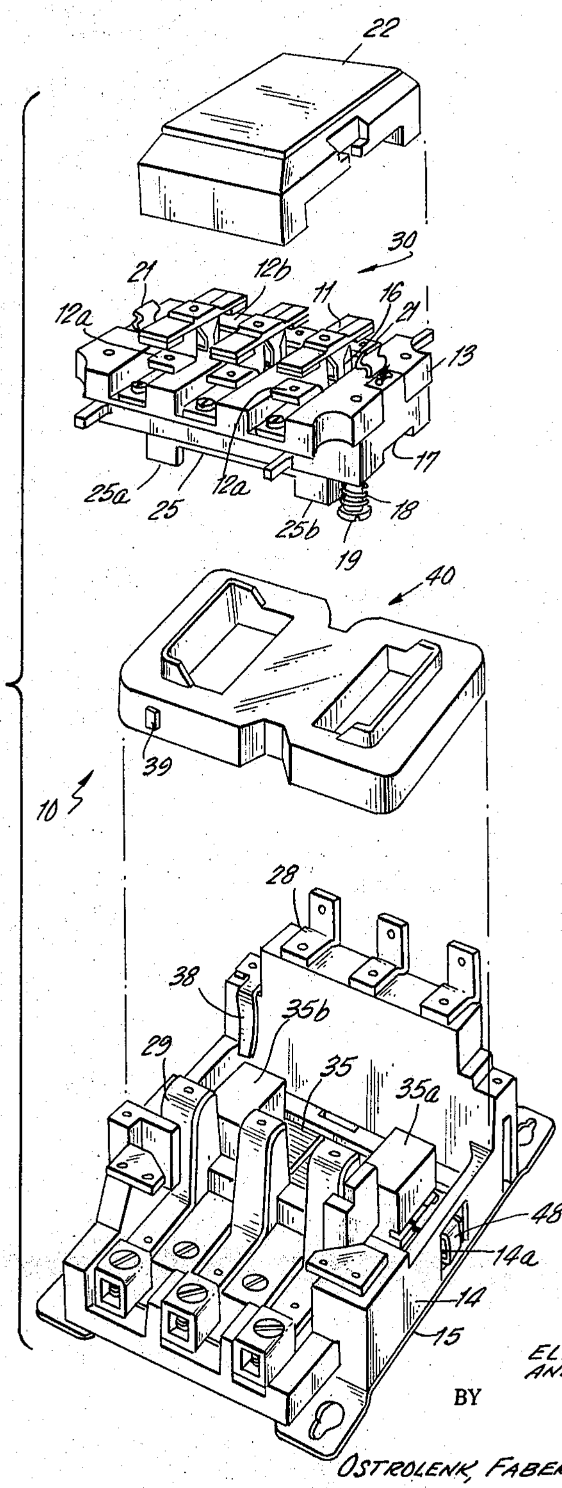
March 29, 1966 E. T. PLATZ ETAL 3,243,545

TWO-WAY CUSHION FOR CONTACTOR

Filed May 24, 1963 3 Sheets-Sheet 1

FIG. 1.



INVENTORS
ELWOOD T. PLATZ
ANDREW J. KRALIK

BY

OSTROLENK, FABER, GERB & SOFFEN
ATTORNEYS

March 29, 1966 E. T. PLATZ ETAL **3,243,545**

TWO-WAY CUSHION FOR CONTACTOR

Filed May 24, 1963 3 Sheets-Sheet 2

FIG. 2.

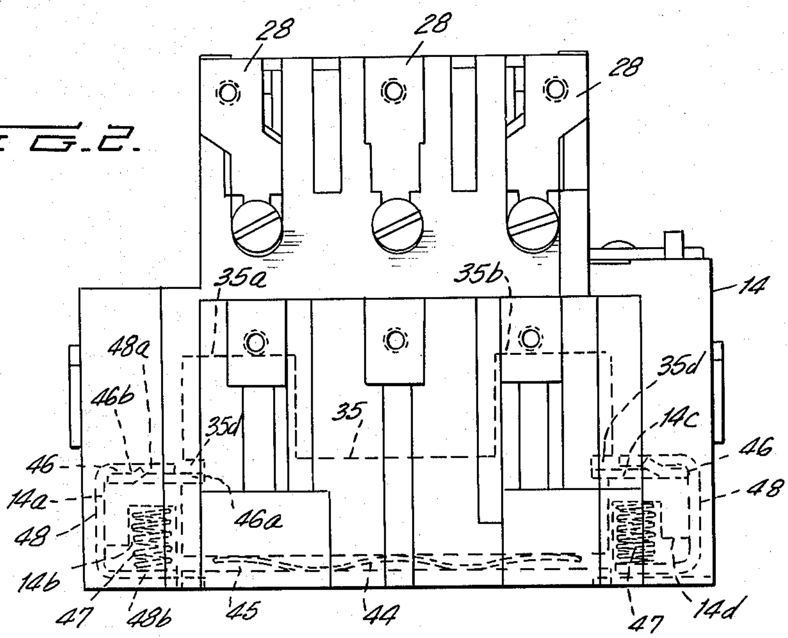
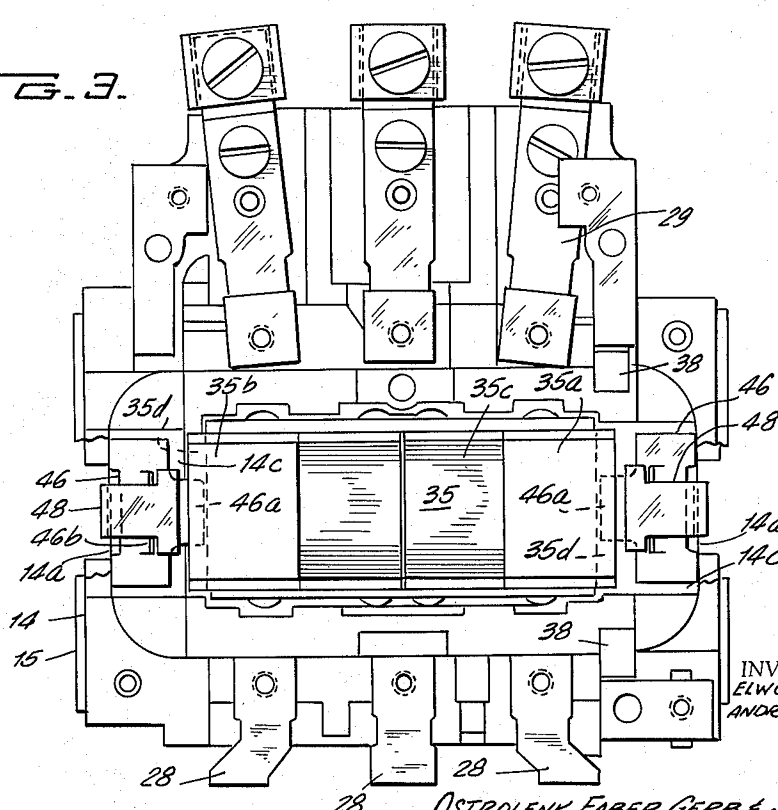


FIG. 3.



INVENTORS
ELWOOD T. PLATZ
ANDREW J. KRALIK

OSTROLENK, FABER, GERB & SOFFEN
ATTORNEYS

TWO-WAY CUSHION FOR CONTACTOR

Filed May 24, 1963 3 Sheets-Sheet 3

FIG. 4.

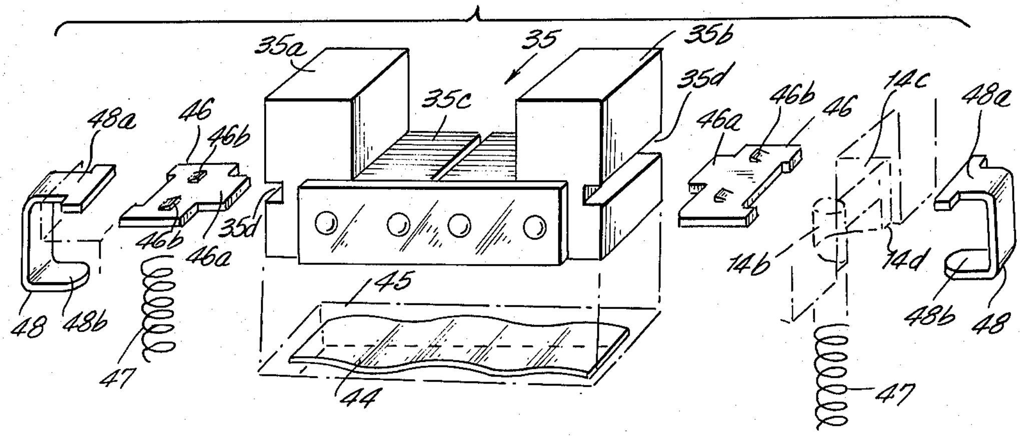


FIG. 5.

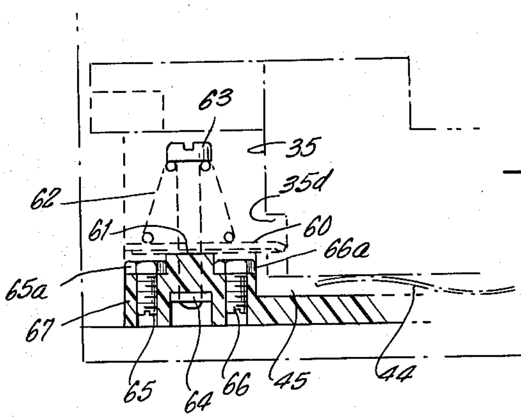
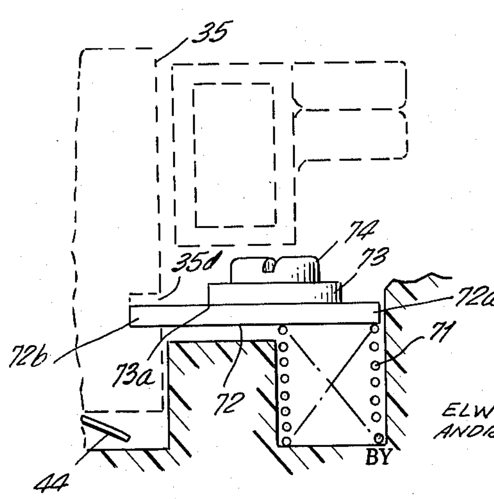


FIG. 6.



INVENTORS
ELWOOD T. PLATZ
ANDREW J. KRALIK

BY

OSTROLENK, FABER, GERB & SOFFEN
ATTORNEYS

United States Patent Office

3,243,545

Patented Mar. 29, 1966

3,243,545

TWO-WAY CUSHION FOR CONTACTOR

Elwood T. Platz, Grosse Pointe Farms, and Andrew J. Kralik, Detroit, Mich., assignors to I-T-E Circuit Breaker Company, Philadelphia, Pa., a corporation of Pennsylvania

Filed May 24, 1963, Ser. No. 283,084
9 Claims. (Cl. 200—87)

This invention relates to contactors in general and more particularly to an improved means for absorbing shocks which are generated when the contactor magnet is energized.

In the Cataldo et al. copending application Serial No. 189,915, filed April 24, 1962, entitled "Electrical Device," and assigned to the assignee of the instant invention, there is disclosed a contactor of the type to which the instant invention is applicable. Briefly, the contactor is a multiphase unit having two stationary contacts and a movable bridging contact for each phase. The bridging contacts of all phases are operatively connected to the armature of an electromagnet. The magnet yoke is positioned by a cushion mounting so that the shocks which are generated upon the engagement of the armature with the magnet will minimize damage.

It is not only the direct impact of the armature engaging the yoke which must be absorbed but there is also a rebound shock which must be absorbed. Some prior art constructions attempt to absorb both the direct and rebound shocks by utilizing a single spring member. This has proven to be less than satisfactory since the shock absorbing means must be tied to the same means which positions the yoke relative to the armature for the deenergized condition of the electromagnet. It is essential that the air gap between the two magnetic core members be accurately controlled and that this gap not vary appreciably when the contactor is subjected to external shock forces. By utilizing a single shock absorbing member in an effort to accomplish both direct and rebound shock absorption it is necessary to resort to compromises and as a result it is necessary to settle for less than top performance.

The instant invention overcomes this difficulty of the prior art by providing a construction in which one spring means is utilized for the absorption of direct shocks while another spring means is utilized for the absorption of rebound shocks. The construction is such that upon rebound contact separation or lift-off is substantially prevented so that arcing, hence contact erosion, is minimized. Further, the magnet yoke is not rigidly tied to the stationary base so that the former is not tied to a large encumbering mass. The yoke is relatively free to recoil under the shock of closing thereby reducing distortion and wear at the pole faces.

In some of the embodiments to be hereinafter described, means are also provided for adjusting the yoke relative to the armature so that air gap length may be accurately controlled. Not only are the shock absorbing abilities of the device of the instant invention vastly superior to those of similar prior art devices, but in addition the shock absorbing means is so constructed that assembly of the contactor is facilitated.

Accordingly, a primary object of this invention is to provide a novel shock absorbing means for an electromagnetic contactor.

Another object is to provide a shock absorbing means of this type having a novel construction in which a means is provided for the absorption of direct shocks and a separate means is provided for the absorption of rebound shocks.

Still another object is to provide a novel means for mounting the magnet yoke of a contactor such that the adverse effects of armature impact on contact life and pole face conformation will be minimized.

A further object is to provide a cushioning means of this type having means for adjusting air gap length between the armature and yoke for the deenergized condition of the electromagnet.

These as well as further objects of this invention shall become readily apparent after reading the following description of the accompanying drwings in which:

FIGURE 1 is an exploded perspective of the main elements of a contactor incorporating the novel shock absorbing means constituting the instant invention.

FIGURE 2 is a load side view of the contactor base with the magnet yoke and retaining elements mounted thereto.

FIGURE 3 is a plan view of the contactor base with the magnet yoke and retaining elements mounted thereto.

FIGURE 4 is an exploded perspective of the magnet yoke and the shock absorbing elements.

FIGURE 5 is a fragmentary view partially sectioned to illustrated another embodiment of the invention in which two elements are provided for adjusting the air gap length between the leg and armature for the deenergized condition of the electromagnet.

FIGURE 6 is a view similar to FIGURE 5 illustrating a third embodiment of the instant invention.

Now referring more particularly to FIGURES 1 through 4. Contactor **10** is a multiphase unit of the type described in detail in the aforesaid copending application 189,915. Each phase is provided with a bridging element **11** which is movable downward with respect to FIGURE 1 into engagement with a pair of stationary contacts **12*a***, **12*b***. All of the stationary contacts **12*a***, **12*b*** are secured to plate **13** which is mounted in fixed position upon molded insulating base **14** with the latter being secured to mounting plate **15**. It is noted that in operation plate **15** is positioned in a vertical plane so that all of the elements of the contactor are deemed to be mounted on the forward side of plate **15**.

Each of the bridging contacts **11** is mounted at the forward end of a projection **16** extending forwardly from movable contact carrier **17**. The latter is mounted to the rear of plate **13** being biased thereagainst by two coil springs **18**, only one of which is shown in FIGURE 1. Studs **19** extend through coil springs **18** and clearance apertures in contact carrier **17**, into plate **13**, so as to constitute guides for the movement of carrier **17** relative to plate **18**. Springs **18** are coiled compression elements with one end of each resting against the rear surface of carrier **17** and the other end resting against the enlarged head of stud **19**. Plate **13** carries pivotally mounted clips **21** which removably secure cover **22** in operative position to cooperate with plate **13** in covering the contacts **11**, **12*a*** and **12*b*** of all phases.

Secured to contact carrier **17**, in a manner described in detail in the aforesaid copending application 189,915, is U-shaped armature **25** whose legs extend rearwardly. When the plate-contact carrier assembly **30** is mounted to base **14**, the heads of studs **19** rest against fixed portions of base **14** so that plate **13** is fixed in relation to base **14**. Screws secure stationary contacts **12*a*** to line terminals **29** and other screws secure contacts **12*b*** to load terminals **28**.

Coil springs **18** position pole faces **25*a*** and **25*b*** a predetermined distance from confronting pole faces **35*a*** and **35*b*** of magnet yoke **35**. Yoke **35** is a U-shaped member mounted to base **14** in a manner to be hereinafter explained, with the legs of yoke **35** extending forwardly toward the legs of armature **25**. Magnet core **25**, **35** is energized by current passing through coil assembly **40** which is two coils connected to form a figure eight with the loops encompassing the legs of yoke **35**. Coil assembly **40** is provided with two contact buttons **39** which engage spring contacts **38** mounted in base **14**. It is noted that portions of the enlarged heads of studs **19** rest against the forward surface of coil assembly **40** to limit forward movement thereof.

Serpentine leaf spring **44** is interposed between base **14** and the rear surface of the yoke web **35***c*, being disposed within base pocket **45** which receives the yoke web **35***c*. Yoke **35** is secured to base **14** by means of two sets of elements. Each of these sets comprise a plate **46** a coil spring **47**, and a retainer **48**.

Edge **46***a* of plate **46** extends into side recess **35***d* of yoke **35**. It is noted that the height of recess **35***d* is considerably greater than the thickness of plate **46** so that a lost motion connection is formed between yoke **35** and plates **46**. The arms **48***a*, **48***b* of U-shaped retainer **48** receive base formation **14***a* therebetween. Coil spring **47**, disposed within recess **14***b* of base formation **14***a*, is a compression member one end of which bears against the forward boundary of recess **14***b* and the other end of which extends beyond the rear end of recess **14***b* and bears against retainer arm **48***b*.

Plate **46** is interposed between retainer arm **48***a* and surface **14***c* of base formation **14***a*. Retainer **48** is resiliently held in place by virtue of the fact that the outwardly extending wing tip of retainer arm **48***a* are positioned inwardly of plate ears **46***b*.

As seen in FIGURE 2, when magnet coil assembly **40** is deenergized serpentine spring **44** urges yoke **35** forwardly so that the rear boundary of yoke slot **35***d* engages plate edge **46***a* to establish the desired position for yoke **35** relative to base **14**.

When coil assembly **40** is energized, the direct impact of armature **25** engaging yoke **35**, yoke **35** moves to the rear and the shock is absorbed by serpentine spring **44**. However, during this period certain rebound forces are generated due to the fact that spring **44** is being deformed, opening springs **18** are being compressed and the contact pressure springs (not shown) are also being compressed. Thus, a rebound force of considerable magnitude is built up.

After the direct closing the shock is absorbed by serpentine spring **44**, yoke **35**, armature **25** and contact carrier **17** rebound as a unit. If plates **46** were not resiliently mounted the rebound shock would cause excessive damage. However, as yoke **35** moves forward the inward edge **46***a* of plate **46** also moves forward. This movement is permitted since retainer leg **48***b* rests against the rear end of spring **47** and is free to move at least as far as the surface **14***d* of base formation **14***a*. Prior to engagement the rebound forces have been expended.

Springs **47** are so constructed that their combined forces is slightly in excess of the normal steady combined forces of return springs **18**, contact pressure springs (not shown) and the spring of any interlock device which may be connected to contactor **10**.

In the embodiment of FIGURE 5 the same serpentine spring **44** is utilized to absorb direct shocks. Plate **60** which extends into yoke recess **35** is maintained against base surface **61** by conical coiled compression spring **62** with the wide end of spring **62** bearing against plate **60** and the narrow end of spring **62** bearing against the head of retaining screw **63**. Screw **63** extends through spring **62** and the base formation which includes surface **61** with the end of screw **63** remote from its head being engaged by nut **64** whose position determines the loading of spring **62**. Nuts **65***a* and **66***a* are mounted within recesses of base **67** adjacent to surface **61** with these recesses being shaped so that nuts **65***a*, **66***a* are prevented from rotating. Threadably mounted to nuts **65***a* and **66***a* are adjusting screws **65** and **66**, respectively.

Yoke **35** is moved forwardly by turning screw **66** so that it moves toward plate **60**. Similarly, yoke **35** is moved rearwardly by turning screw **65** so that it moves forward. After all of the adjustments have been made, a suitable sealer may be applied to assure that these adjustments will remain fixed.

In the embodiment of FIGURE 6 compression coil spring **71** disposed within a base recess engages the outer end **72***a* of plate **72** urging plate **72** forward into engagement with bracket **73** secured to the base by screw retainer **74**. The inner end **72***b* of plate **72** extends into yoke recess **35***d*. The engagement of yoke **35** with plate **72** in its normal position of FIGURE 6 establishes the normal position for yoke **35** relative to the base. Adjustment of screw **74** determines the position of bracket **73**, hence the position of plate **72**.

As in the other embodiments serpentine spring **44** provides a cushion for direct shock. During rebound yoke **35** attempts to move forward. This causes the inner end **72***b* of plate **72** to move forward so that plate **72** pivots about bracket **73** at edge **73***a* with the outer end **72***a* of bracket **72** compressing spring **71**.

Thus, this invention provides a novel construction for a shock absorbing means utilized with contactor magnets. The construction is such that individual spring elements are utilized for absorbing direct and rebound shock forces so that no compromises need be made. This results in minimizing the adverse effects of armature impact on contact life and pole face conformation.

Although there has been described a preferred embodiment of this novel invention, many variations and modifications will now be apparent to those skilled in the art. Therefore, this invention is to be limited, not by the specific disclosure herein, but only by the appending claims.

The embodiments of the invention in which an exclusive privilege or property is claimed are defined as follows:

1. A device for the class described comprising a set of cooperating contacts and an electromagnet operatively connected to said contacts for operation thereof; said electromagnet comprising a core and an energizing winding therefore; said core comprising a movable core member and a relatively stationary core member; means biasing said first core member away from said second core member; means mounting said first core member for movement in a first direction toward said second core member upon energization of said winding; first means supporting said second core member and constituting means for absorbing direct shock brought about by engagement of said second core member; second means separate from said first means for normally limiting movement of said second core member in a second direction toward said first core member; said second means including a resilient portion operatively engaging said second core member so as to yield to a limited extent as said second core member rebounds under the influence of said first means, said second means includes a plate, a spring, and a stop; said spring urging said plate against said stop; said plate extending into a recess in said second core member; said recess and said plate being so proportioned as to permit movement of said second core member relative to said stop.

2. The device of claim **1** in which the first means normally urges a portion defining said recess into engagement with said plate, said first means constructed to permit said portion to disengage said plate upon the occurrence of direct shocks.

3. The device of claim **2** in which said portion engages said plate as said second core member rebounds thereby causing said plate to move relative to said stop.

4. The device of claim **3** in which the second means also includes a U-shaped retainer having a first and a second leg; said spring engaging said first leg and urging said retainer in said first direction; said second leg being in engagement with said plate with said plate being interposed between said stop and said second leg.

5. The device of claim 2 in which the spring directly engages said plate; said stop being comprised of adjustable means whereby the position of the second core member relative to the first core member is adjustable to a desired position when said winding is deenergized.

6. The device of claim 5 in which said stop is comprised of screw means directly engaging said plate.

7. The device of claim 2 in which one end of the plate extends into the recess of the second core member and the spring directly engages the plate near the other end thereof.

8. The device of claim 7 in which stop includes an edge defining a pivot about which said plate is rockable during the process of absorbing rebound shocks.

9. The device of claim 8 in which the stop is adjustably mounted whereby the position of the second core member relative to the first core member is adjustable to a desired position when said winding is deenergized.

References Cited by the Examiner

UNITED STATES PATENTS

2,544,491	3/1951	Davis	317—195
3,057,980	10/1962	Ferk et al.	317—195
3,060,355	10/1962	Kruzic	317—195

FOREIGN PATENTS

974,278	10/1960	Germany.
584,050	1/1947	Great Britain.

BERNARD A. GILHEANY, *Primary Examiner.*

ROBERT K. SCHAEFER, *Examiner.*

B. DOBECK, *Assistant Examiner.*