

July 4, 1939.

D. ELLIS ET AL

2,165,037

ELECTROMAGNET

Filed July 31, 1936

Fig. 1.

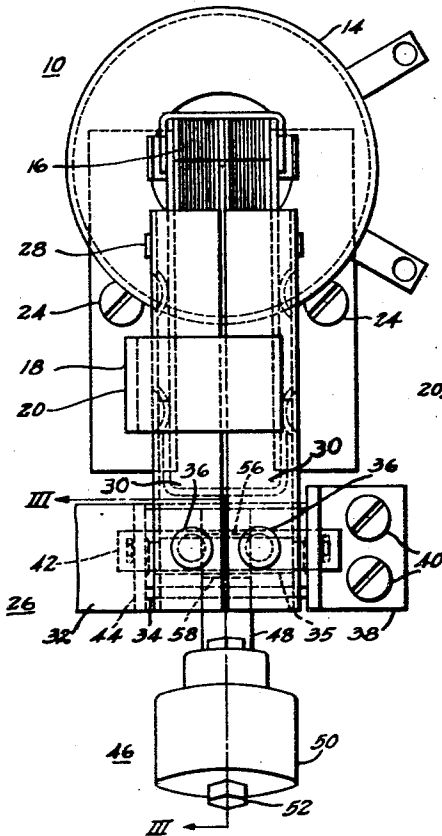


Fig. 2.

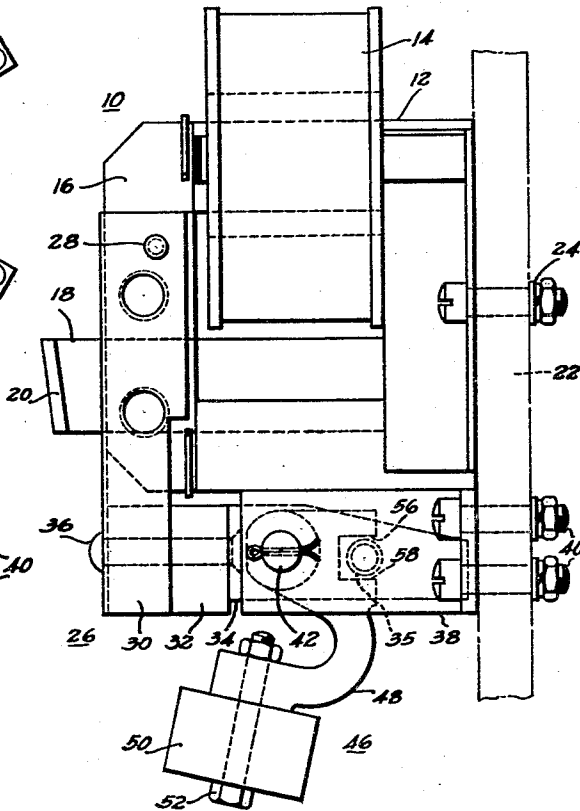


Fig. 3.

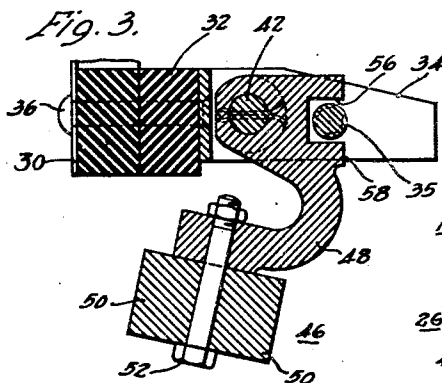


Fig. 4.

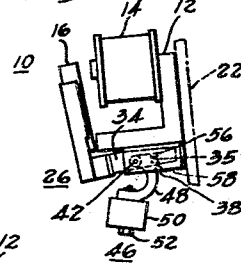
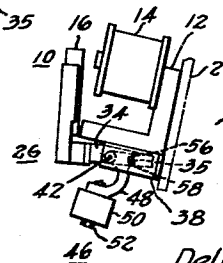


Fig. 5.



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2,165,037

ELECTROMAGNET

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Application July 31, 1936, Serial No. 93,590

9 Claims. (Cl. 175—336)

This invention relates to electromagnets.

In the construction of contactors, the movable contact members are sometimes carried by a bar which may be actuated to carry them into engagement with complementary contact members to what is generally described as a circuit closing position. The bar is usually so mechanically connected to the armature of an electromagnet that when a predetermined voltage is impressed on the actuating coil of the electromagnet the armature and bar are actuated to move the contact members into closed position.

In practice, however, it is found that the armature and the bar carrying the movable contact members are not always actuated to a circuit closing position when the desired pick-up voltage is imposed on the actuating coil of the electromagnet. This is especially true in applications of contactors of this type on board ship where the motion of the ship tilts the electromagnet and the contactors forward and backward with respect to a vertical position.

When the contactor and the electromagnet for actuating the contact members are tipped in the forward position, the center mass of the armature actuated by the electromagnet is so shifted that a predetermined pick-up voltage impressed on the electromagnet coil will not cause sufficient magnetic pull to actuate the armature and the bar carrying the contact members to a circuit closing position. When the contactor is tilted backward from a vertical position, the center of mass of the armature is so shifted that the armature of the electromagnet and the bar may be moved to the circuit closing position when a voltage less than the predetermined pick-up voltage is impressed on the actuating coil.

In this type of apparatus, the electromagnet is often subjected to physical shocks which, if the armature is in a circuit closing position, will cause the armature to be jarred out of its circuit closing position. If the armature is in its circuit interrupting position and the electromagnet is subjected to a shock, the resultant forces of the shock sometimes cause the armature to be actuated to a circuit closing position. This movement of the armature and the bar carried thereby often results in serious damage to apparatus connected in circuit by the contactors.

An object of this invention is to provide for the actuation of the armature of an electromagnet to complete a magnetic circuit upon the occurrence of a predetermined magnetic pull when the electromagnet is in a vertical position or tilted at an angle to the vertical position.

Another object of this invention is to provide for stabilizing the armature of an electromagnet to prevent movement of the armature when the electromagnet is subjected to shocks.

Another object of this invention is the provision of a shock absorber for electromagnets.

Other objects of this invention will be apparent from the following description when taken in conjunction with the accompanying drawing, in which:

Figure 1 is a front elevational view of an electromagnet embodying the features of this invention,

Fig. 2 is a side elevational view of the electromagnet shown in Fig. 1,

Fig. 3 is a view in section taken along lines III—III of Fig. 1 and illustrating the shock absorber as embodied in this invention, and

Figs. 4 and 5 are schematic views of the electromagnet with its armature in the circuit interrupting position in forward and backward tilted positions, respectively, from a vertical position.

Referring to the drawing and Figs. 1 and 2 in particular, this invention is illustrated with reference to an electromagnet 10 comprising a yoke member 12, an actuating coil 14 suitably disposed on the yoke member and an armature 16 disposed for movement to complete a magnetic circuit with the yoke member 12. In order to limit the movement of the armature to the open position of the electromagnet, a stop bracket 18 having a flange 20 projecting into the path of movement of the armature 16 may be carried by the panelboard 22 upon which the electromagnet 10 is mounted. The electromagnet 10 may be secured to the panelboard 22 in some suitable manner, such as by bolts 24.

In order to provide for supporting the armature 16 and for carrying it into and out of the closed position in which it completes a magnetic circuit with the yoke member 12, the armature 16 is suitably carried by an armature arm 26 as by means of the pin 28. The armature arm 26 comprises the plates 30 between which the armature 16 is carried, disposed on a bar 32 which is disposed to carry the movable contact members (not shown) of a contactor, and a U-shaped tail piece 34. The U-shaped tail piece carries a pin 35 between the legs of the U, the purpose of which will be explained hereinafter. The members of the armature arm are rigidly held together by means of the rivets 36.

In order to provide a fixed point for the armature arm 26, a pivot pin 42 is disposed in the bracket 38 for carrying the armature arm. The

bracket 38 may be suitably mounted on the panel-board 22 as by means of the bolts 40. The pivot pin projects through suitable openings in the legs of the tail piece 34 and carries the armature arm

26. The bar 32 extends from the armature arm and carries the movable contact members (not shown) of the contactor, the operation of which it is desired to control by means of the electromagnet 10. In order to provide a suitable support for the end of the pin 42 opposite the bracket 38, a plate 44 is disposed on the bar 32, for carrying the other end of the pin 42. A support similar to bracket 38 may be provided on the panelboard 22 at the other end of the bar 32 which carries the movable contact members of the contactor between its ends for providing a suitable bearing pivot point for the other end of the bar which carries another plate similar to plate 44 disposed to receive another pivot pin similar to the pin 42.

In order to provide for the actuation of the armature 16 to a closed position only upon the occurrence of a predetermined magnetic pull in the yoke member 12 and to stabilize the armature against shocks which might occur at any time, a weight member 46 is carried by the pivot pin 42 between the legs of the tail piece 34 for cooperating with the armature arm, as will be explained hereinafter. Since the said member is disposed between the legs of the tail piece and is pivotally carried by the pin 42, any movement of the said member is definitely fixed with respect to the armature and armature arm assembly and is within their plane of movement. The weight member 46 as employed in this invention comprises a substantially U-shaped link 48 having an opening at one end thereof for receiving the pivot pin 42. A weight 50 is mechanically connected to the other end of the link, as by means of the bolt 52. Since the armature 16, the armature arm 26 and the weight member 46 are linked together by pins 28 and 42, the assembly may be termed an articulated armature having an upper portion comprising the armature and armature arm and a lower portion comprising the weight member.

In the particular embodiment shown in the drawing, projections 56 and 58 are provided near the end of the U-shaped link 48 adjacent the pivot pin 42 for cooperating with the pin 35 carried by the tail piece 34 to stabilize the armature 16 against shocks. As shown, the projections 56 and 58, respectively, extend from the link to a position above and below the pin 35 where they are adapted to engage the pin 35 and cooperate therewith to control the movement of the armature arm 26.

In operation, if the actuating coil 14 is energized to provide a predetermined magnetic pull, the armature 16 is actuated to complete a magnetic circuit with the yoke member 12. When the armature 16 is in the closed circuit position, the weight member 46 stands in the position shown in Fig. 2 of the drawing. In this position, it is noted that there is a clearance between the pin 35 carried by the armature arm 26 and the projections 56 and 58 of the weight member 46.

If the electromagnet 10 is subjected to a shock when in the closed vertical position, the armature 16 is retained in the closed position by the weight member 46, since the shock is transmitted through the armature 16, armature arm 26 and pin 35 to the weight member 46 to cause a bobbing movement of the weight member about its

pivot pin 42. The bobbing movement of the weight member is occasioned by the clearance between the pin 35 and the projections 56 and 58 of the weight member. The clearance provides a lost motion between the weight member and the projections so that as the weight member moves about the pivot pin 42 in response to the force of the shock, the projections 56 and 58 alternately strike the pin 35 until the force of the shock is dissipated by movement of the weight 50.

If the actuating coil is deenergized, the armature drops to a circuit interrupting position, and the tail piece 34 of the armature arm moves in a counterclockwise direction about the pivot pin 42 to a position where the projection 56 engages the pin 35. Thus the weight member 46 tends to bias the armature to its circuit closing position, so that by adjusting the weight 50 of the weight member 46 the pick-up voltage at which the armature 16 is actuated to its circuit closing position may easily be determined.

If the electromagnet is tilted forward with respect to its vertical position when the armature is in its circuit interrupting position, as shown in Fig. 4, the weight member 46 is moved in a counter-clockwise direction about its pivot pin 42 to shift the center of mass of the armature. As the weight member 46 moves about its pivot pin 42 in response to a tilting of the electromagnet, the center of mass of the weight member shifts and the weight member tends to bias the armature to a circuit closing position. The shifting of the center of mass of the weight member so equalizes the shifting of the center of mass of the armature that the armature will be actuated to its circuit closing position when the actuating coil is energized to provide the predetermined magnetic pull.

If the electromagnet is tilted backwards with respect to a vertical position when the armature is in its circuit interrupting position, as shown in Fig. 5, the pin 35 carried by the tail piece of the armature arm engages the lower projection 58 of the weight member 46 to rotate the weight member in a clockwise direction about the pivot pin 42. In this tilted position, the weight member 46 acting through the pin 35 tends to so bias the armature 16 carried by the armature arm 26 to its circuit interrupting position, that it will not move to complete the magnetic circuit with the yoke member until after the actuating coil 14 is energized to provide the predetermined magnetic pull.

If the electromagnet is subjected to a shock when tilted backwards with its armature in the circuit interrupting position, the armature will not drop to its circuit closing position but instead the shocks will be transmitted from the armature through the armature arm to the weight member 46 to cause a bobbing action of the weight member to dissipate the force of the shock. The armature is not actuated to its closed position during the bobbing of the weight member 46 because as the weight member bobs it strikes the lower side of the pin 35 carried by the armature arm and thus tends to bias the armature to its open position.

Thus as the electromagnet is tilted forward or backward with respect to a vertical position, the force of any shocks applied to the electromagnet will be dissipated by the bobbing action of the weight member.

By providing the controlling electromagnet of a contactor with the weight member, as herein

disclosed, it is evident that the weight of the weight member may be so selected that the armature of the electromagnet will not be moved to its circuit closing position to actuate the contact members of the contactor unless the actuating coil of the electromagnet is energized to provide a predetermined magnetic pull. The shift of the center of mass of the weight member in the different positions of the electromagnet is sufficient to require a predetermined magnetic pull in the yoke member before the armature is actuated to its circuit closing position. Further by means of this invention even though the electromagnet is tilted to an angle with respect to a vertical position, the armature is stabilized against any movement occasioned by shocks.

Although this invention has been described with reference to a particular embodiment thereof, it is, of course, not to be limited thereto except insofar as is necessitated by the prior art and the scope of the appended claims.

We claim as our invention:

1. In an electromagnet, in combination, a yoke member, a coil for energizing the yoke member, an armature for completing a magnetic circuit with the yoke member, a pivotally mounted armature arm for carrying the armature, the armature arm disposed for movement from an open position to carry the armature to a closed position to complete the magnetic circuit when the coil is energized to provide a predetermined magnetic pull in the yoke member, a pin carried by the armature arm, a weight member carried by the armature arm, a plurality of means disposed on the weight member for engaging the pin when the armature arm is in the open position and the electromagnet is at an angle to a vertical position, one of the plurality of means disposed to engage the pin to so bias the armature to the closed position when the electromagnet is tipped forward at an angle to a vertical position that the armature is actuated to complete the magnetic circuit when the coil is energized to provide the predetermined magnetic pull in the yoke member, another of the plurality of means disposed to engage the pin to so bias the armature arm to the open position when the electromagnet is tipped backward at an angle to a vertical position to prevent the actuation of the armature to complete the magnetic circuit until the coil is energized to provide the predetermined magnetic pull in the yoke member, the weight member also providing a mass for cooperating with the armature arm to stabilize the armature against movement when subjected to shocks.

2. In an electromagnet, in combination, a yoke member, a coil for energizing the yoke member, an armature for completing a magnetic circuit with the yoke member, an armature arm for carrying the armature, a pin disposed for pivotally supporting the armature arm, the armature arm being disposed for movement from an open position to carry the armature to a closed position to complete the magnetic circuit when the coil is energized to provide a predetermined magnetic pull in the yoke member, a pin carried by the armature arm, and means movably supported on the armature arm supporting pin for limited pivotal movement relative to the armature arm and independent thereof and in a fixed plane with respect to the armature and armature arm for all positions of the electromagnet for cooperating with the pin carried by the armature arm when the armature arm is in an open position and the electromagnet is at an angle to a vertical po-

sition to permit the armature to be actuated to the closed position when the coil is energized to provide the predetermined magnetic pull, the means also providing a mass for cooperating with the armature arm to stabilize the armature against shocks.

3. In an electromagnet, in combination, a yoke member, a coil for energizing the yoke member, an armature for completing a magnetic circuit with the yoke member, an armature arm for carrying the armature, a pin disposed for pivotally supporting the armature arm, the armature arm being disposed for movement from an open position to carry the armature to a closed position to complete the magnetic circuit when the coil is energized to provide a predetermined magnetic pull in the yoke member, a pin carried by the armature arm, a weight member pivotally carried by the supporting pin for limited pivotal movement relative to the armature arm and independent thereof and having a plane of movement substantially parallel to the plane of movement of the armature for all positions of the electromagnet, and means disposed on the weight member for engaging the pin carried by the armature arm when the armature is in the open position and the electromagnet is at an angle to a vertical position whereby the weight member cooperates with the armature arm to permit the armature to be actuated to the closed position when the coil is energized to provide the predetermined pull, the weight member also providing a mass for cooperating with the armature arm to stabilize the armature against shocks.

4. In an electromagnet, in combination, a yoke member, a coil for energizing the yoke member, an armature assembly for completing a magnetic circuit with the yoke member, a pin disposed for pivotally supporting the armature assembly, a pin carried by the armature assembly, and a member carried by the supporting pin of the armature assembly and disposed thereon for limited independent pivotal movement relative to the armature assembly and for movement in a fixed plane with respect to the armature for all positions of the electromagnet to cooperate with the pin carried by the armature assembly to compensate for the tilting of the electromagnet from the vertical to provide for the operation of the armature by a substantially constant magnetic pull independently of the position in which the electromagnet stands, the member also cooperating with the pin carried by the armature assembly to stabilize the armature against movement when subjected to shocks.

5. In an electromagnet, in combination, a yoke member, a coil for energizing the yoke member, an articulated armature assembly for completing a magnetic circuit with the yoke member, the articulated armature assembly having an upper and a lower portion, a pin disposed for pivotally supporting the upper and lower portions in assembled relation, a pin carried by the upper portion of the armature assembly, the upper portion being disposed for predetermined angular movement independently of the lower portion when the electromagnet stands in a vertical closed position, the lower portion being disposed for movement in a fixed plane with respect to the upper portion of the assembly for all positions of the electromagnet, means carried by the lower portion for engaging with the pin carried by the upper portion to cooperate therewith to compensate for the tilting of the electromagnet from the vertical to provide for the operation of the

armature by a substantially constant magnetic pull independently of the position in which the electromagnet stands.

6. In an electromagnet, in combination, a yoke member, a coil for energizing the yoke member, an articulated armature assembly for completing a magnetic circuit with the yoke member, the articulated armature assembly having an upper and a lower portion, a pin disposed for pivotally supporting the upper and lower portions in assembled relation, a pin carried by the upper portion of the armature assembly, the upper portion being disposed for predetermined angular movement independently of the lower portion when the electromagnet stands in a vertical closed position, the lower portion being disposed for movement in a fixed plane with respect to the upper portion of the assembly for all positions of the electromagnet, a plurality of means carried by the lower portion for engaging with the pin carried by the upper portion in a predetermined manner to cooperate therewith to compensate for the tilting of the electromagnet from the vertical to provide for the operation of the armature by a substantially constant magnetic pull, the plurality of means carried by the lower portion being disposed to alternately engage the pin carried by the upper portion to cooperate therewith to stabilize the upper portion against movement when the electromagnet is subjected to shocks.

7. In an electromagnet, in combination, a yoke member, a coil for energizing the yoke member, an articulated armature assembly for completing a magnetic circuit with the yoke member, the articulated armature assembly having an upper and a lower portion, a pin disposed for pivotally supporting the upper and lower portions in assembled relation, the upper portion of the assembly including an armature, armature arm and a pin carried by the armature arm and being disposed for predetermined angular movement, the lower portion of the assembly comprising a weight member and a plurality of means carried thereon for engaging the pin carried by the armature arm when the electromagnet is tipped forward or backward at an angle to a vertical position, the weight member cooperating with the upper portion of the assembly when any one of said plurality of means engages the pin carried by the armature arm to control and permit movement of the armature only in response to or failure of a predetermined energization of the coil and yoke member, the weight member also providing a mass for cooperating with the upper portion of the assembly to stabilize the armature against shocks.

8. In an electromagnet, in combination, a yoke member, a coil for energizing the yoke member, an articulated armature assembly for completing a magnetic circuit with the yoke member, the articulated armature assembly having an upper

and a lower portion, a pin disposed for pivotally supporting the upper and lower portions in assembled relation, the upper portion of the assembly including an armature, an armature arm and a pin carried thereon and being disposed for predetermined angular movement, the lower portion of the assembly comprising a weight member and a plurality of means carried thereon for engaging the pin carried by the armature arm when the upper portion of the assembly is in the open position and the electromagnet is at an angle to a vertical position, one of the plurality of means disposed to engage the pin to so bias the upper portion of the assembly toward the closed position when the electromagnet is tipped forward at an angle to a vertical position that movement of the armature to the closed position is permitted when the coil is energized to provide a predetermined magnetic pull in the yoke member, another of the plurality of means disposed to engage the pin to so bias the upper portion of the assembly toward the open position when the electromagnet is tipped backward at an angle to a vertical position to prevent the actuation of the upper portion to the closed position until the coil is energized to provide the predetermined magnetic pull in the yoke member, the weight member also providing a mass for cooperating with the upper portion of the assembly to stabilize the armature against shocks.

9. In an electromagnet, in combination, a yoke member, a coil for energizing the yoke member, an articulated armature assembly for completing a magnetic circuit with the yoke member, the articulated armature assembly having an upper and a lower portion, a pin disposed for pivotally supporting the upper and lower portions in assembled relation, the upper portion of the assembly comprising an armature, an armature arm for carrying the armature, the armature arm terminating in a tail piece having a plurality of legs, and a pin carried between the legs of the tail piece, the lower portion of the assembly comprising a weight member disposed to be carried on the supporting pin between the legs of the tail piece and having a plane of movement fixed with respect to the plane of movement of the upper portion of the assembly, means carried by the weight member for engaging the pin carried by the legs of the tail piece when the electromagnet is tipped forward or backward at an angle to a vertical position, the weight member cooperating with the upper portion of the assembly when said means engages the pin to control and permit movement of the armature only in response to or failure of a predetermined energization of the coil and yoke member, the weight member also providing a mass for cooperating with the upper portion of the assembly to stabilize the armature against shocks.

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