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ELECTRICALLY ACTUATED CONTACTOR

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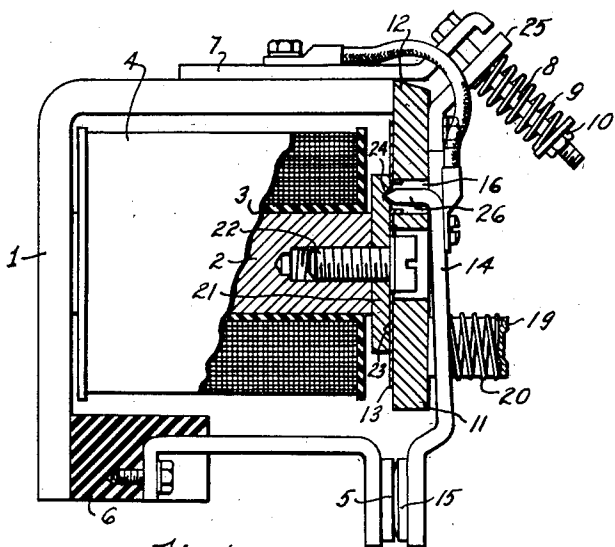


Fig. 1.

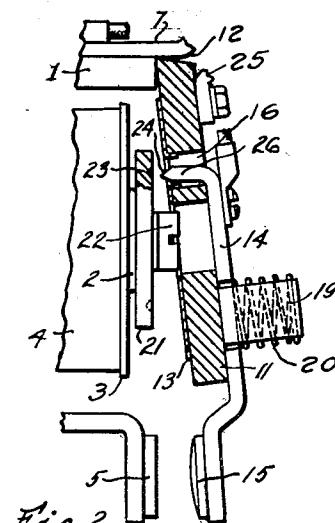


Fig. 2.

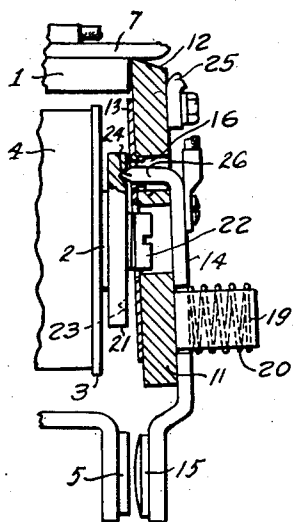


Fig. 3.

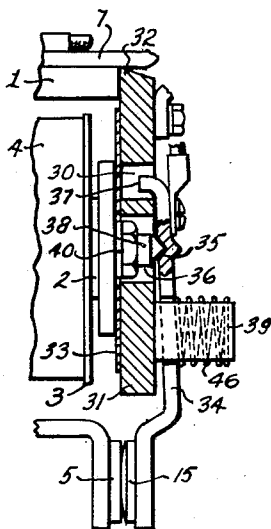


Fig. 4.

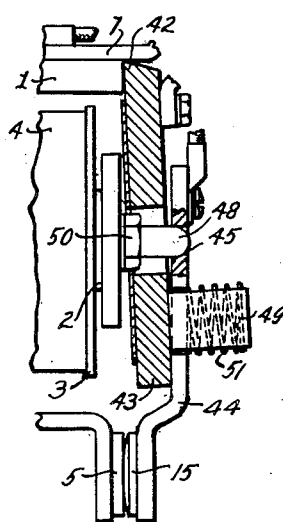


Fig. 5.

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ELECTRICALLY ACTUATED CONTACTOR

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5 Claims. (Cl. 200—87)

Our invention relates to electrically actuated contactors in which a contact carrier is resiliently linked to a rocking armature so as to permit the armature to continue its contact closing motion to a limited extent after the electric contact has been initiated by the contact carrier.

During this limited overtravel motion in the known relays of this type, the contact mounted on the carrier performs a sliding or rolling motion relative to the cooperating stationary relay contact.

It is one of the recognitions underlying this invention that the above-mentioned phenomenon is apt to increase the electrical stress and wear on contacts of the non-wiping type, thus limiting the useful life of the contacts and hence the period of undisturbed relay operation. The reason for this detrimental effect lies in the fact that the relative motion between the contacts occurring after the electrical engagement has been established causes or supports the transfer of contact material from one contact to the other and may also produce slight local sparking, enhancing the transfer effect. This is especially the case with contacts of silver, or the like highly conductive material as is preferably employed in circuit-closing contacts, for instance, in time-limit relays.

Therefore, an object of the invention is to provide a relay of the type here concerned, which affords a considerable increase in the life or undisturbed operating time of the contacts controlled by the relay armature.

Another object, related to the foregoing is to reduce or substantially eliminate the tendency of non-wiping contacts to arc or spark and to develop a transfer of contact material during the overtravel period of the armature.

According to another object, the invention aims at achieving these results by providing a relay in which the overtravel motion of the armature has no noticeable effect on the motion of the contact member resiliently assembled with the armature so that sliding, bouncing or rolling motions due to the overtravel motion are prevented.

An object in conjunction with those mentioned is to prevent relative motion of the relay contacts during the overtravel period by means of simple construction and easy method of assembly so that the desired advantages are obtained without drawbacks in other respects.

For achieving these objects, and in accordance with our invention, we provide a contactor with a contact carrier or contact finger which is resiliently linked to the contactor armature so as to move together with the armature when the

contacts are disengaged, and which engages the stationary or supporting structure of the contactor at a pivot or abutment point during the overtravel period.

5 According to a subsidiary feature of the invention, the engagement between the contact finger and the stationary structure is established slightly previous to the initial engagement between the contacts of the contactor and remains effective
10 over the entire period of contact closure.

In another aspect of the invention, the pivot or fulcrum of the contact finger established by its temporary engagement with the stationary contactor structure is spaced from the place of contact engagement and lies close to the plane determined by the pivot axis of the rocking armature and the place of contact engagement. As a result,
15 any lateral motion between the contacts is effectively prevented during the period of overtravel.

20 According to still another feature of the invention, the contact finger is located at the side of the armature away from the magnet core of an electromagnetic contactor and adapted to establish the aforementioned stationary engagement through an opening of the armature. This leads to a construction of especially simple design and permits an easy assembly and disassembly of the device.
25

30 It is also one of the essential features, in a specific aspect of the invention, to provide the magnet core of a contactor of the just-mentioned type with means, placed on the front or pole surface of the core, for engaging the contact finger, the finger and the core means being shaped with respect to each other so that one of them forms a projection and the other a recess, hole, or groove to be engaged by the projection.
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Still more specifically, a preferred embodiment
40 in accordance with the last-mentioned aspect employs a knife edge and groove type engagement so that the contact finger is firmly held against the magnet core during the overtravel period.

45 These and other objects and features of the invention will be apparent from the following description of the contactors illustrated in the drawing, in which:

Figure 1 is a lateral and part sectional view of
50 a complete electromagnetically actuated contactor according to the invention, the armature and contact assembly being represented in contact-closing position.

55 Figs. 2 and 3 are partial views of the same device with the armature and contact assembly in

contact opening and intermediate position, respectively.

Fig. 4 is a partial and part sectional side elevation of another embodiment of the invention, while

Fig. 5 shows a similar elevation of a third embodiment.

Referring to the relay shown in Fig. 1, the numeral 1 denotes an L-shaped magnetic base structure. An elongated cylindrical magnet core 2 is firmly attached to the structure 1 so as to extend in parallel to one of its legs. A tubular coil carrier 3 of non-magnetic material is placed on the core 2 and carries the operating coil 4 of the relay. A stationary contact 5 is mounted on an insulating carrier 6 which, in turn, is firmly secured to the base structure 1. An abutment plate 7 is mounted on the exterior surface of one of the legs of the structure 1 and projects over the end of this leg in order to form a dihedral pivot bearing for the armature. The projecting end of the abutment plate 7 carries a threaded bolt 8 which serves as a holder for a coiled compression spring 9 whose force is adjustable by means of a nut 10 engaging the bolt 8.

The armature 11 of the relay consists essentially of a flat plate-shaped structure and has a beveled end which forms a knife-type pivot edge at 11. This pivot edge rests against the angular pivot bearing formed by the structure 1 and the abutment plate 7 so that the edge 12 defines the axis of the pivotal rocking motion of the armature 11. A bracket 25 is firmly attached to the armature 11 and has an opening traversed by the bolt 8. The bracket 25 serves as an abutment for the spring 9 so that the force of the spring biases the armature 11 away from the magnet core 2. The upper end of the bracket 25 and the adjacent end of the abutment plate 7 form also a stop for limiting the spring biased movement of the armature about the pivot edge 12. A non-magnetic shim plate 13 is mounted on the side of the armature facing the magnet core.

A rigid contact finger 14 of highly conductive material, such as copper, is resiliently and pivotally linked to the armature in the following manner. The finger 14 has a projection 26 which is bent towards the magnet core 2 and projects through an opening 16 of the armature. A guiding member 19 attached to the armature 11 surrounds the finger 14 so as to prevent it from effecting lateral motions perpendicular to the plane of illustration. A helical compression spring 20 is placed between the guiding member 19 and the finger 14 and tends to hold the finger 14 against the upper surface of the armature 11. Consequently, when the armature is in the position shown in Fig. 2, the finger 14 lies flat against the armature and participates in the angular pivotal motion of the armature without effecting any motion relative to the armature. A contact 15 is arranged at the peripheral end of the contact finger relative to the just-mentioned pivotal motion and serves to establish electric contact with the stationary contact 5 when the armature 11 is attracted by the magnet core 2, as shown in Fig. 1.

A pole plate 21 consisting, for instance, of magnetizable material is mounted on the front or pole surface of the magnet core 2 by means of a screw 22. The pole plate 21 has a circular groove 23 at its upper surface which is so located as to be engaged by a knife edge 24 formed by the outermost end of the projection 26.

When the armature is in the contact-opening

position shown in Fig. 2, the edge 24 of projection 26 is disengaged from the groove 23 of plate 21. When the magnet coil 4 is energized, the core 2 attracts the armature and moves the contact 15 into closing position. During this motion and immediately previous to the initial engagement between contacts 5 and 15, the armature passes through the position illustrated in Fig. 3. In this position, the edge 24 of projection 26 engages the groove 23 of plate 21. From this moment on, the further motion of the contact finger 14 is limited to a rocking motion about the pivot axis of the engagement at 23 and 24. From the subsequent moment when the contacts 15 and 5 establish their initial engagement, the position of contact finger 14 and contact 15 relative to the magnet core and the stationary contact 5 remains unchanged while the armature 11 performs an additional angular motion towards the magnet core under compression of the spring 20 until it reaches the final position apparent from Fig. 1.

It will be noted from the foregoing that due to the temporary pivotal engagement of the contact finger 14 with a stationary part of the relay, a wiping, rolling or bouncing motion between the relay contacts is prevented, from shortly previous to the initial contact engagement to the end of the contact closing operation without interfering with the freedom of the armature 11 to perform the desired overtravel motion after establishment of the initial contact engagement.

In the above-described embodiment according to Figs. 1, 2 and 3, the pivot edge 24 of the contact finger 14 is spaced relatively far away from the point of contact engagement. Furthermore, the pivot edge when in operative engagement with the groove 23 of the pole plate 21 is so located that it lies approximately in the geometrical plane determined by the pivot axis of the armature 11 and the place of contact engagement between contacts 5 and 15. Due to these features, any relative motion of contacts 5 and 15 within the plane of contact engagement is most effectively prevented.

Due to the location of the contact finger 14 at the armature side away from the magnet core 2, the contact finger and its appertaining parts are easily accessible from the outside so that the assembly or disassembly of the contact finger from the armature, or of the entire armature assembly including the contact finger from the stationary relay structure, is facilitated. The provision of a circular groove in plate 21 eliminates the necessity of adjusting the groove 23 relative to the pivot edge 24 of contact finger 14. However, it will be understood that instead of a circular groove, a recess or edge of limited length, properly located on pole plate 21, may also be used.

The embodiment shown in Fig. 4 represents a relay whose stationary structure is substantially similar to that of the above-described device and hence only partially illustrated in Fig. 4. In this embodiment, the magnet core 2 of the relay energized by the coil 4 and mounted on the stationary structure 1 carries a conical projection 38 screwed onto the core 2 by means of a nut 40 which permits an adjustment of the apex of the cone as regards its distance from the core 2. The armature 31 carries on its underside a non-magnetic shim 33 and has a pivot edge 32 resting against a dihedral pivot bearing formed by the structure 1 and the appertaining abutment plate 7. A contact finger 34, carrying a movable contact 15 for engagement with the stationary relay contact 5,

is located on the upper side of the armature 31 and has a projection 37 bent downwardly in order to engage a bore 38 of the armature. This engagement as well as a guiding member 39 secures the contact finger 34 in proper position relative to the armature. A spring 46 placed between the guiding member 39 and the contact finger 34 holds the finger in face-to-face relationship with the armature when the contacts are opened.

The contact finger 34 has a recess or indented portion at 35, which is so located as to be engaged by the conical projection 38 when the contacts are just about to touch each other, while the armature 31 is attracted by the magnet core 2. As a result, the armature is permitted to perform an additional overtravel motion towards the end position shown in Fig. 4, while the contact finger is limited to pivotal motion about the axis of the cone 38 under compression of spring 46.

According to the embodiment represented by Fig. 5, the magnet core 2 surrounded by the magnetizing coil 4 and mounted on the stationary structure 1 of the contactor is provided with a rounded projection 48 which is adjustable within limits by means of a screw nut 50. The armature 41 is pivoted at 42 in the same way as described in connection with the preceding embodiments and carries a non-magnetic shim 43 at its side facing the magnet core 2. A contact finger 44, consisting substantially of a flat strip element and of sufficient rigidity to avoid undesired rolling motions of the contact 15 mounted thereon, is placed flat on the upper surface of the armature 41 and held in proper position by means of a guiding member 49 which contains a spring for pressing the finger 44 against the armature 41. The finger 44 has an opening at 45 which is engaged by the projection 48 when the armature 41 moves towards the magnet core 2 and reaches a position slightly prior to the initial engagement between contacts 5 and 15. The further motion of the contact finger 44 is limited to a sliding and partially pivotal motion about the projection 48 under the exclusion of wiping motions in the plane of the contact engagement, while the armature is free to perform its overtravel motion under compression of the spring 51.

Since, as shown in the foregoing, our invention is capable of being modified in various forms without departing from its spirit and scope, we wish this specification to be understood as being illustrative and not in a limiting sense.

We claim as our invention:

1. An electric contactor, comprising a stationary structure having a stationary contact, an actuating member pivoted to said structure, a contact finger having a contact to engage said stationary contact and being linked to said member for limited angular motion relative to said member, said structure and said finger being adapted to engage each other during the period of said relative motion and at a point spaced from said contacts so as to reduce relative motion between said contacts during said period.

2. An electric contactor, comprising a stationary structure having a stationary contact, an armature pivoted to said structure, a substantially rigid contact finger having a contact to engage said stationary contact and being resiliently mounted on said armature so as to be capable of limited angular motion relative to said armature, said structure and said finger being adapted to engage each other during the period of said relative motion and at a point spaced from said contact and being located substantially in the plane of contact engagement so as to substantially prevent relative wiping motion of said contacts during said period.

3. An electric contactor, comprising a stationary structure having a stationary contact, an armature pivoted to said structure, a substantially rigid contact finger having a contact to engage said stationary contact and being resiliently linked to said armature to afford overtravel motion of said armature upon initial engagement of said contacts, said structure having means for engaging said contact finger during said overtravel motion at a point between said contacts and the axis of pivotal motion of said armature.

4. An electric contactor, comprising a stationary structure including a magnet core and a stationary contact, an armature pivoted to said structure in front of said core to be operated thereby, a contact finger having a contact to engage said stationary contact and being resiliently attached to said armature for permitting overtravel motion of said armature relative to said finger when said armature moves into contact closing position and upon initial engagement between said contacts, said finger having a portion spaced from said contacts adapted to form one part of a pivot joint, and said core having means for engaging said portion during the period of said overtravel so as to form the other part of the pivot point in order to prevent relative lateral motions between said contacts after said initial contact engagement.

5. An electric contactor, comprising a stationary structure including a magnet core and a stationary contact, an armature having an opening and being pivoted to said structure in front of said core to be operated thereby, a contact finger having a contact to engage said stationary contact and being resiliently attached to said armature for permitting overtravel motion of said armature relative to said finger upon initial engagement between said contacts, said finger being located at the armature side away from said core and having a recessed portion adjacent to said opening, and said core having means for projecting through said opening to engage said portion during the period of said overtravel to prevent wiping motion between the engaging contacts.

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