

THE HALL SIGNAL COMPANY'S NEW RELAY.

The design of relays for use in signal work has received much attention from railway engineers and manufacturers during the past five years; and improvements have been made which have resulted in some very substantial and reliable instruments as compared to many of the older types. Most of these improvements have been in the nature of providing better insulation and more permanent and rugged construction. But no substantial improvement has been made in the form of contacts. The imperfections and limitations of relay contacts have been, up to the present time, a most annoying and most frequent cause of signal failures; and it is generally recognized that there is a great need of a form of contact which has the qualifications necessary for the proper performance of the functions for which it is intended.

contact which has given the most satisfactory results heretofore is the one used in the older forms of Hall relays, as shown in Fig. 1. This contact has a larger surface than the later forms used, and, although not perfect, it was much more satisfactory than the later types. In their efforts to improve this contact, the engineers of signal companies confined their efforts to securing a design that would give a greater rub and provide a maximum pressure, but in accomplishing this a poorer form was made.

The type shown in Fig. 2 was almost universally used for a number of years. It was with this contact that the greatest trouble was experienced. The resistance of a contact is proportional to the amount of pressure, to a certain extent, but the pressure of the members of the contact does not affect the resistance to nearly as great a degree as its area. For example, a contact of the type shown in Fig. 2, when new, and when operated in a four-ohm relay by a current of 100 milli-amperes, and giving a resistance of .13 of an ohm, shows a resistance of approximately .09 of an ohm with a current of 250 milli-amperes applied to the relay.

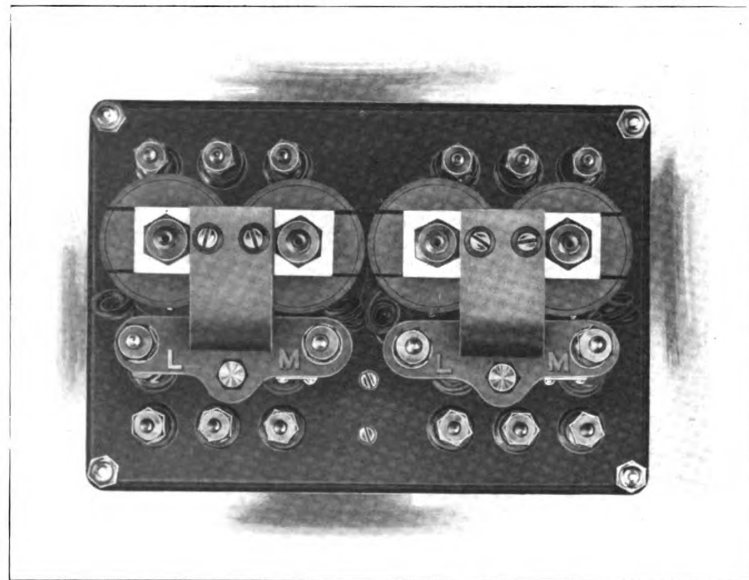
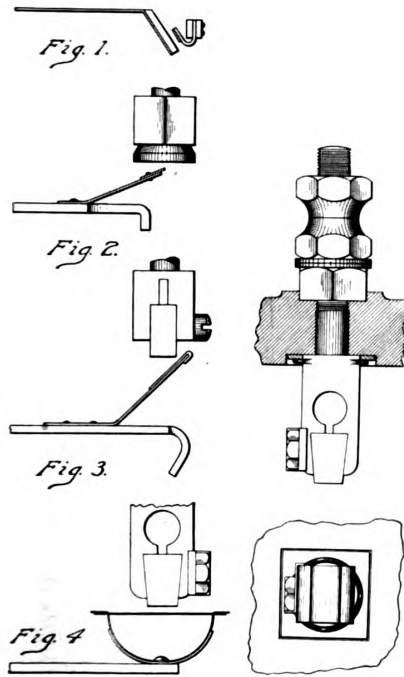


Fig. 5.

Top View Interlocking Relay.

The present forms of contacts, with one member of silver or platinum and the other member of carbon or graphite, are known to be unreliable, since, after an indeterminate number of operations, the resistance of the contact in many cases increases to such an extent as to interfere seriously with proper signal operations. This increase in resistance is generally ascribed to a glazing effect on the carbon caused by the rubbing or digging of the metal finger. This is only partly true. A close examination of a carbon contact in which the resistance is abnormal discloses the fact that there are slight projections in the carbon due to the softer portions wearing more rapidly than the harder. The metal part of the contact bears against these points, thus providing a contact of very small surface and consequently high resistance. This relation between area and resistance of contact seems to have been lost sight of to a large extent in the design of contacts used on some signal apparatus, yet it is one of the simplest electrical laws that resistance is directly proportional to area, and that heat is generated in a conductor in direct proportion to the current and in inverse proportion to the area. It is therefore reasonable to expect that a relay contact will offer resistance in proportion to its area, all other things being equal. This is a fact readily proved both by test and by experience. The

This same contact may easily show a resistance of 5, 10, or even 50 or more ohms, after a number of operations, due to the fact that the area of the contact gradually becomes reduced by the rubbing of the metal finger against the carbon post.

A later form of contact (Fig. 3) was subsequently developed and is now used in some instruments. This is an improvement over the type shown in Fig. 2, in that the metal portion of the finger does not wear away the surface of the carbon as rapidly as in the type previously used. But it is questionable if this type is as uniform in resistance as the type shown in Fig. 1.

With these experiences in mind, and after a careful consideration of the theories and requirements, the engineers of the Hall Signal Company designed a contact, shown in Fig. 4, which exhaustive tests have proved to be much superior to any type previously used on signal relays. This contact is designed on scientific principles in that a good pressure is afforded, the materials are non-fusible (one member being carbon), a movement of the contact is made after engagement, and the area is many times larger than in any contact previously designed. This contact is revolutionary in that nearly a constant resistance is maintained after many operations, and it is practically impossible to fuse. The

carbon member is supported in the binding post by a clamp arrangement with a screw holding the carbon in place. The carbon and brass are beveled in such a way that if the

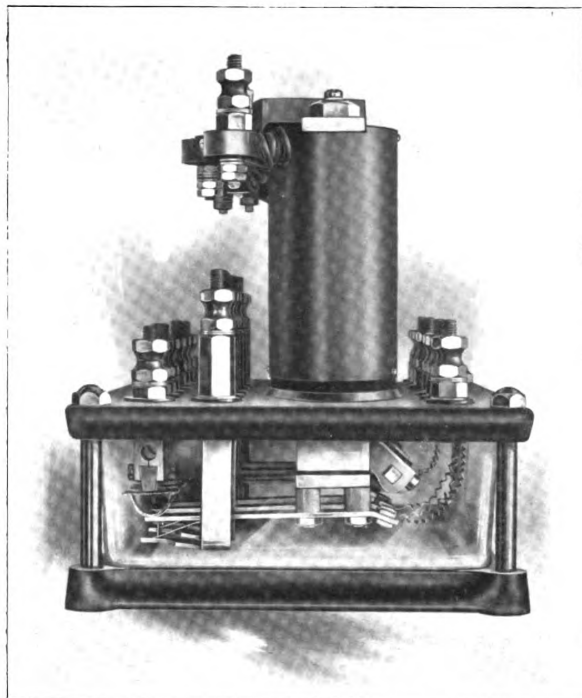


Fig. 6. Shelf Type Relay.

carbon should crack from excessive pressure it will not drop out of place. The metal portion is made of a silver gauze

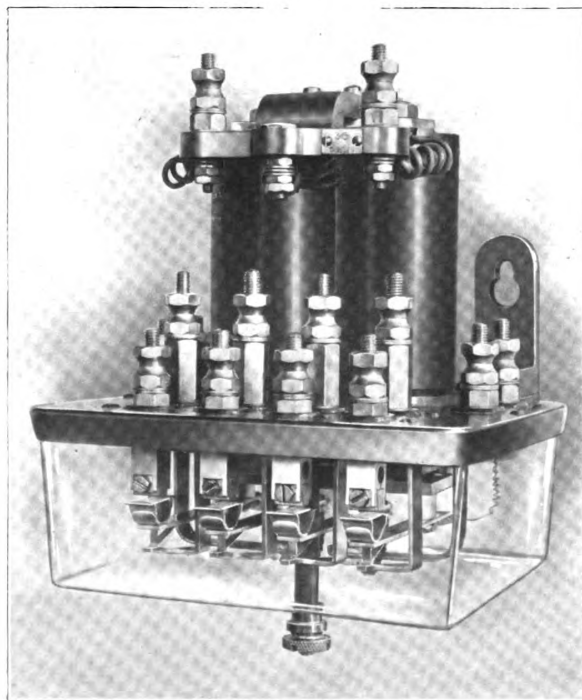


Fig. 7. Wall Type Relay.

piece held in a German silver spring support rigidly fastened and locked in the relay finger. This gauze portion of the

contact is flexible and can be removed or replaced without any tools in a few seconds. The flexibility provided by the gauze portion of this contact assures large area under all conditions of the carbon, and provides for a reasonable movement of the finger after engagement. With the use of specially treated graphite, it is possible to obtain a contact of this construction that will not exceed in resistance from .3 to .5 of an ohm, and in most cases a resistance of much less than this is maintained, regardless of the number of operations. The large area has advantages other than the uniformly low resistance. Greater carrying capacity is obtained, and the contact is less likely to fuse. Actual tests have shown that with a current of 80 amperes carried through this contact, the wire gauze will burn off in one minute and 10 seconds, whereas in the older forms of contact, such as the one shown in Fig. 2, the platinum will fuse with the same current in approximately 20 seconds. This test demonstrates that not only is the carrying capacity of the new

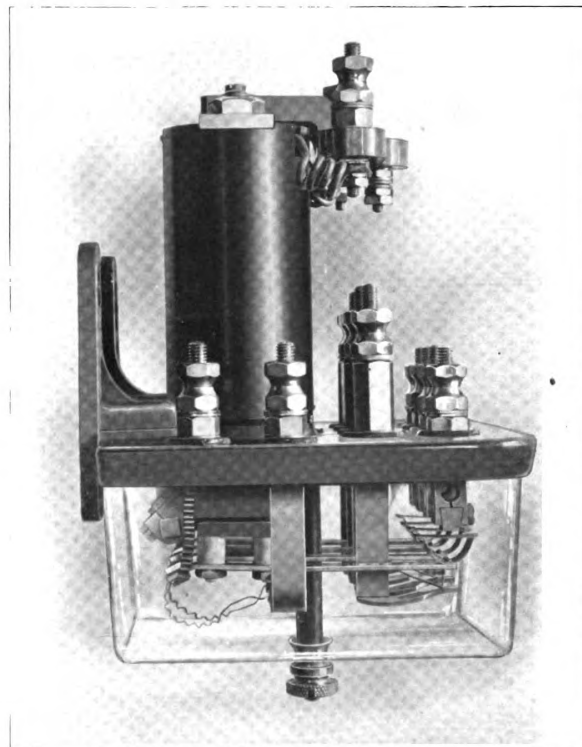


Fig. 8. Side View Wall Type Relay.

contact greater, but that it is a safer form to use, in that there is much less liability to the fusing of a contact. Moreover, on account of the mechanical construction, when the gauze portion fuses the particles separate, and connection is absolutely broken between the carbon and the metal finger; whereas with the older form it is possible to fuse the platinum to the carbon in such a way as to maintain a closed contact with the relay de-energized.

Another important detail in the new relay is the form of magnet support used. This part is made of a new insulating material which is impervious to heat and moisture, will not change its shape in the slightest degree in any conditions of temperature or exposure, has relatively great mechanical and dielectric strength, and is in every way ideal for the support of the parts carrying current. In fact, this magnet support has all the advantages of the Hall Signal Company's porcelain base used in the older forms of Hall instruments, and has none of its disadvantages. It is moulded in exactly the proper form, the pieces not varying .001 of

an inch in any dimension. The advantage of a piece which can be formed with such accuracy, and which does not require any bushings or insulations between metal parts, is

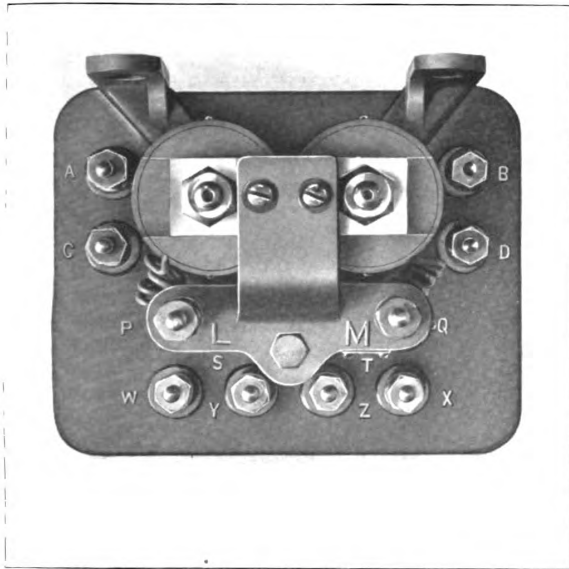


Fig. 9. Top View Wall Type Relay.

at once apparent. In fact, throughout this instrument no parts carrying current are supported in metal pieces insulated therefrom, but are in every case carried through mate-

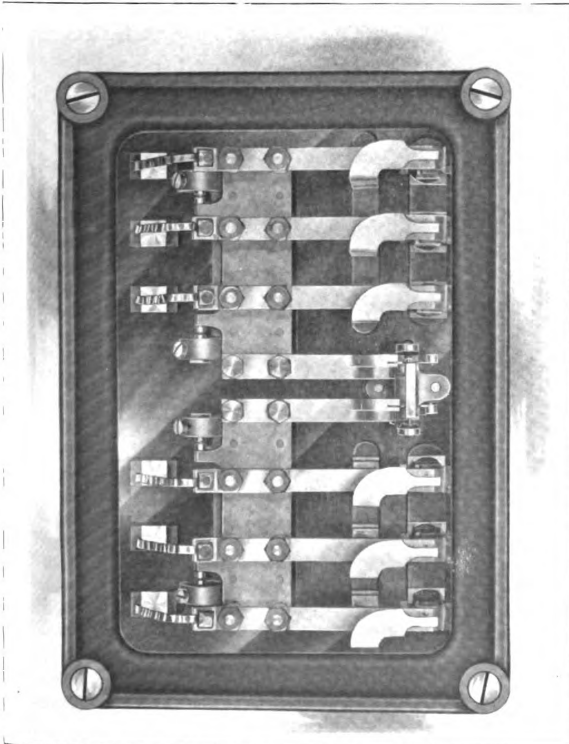


Fig. 10. Bottom View Interlocking Relay.

rials which provide the instruments with ideal insulating properties, and thus make them less susceptible to lightning influences than any instrument heretofore designed.

The binding post construction of these relays is a substantial improvement over previous designs, in that the

pieces carrying the front contacts are so supported in the insulated magnet support that they cannot turn, nor can they be turned or changed from the outside of the instrument. This construction is shown in Fig. 5. The arrangement is such that the top nut fits in an insert in the insulated support and is screwed in place from the bottom, for which a square washer with a hexagonal opening is supplied for the binding post; and into another insert in the bottom of the support, and in the groove of the binding post a flexible ring is fitted under this square washer in such a way as to hold the square washer in place.

A detail of this design, which is mentioned to show the care and attention given to every feature in both design and manufacture, is shown in the manner of supporting the armature lever. The pivot support for this armature lever is composed of turned pins fitted in a clamped opening in such a way that it is impossible to tighten the armature. A perfect alignment is assured by this construction. The Hall Signal Company has maintained the best features of its older types of insulation, such as the bone insulation be-

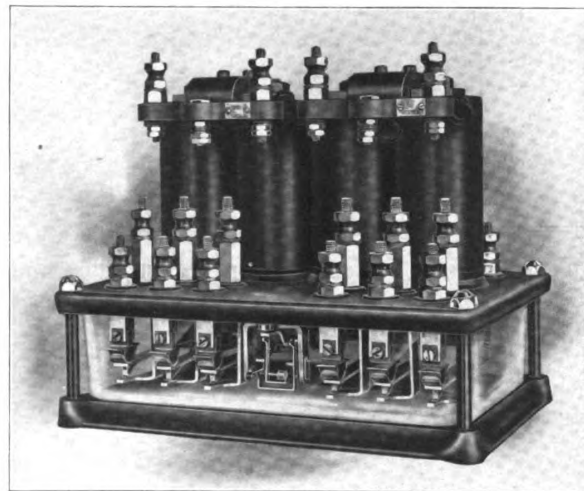


Fig. 11. Hall Interlocking Relay.

tween the armature and fingers, which was originated by the Hall Company, and the glass made in cup form, which provides one joint at the top instead of one at the top and another at the bottom; and this company has introduced one or two other slight improvements, such as the method of sealing, which may be noticed in the illustrations, and the raising of the binding posts of the back contacts to a higher plane than the binding posts of the front contacts, thus making all these connections more accessible.

Particular attention is called to the two types of relays which this company manufactures. One of these, known as the "shelf-type," shown in Fig. 6, and the other known as the "wall-type." The "wall-type" has many advantages over the "shelf-type," but the Hall Company is prepared to furnish either kind, according to requirements.

Figs. 10 and 11 are views of the Improved Interlocking Relay. The same general construction is used in this relay as in those just described, and all the improvements mentioned are embodied in this instrument.

The Hall Signal Company has now produced a relay in which the resistance of the contacts does not increase with use. The importance of this improvement will be universally conceded. The relay is scientifically designed and the details of construction carefully worked out. The company submits this relay to the inspection and tests of signal engineers with confidence that it will merit the approval of all who are interested in the advancement of the art of signaling.