March 26, 1963 J. G. GLASS 3,083,279

HINGED ARMATURE RELAYS

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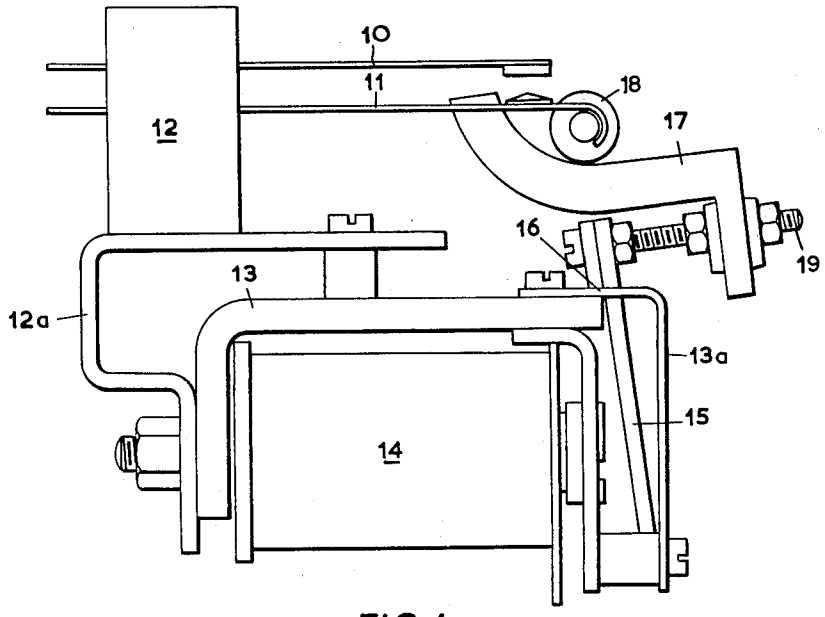

FIG. 1

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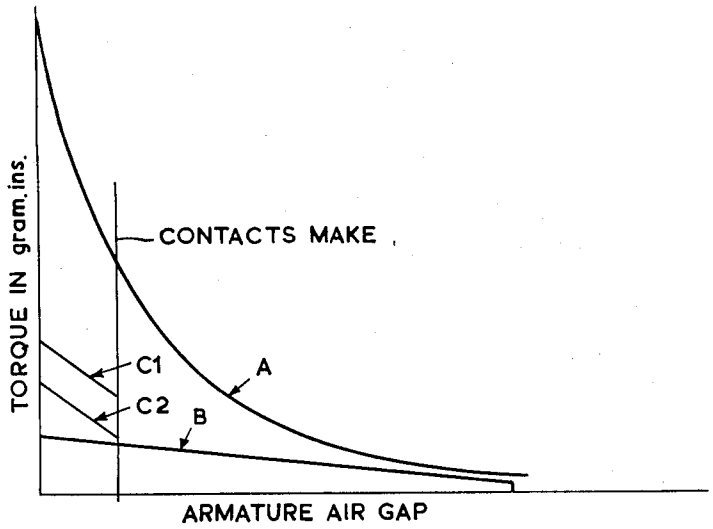

FIG. 2

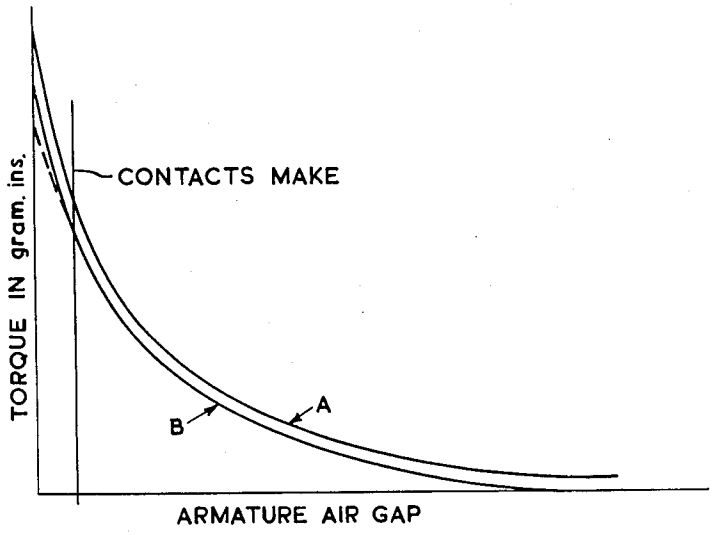

FIG. 3

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HINGED ARMATURE RELAYS

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4 Claims. (Cl. 200—87)

This invention relates to hinged armature relays and is applicable to relays of the conventional post office type.

According to the invention, a hinged armature relay has a contact-actuating member connected for movement with said armature which has a cam-acting connection with the contact system so shaped as to match the characteristic of the armature restoring force with the characteristic of the relay operating forces applied to said armature.

According to a feature of the invention, the cam-acting connection is adjustable.

According to another feature of the invention, a roller is mounted at the end of a resilient strip forming part of a contact spring-set which is displaced laterally with respect to its longitudinal direction for contact operation and said cam-acting connection is shaped to displace a follower on this strip laterally as the armature pivots about its hinge.

Other features of the invention will be apparent from the following description with reference to the accompanying drawing in which:

FIG. 1 shows a hinged armature relay having two normally open contact members,

FIG. 2 shows curves relating magnetic pull to armature restoring torque for a typical conventional hinged-armature relay, and

FIG. 3 shows similar curves for a relay according to the invention.

Referring to FIG. 1 of the drawing a hinged armature relay is shown to comprise a contact system in the form of a spring-set consisting of two contact members **10** and **11** supported in an insulating block **12** mounted on a bracket **12***a* attached to a magnetic core structure **13** which is energized by an operating coil **14** and has a hinged armature **15** which controls the position of the movable contact **11**. The armature **15** is shown to pivot about an abutment **16** and is held by a bracket **13***a* so as to move between extreme positions according to whether the coil **14** is energized or not. Thus far the relay is quite conventional and a more detailed description of its construction is thought to be unnecessary.

In conventional relays it is usual for the armature **15** to be L-shaped, one of the legs being operative to bridge the working gap in the magnetic core structure **13** and the other leg being connected by some suitable connecting means positioned at the extremity of this leg to displace the contact member **11** laterally with respect to its longitudinal direction and so operate the contacts. One disadvantage of such a relay is that although the restoring force arising from the resilience of the contact member **11** is somewhat linearly related to the displacement of the armature the magnetic force on the other leg of the armature when the coil **14** is energized is not linear but increases rapidly as the armature closes with the result that the relay operating current is sensitive to the actual position of the armature. This effect may be contrasted with one in which there is a perfect match between the restoring force characteristic and the operating force characteristic. In this latter case, regardless of the actual position of the armature there will be a certain threshold value for the operating current of the relay which when exceeded will promote the closure of the relay contacts and which when not exceeded will result in the opening of the relay contacts. Such a relay would have a very high drop out value, and would be particularly stable under shock and vibration conditions.

In the relay of the invention, as shown in FIG. 1 of the drawing, a matching effect is introduced by providing a suitably shaped cam member **17** attached to the armature **15**, and arranged to co-operate with a roller **18** on the contact member **11** so that as the armature closes the displacement of the contact member **11** in the contact closing direction varies non-linearly in a manner calculated to match the operating force characteristics of the magnetic system. In this way the advantages of a relay having a matched restoring and magnetic operating force characteristic can be obtained in a simple way in the hinged armature relay.

The roller **18** and/or the cam member **17** which engages this roller may be of insulating material. The cam member **17** is secured to the armature **15** by a pair of screws **19** which also serve to attach the abutment **16** to the armature. The cam member **17** is clamped between nuts on the screws **19** so that its position may be varied to adjust the rate of contact travel.

In the common hinged armature relay the magnetic pull curve follows usually the square law, which is matched with a straight line mechanical performance. This is shown by the curve in FIG. 2. In this figure curve A represents the magnetic pull at a certain level of energizing ampere turns. Curve B represents the torque exerted on the armature by the moving contact springs. Curves C1 and C2 represent the additional torque exerted on the armature by the fixed contacts when the contacts make. C1 gives the performance of contacts pre-tensioned on supports and C2 of contacts not so pre-tensioned.

The improved design allows for a much better matching of the magnetic pull curve regardless of its shape as shown in FIG. 3, where curve A represents the magnetic pull at a certain level of energizing ampere-turns. Curve B represents the torque exerted on the armature by the moving contact springs. The rise in B at the instant the contacts make is caused by the lifting of the fixed contacts.

What I claim as my invention and desire to secure by Letters Patent, is:

1. A relay comprising in combination a lever system defined by an armature assembly and a hinge supporting said armature assembly for pivotal movement, electromagnetic means for applying a force to said armature assembly at a first radius from said hinge to produce a relay operating torque so as to pivot the armature assembly between an attracted and an unattracted position, spring contact means actuable by pivotal movement of said armature assembly and arranged to exert a force on said armature assembly at a second radius from said hinge to produce a torque opposing said relay operating torque, said lever system and contact means comprising co-operating means for progressively increasing the ratio of said second to said first radius as the armature assembly approaches the attracted position, whereby to match the relay operating and opposing torque characteristics.

2. A relay comprising in combination a lever system defined by an armature assembly and a hinge supporting said armature assembly for pivotal movement, electromagnetic means for applying a force to said armature assembly at a first radius from said hinge to produce a relay operating torque so as to pivot the armature assembly between an attracted and an unattracted position, spring contact means actuable by pivotal movement of said armature assembly and arranged to exert a force on said armature assembly at a second radius from said hinge to produce a torque opposing said relay operating torque, said lever system and contact means comprising adjustable

co-operating means for progressively increasing the ratio of said second to said first radius as the armature assembly approaches the attracted position, whereby to match the relay operating and opposing torque characteristics.

3. A relay comprising in combination a lever system defined by an armature, a hinge supporting said armature for pivotal movement, and a cam member carried by said armature, electro-magnetic means for applying a force to said armature at a first radius from said hinge to produce a relay operating torque so as to pivot the armature between an attracted and an unattracted position, contact means including a resilient moving contact actuable by pivotal movement of said armature and a follower carried by said resilient moving contact, said follower being arranged to engage said cam member at a second radius from said hinge so as to produce a torque opposing said relay operating torque, said follower and said cam member being arranged to co-operate so as to progressively increase the ratio of said second to said first radius as the armature approaches the attracted position whereby to match the relay operating and opposing torque characteristics.

4. A relay comprising in combination a lever system defined by an armature, a hinge supporting said armature for pivotal movement, and a cam member adjustably

supported by said armature, electro-magnetic means for applying a force to said armature at a first radius from said hinge to produce a relay operating torque so as to pivot the armature between an attracted and an unattracted position, contact means including a resilient moving contact actuable by pivotal movement of said armature and a follower carried by said resilient moving contact, said follower being arranged to engage said cam member at a second radius from said hinge so as to produce a torque opposing said relay operating torque, said follower and said cam member being arranged to co-operate so as to progressively increase the ratio of said second to said first radius as the armature approaches the attracted position whereby to match the relay operating and opposing torque characteristics.

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