Aug. 25, 1964 D. R. HAZELQUIST 3,146,315

READILY ADJUSTABLE RELAY CONTACT STRUCTURE

Filed May 16, 1962

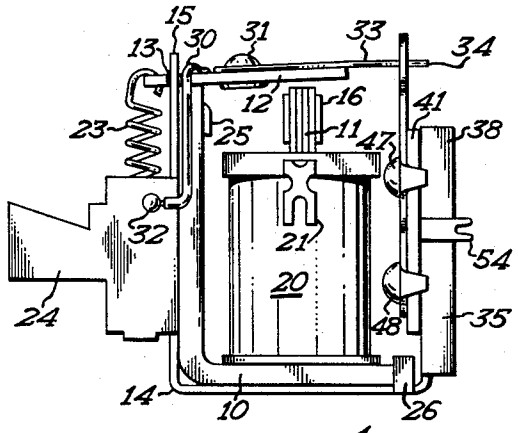


Fig 1

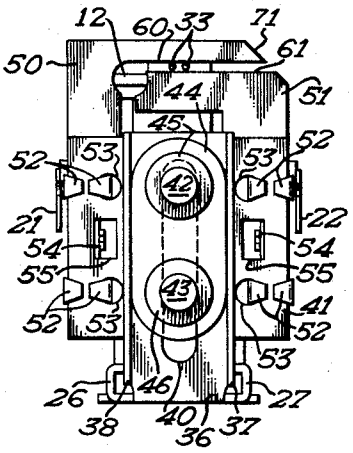


Fig 2

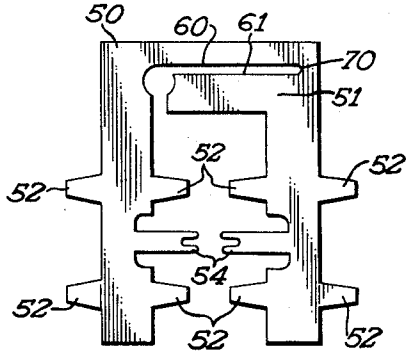


Fig 3

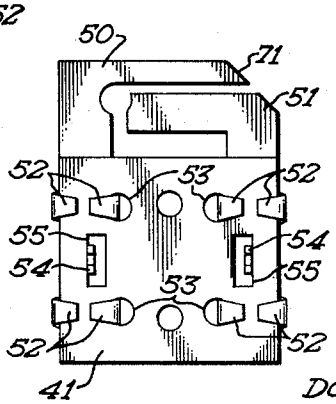


Fig 4

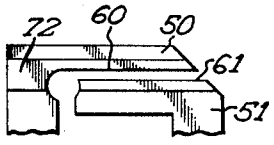


Fig 5

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READILY ADJUSTABLE RELAY CONTACT STRUCTURE

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The present invention is directed to an electro-magnetically operated relay, and more particularly is directed to a relay having a unique type of contact structure. The invention is further directed to a method of manufacturing the contact structure in a more economical fashion than has been previously available.

The relay art is a very highly developed art and as such is exceedingly competitive in nature. Any advantage which can be gained by the utilization of a particular type of relay structure or a method of fabricating part of a relay structure or contact structure is exceedingly important in the commercial world. In the field of control, that is the switching of relatively small currents at varying voltages, it has been desirable to provide a relay structure that is reliable in contact action and also which can be manufactured at a reasonable cost. The present relay is directed both to a relay that provides reliable contact action and also provides a method of fabricating the contact structure that is exceedingly cheap and convenient.

It is a primary object of the present application to disclose a novel contact structure for a relay and further to disclose a method of manufacturing the contact structure.

It is a further object of the present invention to disclose a contact structure that can be readily adjusted and which adjustment remains fixed after the adjustment has been made.

Still a further object of the present invention is to disclose a contact structure that is exceedingly rigid because of its form and method of manufacture thereby providing a reliable contact structure.

These and other objects will become apparent when the drawings of the present application are considered, wherein:

FIGURE 1 is a side view of a clapper type of relay utilizing the present invention;

FIGURE 2 is an end view of the relay of FIGURE 1 from the end where the contact structure is mounted;

FIGURE 3 is an elevation of a piece of the contact structure in a first step in a method of manufacturing the contact structure;

FIGURE 4 is an assembled contact means prior to its mounting on a mounting means of the relay of FIGURES 1 and 2, and;

FIGURE 5 is a partial view of the contact portion of FIGURE 4 wherein a silver overlay has been added to the contact areas for more reliable operation.

The entire relay structure is shown in FIGURES 1 and 2. This relay is formed by a solid magnetic member **10** that has a laminated leg **11** which forms a fixed magnetic portion of the over-all magnetic circuit. The magnetic circuit is completed by an armature **12** of magnetic material that is pivoted at **13** on a frame **14**. The frame **14** extends upward at **15** to form a hinge member for the armature **12** so that it can cooperate magnetically and mechanically with the laminated leg **11**. The laminated leg **11** has a copper ring **16** embedded in it and ring **16** forms a conventional shading coil for the device.

Encircling the laminated leg **11** is a coil **20** that has a pair of terminals **21** and **22** to which are connected the normal leads for energizing the electric coil. The electric coil **20**, when it is energized from a normal source of

electric power, provides a magnetic flux that can flow in the magnetic circuit means formed by the member **10**, the laminated leg **11**, and the armature **12**. The structure described is conventional in the clapper type of relay and warrants little or no further explanation.

A conventional tail spring **23** is connected between an end of the armature **12** and the frame **14** at a point not shown. The frame **14** has an extension **24** that can be placed through a panel and bent over or crimped to provide a mounting means for the relay. The frame **14** has tabs **25**, **26** and **27** that are bent around the magnetic member **10** to hold the device in a unitary form. A conductor **30** joins a rivet **31** electrically with the frame **14** at a point **32** so that the frame **14** becomes part of any electric circuit to which the relay is connected. This is accomplished by wrapping a conductive wire **33** around the rivet **31** and allowing the wire **33** to extend outwardly at **34** beyond the armature **12**. It should be understood that the wire **33** is wrapped around the rivet **31** could be replaced by any type of elongated contact means that would project beyond the armature **12** to the point **34** and which would form a part of an electrical contact structure for the relay. The elongated contact means or wire **33** is preferably somewhat flexible in nature so that good alignment will be accomplished when the device is utilized, as will be seen later in the present disclosure.

An upstanding channel **35** is provided integrally with the frame **14** and is U-shaped in cross section. The U-shaped channel **35** has a bight portion **36** and two upstanding channel members **37** and **38**. A slot **40** is cut in the bight **36** and provides a means for mounting the novel contact structure of the present relay.

The novel contact structure of the present relay is formed by an insulating member **41** that holds the contact means generally. The insulating member **41** is attached by rivets **42** and **43**, with enlarged heads **45** and **46**, through the slot **40** along with a large frictional spacing member **44**. When the rivets **42** and **43** are placed through the frictional member **44** and properly flattened with heads at **47** and **48** on the back side of the insulator **41**, a unitarily mounted contact structure is provided. The insulating member **41** can be slid frictionally in the slot **40** for adjustment purposes. The frictional engagement of member **44** provides an adjustment feature. After the device is adjusted it normally will retain its adjustment without further locking means. If the particular relay is to be subjected to any unusual environmental conditions, the adjusting or frictional member **44** can be further locked by cements, ambroid, glues, or any similar material after the position of the insulator **41** has been accomplished.

The insulator **41** carries a fixed contact means for the present device and the fixed contact means is made up of two L-shaped contact members **50** and **51**. The L-shaped member **50** has a plurality of tabs **52** that are crimped or bent around a portion of the insulating member **41** by passing the tabs **52** through holes **53** in the insulating member **41**. Also integrally connected to the contact **50** is a terminal **54** that passes through an opening **55** in the insulated member **41**.

The contact member **51** also has tabs **52** and a hole **53** in the insulator **41**. The tabs **52** are bent to hold the contact **51** is position also. The contact **51** further has a terminal **54** that passes through an opening **55** in the insulator **41** as did the contact member **50**.

The contact members **50** and **51** are stamped from a sheet of metal and the portions that are generally at right angles to one another are of a sufficient thickness to maintain the relationship of the parts in a fixed manner so that the contact is not subject to bending or adjustment after the tabs **52** have been crimped or bent into place. The contact **50** further has a contact surface **60**

that is substantially parallel to the contact surface **61** that is formed along the top edge of the contact **51**. It will be noted that the wire **33** of the elongated contact means passes between the surfaces **60** and **61** and bears against the surface **60** when the relay is in a de-energized condition. When the relay is energized the wires **33** move downward in the space between the contact members **50** and **51** to engage the surface **61** of contact **51**. By adjusting the position of the insulating member **41**, as previously described, the location of the opening between the surfaces **60** and **61** can be set for proper relay operation. It will thus be noted that a single pole double throw relay contact structure has been provided wherein the frame **14** of the relay is common between the contacts **50** and **51** which are electrically isolated on the insulating member **41**.

The description of the relay of FIGURES 1 and 2 has been made with the discussion of the contacts **50** and **51** being separate movable contact members on a mounting means of an insulated type. In fabricating this relay the method of manufacturing the contacts **50** and **51** forms an important part of the design and construction of the relay. In order to explain this, FIGURES 3 and 4 will be considered. In fabricating the contact structure for the relay a single contact member or structure is punched or formed from a sheet of metal. This unitary contact structure is shown in FIGURE 3 with the contact **50** and the contact **51** joined at a corner **70**. It will be noted that structurally the contacts **50** and **51** are interconnected when the contact structure is initially formed. The spacing and position of the contact surfaces **60** and **61** is established by the design of the die which punches the contact structure disclosed in FIGURE 3 from the sheet of metal. The tabs **52** are integrally formed to the single contact structure member as are the terminals **54**. After the contact structure shown in FIGURE 3 has been punched out of a solid sheet of conductive material, the tabs **52** and the terminals **54** are bent perpendicular to the contact members **50** and **51**. It wil be noted that both the contact members **50** and **51** are generally L-shaped in their configuration and that they are interconnected only at the corner **70**.

The next two steps in the assembly or manufacture of the contact section of the present relay are shown in FIGURE 4. The insulating member **41** is placed over the structure disclosed in FIGURE 3 and the tabs **52** are bent over after passing through the holes **53** in the insulating member **41**. After the tabs **52** are bent down or crimped, it will be obvious that the contact structure and the insulating member form a rigidly mounted single contact structure. In order to electrically separate the two contacts **50** and **51** the corner **70** is clipped off on a line **71** which passes through the corner **70** at approximately a 45 degree angle. The separation of the two contacts leaves two rigidly fixed contact members that are not subject to any type of bending or displacement after assembly. In severing the corner of the contact structure the interconnection has been removed and the two L-shaped members form two electrically independent relay contacts. The contact assembly disclosed in FIGURE 4 is then mounted by rivets **42** and **43** into place as has been previously described. The adjustment is accomplished and the relay is ready for operation.

Since one of the primary objects of the present relay is reliable switching action, it will be noted that the elongated contact structure has been shown as two wires **33**. The two wires provide redundant contact with the surfaces **60** and **61** so that exceedingly small voltages can be reliably switched without the normal effects of dirt and deposits on the contact surfaces. The elongated contact members **33** are quite flexible and thereby adjust to the surfaces **60** and **61** to provide good contact. In an improved version where exceedingly sensitive control is required, an arrangement disclosed in FIGURE 5 is utilized. The contact structure disclosed in FIGURE 3 is punched from metal stock having a silver overlay **72** that passes adjacent the surfaces **60** and **61**, thereby providing a silver edge on the contact surfaces **60** and **61**. It will be noted that with the arrangement of FIGURE 5 the contact wires **33** pass over the edge of the silver thereby giving an exceedingly reliable contact structure that normally accomplishes the job of a silver or similar electrical overlay but without the expense of using silver or similar contact material on the entire structure.

It will be noted in this entire discussion that the contact structure disclosed is an exceedingly rigid contact structure as far as the members **50** and **51** are concerned. The members are of sufficient thickness and of such cross-section that they cannot be readily moved by bending the sections and therefore the control of the contact placement can readily be accomplished in the punching operation. The contact surfaces **60** and **61** can either be punched parallel to one another or in some other alignment depending upon the type of contact operation desired. While the contacts **50** and **51** could be made and aligned separately by manual means, this would defeat the advantage of the present structure. The present relay is designed for substantially automatic production in exceedingly high volume and the cost saving in assembling a single part to the insulator **41** and then severing the part to provide the two contact members is a substantial improvement in the manufacture of this type of relay. The sections of metal involved are of sufficient size so that the contact surfaces **60** and **61** remain substantialy fixed throughout the life of the device and require no further adjustment in production or use. It is obvious that many of the features of the present invention could be modified by one skilled in the art and the applicant wishes to point out that only one of the preferred embodiments of the invention has been disclosed. As such, the applicant wishes to be limited in the scope of his invention only by the scope of the appended claims.

I claim as my invention:

1. In an electromagnetically actuated relay, comprising: magnetic circuit means including magnetic flux generating means for providing a controlled magnetic flux in said circuit means; said circuit means including a fixed magnetic member and a movable magnetic member which move relative to each other as said magnetic flux is controlled; elongated contact means carried by said movable magnetic member; fixed metal contact means including two contacts of rectangular cross section having adjoining contact surfaces and each further having an integral extension at generally right angles to said contact surfaces; said contact surfaces and said extensions lying in a plane perpendicular to and intersected by said elongated contact means; and an insulating member attached to said extensions to mount said contact surfaces adjoining each other; said contacts and said extensions being integrally formed of a metal of sufficient thickness to maintain a fixed relationship between said contacts after said contact means is mounted upon said insulating member; said insulating member mounted upon said magnetic circuit means to allow said elongated contact to pass between said contact surfaces.

2. In an electromagnetically actuated relay, comprising: mounting means and magnetic circuit means including magnetic flux generating means for providing a controlled magnetic flux in said circuit means; said circuit means including a fixed magnetic member and a movable magnetic member which move relative to each other as said magnetic flux is controlled; elongated contact means carried by said movable magnetic member; fixed metal contact means including two contacts of rectangular cross section having adjoining substantially parallel contact surfaces and each further having an integral extension at generally right angles to said contact surfaces; said contact surfaces and said extensions lying in a plane perpendicular to and intersected by said elongated con-

tact means; and an insulating member attached to said extensions to mount said contact surfaces adjoining each other; said contacts and said extensions being integrally formed of a metal of sufficient thickness to maintain a fixed relationship between said contacts after said contact means is mounted upon said insulating member to maintain said substantially parallel relationship; said insulating member mounted upon said mounting means to allow said elongated contact to pass between said contact surfaces.

3. In an electromagnetically actuated relay, comprising: a mounting frame and magnetic circuit means including an electrical coil for providing a controlled magnetic flux in said circuit means; said circuit means including a fixed magnetic member and a movable magnetic armature which move relative to each other as said magnetic flux is controlled; an elongated contact formed of at least two wires carried by said magnetic armature; fixed metal contact means including two rigid L-shaped contacts of rectangular cross section having adjoining substantially parallel contact surfaces; both said L-shaped contacts lying in a single plane perpendicular to and intersected by said elongated contact; and an insulating member attached to a lower portion of said L-shaped contacts to mount said contact surfaces adjoining each other; said contacts including said lower portions being formed of a metal of sufficient thickness to maintatin a fixed relationship between said contact surfaces after said contact means is mounted upon said insulating member to maintain said substantially parallel relationship; said insulating member mounted upon said mounting frame to allow said elongated contact wires to pass between said contact surfaces.

4. In an electromagnetically actuated relay, comprising: mounting means including sliding connection means; magnetic circuit means including magnetic flux generating means for providing a controlled magnetic flux in said circuit means mounted upon said mounting means; said circuit means including a fixed magnetic member and a movable magnetic member which move relative to each other as said magnetic flux is controlled; elongated contact means carried by said movable magnetic member; fixed metal contact means including two contacts of rectangular cross section having adjoining contact surfaces and each further having an integral extension at generally right angles to said contact surfaces; said contact surfaces and said extensions lying in a plane perpendicular to and intersected by said elongated contact means; and an insulating member attached to said extensions to mount said contact surfaces adjoining each other; said contacts

and said extensions being integrally formed of a metal of sufficient thickness to maintain a fixed relationship between said contacts after said contact means is mounted upon said insulating member; said insulating member mounted upon said mounting means by said sliding connection means to allow said elongated contact to pass between said contact surfaces; said sliding connection means further providing for adjustment of the position of said elongated contact means with respect to said contact surfaces.

5. In an electromagnetically actuated relay, comprising: a mounting frame including sliding connection means; magnetic circuit means including an electrical coil for providing a controlled magnetic flux in said circuit means mounted upon said mounting means; said circuit means including a fixed magnetic member and a movable magnetic armature which move relative to each other as said magnetic flux is controlled; elongated contact means carried by said movable magnetic armature; fixed metal contact means including two rigid L-shaped contacts of rectangular cross section having adjoining substantially parallel contact surfaces; both said L-shaped contacts lying in a single plane perpendicular to and intersected by said elongated contact means; and an insulating member attached to a lower portion of said L-shaped contacts to mount said contact surfaces adjoining each other; said contacts including said lower portions being formed of a metal of sufficient thickness to maintain a fixed relationship between said contact surfaces after said contact means is mounted upon said insulating member; said insulating member mounted upon said mounting means by said sliding connection means to allow said elongated contact to pass between said contact surfaces; said sliding connection means further providing for adjustment of the position of said elongated contact means with respect to said contact surfaces.

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