July 3, 1934. W. KOHLHAGEN 1,965,104

ELECTROMAGNETIC CONTACT DEVICE

Filed Nov. 22, 1933

Fig. 1.

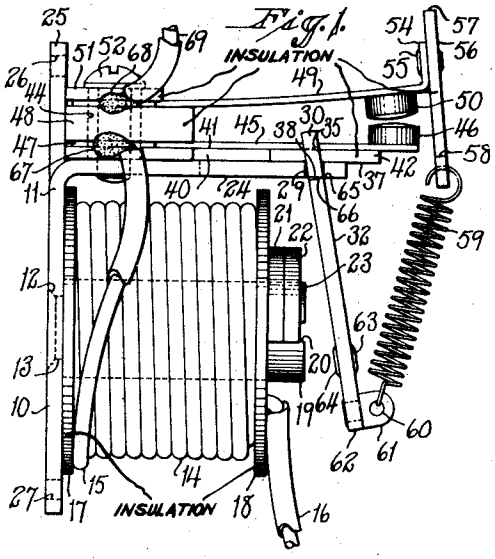


Fig. 2.

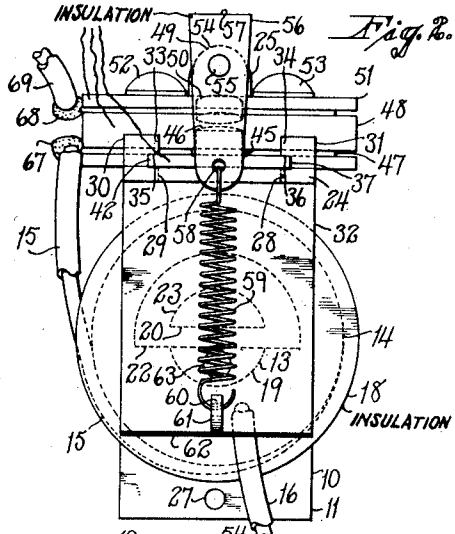


Fig. 3.

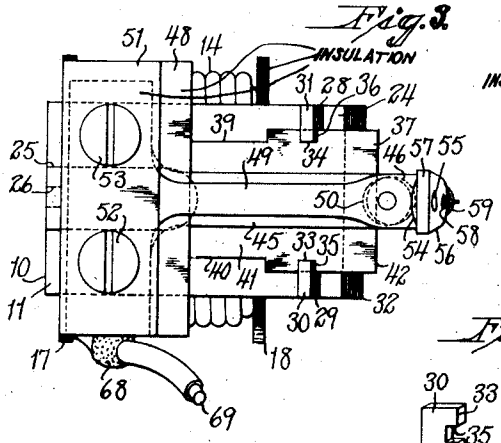


Fig. 6.

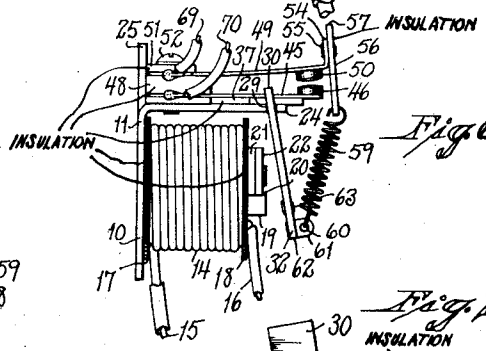


Fig. 4.

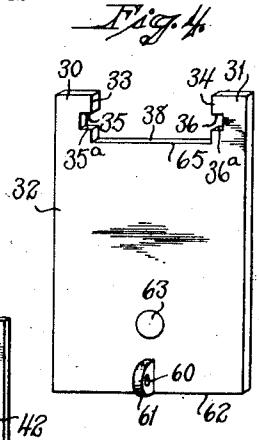


Fig. 7.

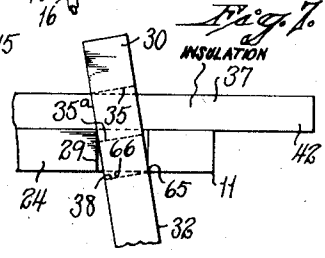


Fig. 5.

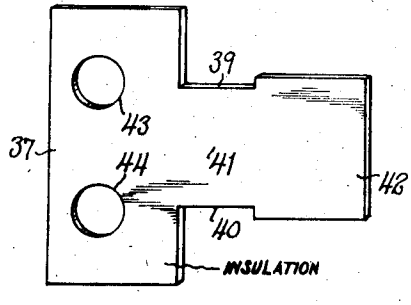
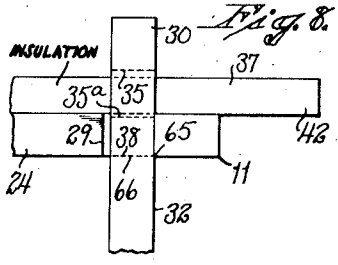


Fig. 8.



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ELECTROMAGNETIC-CONTACT DEVICE

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Application November 22, 1933, Serial No. 699,190

6 Claims. (Cl. 200—87)

This invention relates to improvements in electromagnetic-contact devices.

One object of this invention is to provide an electromagnetic-contact device in which the armature has a relatively-small, and preferably nearly-constant, spring resistance to a force tending to close the armature, throughout the amplitude of movement of the armature.

Another object of this invention is to provide an electromagnetic-contact device adapted to operate on alternating current with minimum tendency to produce humming.

Another object of this invention is to provide an electromagnetic-contact device in which there is no pigtail connected to the armature.

Another object of this invention is to provide an electromagnetic-contact device constructed of simple parts easily made and assembled, and providing a rugged construction of low cost.

With the above and other objects in view, this invention includes the improved features, parts and combinations of parts disclosed in the following description, appended claims and accompanying drawing forming a part of this specification.

In the accompanying drawing, in which certain ways of carrying out the invention are shown for illustrative purposes:

Fig. 1 is a side elevation illustrating an embodiment of the invention located in one of its possible positions for operation;

Fig. 2 is a right-end elevation of Fig. 1;

Fig. 3 is a top plan view of Fig. 1;

Fig. 4 is a perspective view of the armature;

Fig. 5 is a perspective view of a member which serves as insulation and also as a locking-key to hold the armature in loosely-pivoted position;

Fig. 6 is a small view, similar to Fig. 1, illustrating a different arrangement of electrical connections to be used when the device is to be used as a relay;

Fig. 7 is an enlarged view of the pivoted connection of the armature when the armature is in the open position shown in Fig. 1; and

Fig. 8 is a view similar to Fig. 7 when the armature is in closed position.

The base 10 of the bracket 11 is composed of magnetizable material and is connected as at 12 by riveting or otherwise to a magnetizable core 13 which is surrounded by the wire coil 14 having opposite end terminals 15 and 16. The coil 14 is located between the two insulating disks 17 and 18. The exposed end 19 of the core 13 is slotted as at 20 and provided with one or more closed-circuit copper-shading rings 21 and 22, which surround the portion 23 of the exposed end 19 of the core for a purpose well understood in the art.

The bracket 11 has an integral arm or support 24 at right angles to the base-portion 10 so as to extend along parallel to or in the same general direction of the core 13 of the electromagnet. The arm or support 24 has an integral portion 25 thereof struck out and extending in line with and forming a part of the base-portion 10, and is provided with a hole 26 which, together with the hole 27 at the other end of the base 10, provides suitable means for attachment to any desired supporting structure.

The support 24 is provided in its opposite edges with slots 28 and 29, through which extend extensions 30 and 31 of an armature 32 of magnetizable material, which extensions respectively have ears 33 and 34 extending inwardly toward each other to provide engaging shoulders 35 and 36, between which engaging shoulders and the support 24 is located a locking-key 37 preferably formed of a sheet or plate of insulation (Fig. 5). The thickness of the locking-key 37 and support 24 is substantially less than the distance between the shoulders 35, 36 and the rear edge face 38 of the armature 32, thus providing a loose pivot or hinge-like construction which permits the armature to swing through a suitable angle from its open position shown in Fig. 1 to its closed position, where it is in contact with the end 19 of the core 13. The combined insulation-and-key member 37 has notched portions 39 and 40 to provide a narrow neck-portion 41 adapted to pass between the ears 33 and 34 in assembling the parts, whereupon the member 37 is slid lengthwise along the support 24 to bring the enlarged key-portion 42 into locking position between the shoulders 35, 36 and 35^a, 36^a, the distance between the shoulders being greater than the thickness of the key 37.

This assembling operation brings the openings 43 and 44 in line with corresponding screw-threaded openings in the support 24. The contact-member 45, carrying the contact 46 and having a widened base-portion 47 provided with suitable holes in line with the holes 43 and 44, is arranged upon the insulated key-member 37. One or more insulation blocks 48, also provided with holes aligning with holes 43 and 44, are next placed in position, after which the second spring-arm contact-member 49 which forms one of a pair of contact-members with the contact-member 45, is assembled in position to bring the two holes in its wide lower end in line with holes 43 and 44. The spring-arm contact-member 49 car-

ries a contact 50 which, with the contact 46, forms a pair of contacts. Next in position is another insulation-block 51 having holes aligning with holes 43, 44, and through all of which groups of holes pass two screws 52 and 53, which threadedly engage in the threaded holes in the support 24 to hold the parts described in their assembled relation.

The upper end of the spring-arm contact-member 49 is provided with an angular extension 54 to which is secured, by a rivet 55 or otherwise, an abutment or actuation-member 56, preferably of insulation material and having the rear edge 57 adapted to be engaged by any desired piece of mechanism to mechanically move the spring-arm contact-member 49 to bring the contact 50 in engagement with the contact 46 to close an electric circuit.

Engaged within a hole 58 in the actuation-member 56 is a coil-spring 59 which has its other end engaged through a hole 60 in an anchor-lug 61, riveted or otherwise secured in the free or non-hinge end 62 of the armature 32. The spring 59 can be made of comparatively fine weak spring-wire and normally holds the armature in its open position, as shown in Fig. 1.

The armature 32 is preferably provided with an insert 63 of non-magnetizable material and having a slightly-projecting portion 64 adapted to prevent sticking of the armature to the core in a way well known in the art.

It will be observed that, due to the mode of construction in which the contacts 50 and 46 are arranged in the manner disclosed, without either of them being mounted upon the armature 32, the use of any electrical pigtail connection such as is necessary when one of the contacts is mounted on the armature, is avoided, with the consequent manifest advantages that are well appreciated by those skilled in the art.

Inasmuch as the pivoted or hinge construction of the armature depends upon the engagement of the edge 65 of the rear edge face 38, a rocking action about this edge 65 takes place, with the consequent swinging inward of the rear edge face 38 which is brought into abutting engagement with the adjacent face portion 66 of the support 24. Therefore, due to this mode of action of the armature pivot and the arrangement of the armature 32 and spring 59 in directions extending transverse to the core, in the manner illustrated in the drawings, the armature has a relatively-small and nearly-constant spring resistance to a force tending to close the armature throughout the amplitude of swinging movement of the armature. In other words, the torque tends to remain substantially constant due to the transverse arrangement of the spring 59 and the angular movement of the spring, thereby reducing the lever-arm as the force of the spring increases. Also, due to the fact that the pivot of the armature is a loose, free construction, when the armature is brought into closed position against the end of the core by the electromagnetic force, the armature is permitted to shift sufficiently to center itself, thus minimizing the tendency of the armature to vibrate and produce hum when the device is used with an alternating current. The tendency to hum is also reduced to the minimum by the spring being arranged in a direction transverse to the core, whereby the spring exercises a small and substantially-constant resistance to a force acting to pull the armature into closed position against the core. These features of construction enable the electromagnet to be successfully actuated by a very small current which still further tends to reduce humming when alternating current is employed.

In the form of the device illustrated in Fig. 1, the electromagnetic portion of the device can only function after the contacts 50 and 46 have been brought into engagement with one another by the member 56 being mechanically actuated in the manner previously described. When the contacts 50 and 46 have been brought into engagement with each other, the current passes from one terminal 16 of the coil 14 out the terminal 15 to its point of connection 67 with the contact-member 45, through the contacts 46 and 50, along the spring-arm contact-member 49, to its point of connection 68 with the wire terminal 69, in consequence of which the electromagnetic force of the electromagnet attracts the armature 32 down into closed position in engagement with the end 19 of the core 13, and holds it there during such time as the current continues to flow through the coil 14. During this swinging movement of the armature 32 to closed position against the action of the spring 59, the latter exercises sufficient pull upon the member 56 to hold the contacts 50 and 46 in engagement with one another, so that even though the piece of apparatus that originally pushed against the member 56 to engage the contacts 50 and 46 has moved away, this pair of contacts 50 and 46 remains closed and the armature 32 remains held in the closed position until the electric circuit is broken at some other location beyond the device constituting this invention. But once the electric circuit is broken, the spring 59 swings the armature 32 upward and permits the contact 50 to swing away from the contact 46, thereby breaking the circuit which cannot be reestablished until the member 56 is again mechanically pushed to bring the contact 50 into engagement with the contact 46. The device illustrated in Fig. 1 may be used as a self-locking switch inasmuch as it maintains its own circuit closed. One particular example of a use for this form of the device is in connection with the defrosting of iceless refrigerators. This form of the device may also be used as an automatic circuit breaker designed to have the armature swing to open position and consequently permit the contacts 50 and 46 to separate, when a short circuit results in insufficient current in the coil to hold the armature closed. The points of connection 67 and 68 are shown in the drawing at the same side of the device for convenience of clearly illustrating these parts in Fig. 1, although in practice, in order to gain greater spacing between these electrical connections, ordinarily the connection 68, for example, will be made, when possible, at the opposite side of Fig. 2 from which it is shown, so as to be well spaced from the connection 67.

In the form of the invention illustrated in Fig. 6, the terminal 15 of the coil 14 is disconnected from the connection 67 and forms, with the end 16, the two terminals for supplying electricity to the coil. It will be observed that in this form of the invention, electromagnetic action of the coil 14 is entirely independent of the contacts 50 and 46 and is solely dependent upon the closing of the circuit through the ends 15 and 16 by any suitable means (not shown).

The contact-members 45 and 49 have electric conductors 69 and 70 (Fig. 6) connected therewith. In this form of the device, it will be observed that the construction constitutes a relay having a wide variety of uses, as is well known.

Thus, when current is caused to flow through the coil 14, the core 13 attracts the armature 32 and causes it to swing downwardly to closed position against the action of the spring 59, which spring 59, by its pull on the member 56, moves the contact 50 into engagement with the contact 46, thereby closing the relay circuit through the electric conductors 69 and 70. The relay circuit is maintained closed as long as current continues to flow through the circuit actuating the electromagnet, but when current through the latter is interrupted, the armature 32 is swung upwardly by the spring 59 which latter then permits the spring-arm 49 to swing the contact 50 away from the contact 46, thereby also breaking the relay circuit.

The device illustrated in the drawing is adapted to successfully operate when installed in any angular position whatever, including a position in which the armature is beneath the core.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are therefore to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

I claim:

1. An electromagnetic-contact device comprising: an electromagnet having a core; a support of magnetic material provided with slots and magnetically connected to one end of the said core; an armature of magnetic material extending in a direction transverse to said core and having an edge abutting against said support, and having extensions extending through said slots and beyond the opposite face of the said support; key-means located adjacent the said opposite face of said support and loosely locking said extensions in place; and yieldable means connected to said armature and adapted to yieldably hold the armature away from the core and hold said edge against said support to insure a magnetic path of low reluctance between the latter and the said armature.

2. An electromagnetic-contact device comprising: an electromagnet having a core; a support provided with slots; an armature extending in a direction transverse to said core and having an edge abutting against said support, and having extensions extending through said slots; key-means formed of insulation and serving to loosely lock said extensions in place; a first electric contact-member mounted on said insulation and having a contact; a second electric contact-member connected to said support and having a contact adjacent but normally yieldably spaced from said first contact; and means yieldably connecting said armature and said second contact-member and adapted to yieldably hold said armature away from the core and hold said edge against said support.

3. An electromagnetic-contact device comprising: an electromagnet having a core; a pivoted armature extending in a direction transverse to said core; a pair of electric contacts adjacent the pivot of the armature with one of said pair of contacts normally yieldably spaced from the other of said pair of contacts; and means yieldably connecting said armature and said yieldably spaced contact and adapted to yieldably hold said armature away from the core.

4. An electromagnetic-contact device comprising: an electromagnet having a core; a support at one side of said electromagnet; an armature pivoted to said support and extending in a direction transverse to said core; a pair of electric contacts connected to said support and located adjacent the pivot of the armature with one of said pair of contacts normally yieldably spaced from the other of said pair of contacts; and means yieldably connecting said armature and said yieldably spaced contact and adapted to yieldably hold said armature away from the core.

5. An electromagnetic-contact device comprising: an electromagnet having a magnetizable core; a magnetizable bracket including a base connected to said electromagnet and a support extending along one side of said electromagnet; a magnetizable armature pivoted to said support and extending in a direction transverse to said core; a pair of electric contacts connected to but insulated from said support and located adjacent the pivot of the armature, one of said pair of contacts being mounted on a spring-arm, which latter holds the contact mounted thereon normally yieldably spaced from the other of said pair of contacts; and a spring connecting the free end portion of said armature and said spring-arm and adapted to yieldably hold said armature away from the core.

6. An electromagnetic-contact device comprising: an electromagnet having a magnetizable core; a magnetizable bracket including a base connected to said electromagnet and a support extending along one side of said electromagnet; a magnetizable armature pivoted to said support and extending in a direction transverse to said core; a pair of electric contacts connected to but insulated from said support and located adjacent the pivot of the armature, one of said pair of contacts being mounted on a spring-arm, which latter holds the contact mounted thereon normally yieldably spaced from the other of said pair of contacts; a spring connecting the free end portion of said armature and said spring-arm and adapted to yieldably hold said armature away from the core; and an abutment mounted on said spring-arm adjacent the contact thereon and adapted to be actuated to cause the contact on said spring-arm to engage the other of said pair of contacts.

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