Sept. 22, 1959 W. J. HARRISON 2,905,788

CONTACT STRUCTURES FOR RELAYS

Filed March 14, 1957

Fig. 1

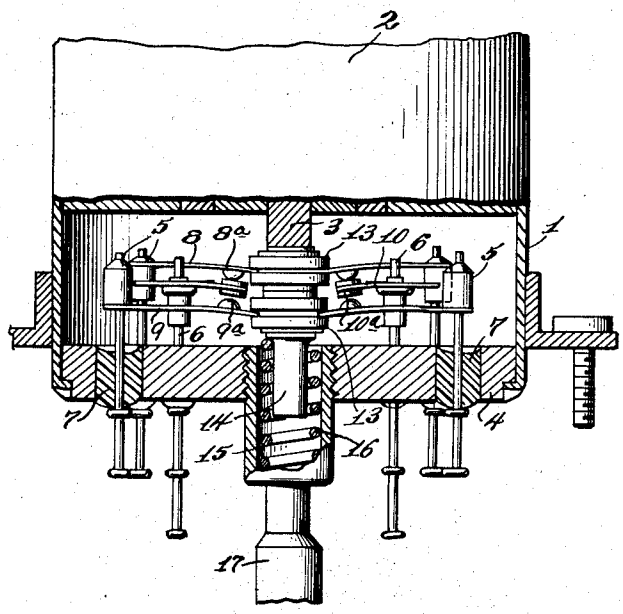


Fig. 5

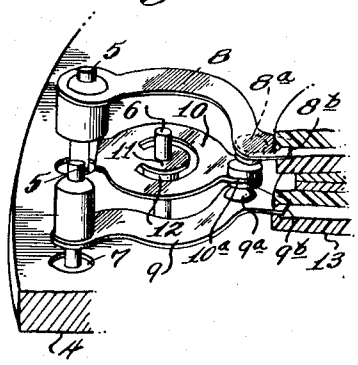


Fig. 4

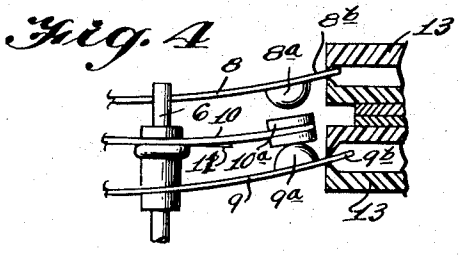
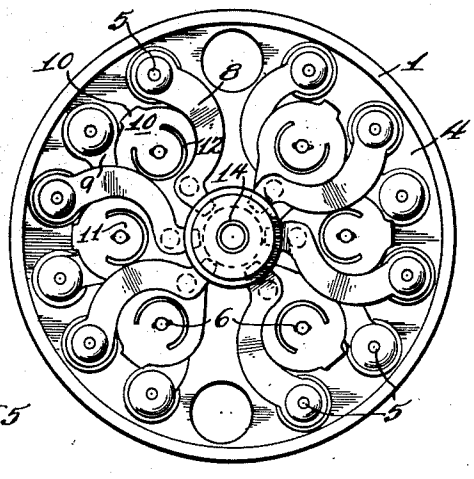


Fig. 2



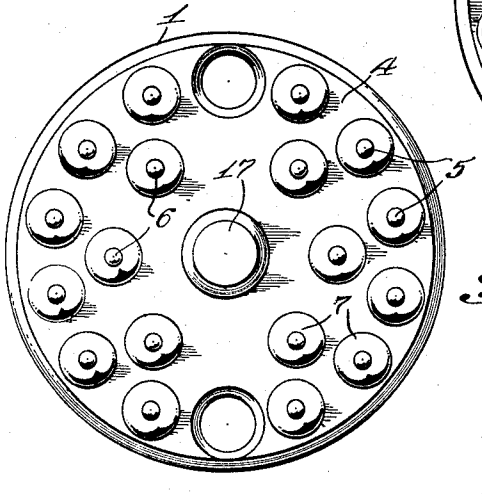


Fig. 3

INVENTOR
WILLIAM J. HARRISON
by D. C. Roylance

ATTORNEY

United States Patent Office 2,905,788 Patented Sept. 22, 1959

2,905,788

CONTACT STRUCTURES FOR RELAYS

William J. Harrison, Mount Carmel, Ill., assignor to Potter & Blomfield, Inc., a corporation of Illinois

Application March 14, 1957, Serial No. 646,071

3 Claims. (Cl. 200—104)

This invention relates to contact structures for relays, and more particularly for relays in which a plurality of contact-carrying arms are operated simultaneously, so as to open or close a number of different circuits. Such contact arms have usually been arranged in a circular assembly, with the arms disposed more or less radially, and with the electromagnetic operating means at the center.

Heretofore, in relays of this type which are subjected to vibratory forces or shock, trouble has been experienced with faulty or intermittent closing or opening of the contacts due to vibration of the arms. This has resulted from the fact that in many cases straight, resilient arms supported at one end only have been employed, and these are easily thrown into vibration when subjected to vibratory forces.

The general object of the present invention is to devise a contact assembly of this type having high resistance to vibration and shock in both energized and unenergized positions of the relay. To this end, the invention provides an assembly from which have been eliminated all free or unsupported contact arms in which a resonant vibration can be generated. All arms are either supported at both ends or held under a stressed condition.

A more specific object is to devise a construction in which, for each switching unit or set of contacts, a pair of movable arms is provided, with a single fixed arm disposed between them, as distinguished from the usual arrangement of a pair of spaced, fixed arms with a single movable arm between them. As will hereinafter appear, such a construction possesses distinct advantages.

In order that the invention may be readily understood, reference is had to the accompanying drawing, forming part of this specification, and in which:

Fig. 1 is a longitudinal section through my improved contact assembly, parts being shown in elevation;

Fig. 2 is a plan view of the entire contact assembly;

Fig. 3 is an inverted plan view thereof;

Fig. 4 is a fragmentary view on an enlarged scale showing in side elevation one of the switch units or sets of contacts and the actuating device therefor, parts being in section, and

Fig. 5 is a perspective view showing such switching unit or set of contacts, parts being in section.

Referring to the drawing in detail, my improved relay comprises a cylindrical casing 1 in the upper part of which 2 is enclosed a suitable solenoid having a central operating rod or pin 3. These elements may be similar to what is shown in British Patent No. 751,762 to the W. N. Borg Corporation, published July 4, 1956, and form no part of my invention.

Secured at the lower end of the cylindrical housing 1 is a plate or disc 4, constituting a header for supporting the terminals.

Two sets of terminals 5 and 6 are provided, as best shown in Fig. 3, and these are arranged in concentric inner and outer circles, the number of terminals in the outer circle being twice as great as the number in the inner circle. Each terminal extends through the header 4 and is insulated therefrom as by means of glass bushings 7.

Secured to the terminals 5 is an annular series of movable arms 8 and 9, and secured to the terminals 6 is an annular series of relatively fixed contact arms 10. These contact arms 10 are considerably shorter than the arms 8 and 9 and are relatively wide and flat. They are secured to the terminals 6 in a special way, as best shown in Fig. 5. An arcuate slot 12 is cut in the contact arm around the inner side of and concentric with the terminal, thus providing a central portion 11 which is rigidly secured to the terminal. This construction permits the arm 10 to flex freely about a point at the outer side of the terminal where the arm is joined to said central portion, thus increasing the effective length of the arm. It will be seen that all parts of the arm normally lie in the same transverse plane, thus rendering it laterally rigid.

The arms 8 and 9 carry at their free ends contacts 8^a and 9^a, and the arms 10 carry at their inner ends double contacts 10^a. It will be seen that the contact arms making up the annular series above described extend substantially radially inward toward the center of the disc or header.

The series of arms above described constitute a plurality of switching units or sets of contacts, one of which units or sets is best illustrated in Fig. 5. Referring to this figure, it will be seen that each set or unit is made up of a pair of movable contact arms 8 and 9 disposed in spaced parallel planes and secured at their outer ends to a pair of adjacent terminals 5 on the outer circle. Confined between the spaced parallel movable arms 8 and 9 is one of the relatively fixed arms 10. The arms 8 and 9 converge toward each other at their inner ends and the inner or free ends of all three arms are disposed in overlapping relation. It will be further observed that the two outer terminals 5 and the inner terminal 6, shown in Fig. 5, are arranged at the apices of a triangle, and that the arm 10 extends from one of the terminals in a direction away from the other two. It will be still further noted, especially by reference to Fig. 2, that the arms 8 and 9 are of curved or arcuate shape. One purpose of this is to enable them to extend around or encircle the terminal 6 which is located between them, so that their inner ends may converge and overlap, as described. Another reason is that high frequency vibrations tend to propagate more readily along a straight path than along a curved path, and the use of a curved arm thus serves to reduce high frequency vibrations.

The solenoid rod or pin 3 acts against the upper end of a movable structure 14 on which are rigidly mounted two pairs of insulating discs 13. The free ends 8^b and 9^b of the movable arms 8 and 9 extend inwardly beyond the end of arm 10 and these extended ends are held between the upper and lower pairs of insulating discs 13. Thus the movable arms 8 and 9 are supported at both ends.

The lower part of the structure 14 is surrounded by a helical spring 16 which is enclosed within a housing 15 which is screw threaded into a central opening in the disc or header 4. An extension 17 may be provided by means of which the housing 15 can be unscrewed.

It will thus be understood that the movable contact arms are shifted in one direction by the solenoid acting on the upper end of the structure 14 and in the other direction by the spring 16.

It will be particularly noted that the spring normally holds the movable arms in such a position that the contacts 9^a of the lower arms 9 are in engagement with the

contacts 10a of the fixed arms 10, as shown in Fig. 4, and that when the solenoid is energized the rod or plunger 3 moves the structure 14 in the opposite direction against the tension of the spring 16, thus bringing the upper arms 8 into engagement with the fixed arms 10, as shown in Fig. 1. Hence at no time are the fixed arms 10 left free, because they are always in engagement with either the arms 8 or the arms 9. Thus these arms 10 are maintained under stress or strain by the pressure of the arms 8 or 9 and are thereby prevented from vibrating.

What I claim is:

1. A terminal header and contact assembly for electromagnetic relays comprising a disc, a plurality of contact terminals mounted on said disc and insulated from one another, all of said terminals including portions extending from the same side of said disc, said terminals being arranged to define two spaced concentric circles with the number of terminals in the outer circle being double the number of terminals in the inner circle, and a plurality of sets of contact members, the number of said sets being equal to the number of terminals in said inner circle, each of said sets including (1) a relatively fixed contact member comprising a wide, flat mounting portion fixed to a terminal of said inner circle and extending transversely thereof, and a flat contact-carrying portion extending from a point outwardly of such terminal radially inwardly with respect to said inner circle and being flexibly connected to said mounting portion only at a point outwardly of such terminal, whereby the effective length of said relatively fixed contact member is increased, said contact-carrying and mounting portions normally tending to lie in the same plane and (2) a pair of relatively movable, resilient contact arms supported on adjacent terminals of said outer circle and lying in separate planes on opposite sides of said relatively fixed contact member, said pair of arms extending generally radially inwardly from said outer circle and each having an intermediate, arcuate portion extending around the terminal carrying said relatively fixed contact member, the tips of said arms being disposed in overlapping relation each on a different side of the tip of said relatively fixed contact member.

2. A terminal header and contact assembly for electromagnetic relays comprising a disc, a plurality of contact terminals mounted on said disc and insulated from one another, all of said terminals including portions extending from the same side of said disc, said terminals being arranged to define two spaced concentric circles with the number of terminals in the outer circle being double the number of terminals in the inner circle, and a plurality of sets of contact members, the number of said sets being equal to the number of terminals in said inner circle, each of said sets including (1) a relatively fixed, flat contact member having an enlarged portion and a contact-carrying tip, said enlarged portion being fixed to and extending transversely of a terminal of said inner circle and being provided with an arcuate slot extending about such terminal on the side thereof inwardly of said inner circle, the ends of said slot being located outwardly from such terminal, and (2) a pair of relatively movable, resilient contact arms supported on adjacent terminals of said outer circle and lying in separate planes on opposite sides of said relatively fixed contact member, said pair of arms extending generally radially inwardly from said outer circle and each having an intermediate, arcuate portion extending around the terminal carrying said relatively fixed contact member, the tips of said arms being disposed in overlapping relation each on a different side of the tip of said relatively fixed contact member.

3. In an electromagnetic relay of the type comprising a contact actuating member and means for reciprocating the same, the combination of a header disc having an opening through which the actuating member extends, a plurality of contact terminals mounted on said disc and insulated from one another, all of said terminals including portions extending from the same side of said disc, said terminals being arranged to define two spaced concentric circles centered on said opening, the number of terminals in the outer circle being double the number of terminals in the inner circle, and a plurality of sets of contact members, the number of said sets being equal to the number of terminals in said inner circle, each of said sets including (1) a relatively fixed contact member comprising a wide, flat mounting portion fixed to a terminal of said inner circle and extending transversely thereof, and a flat contact-carrying portion formed integrally with and normally tending to lie in the same plane as said mounting portion, said contact-carrying portion extending from a point outwardly of such terminal radially inward with respect to said circle toward said actuating member but terminating short thereof, said contact-carrying portion being flexibly connected to said mounting portion only at a point outwardly of such terminal, and (2) a pair of relatively movable resilient contact arms supported on adjacent terminals of said outer circle and lying in separate planes on opposite sides of said relatively fixed contact member, said pair of arms extending generally radially inwardly from said outer circle and each having an intermediate, arcuate portion extending around the terminal carrying said relatively fixed contact member, the tip portions of said arms being fixed to said actuating member and disposed in overlapping relation each on a different side of the tip of said relatively fixed contact member.

References Cited in the file of this patent

UNITED STATES PATENTS

1,294,599	Bair et al.	Feb. 18, 1919
2,472,709	Knapp	June 7, 1949
2,490,963	Hofgaard	Dec. 13, 1949
2,647,968	Byam	Aug. 4, 1953
2,666,113	Kuhnke	Jan. 12, 1954
2,749,403	Herman et al.	June 5, 1956
2,775,671	Dreyfus	Dec. 25, 1956
2,831,939	Alizon	Apr. 22, 1958