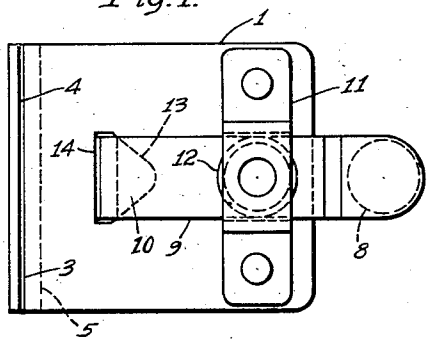
March 26, 1946. F. C. IGLEHART 2,397,113

CONTACTOR

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Fig. 1.



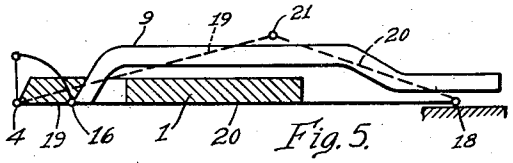


Fig. 5.

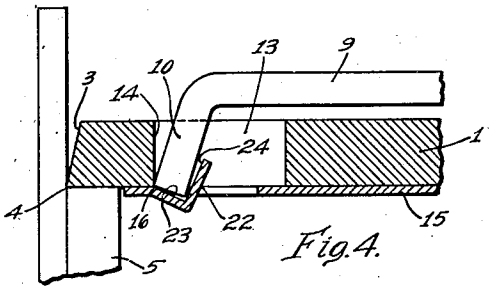
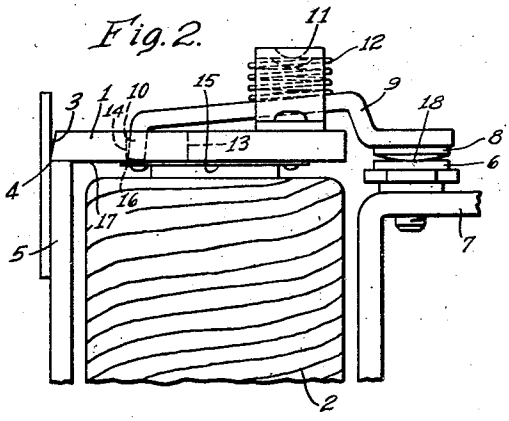


Fig. 4.

Fig. 2.



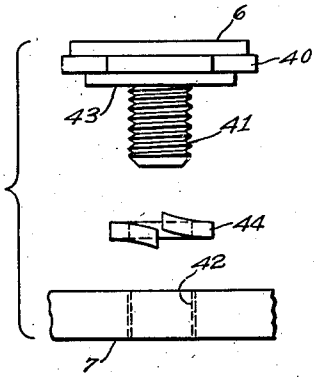
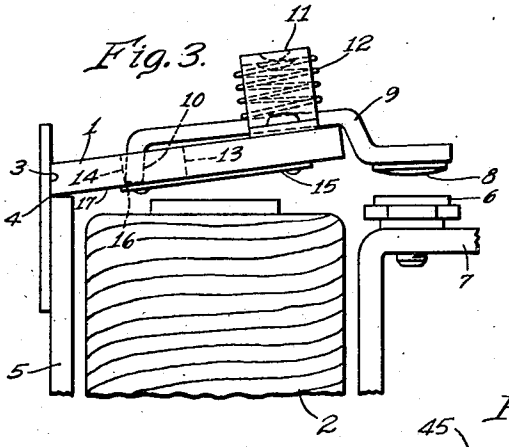


Fig. 6.

Fig. 3.



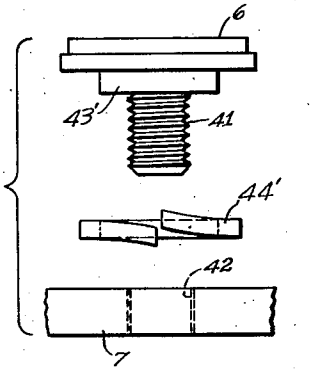
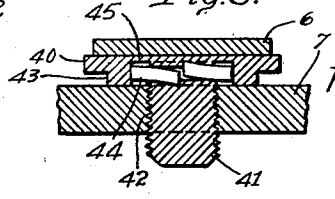


Fig. 7.

Fig. 8.



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CONTACTOR

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Fig.9.

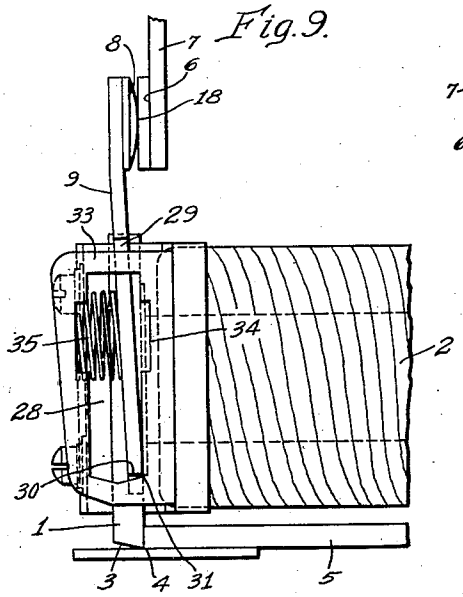


Fig.10.

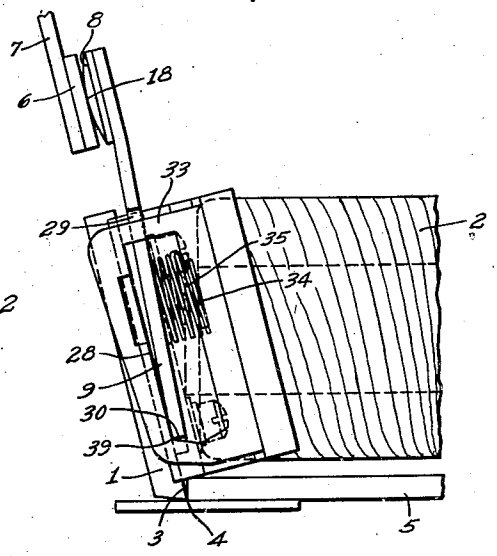


Fig.11.

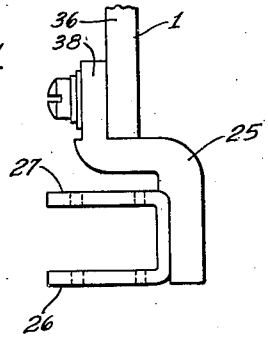


Fig.12.

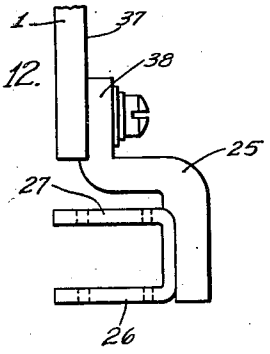
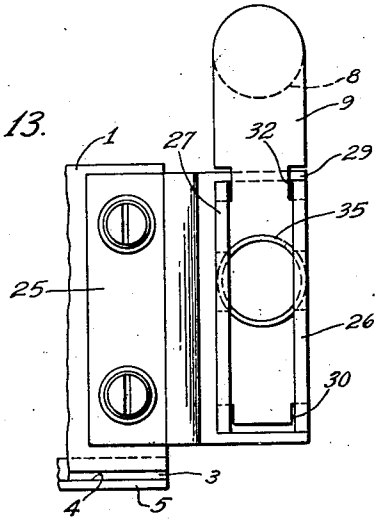


Fig.13.



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UNITED STATES PATENT OFFICE

2,397,113

CONTACTOR

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Application July 31, 1942, Serial No. 453,065

12 Claims. (Cl. 200—87)

This invention relates to a contactor and, more particularly, to an improved mounting for moving a movable contact to and from a closed position.

Electromagnetic switches provided with an armature movable back and forth between limited positions for moving a movable contact into and out of engagement with a stationary contact are well known. The movable contact in such switches is usually carried by a contact finger which is pivotally connected to the armature and provided with resilient means biasing the same into engagement with the armature. As the armature moves toward one of its limited positions the movable contact engages with the stationary contact slightly prior to final movement of the armature into its limited position and causes the contact finger to pivot relative to the armature. This relative movement is desirable in order to insure that the contacts make conducting engagement even after worn from use.

Due to the mounting of the movable contact carrying finger with respect to the armature in switches as heretofore constructed, the relative movement between the movable contact carrying finger and the armature which takes place after initial engagement of the contacts causes a wiping action or sliding movement of one contact upon the other to be had. In some types of contacts such wiping action is desirable as is the case where the contacts are made of hard corrodible material and the wiping action functions to clean the contacts. However, where the contacts are formed of non-corrodible and relatively soft material such as silver, the wiping action is undesirable since an excessive amount of wear is encountered.

One of the principal objects of this invention is to provide a movable contact mounting of the character referred to in which the wiping of the contacts is maintained at a minimum or eliminated as the contacts are moved to and from their closed position.

A further object is to provide a mounting of the character referred to in which the axis of pivotal movement of the movable contact carrying finger is located substantially in a plane containing the armature pivot axis and the point of contact engagement upon movement of the armature to one of its limited positions.

A further object is to provide a movable contact mounting in which the armature pivot axis and the movable contact finger pivot axis are located in a common plane which, upon movement of the armature to one of its limited positions, is rotated substantially to a position containing the point of contact engagement.

A further object is to provide an improved form of stationary contact mounting.

Other objects and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawings, in which:

Figure 1 is a top plan view of a mounting constructed in accordance with the principles of this invention;

Fig. 2 is a side elevational view of the apparatus shown in Fig. 1 showing the relative positions of the parts when the armature is in one of its limited positions closing the contacts;

Fig. 3 is a view similar to Fig. 2 showing the relative positions of the parts when the armature is in the other of its limited positions opening the contacts;

Fig. 4 is an enlarged sectional view of a part of the apparatus shown in Figs. 1 through 3 illustrating a modified construction;

Fig. 5 is a diagrammatic sketch illustrating how the pivot locations affect sliding movement of the contacts;

Fig. 6 is an exploded side elevational view of an improved form of stationary contact mounting;

Fig. 7 is a view similar to Fig. 6 showing a modification;

Fig. 8 is a vertical sectional view of the parts shown in Fig. 6 in assembled relation;

Fig. 9 is a side elevational view of a modified form of mounting embodying the principles of the construction illustrated in Figs. 1 through 3;

Fig. 10 is a view similar to Fig. 9 with the parts rearranged to effect closing of the contacts when the armature is in its deenergized position;

Fig. 11 is a top plan view of a part of the apparatus shown in Fig. 9 showing the arrangement of a supporting bracket with respect to the armature;

Fig. 12 is a view similar to Fig. 11 showing the position of the supporting bracket for the arrangement shown in Fig. 10; and

Fig. 13 is a side elevational view of a part of the apparatus shown in Fig. 9.

Referring to Figs. 1 through 3 of the drawings, the numeral 1 designates an armature having a coil 2 for moving the same from the position shown in Fig. 3 to the position shown in Fig. 2. The armature 1 is beveled as at 3 to provide an edge 4 on its under surface for en-

gagement in the apex of a dihedral angle pivot bearing provided in a support 5 constituting part of the magnetic circuit adapted to be magnetized upon energization of the coil 2. The arrangement is such that the pivotal axis of the armature 1 is defined by the armature edge 4. The armature 1 is provided with resilient or gravitational means (not shown) for biasing it to one of its limited positions as shown in Fig. 3 in a manner well known in the art. The parts thus far described are well known in the art and form no part per se of this invention, this invention being limited to features to be described.

A stationary contact 6 is mounted on a conducting support 7 for engagement with a movable contact 8. The contact 8 is mounted on one end of a conducting finger 9 which is provided with a depending portion 10 at its other end for a purpose to be described. A bracket 11 is mounted on the upper surface of the armature 1 and is provided with a spring 12 engageable with the finger 9 for biasing such finger into engagement with the upper surface of the armature. The armature is provided with an opening 13 for the reception of the depending portion 10 of the finger 9. The back edge 14 of the opening 13 together with the upper surface of a magnetic shield 15 secured to the underside of the armature 1 defines a dihedral angle pivot bearing in the apex of which a corner 16 of the depending portion 10 is adapted to seat. In this manner the axis pivotal movement of the finger 9 with respect to the armature 1 is defined by the edge 16 which coincides with the apex of the dihedral bearing just referred to. It will be particularly noted that both of the pivot axes 4 and 16 are located in a common plane defined by the underside 17 of the armature 1. It will also be noted that when the armature 1 is in its closed position as shown in Fig. 2 the point 18 of contact engagement which is on the upper surface of the stationary contact 6 is also contained in the plane of the underside or surface 17. As will be pointed out, the location of the pivot axes 4 and 16 in a common plane which is rotated to a position containing the point 18 of contact engagement upon movement of the armature 1 to its closed position effectively prevents wiping of the contacts.

When the armature 1 is in its deenergized or open position as determined by its resilient limiting means (not shown) the spring 12 will function to maintain the contact finger 9 in engagement with the upper surface of the armature 1 as shown in Fig. 3. Upon energization of the coil 2, the armature 1 will be pivoted in a clockwise direction to the position shown in Fig. 2. Just prior to movement of the armature to the position shown in Fig. 2 the contact 8 will engage with the contact 6 and thereafter the finger 9 will move relatively to the armature 1 about the pivot axis 16. This action will be accompanied by a compressing of the spring 12. The relative movement between the finger 9 and armature 1 takes place during the final movement of the armature 1 to its closed position. In practice such relative movement which is provided to insure engagement of the contacts and self alignment thereof takes place in the final few degrees of movement of the armature 1. In such portion of movement of the armature 1, the axis 16 is moving in a substantially vertical path with no horizontal component of movement due to rotation about the pivot axis 4, and, consequently, no sliding movement between the contacts 6 and 8 will be had by reason of the location of the axis 16.

The above described parts provide a linkage system for operating and moving the movable contact 8 which will be best understood by reference to the diagrammatic showing of Fig. 5. In this showing the pivot axes are designated by the numerals 4 and 16 and the point of contact engagement is designated by the numeral 18. The parts 19 and 20 are in effect links which are rotated about the axis 4 in moving the contacts into and out of engagement. The dotted lines interconnecting the points 4 and 18 with the pivot point 21 diagrammatically illustrate the constructions heretofore provided in which the pivot for the contact finger was located above the upper surface of the operating armature. It will be apparent that upon rotation of the pivot point 21 in a counterclockwise direction to open the contacts a considerably large sliding movement of such contact will be had as compared with the relative movement between the contacts which will be had when the axis of pivotal movement of the finger 9 is located as at 16. The arrangement of the pivot point as at 21 above the surface of the armature causes a sliding movement of the contact 18 which is in effect a multiple of the relative movement between the interconnecting links. As pointed out above, this sliding movement is practically eliminated by the location of the pivot point 16 in a position substantially in a common plane containing the axis 4 and contact point 18 as the contacts are moved into and out of engagement. Since the relative movement between the finger 9 and armature 1 takes place in the final few degrees of movement of the armature 1, it will be apparent that the pivot point 16 may be located a degree or so out of a plane containing the axis 4 and contact point 18 when the armature 1 is in its closed position without departing from the principles of this invention.

In the showing of Figs. 1 through 3 the surface 14 of the opening 13 limits movement of the finger 9 to the left. The front edge of the opening 13 is tapered as shown in Fig. 1 and engagement of the depending portion 10 with such tapered edge serves to limit movement of the finger 9 to the right. A preferred modification for preventing movement of the finger 9 to the right is illustrated in Fig. 4. In this showing it will be noted that the portion of the magnetic shield 15 underlying the opening 13 has been angled upwardly as at 22. By shaping the portion 22 in this manner the edge 14 cooperates with the upper surface 23 of the angle member 22 to form a dihedral pivot bearing for the edge 16 of the depending portion 10. The surface 24 of the angle member 22 functions to prevent movement of the finger 9 to the right as viewed in Fig. 4.

In Figs. 9 through 13 there is shown a bracket 25 for connecting the finger 9 to the armature 1. The bracket 25 is provided with a U-shaped member having parallel sides 26 and 27. Each of the sides 26 and 27 is provided with an opening 28 best shown in Figs. 9 and 10 substantially in the shape of a rectangle. The finger 9 is notched as at 29 and 30 to permit mounting of the member 9 in position with respect to the sides 26 and 27 of the U-shaped support. In this manner the notches 30 provide a pivot edge engageable in the corners 31 of the openings 28 as viewed in Fig. 9, the corners 31 providing a dihedral pivot bearing for the finger 9. The inner surface 32 of the notches 29 engage with the front portions 33 of the members 27 and 28 and guide the pivotal movement of the finger 9 with respect to the sides 26 and 27. The edges of the openings 28 are

notched as at 34 for the reception of a spring 35 which functions to bias the finger 9 to a limited position with respect to the armature 1.

In the showing of Fig. 9 it will be noted that the pivot axis 31 corresponds to the pivot axis 16 of Figs. 1 through 3 and is located in the same manner as the pivot axis 16 with respect to the pivot axis 4 and point of contact engagement 18. The armature 1 is shown in its closed position corresponding to the showing of Fig. 1. Resilient means (not shown) is provided for moving the armature 1 to an open position corresponding to the position shown in Fig. 3.

Since electromagnetically operated armatures are movable back and forth between limited positions, one of such positions being limited by the magnetizing means and the other of such positions being limited or determined by the resilient biasing means, such switches may be adapted to close the contacts either upon energization of the magnet or deenergization of the magnet. The bracket 25 and associated parts are reversible with respect to the armature 1 according to the manner in which the electromagnet switch is to be operated. In the showing of Fig. 9 the contacts are shown closed when the magnet is energized and in this showing it will be noted that the bracket 25 is secured to the side 36 of the magnet 1. In the event that it is desired to have the contacts closed when the magnet is deenergized then it is merely necessary to secure the bracket 25 to the side 37 of the armature 1 as shown in Fig. 12, the portion 38 of the bracket 25 being provided with angular seats on both sides for engagement with either side of the magnet 1. When the bracket 25 is secured to the side 37 it is necessary to reverse the position of the spring 35 and of the finger 9 so that the edges of the notch 30 will engage in the corner 39 of the opening 28. The corner 39 provides a pivotal bearing for the finger 9 in the same manner as does the corner 31 in the showing of Fig. 9 and corresponds to the axis 16 of Figs. 1 through 3. It will thus be apparent that the bracket 25 and associated parts provide a contact finger support in accordance with the principles of the invention as shown in Figs. 1 through 3 and which is interchangeable to adapt the mounting for use in accordance with the manner in which the electromagnet is to be operated.

The preferred construction and mounting of the stationary contact 6 is shown in Figs. 6 through 8. In this showing the stationary contact 6 is integrally connected to a hexagonally shaped member 40 formed of conducting material and having a threaded member 41 depending therefrom. The support 7 is provided with an internally threaded opening 42 for the reception of the member 41 which may be screwed into position by applying a pair of pliers or wrench to the hexagonal member 40. To insure a good electrical connection between the contact 6 and its support 7 an annular shoulder 43 is formed integrally with the member 40 and is adapted to frictionally engage with the support 7 upon screwing of the contact 6 into position.

In order to prevent loosening of the contact 6 in such manner as would interfere with the electrical connection between the annular member 43 and the support 7 lock washer 44 is provided. The washer 44 is receivable in an annular groove 45 formed in the member 40 intermediate the shoulder 43 and member 41 in the showing of Figs. 6 and 8. The thickness of the washer 44 is made less than the depth of the groove 45 in order that such washer will not be fully compressed and thus interfere with the frictional engagement within the shoulder 43 and the support 7. The tips of the lock washer 44 will engage with the bottom of the groove 45 and the surface of the support 7 and gouge into such surfaces to effectively lock the contact 6 against turning movement.

In the modified construction shown in Fig. 7 the construction is essentially the same except for the omission of the groove 45. In this showing the internal diameter of the lock washer 44' is made larger than the external diameter of the shoulder 43'. However, the effective height of the shoulder 43' is greater than the thickness of the washer 44' in order that frictional engagement of the shoulder 43' with the base 7 will not be interfered with. In both constructions it will be noted that there is provided a contact structure having an annular portion or shoulder 43 or 43' together with a lock washer 44 or 44' having a thickness less than the effective height of the shoulder portion adapted to frictionally engage the conducting support.

Since certain changes may be made in the above construction and different embodiments of the invention may be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim as my invention:

1. An electric switch comprising a stationary contact, an armature pivoted for movement back and forth between limited positions, a movable contact and a supporting finger therefor, and means mounting said finger on said armature comprising a support connected to said armature, and a pair of spaced members having parts engageable with said finger to provide a pivot therefor and to guide the movement thereof about said pivot, and resilient means for holding said finger in position between said members, the axis of said last named pivot being in a plane containing the pivot axis of said armature and the point of contact engagement when said armature is in one of said limited positions.

2. An electric switch comprising a support having a dihedral angular pivot bearing, a stationary contact mounted on said support, a member having a pivot edge engaging said bearing for limited pivotal movement relative to said support and forming another dihedral angular pivot bearing having the pivot axis in a common plane with said pivot edge, a contact finger having a pivot edge engaging said other pivot bearing for limited pivotal movement of said finger relative to said member, means for biasing said finger towards a limit position relative to said member, and a contact mounted on said finger to engage said stationary contact and having a contact surface extending substantially in said common plane.

3. An electromagnetic contactor comprising a stationary magnet structure including a magnet core, a stationary contact on one side of said core, and a pivot bearing at the opposite side of said core, an armature engaging said bearing for pivotal movement relative to said core and having a dihedral angular pivot bearing disposed in a common plane with the pivot axis of said bearing and located between said edge and said contact and closer to said edge than to said contact, a contact finger having a pivot edge engag-

ing said latter bearing for pivotal movement relative to said armature, stop means for limiting said relative movement to a small angular extent as compared with that of said armature relative to said core, a spring disposed between said armature and said finger for biasing said finger towards one of its limit positions and said edge towards said dihedral pivot bearing, and a contact mounted on said finger to engage said stationary contact and having a contact surface located relative to said bearings as to lie substantially in said common plane when in contact engagement.

4. An electromagnetic contactor comprising a support, a stationary contact, a contact finger having a movable contact thereon, a dihedral pivot bearing on said support, an armature presenting a flat surface and having an edge of such surface seated in said bearing, said armature having an opening and forming a dihedral pivot bearing located adjacent the side of said opening next to said edge and having a pivot axis extending in the plane of said surface and in parallel to said edge, said finger having a depending portion extending through said opening and having a pivot edge engaging said latter pivot bearing, said armature being movable back and forth to a contact closing position in which the point of contact engagement is located substantially in said plane.

5. An electromagnetic contactor comprising a stationary structure including a magnet core, a stationary contact and a pivot bearing, an armature having an opening and engaging said bearing for pivotal motion relative to said core, a non-magnetic shim plate mounted on said armature at the side facing said core and forming another pivot bearing in proximity to said opening and in parallel to said first pivot bearing, a contact finger extending through said opening and engaging said other bearing for limited pivotal motion relative to said armature, and a contact mounted on saaid contact finger for engaging said stationary contact.

6. An electromagnetic contactor comprising a stationary structure including a magnet core, a stationary contact and a pivot bearing, an armature having an opening and engaging said bearing for pivotal motion relative to said core, a non-magnetic shim plate mounted on said armature at the side facing said core and forming a dihedral pivot bearing in proximity to said opening and with a pivot axis in parallel to that of said pivot bearing, a contact finger extending through said opening and having a pivot edge engaging said dihedral bearing for limited pivotal motion relative to said armature, and a contact mounted on said contact finger so as to engage said stationary contact in the plane determined by the axes of said two pivot bearings.

7. An electromagnetic contactor comprising a stationary structure including a magnet core, a stationary contact and a pivot bearing, an armature engaging said bearing for pivotal motion between two limit positions relative to said core, a contact finger and a contact thereon for engaging said stationary contact, and another pivot bearing separably mounted on said armature for pivotally engaging said contact finger, said armature and said other bearing being adapted for arrangement of said bearing on either side of said armature toward and away from said core respectively, according to the limit position in which said contacts are to engage each other.

8. An electromagnetic contactor comprising a stationary structure including a magnet core, a stationary contact and a pivot bearing, an armature engaging said bearing for pivotal motion between two limit positions relative to said core, a contact finger having pivot edges, a contact mounted on an extremity of said finger remote from said edges for engaging said stationary contact, a bracket member and means for fastening said member to either side of said armature toward and away from said core respectively, said member forming pivot surfaces for engagement by said edges respectively in order to permit said contact finger to be pivotally mounted on either side of said armature in accordance with the limit position in which said contacts are to engage each other.

9. With a pivotally mounted armature, the combination of a contact support comprising a U-shaped bracket having a base portion mounted on said armature and two parallel side portions projecting at right angles from said base portion, said armature and base portion being adapted for arranging said bracket selectively at either side of said armature, each of said side portions having a substantially rectangular opening formed therein, an elongated contact finger having each of its longitudinal edges notched at spaced points, one of said notches of each edge being pivotally seatable in a corner at one side of one of said openings, the other of said notches being engageable with the part of the appertaining side portion defining an opposite side of said opening for guiding movement of said finger with respect to said bracket, the edges of each of said openings interconnecting said sides having spring seating notches formed therein, and a spring seated in said last named notches and engageable with said finger for biasing said finger against movement about its pivot seat.

10. An electric switch, comprising a support, a stationary contact, a contact carrying finger having a movable contact thereon, a dihedral pivot bearing on said support, a lever-type member presenting a flat surface and having an edge of such surface seated in said bearing, said member having an opening therein, said finger having a depending portion extending through said opening and pivoted on said member for movement about an axis located in a plane containing said edge and the point of contact engagement of said movable contact, said member being movable back and forth to a contact closing position in which the point of contact engagement is located substantially in said plane.

11. An electromagnetic contactor comprising a stationary magnet structure including a stationary contact and a dihedral angular pivot bearing spaced from said contact, an armature having a pivot edge engaging said bearing for pivotal movement relative to said structure and being provided with a dihedral angular pivot bearing disposed in a common plane with said edge and located closer to said edge than to said contact, a contact finger having a pivot edge engaging said latter bearing for pivotal movement relative to said armature, means for biasing said finger towards a limit position relative to said armature, and a contact mounted on said finger to engage said stationary contact at a point substantially in said common plane, whereby relative wiping motions between said contacts are substantially prevented during periods of relative motion between said finger and said armature.

12. An electromagnetic contactor comprising

a stationary structure including a magnet core and a stationary contact and forming a dihedral pivot bearing, an armature having a surface facing said core and having a pivot edge at said surface in engagement with said bearing so as to permit limited pivotal motion of said armature relative to said core about an axis in the plane of said surface, said armature having a dihedral pivot bearing whose pivot axis is also located in said plane and extends in parallel to said pivot edge, a contact finger having a pivot edge engaging said dihedral pivot bearing of said armature for limited pivotal movement of said finger relative to said armature, means for biasing said finger towards a limit position relative to said armature, and a contact mounted on said finger to engage said stationary contact and having a contact surface extending substantially in said plane.

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