Performance of Automatic Block Signals Under Unfavorable Conditions.*

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II.—RELAYS AND THEIR ENCLOSURES.

The operation of automatic block signals involves the use of electro magnets with arms or armatures, commonly termed relays (similar in design to those employed for telegraph purposes). These are used to open and close suitable contacts in the electrical circuits which perform the various functions. These contacts consist, first, of levers or arms, usually termed fingers; and, second, of contact arms in the form of an anvil or a spring. The fingers are attached to the armature plate, and they close the circuit by touching the spring, which is fastened to some immovable part of the relay. The finger is fastened to the armature plate by screws passing through rubber, mica or other suitable insulating material. Bone is used in some relays, being threaded so that it can be fastened to the plate. As a general rule, the finger is made of aluminum with a platinum contact point. It is desirable to keep the weight of the armature plate reduced as much as consistent so that it may be readily operated by its magnet. The anvil is a spring as well as a contact, some tension being required to insure a good connection.

These contacts must be of a material which will insure low resistance; they must not wear, for wear results in particles lodging between the contacts, making a resistance to the current. On many relays both the finger and

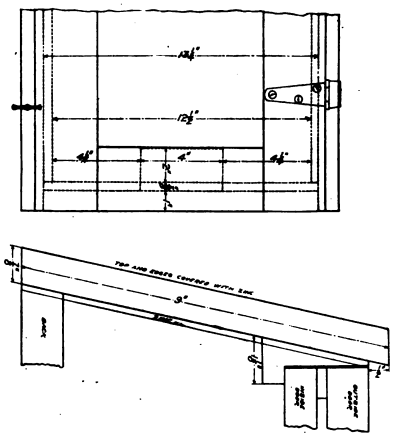

Fig. 1.—Wooden Relay Box.

the spring have platinum contacts; others have platinum on the finger with carbon on the spring; in a few cases, the finger has a carbon roller and three or four platinum contacts are attached to the spring.

Platinum being a good conductor, only a platinum contact is made small; but what is gained in conductivity is lost in its tendency to readily gather moisture. Winter or summer, when sudden changes in temperature take place, moisture will be found collected on platinum surfaces. If this moisture is collected in the winter, it is frequently frozen into ice insulating the contacts one from the other, and interrupting the proper working of the signal.

A piece of carbon mounted on a German silver spring or other metal is a poor conductor for low potential circuits, and not infrequently causes mysterious train-stops owing to its uneven and granulated surface. To overcome this difficulty such contacts are plated with a very thin layer of silver or copper. This design of contact is far less susceptible to changes of temperature and humidity than is platinum. When carbon rollers are used, they are not silver plated. There are in service a large number of carbon contact springs without the plating; it is on this design that practically no moisture collects. When this design of contact causes interruption to the circuit, it is traceable to the precipitation of moisture on the platinum contact finger, which it is necessary to use to reduce the resistance of the contacts. When the carbon is not plated, the resistance is so great as to make it necessary to connect not less than two fingers and springs in multiple.

*Previous articles on pages 137 and 242.

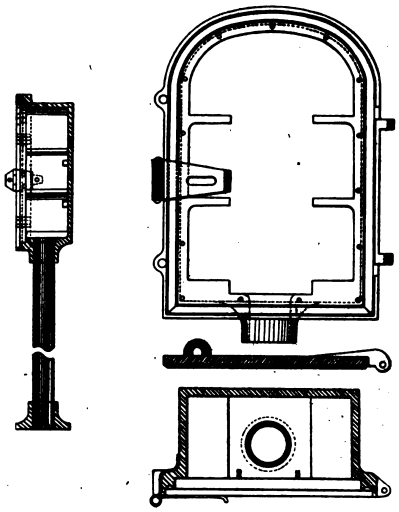

Fig. 2.—Iron Relay Case.

A number of relays with aluminum contacts (both finger and spring) have shown remarkable freedom from precipitation of moisture. This test was employed in extreme frost conditions in both wood and iron enclosures. The only trouble with aluminum contacts is their tendency to become dirty from sparking. With good inspection, these contacts can be made to work without failures. But some new metal or combination of metals

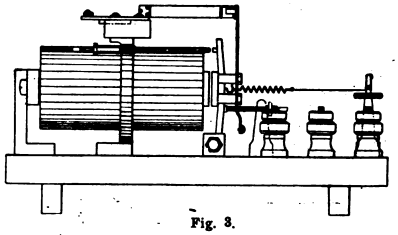

Fig. 3.

ought to be tried for contacts, all thus far tried having proved unsatisfactory in one way or another.

While the question of the contacts of relays is vital and furnishes food for serious thought, we must not lose sight of the "air gap," which separates the armature from its magnets or pole pieces. The precipitation of moisture on the pole pieces and armature plates is considerable. When this precipitation occurs just before a fall in temperature, the moisture is frozen into ice.

Very few relays now in service are placed so that this

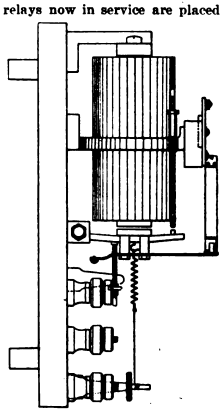

Fig. 4.

moisture can drop down between the pole piece and its armature plate, before it freezes. The surface of the side of the plate being horizontal, this moisture, when it freezes, seals the plate to the pole piece. Then, again, on many relays the air gap is too small.

The general practice is to so arrange the armature plate with reference to its pole pieces that it drops away from them by gravity when the magnet is de-energized, as in Figs. 4 and 5. There should be a greater gap between pole pieces and armature plates. The pole pieces should be smaller or of a different shape, and all relays should be set (as in Fig. 3) so that moisture cannot be held between pole pieces and armature plates. This is a radical departure from present practice, and it will necessitate the employment of some new arrangement whereby the armature plates can be withdrawn from their pole pieces by gravity, because it is not wise to depend entirely on springs to do this work.

More freezing of armature plates to pole pieces occurs where relays are enclosed with glass covers placed over the contacts and magnets than with those having no cover. This is not difficult to understand. Where covering is employed, there is an absence of circulation of air, and, consequently, as described in a previous article, the moisture cannot be absorbed by the air. If these relays were built so that there could be a vacuum around the parts named, then moisture would make no trouble.

A great deal of the trouble with relay contacts and armatures is due to the character of the design of the case or enclosure. Relays in the bases of iron signal masts, wherein are also contained the mechanism operating the signal suffer much from frost. This condition is caused by the same circumstances which disturb the other mechanism, as described in previous papers.

On a certain installation of 15 miles, where iron masts are in service, the relays for two winters were located in wood relay boxes (Fig. 1) attached to the iron signal mast; and not a single case of interruption of their proper operation was noted. Since that time, these relays have been put into the iron case located at base of the iron signal mast, and there have been interruptions. Where these wood relay boxes are in service for the control of disk signals, and for repeating from one track section to another, where, as a rule, they are attached to telegraph poles, it is rare for the contacts to become coated with moisture; and no case is known where there was enough moisture to interrupt the proper operation of the armature plate.

There is in use an iron relay case (Fig. 2), sometimes with and sometimes without wood lining. A large number of failures have occurred in these cases due to frost

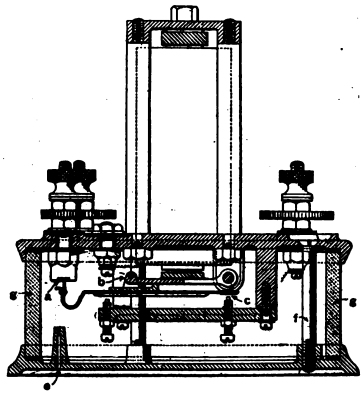

Fig. 5.—Enclosed Relay.

and ice forming on the relay points. Where relays in iron relay cases, with a wood back lining, have been transferred to wood cases, a marked improvement has been noted.

Where relays are located in surface battery houses or in "banjo" signal cases, there is no trouble from interruption.

From all these experiences the conclusion is warranted that all relays should be contained within wood enclosures.

Relay magnet terminals corrode and break where the wire passes through the fibre or rubber end pieces. The life of these terminals on relays located in wood enclosures is about three times greater than on those in iron enclosures. This seems to be due to the continual precipitation within iron enclosures. This precipitation is about as great in the summer as in the winter. When these terminals lead through bone or similar insulation and no rubber is used, their life is much prolonged. These conditions have been overcome to some extent by using shellac, varnish or paraffine to seal the terminals at the entrance to the magnet.

High Speed Tool Steels.

At the sixth annual convention of the National Metal Trades Association Mr. Wm. Lodge, of Cincinnati, Ohio, read a paper from which the following extracts are made:

To obtain full benefit of high-speed steels it has become necessary, in order to equalize all the conditions, not only to redesign the machines themselves, but also to rearrange the old methods of both holding and driving the work. New methods of mounting and holding, as well as dressing and grinding the tools are demanded, and while this may not apply so very seriously to small jobbing shops it is one of the most significant questions that manufacturing concerns have to deal with. Manufacturing establishments that formerly got along reasonably well with the old methods of handling, storing, distributing and succession of the work in course of construction, will find it necessary to make a complete change in order that the various processes may uniformly keep abreast with each other in the rapid movement of the work going through the factory. The stock room man must be in evidence, as