Dec. 12, 1950

C. R. PETER

ELECTRIC SWITCH WITH FLEXIBLE LEAD DEFORMED BY TORSION

2,533,397

Filed Jan. 15, 1949

2 Sheets-Sheet 1

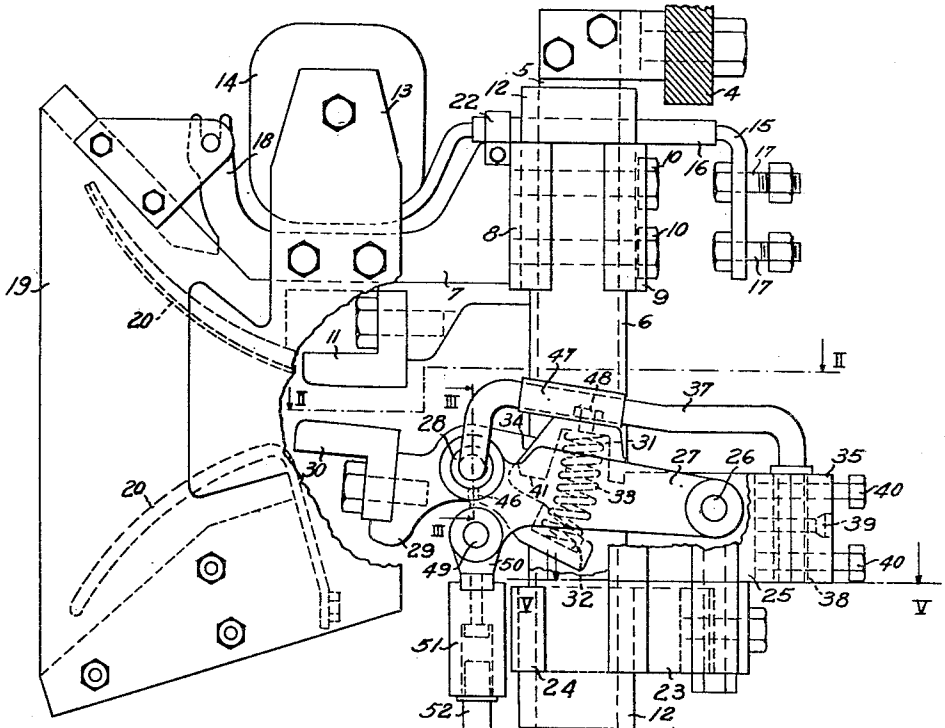


Fig. 1

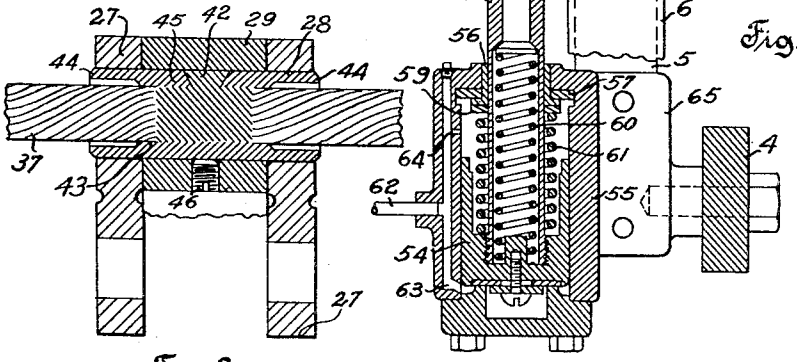


Fig. 3

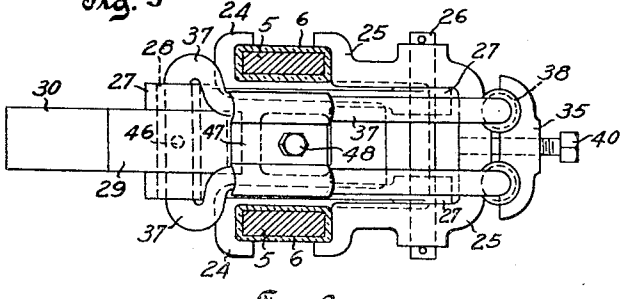


Fig. 2

Inventor
Charles R. Peter
by J. Lloyd Le Fave
Attorney

Dec. 12, 1950 C. R. PETER 2,533,397

ELECTRIC SWITCH WITH FLEXIBLE LEAD DEFORMED BY TORSION

Filed Jan. 15, 1949 2 Sheets-Sheet 2

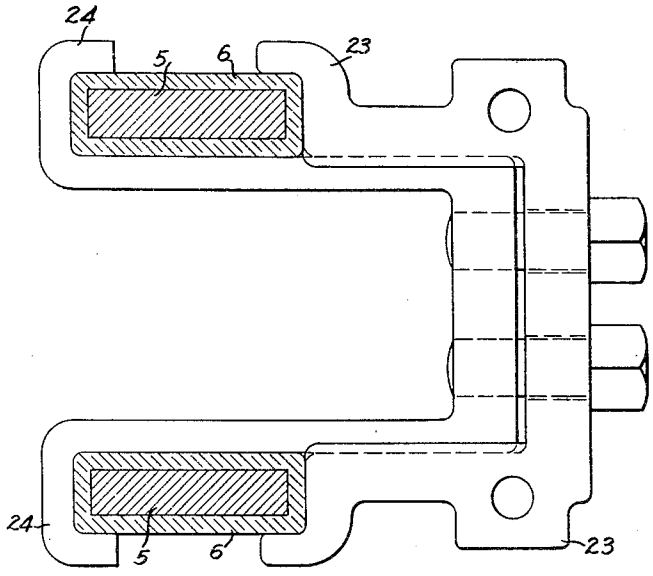


Fig. 5

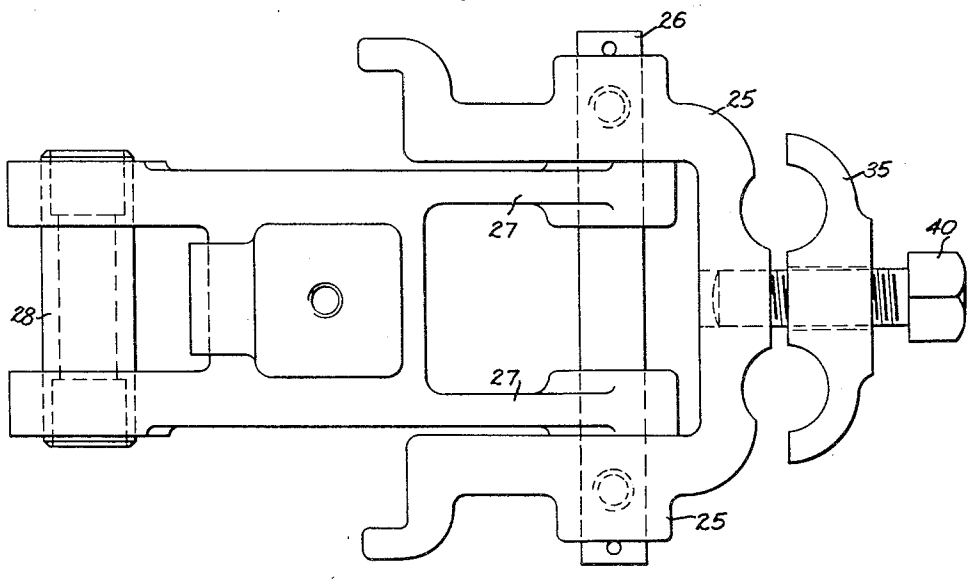


Fig. 4

Inventor
Charles R. Peter
by J. Lloyd La Faive
Attorney

Patented Dec. 12, 1950

2,533,397

UNITED STATES PATENT OFFICE

2,533,397

ELECTRIC SWITCH WITH FLEXIBLE LEAD DEFORMED BY TORSION

Charles R. Peter, Milwaukee, Wis., assignor to Allis-Chalmers Manufacturing Company, Milwaukee, Wis., a corporation of Delaware

Application January 15, 1949, Serial No. 71,193

5 Claims. (Cl. 200—166)

1

This invention relates in general to improvements in electric switches and more particularly to means eliminating contact bounce in a switch of high current carrying capacity providing rapid closing of its contacts.

In prior art contactor switches, the movable structure including a contact carrier has a flexible connector with one end mounted on a face thereof, and with the other end mounted on the frame of the switch. The flexible connector is caused to move due to either rectilinear or pivotal movement of the carrier, adding considerably to the kinetic energy of the movable structure during closing of the switch. These disadvantages may be overcome by mounting the flexible connector on the carrier so that pivotal movement of the carrier produces only torsion therein while rectilinear movement of the carrier causes substantially no flexure of the flexible connector.

It is therefore an object of this invention to reduce movement of the flexible connection of an electric switch due to pivotal movement of the contact carrier for substantially reducing the kinetic energy of the movable structure.

Another object of the invention is to provide an improved electric switch in which the flexible connection between the movable contact and a terminal is distorted mainly by torsion rather than by flexure.

Another object of the invention is to provide an improved electric switch in which the flexible connection between the movable contact and a terminal is applied to a point of the movable contact having the least movement.

Another object of the invention is to provide an improved electric switch in which the kinetic energy of the actuated structure of a given mass is substantially reduced.

Objects and advantages other than those above set forth will be apparent from the following description when read in connection with the specific embodiment shown in the accompanying drawing, in which:

Fig. 1 is a view in elevation, partly in cross section, of a switch comprising a flexible cable coaxially connected to a pivotal contact carrier;

Fig. 2 is a view taken along line II—II of the switch shown in Fig. 1;

Fig. 3 is a cross sectional view along line III—III of Fig. 1 showing the mounting of the flexibe cable in the pivot of the contact carrier;

Fig. 4 is a top view on an enlarged scale of some of the switch elements shown in Fig. 1; and

Fig. 5 is a cross sectional view along line V—V of the switch shown in Fig. 1.

2

Referring more particularly to the drawing, numeral 4 indicates a pair of cross members forming part of the frame of the switch. A pair of spaced parallel bars 5 are vertically mounted on the cross members 4. The vertical bars are insulated by suitable coverings or sleeves 6 including collars 12 for supporting the current carrying structure of the switch.

A support 7 having a clamp portion 8 is mounted on the insulated vertical bars by means of a corresponding clamp 9 mounted across the opposite edges of the spaced bars and fastened to the clamp portion of the support by a pair of bolts 10 which pass between the two bars 5.

A fixed contact 11 is mounted on the support 7. Also mounted on support 7 are a pair of plates 13 of suitable magnetic material which extend to opposite sides of the fixed contact 11 and its associated movable contact and which support a blowout coil 14. One end of the winding of the blowout coil is connected to the support 7, the other end forming a lead conductor 15 is covered with insulation material 16 and supported in a clamp 22 mounted on support 7 to form one of the terminals of the switch. A pair of stud bolts 17 extend from the conductor 15 for connecting a bus bar thereto.

An upright finger 18 extends from support 7 for removably supporting a pair of spaced arc shields 19 between magnetic plates 13. A pair of arc runners 20 are mounted in any suitable known manner between the arc shields with their converging portions adjacent the contacts.

A divided clamp 23, 24 is firmly mounted on the insulated vertical bars 5 for supporting the movable contact assembly. Clamp half 23 comprises an offset portion 25 on which an H shaped arm 27 is pivotally mounted by a pin 26 which extends through a bore in both arm 27 and clamp 25. The other end of arm 27 also contains a bore for receiving a tubular pivot 28. A contact carrier 29 is supported on pivot 28 on the end of arm 27.

Arm 27 has a portion 31 recessed to form a cup between pivots 26 and 28. Contact carrier 29 extends longitudinally of arm 27 and has a recessed portion 32 facing the cup like recess 31 of arm 27. A spring 33 is mounted in recess 31 of arm 27 and recess 32 of carrier 29 for biasing the carrier and the movable contact 30 mounted thereon to pivot clockwise on arm 27. A heel of carrier 29 abuts against an outer surface of cup portion 31 of arm 27 to form a stop 34 limiting the clockwise pivoting of the carrier on arm 27.

Contact 30 is connected to the second switch terminal through a looped flexible lead 37 which

has each end brazed in a sleeve 38 which is removably mounted under an end clamp 35 fastened to clamp portion 25. A screw 39 holds end clamp 35 in place. Studs 40 are provided for attaching a bus bar to clamp portion 25, whereby sleeves 38 and clamp 35 are pressed between the bus bar and clamp portion 25. Flexible lead 37 extends through bore 43 of pivot 28 to which it is integrally connected by brazing to the central portion 45 of pivot 28. The brazing metal is introduced in pivot 28 through a drilled hole 42 in the wall thereof. The end portions 44 of pivot 28 are drilled oversize so that a free portion of the flexible lead is coaxial with pivot 28. A set screw 46 mounted in carrier 29 holds the pivot 28 firmly in place assuring a good contact between pivot 28 and carrier 29.

The path for the passage of electric current comprises clamp 35, flexible lead 37, pivot 28, contact carrier 29, movable contact 30, fixed contact 11, support member 7, coil 14, and end 15 of the coil.

The portions of flexible lead 37 intermediate pivot 28 and sleeves 38 are fastened to arm 27 by a cable clamp 47 held by a screw 48, so that the flexible lead will not swing upon movement of arm 27.

The means for actuating arm 27 to cause closure of the contacts comprise a crosshead 50 pivotally connected to the extended end of arm 27 by a pin 49 extending through bores in crosshead 50 and in arm 27. Crosshead 50 is rigidly fastened to a coupling 51 of insulating material. A push rod 52 also rigidly connected to coupling 51 cooperates with a sleeve 58 of a piston 54, in which the push rod is slidably mounted. Sleeve 58 contains a spring 60 for biasing rod 52 upward to contact closed position.

A cylinder 55 envelops piston 54. An L-shaped guide bushing 56 extends from the inner side of the top wall of cylinder 55, where it seats on a gasket 57, to the outer surface of the cylinder. A washer 59 which is machined for a close fit on sleeve 58 is seated on the bushing. Piston 54 also contains a coiled spring 61 which is seated on the head of the piston and on washer 59, to bias the piston toward the bottom of cylinder 55.

A source of compressed air is connected to the bottom of the cylinder through a pipe 62 and a large opening of a duct 63. Duct 63 has a relatively small opening 64 for admitting a relatively small amount of compressed air above piston 54 to cushion the impact of the piston at the end of its stroke.

The pneumatic means for actuating the movable contact comprising a cylinder 55 are attached by a suitable clamp 65 to the pair of vertical bars 5 which are mounted on frame cross members 4.

When compressed air is admitted into the cylinder it forces the piston to move upward, compressing spring 61. Spring 60 under compression forces push rod 52 to move upward with piston 54, causing arm 27 to pivot clockwise about its supporting pin 26.

When piston 54 passes bypass opening 64, the air ahead of the piston is trapped and compressed by the further completion of the stroke. This trapped air slowly escapes between sleeve 58 and the L shaped guide bushing 56 and washer 59. Washer 59 provides the limiting clearance for escape of the trapped air. The compression of the trapped air retards the stroke of the piston near its point of completion and thus decreases the force transmitted to movable contact 30 upon closing of the contacts to reduce or eliminate contact bounce due to the force with which the contacts are closed.

The tip of movable contact 30 engages the tip of the fixed contact 11 when arm 27 has moved to a predetermined extent. Further pivotal movement of arm 27 causes the movable contact to rock on its associated fixed contact, causing contact carrier 29 with its pivot 28 to pivot counterclockwise on arm 27 against the bias of spring 33. Carrier 29 pivots counterclockwise, compressing spring 33 until the carrier abuts a stop 41 on arm 27. Stop 41 is designed to maintain proper alignment of the contacts when in closed position.

The portion of the flexible lead between cable clamp 47 and terminal connection 28 flexes somewhat with pivoting of arm 27 caused by rectilinear movement of cross head 50, the extent of which is relatively small. Therefore the flexing of the flexible lead does not materially affect closing of the contacts.

Pivot 28, being machined for a close fit in the bore of carrier 29 and being held securely by a set screw 46, rotates with the carrier, thereby causing torsion in the flexible lead. The amount of twist resulting in the flexible lead is small since the amount of pivotal movement of the carrier is limited to a small angle. Therefore the portion of the flexible lead coaxial with pivot 28 need not be very great. Besides the small amount of twist, there is substantially no other movement of the flexible lead due to pivoting of carrier 29. Therefore rapid closing of the contacts does not cause whipping movement of the flexible lead. Elimination of whipping movement of the flexible lead greatly decreases the force transmitted to the movable contact at the time of closure due to the kinetic energy of the moving parts of the switch, which tends to produce bounce between the contacts and serious arcing.

Although but one embodiment of the present invention has been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

It is claimed and desired to secure by Letters Patent:

1. A switch comprising a frame, a fixed contact mounted on said frame, an arm pivotally mounted on said frame, a hollow pivot mounted on said arm for rotation with respect thereto, a carrier mounted on said hollow pivot, a movable contact mounted on said carrier, a flexible lead having a portion mounted on said frame and another portion coaxially mounted in said hollow pivot, and means pivotally moving said arm to cause said carrier to pivot on said arm for closing said contacts, whereby, said pivoting of said carrier produces only torsion of said flexible lead so as not to cause contact bounce of said contacts.

2. A switch comprising a frame, a fixed contact mounted on said frame, an arm pivotally mounted on said frame, a pivot mounted on said arm for relative rotation with respect thereto, a carrier mounted on said pivot, a movable contact mounted on said carrier, a flexible lead having a portion mounted on said frame and a second portion mounted on said arm, a third portion of said lead adjacent said second portion being coaxially connected to said pivot, and means moving said arm to cause closure of said contacts.

3. A switch comprising a frame, a fixed contact

mounted on said frame, an arm pivotally supported on said frame, a pivot mounted on said arm for rotation with respect thereto, a carrier mounted on said pivot, a movable contact mounted on said carrier, a flexible lead having a portion mounted on said frame and another portion coaxially connected to said pivot, means intermediate said portions of said lead for holding said lead on said arm, stop means for limiting the pivotal position of said carrier, means imparting a bias to said carrier to said limited pivotal position, and means moving said arm to sequentially cause initial engagement of said contacts, pivoting of said carrier against said bias causing said pivot to revolve on said arm to produce torsion of said flexible lead, and rocking contact closure of said contacts, whereby, said closure is accompanied by a minimum of movement of said flexible lead tending to cause bounce of said movable contact.

4. A switch comprising a frame, a fixed contact mounted on said frame, an arm pivotally supported on said frame, a hollow pivot mounted on said arm for rotation with respect thereto, a carrier mounted on said pivot, a movable contact mounted on said carrier, a flexible lead having a portion mounted on said frame and another portion coaxially mounted in said hollow pivot, a stop on said arm for limiting the pivoting of said carrier, means mounted on said arm for biasing said carrier against said stop, and actuating means causing said arm to pivot on said frame to sequentially cause initial engagement of said contacts and pivoting of said carrier away from said stop against said biasing means for rocking contact engagement of said contacts while causing torsion of said flexible lead.

5. A switch comprising a frame, a fixed contact mounted on said frame, an arm pivotally mounted on said frame, a hollow pivot mounted on said arm for rotation with respect thereto, a carrier mounted on said pivot, a movable contact mounted on said carrier, a flexible lead having a portion mounted on said frame and another portion coaxially mounted in said hollow pivot, a stop on said arm for limiting the pivoting of said carrier, and means moving said arm to cause said carrier to pivot away from said stop to close said contacts.

CHARLES R. PETER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,779,659	Carichoff	Oct. 28, 1930