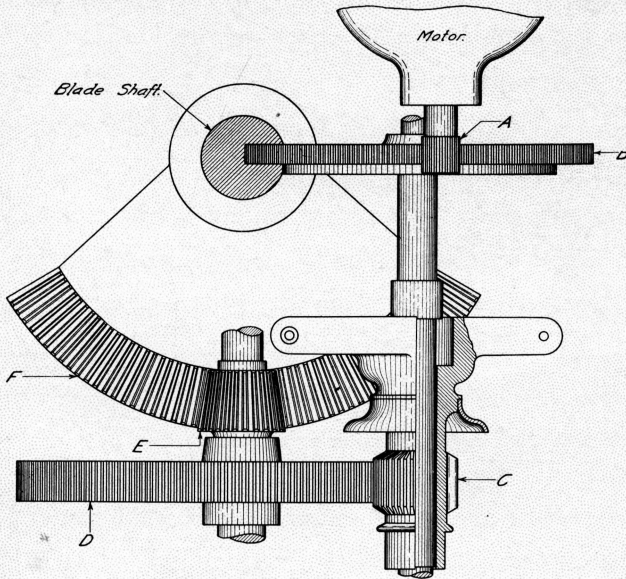


FIG. 4.

magnet G. The armature of the hold clear magnet is supported on a separate shaft from the magnet and gear wheel B, and revolves independently of the magnet. When the current is applied to the motor and hold clear magnet, the blade shaft is

rotated by means of the gear connections in the usual manner. Contact J on circuit breaker H, Fig. 9, normally closed, is adjusted to open when the blade is in the 45° position, and contact K, also normally closed, is adjusted to open when the blade reaches the 90° position. A typical circuit plan of the mechanism wiring for three position operation is shown in Fig. 6. The operation of clearing the blade and holding it at

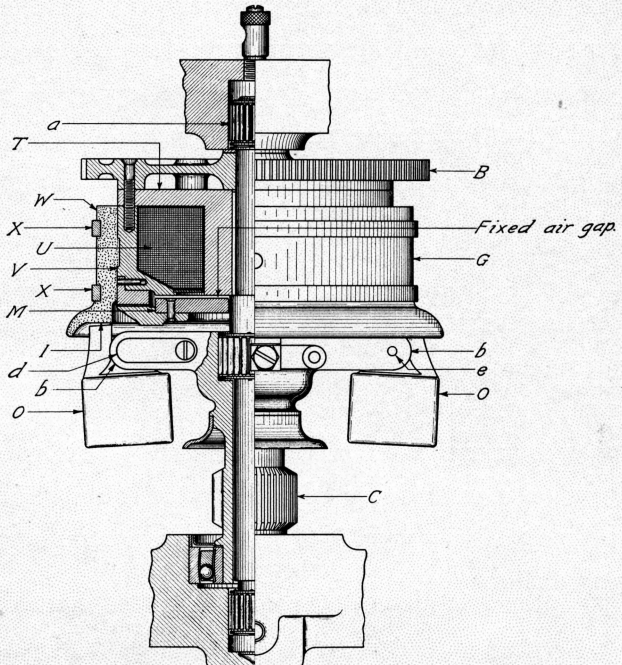


FIG. 5.



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# STYLE "K"

clear is dependent upon the energization of clutch magnet G, Fig. 5. After the blade is moved to the caution or clear position, it is held at rest by the friction of the outside bronze rim on the hold clear armature

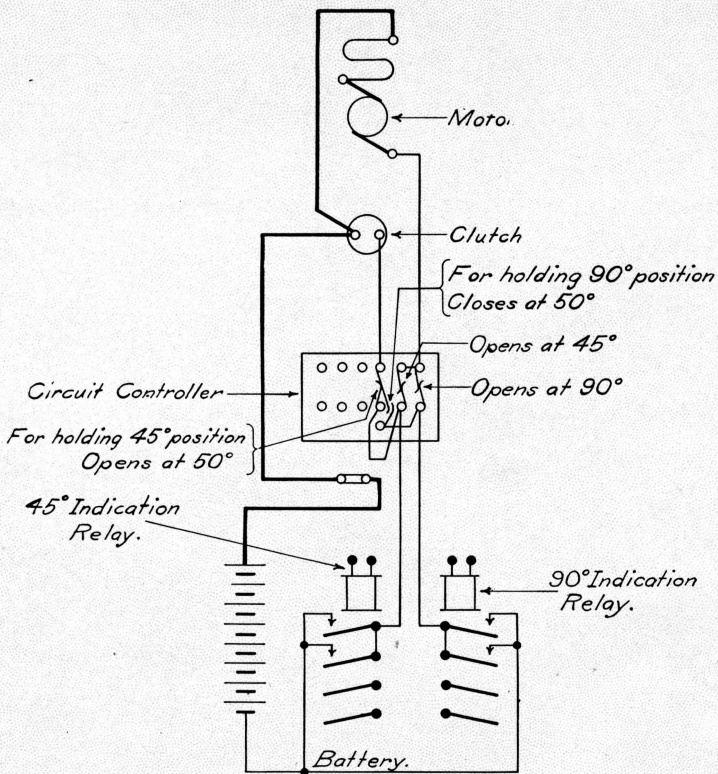


FIG. 6.

M, Fig. 5, against the steel surface on magnet G, which friction is caused by the energization of the clutch magnet. The clear or caution position of the blade is also maintained by motor brake N, Fig. 7, which prevents the reversal of the motor armature. There are, accordingly, two requirements for holding the signal clear: the energization of the hold clear magnet, and the application of the motor brake. When the circuit of the hold clear magnet G is opened, as by a train in the block, the armature of this magnet is released, and the torque of the blade and its casting causes the blade shaft, gears and pinions



## STYLE "K"

F, E, D and C, Fig. 4, and hold clear armature M, Fig. 5, to reverse and the signal to return to its normal position. The governors, 0-0, Fig. 5, are attached to the hold clear armature, and as the speed of the blade in its return to the stop position increases, the governors are thrown outwardly by centrifugal force, and the upper surfaces rub against the surface I of the insulated portion of the hold clear magnet which remains stationary. The friction of the contact of these surfaces retards the movement of the blade: the amount of friction is dependent upon the weight of the governors and the speed of rotation of the armature. The governors are designed so that they regularly check the movement of the blade, and no adjustment is required.

A view of hold clear magnet, armature, and governors is shown in Fig. 5. The magnet is composed of iron core T and winding U; the iron core is fastened to outside shell, which is moulded into insulation piece W and serves as a frictional bearing at surface I for the governors. Brass collector rings X moulded into insulation piece W are connected to the terminals of the magnet winding, the electrical connection between the magnet winding and outside battery being made through these collector rings and spring brushes Z, Fig. 9. Armature M, Fig. 5, with the governors, rotates with hollow shaft gear C independently of magnet G and its shaft. The governors are supported on armature M through lugs "b" by bronze pins "e" which are held in place by snap springs "d". These snap springs are used on the mechanism in place of cotter pins which are liable to drop out of place if not properly split.

At point P on shaft Q, Fig. 7, a ratchet arrangement shown in Fig. 8, is inserted to prevent shock to the mechanism when the blade grip strikes the stop. This ratchet is a well-known design, substantial in construction and in keeping with the design of other parts of the machine.





# STYLE "K"

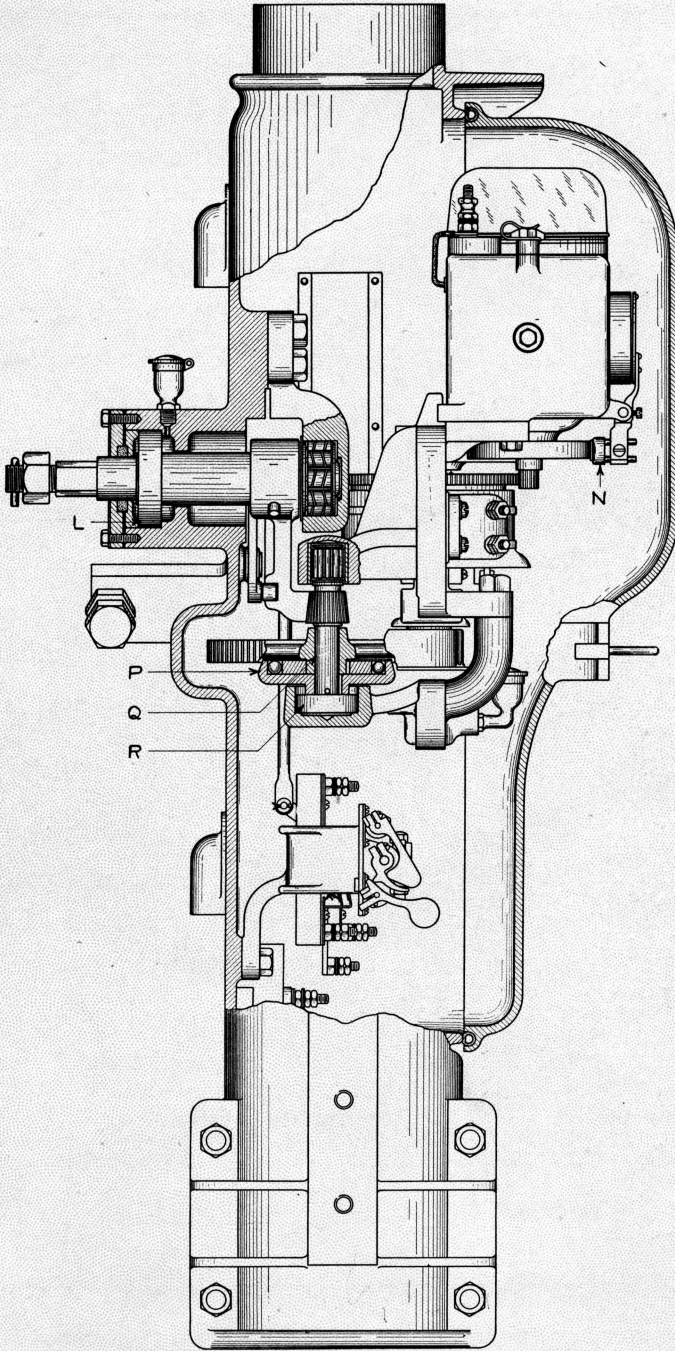


FIG. 7.

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## STYLE "K"

The circuit controller is attached to the blade shaft by direct connections of a most positive character. The contacts which control the

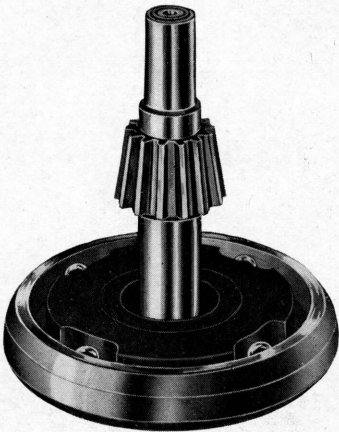


FIG. 8.

operation of the signal blade are made on the principle embodied in our style "G" switch box, with the positive worm gear adjustment, which is a guarantee against slipping cams, and which provides means for the most delicate adjustment.

The counter attachment Y. Fig. 9, is not the least ingenious feature of the mechanism. This provides, in a substantial manner, for registering separately the number of 45 degree and the number of 90 degree movements of the signal arm.

This mechanism was designed originally as a top post type; its adaptability, as such, is evident in its various applications: 1st, In a case sulphured or leaded on a pipe post; 2nd, in a case clamped on top of post, and 3rd, in a case clamped on the side of a post. The flexibility of design is further demonstrated in its applications as a bottom post type of signal, operating one or two blades in the upper or lower quadrant, in two position or three position, and pull clear or push clear type. All these types are furnished, moreover, to operate with alternating or direct current. In all these applications, the same principles of operation are employed, in fact, the greater number of the parts are interchangeable in all types.

A prominent engineer said of the style "K" signal soon after its inception: "It is the last word in signal design." Since this statement was made, these signals have been installed on a large number



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# STYLE "K"

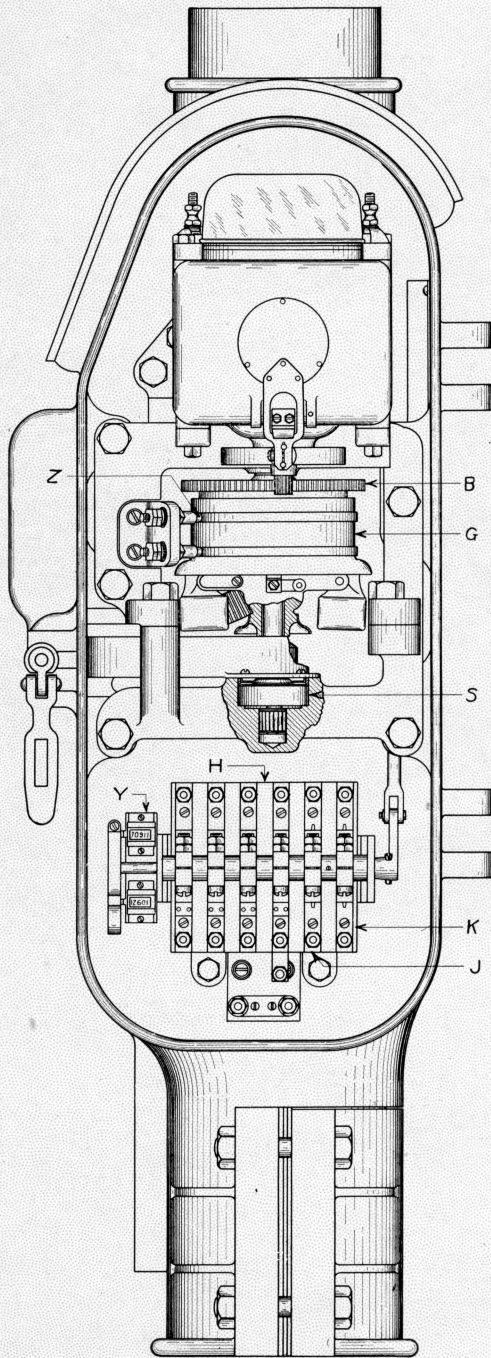


FIG. 9.

of the leading railroads in the United States and Canada; some of them were subjected to two winters service test, a larger number had a full years service test. The signals have operated on railroads in every climate including the rigorous weather of Eastern Canada and the North Western section of the United States, in sections south of the Mason and Dixon Line, and along the eastern and western coasts of this country. In every location, the style "K" signal has demonstrated that the correct principle of design for an automatic signal has been discovered and that a properly manufactured and fully developed signal embodying this principle is at last available.



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