Dec. 1, 1970 T. E. POLIAKOFF 3,544,934

PROXIMITY SWITCH-TYPE CONTROL MEANS

Filed May 8, 1969 2 Sheets-Sheet 1

FIG. 1

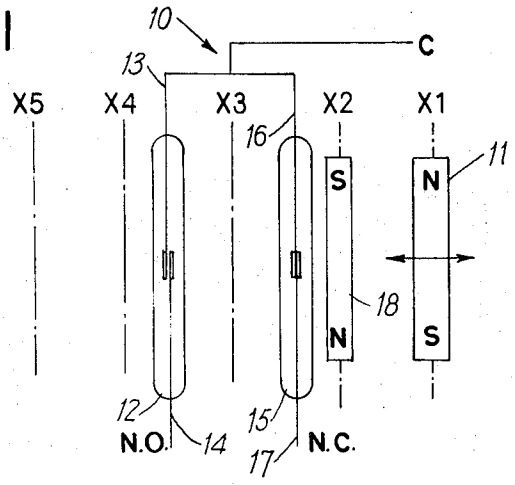


FIG. 3

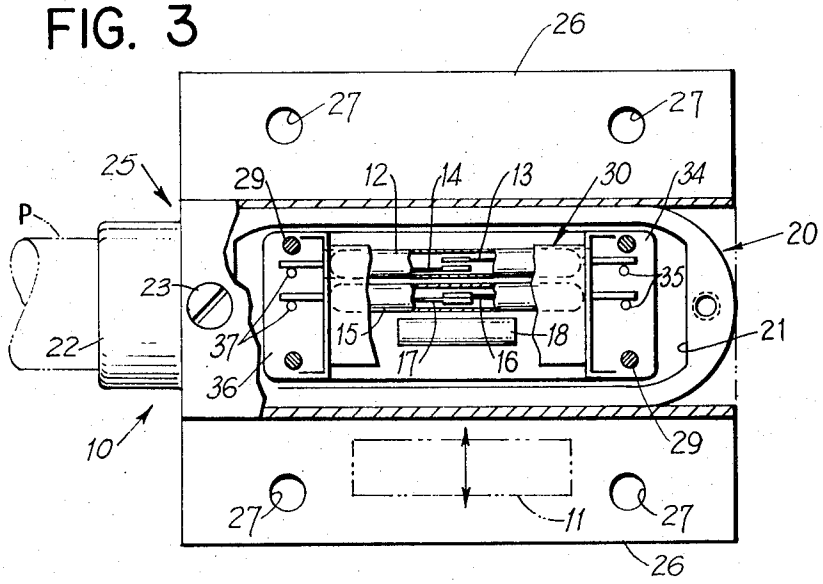
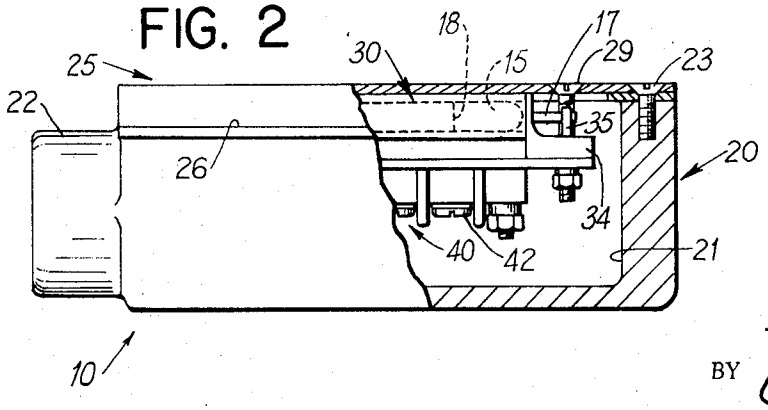


FIG. 2



INVENTOR.
THEODORE E. POLIAKOFF
BY Charles J. Worth
AGENT

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FIG. 4

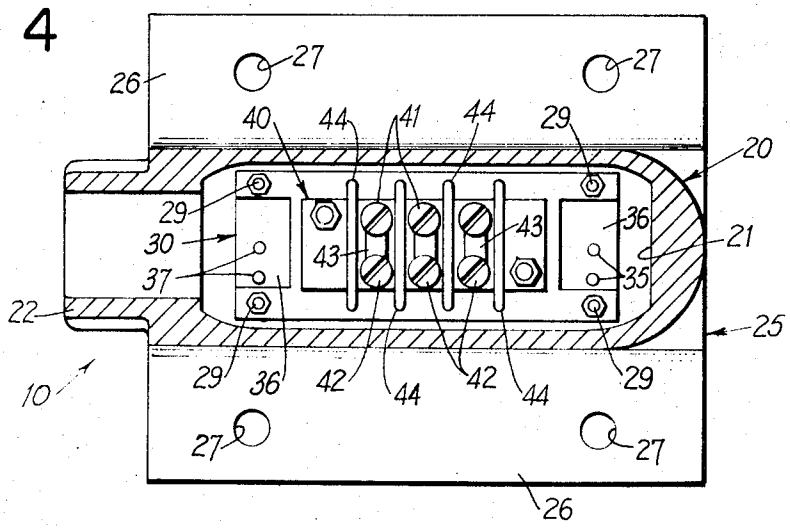


FIG. 6

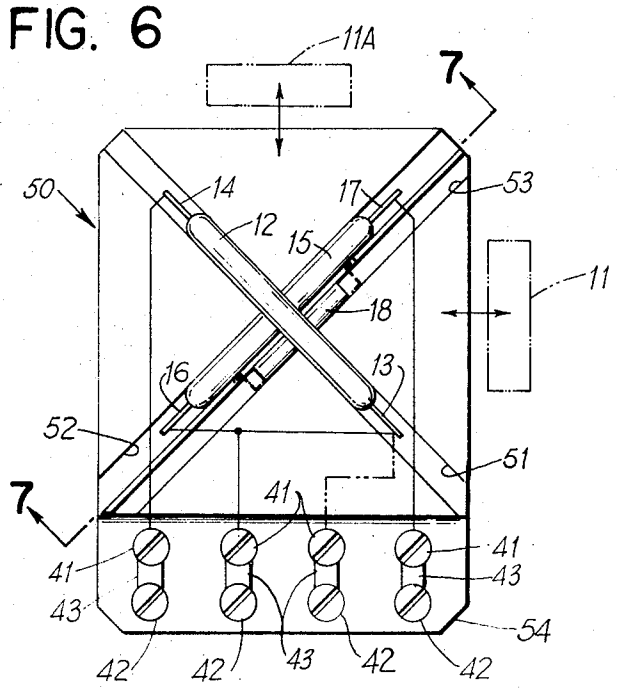


FIG. 7

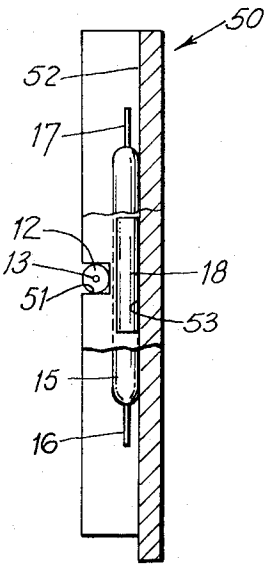
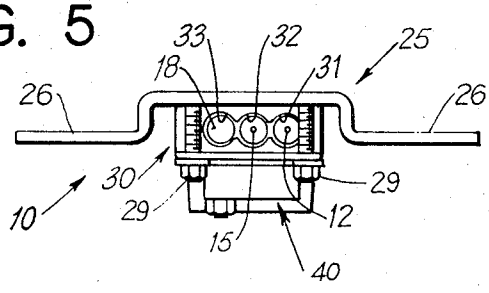


FIG. 5



INVENTOR.
THEODORE E. POLIAKOFF
BY Charles J. Worth
AGENT

United States Patent Office

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PROXIMITY SWITCH-TYPE CONTROL MEANS

Theodore E. Poliakoff, Alexandria, Va., assignor to American Machine & Foundry Company, a corporation of New Jersey

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ABSTRACT OF THE DISCLOSURE

Proximity switch-type control means having magnetic operating means and switching means including at least one reed switch, switch supporting and connecting means, and housing means consisting of a condulet and a cover therefor adapted to be removably mounted on supporting structure.

This invention relates generally to electric controls and more particularly to magnetically responsive proximity control means having reed-type switches.

Switch-type control means made in accordance with the present invention have no actuating portions extending therefrom which can become bent, broke or impacted with foreign matter to prevent operation. Therefore, while such control means may find utility in many different environments, they are particularly adapted for use as limit switches and will be described as such. It should be understood, however, that this is merely a preferred environment and is not to be construed as an implied limitation of the claimed invention.

An object of the present invention is to provide a proximity control means having a magnetic operator means and electric switch means movable relative to each other, and the switch means including at least one reed switch is opened and closed depending upon the relative position of the operator means thereto.

Another object of the present invention is to provide the foregoing control means in which at least one reed switch is a normally closed switch due to the effects of a magnetic bias.

Another object of the present invention is to provide the foregoing control means in which the switch means is enclosed in a releasably mountable housing.

The present invention contemplates a proximity switch-type control means having magnetic operating means and switching means arranged for relative movement therebetween, and the switching means comprising housing means adapted to be removably mounted and defining a switch chamber, switch supporting and connecting means disposed in the switch chamber and releasably connected to the housing means, at least one reed switch carried by the supporting means and having at least one reed extending from each end thereof and conductively connected to the connecting means independent of the other reed, the reeds having a normal switching position and being caused to assume another switching position by the magnetic operating means as it moves adjacent to the housing and into proximity of the reed switch.

The foregoing and other objects and advantages of the invention will appear more fully hereinafter from a consideration of the detailed description which follows, taken together with the accompanying drawings wherein several embodiments of the invention are illustrated by way of example. It is to be expressly understood, however, that the drawings are for illustration purposes only and are not to be construed as defining the limits of the invention.

FIG. 1 is a diagrammatic illustration of the present invention.

FIG. 2 is a side elevational view of switching means made in accordance with the present invention and having a portion of the housing thereof broken away to more fully illustrate the working parts therein.

FIGS. 3 and 4 are sectional views taken on lines 3—3 and 4—4, respectively, of FIG. 2.

FIG. 5 is an end elevational view of the novel switching means of FIG. 2 with the receptacle box portion of its housing removed.

FIG. 6 is a plan view of another form of switch means with its housing removed.

FIG. 7 is a sectional view taken on line 7—7 of FIG. 6.

Referring now to the drawings, FIG. 1 is provided for discussing and teaching the present invention, and is not intended to be limiting to the specific parts as are shown. Thus, the novel proximity control means is comprised of a switch means **10** normally mounted on fixed structure (not shown) and an operating magnet or magnet means **11** suitably mounted on movable structure (not shown). The specific number of reed switches included in the switching means **10** is determined by the number of switching functions which are required. Similarly, whether any particular reed switch is normally open or closed and whether the reed of any switch is connected to a common or an individual conductor **13** or line **15** are determined by the character or type of each switching function required.

As shown, the switching means **10** is provided with a pair of reed switches or switch members **12** and **15** disposed in spaced parallel relationship. The reeds **13** and **14** of the switch **12** are normally open while the reeds **16** and **17** of the switch **15** are normally closed. All of the reeds **13**, **14**, **16** and **17** are made of an electrically conductive magnetic material and the reeds **16** and **17** are normally retained closed by the effects of a biasing bar-type magnet or magnet member **18** with the poles thereof at its ends. The biasing magnet **18** is disposed adjacent and parallel to the reed switch **15**. Reeds **13** and **16** illustrate connecting corresponding ends of the switches **12** and **15** to a common line or conductor C while reeds **14** and **17** are each connected to a different line or conductor. To reiterate, the novel switching means may be provided with one or more reed switches **12** or **14**, or a combination thereof while the specific reeds may be connected to individual or common lines or conductors, as shown.

The operator magnet **11** is of a bar type disposed substantially parallel to the switches **12** and **15** and the magnet **18**, and is movable along a transverse path to its polar axis, as indicated by the arrow in the drawing, between two arbitrary end positions shown as being axes X1 and X5. The axes X1 to X5 do not provide true proportional relationships. It also should be noted that the magnet **11**, with its poles at its ends, is poled oppositely to the magnet **18**.

Considering operation of a novel electric control means as diagrammatically shown in FIG. 1, the operator magnet **11** is disposed in its initial position on axis X1. Therefore, reed switch **12** is open or nonconductive and the effects of the flux of magnet **18** keeps the switch **15** closed or conductive so that the reed **16** connects the common line C to the reed **17**.

As the magnet **11** is moved toward the switch means **10** (to the left as viewed in the drawings) it will arrive at a position in the proximity of axis X2 where its flux will successfully oppose the flux of the biasing magnet **18**. With the effects of the flux of magnet **18** neutralized, reed switch **15** also opens and the common line C is fully disconnected. Continued movement of magnet **11** past switch **15** and toward the axis X3 will cause the effects of its flux on switch **15** to weaken and on switch **12** to strengthen or intensify.

Depending upon the desired switching sequence, one of the switches **12** or **15** can be closed before the other or they may be closed simultaneously. To facilitate description, it will be assumed arbitrarily that the switching means **10** is arranged for sequential closing of switch **12** and then switch **15**. Accordingly, as the magnet **11** approaches its position in the proximity of axis X3, the intensifying effect of its flux on switch **12** will cause this switch to close whereby reed **13** will connect the common line C to the reed **14**. Further movement of the magnet **11** will cause the effects of its flux to reduce to where it is overcome by the effects of the flux of the biasing magnet **18** and cause the switch **15** to reclose. The common line C is now connected to both of the reeds **14** and **17**.

Both of the switches **12** and **15** will remain closed as the magnet **11** travels past the switch **12** to a position in the proximity of axis X4. However, continued travel of the magnet **11** past the axis X4 and toward the axis X5 will cause a progressive weakening of the effects of its flux on the switch **12** and will result in this switch reopening when the operator magnet **11** is in the proximity of axis X5.

It should be fully appreciated that the foregoing is not intended to describe any particular switching sequence but, rather is merely a description of the effects of the magnet **11** during a complete excursion from axis X1 to axis X5. If the novel switch means **10** of FIG. 1 were to operate as a limit switch, the magnet **11** probably would travel only between its position indicated by the axis X1 and X3.

The novel switch means **10** in accordance with the showing of FIG. 1 is shown in FIGS. 2 to 5 as having a housing provided by a condulet or junction box **20** and a cover **25** therefor. The condulet **20** defines a chamber **21**, which is open on one side in the usual manner, and has a portion **22** at one end adapted for connection to a conductor or wire protecting conduit or pipe P, as shown in FIG. 3. The connection portion **22** defines an opening for the conductors or wires (not shown) from the conduit or pipe P into the chamber **21**. The cover **25** is releasably connected by threaded fasteners **23**, in the usual manner, to the condulet **20** for closing the open side of the chamber **21**. However, the cover **25** differs from the usual condulet cover by having lateral flange portions **26** which extend outwardly from or past the sides of the condulet **20**. The flanges **26** are provided with openings **27** for any suitable fastening means (not shown) for releasably connecting the cover **25** to suitable supporting structure (not shown).

A bobbin or support member **30** and a terminal block **40**, both of a suitable dielectric material are releasably mounted by suitable fasteners **29** to the inside of the cover **25** within the chamber **21** when the cover is connected to the condulet **20**. The bobbin **20** is provided with end portions **34** and **36** and are substantially parallel to one another. An epoxy may be used to retain the switches **12** and **15** and the magnet **18** immovable in the respective bores or slots **31**, **32** and **33**. The reeds **13** and **16** of switches **12** and **15**, respectively, are each soldered or otherwise suitably conductively connected to a different one of a pair of conductor pin members **35** which extend through the end portion **34** while the reeds **14** and **17** are each similarly connected to a different one of a pair of conductor pin members **37** which extend through the end portion **36**. It should be understood that, in some instances, the pin members **35** and **37** may be sufficient to hold the switches **12** and **15** in place and an epoxy would not be required.

The terminal block **40** has three connection terminal means each provided by a pair of terminal screws **41** and **42**, and a plate member **43** conductively connecting the terminal screws together. The pin members **35** are conductively connected together and to one of the screws **41** or **42** of connecting terminal means while the pins **37** are each conductively connected to one of the screws of a different one of the remaining two connection terminal means.

The conductors or wires (not shown) extending from the conduit or pipe P into chamber **21** are each connected to the unused screw of the appropriate connection terminal means. When these electrical connections have been completed, the cover **25** is connected by fasteners **23** to the condulet **20** and then by means (not shown) to supporting structure (not shown). The number of connection terminal means can be varied as required and is determined by the number of electrical connections to be made. While the bobbin or switch support means **30** and the terminal block or electrical connecting means **40** are shown and have been discussed as separate parts which are mounted together, the two functions thereof could be served by a single dielectric member.

Towards this end, switch support means **50** and a terminal block means **54** are of a unitary dielectric construction in a modified switching means as is shown in FIGS. 6 and 7. The support means **50** is provided with three diagonal grooves or grooved portions **51**, **52** and **53** for receiving and housing the reed switches **12** and **15** and the magnet **18** which are held in place by epoxy or any other suitable means known in the art. The groove **51** is disposed at a right angle to and crosses the grooves **52** and **53** which are parallel to each other and spaced by a thin wall portion. The crossing grooves are at different levels and, alternatively, may be bores which are provided by molding when the member **50** is formed or by machining thereafter.

The terminal block means or portion **54**, in this instance, is shown at one end of the member **50** and has four terminal connecting means each provided by a pair of terminal screws **41** and **42** conductively connected by a member **43**, as heretofore described. The reeds of the switches **12** and **15** are electrically connected to the three of the electrical connecting means in the same manner as heretofore discussed, however, as indicated, the reeds **13** and **16** may each be connected to a different one of the terminal connecting means if it is so desired.

The operator magnet **11** moves relative to the novel switching means along a path, shown by the arrow in FIG. 6, which is substantially parallel to the terminal board portion **54** and bisects the angle of intersection of the crossed grooves **51** and **52**. The modified switching means may be mounted alternatively so the operator magnet assumes a position **11A** and has a path of travel which are normal to the magnet **11** and its path of travel.

It should be understood that reed switch or reed switch **15** with its biasing magnet **18** may be eliminated if only a single switching function is required. On the other hand, additional switches may be provided to increase the number of switching functions that are available. The number of grooves or bores provided in the switching mounting means **30** or **50** is determined by the number of switches and biasing magnets to be supported while the number of terminal connecting means provided by a terminal block **40** or a terminal block portion **54** depends upon the number of independent reed connections to be made.

Although several embodiments of the invention have been illustratde and described in detail, it is to be expressly understood that the invention is not limited thereto. Various changes may be made in the design and arrangement of the parts without departing the spirit and scope of the invention as the same will now be understood by those skilled in the art.

What is claimed is:

1. In a proximity switch-type control means having magnetic operating means and switching means arranged for relative movement therebetween, comprising

a condulet defining a switch chamber with one open side, and having means at one end thereof adapted

for connection to a conduit enclosing and protecting conductors to be connected to said control means,

said means at said one end defining an opening through said condulet for passage of conductors into said switch chamber,

a cover releasably connected to said condulet thereby closing the open side of said switch chamber, and having a pair of flanges each extending away from the other laterally outward from said condulet,

said pair of flanges being adapted to be removably mounted on supporting structure,

switch supporting and connecting means disposed in said switch chamber and releasably mounted on said cover,

at least one reed switch member being carried by said supporting means adjacent said cover and having at least one reed extending from each end thereof and conductively connected to said connecting means independently of said reed extending the other end, and

said reeds of each of said reed switch members having a normal switching position and being caused to assume another switching position by said magnetic operating means moving adjacent said cover transversely to the axis of and into the proximity of said reed switch member.

2. The proximity switch-type control means in accordance with claim **1**, wherein

said reeds of at least one of said reed switch member assume an open and nonconductive normal switching position and are biased by said magnetic operating means to a closed and conductive other switching position.

3. The proximity switch-type control means in accordance with claim **1**, and

at least one bar-type magnet member carried by said supporting and connecting means adjacent to a reed switch member and having its polar axis substantially parallel to the axis of said adjacent reed switch member,

said bar-type magnet member biasing said reeds of said adjacent reed switch member to a closed and conductive normal switching position, and

said magnetic operating means overcoming the bias of said bar-type magnet member when in the proximity of said adjacent reed switch member thereby causing said reeds of said adjacent reed switch member to assume an open and nonconductive other switching position.

4. The proximity switch-type control means in accordance with claim **1** and having a plurality of said reed switch members, wherein

said reeds of at least one of said reed switch members assume an open and nonconductive normal switching position,

at least one bar-type magnet member carried by said supporting and connecting means adjacent to another reed switch member and having its polar axis substantially parallel to the axis of said other reed switch member,

said bar-type magnet member biasing said reeds of said other reed switch member to a closed and conductive normal switching position,

said magnetic operating means biasing said reeds of said one of said reed switch members to a closed and conductive other switching position when in the proximity of said one of said reed switch members, and overcoming the bias of said bar-type magnet member when in the proximity of said other of said reed switch members thereby causing said reeds of said other of said reed switch members to assume an open and nonconductive other switching position.

5. The proximity switch-type control means in accordance with claim **4**, and said supporting and connecting means comprising:

a supporting member of dielectric material having a plurality of axially disposed and parallel portions each receiving and housing therein a different one of the members carried by said supporting means,

a terminal block of dielectric material,

a plurality of terminal connecting means each independently connecting at least one of said reeds to a conductor, and

each of said terminal connecting means comprising a pair of spaced fasteners threadedly engaging said terminal block, and a member conductively connecting said pair of spaced fasteners together.

6. The proximity switch-type control means in accordance with claim **5**, and

said terminal block having a plurality of integral wall portions extending outwardly therefrom and being disposed in spaced parallel series with one another, and

said terminal connecting means each being disposed between a different two of said wall portions.

7. The proximity switch-type control means in accordance with claim **6**, wherein

said magnetic operating means including a magnet with a polar axis substantially parallel to the axes of said reed switch and bar-type magnet members, and

relative movement between said magnetic operating and switching means causing said magnet to move adjacent said cover in a direction substantially normal to all of said axes.

8. The proximity switch-type control means in accordance with claim **4**, and said supporting and connecting means comprising:

a single support member of dielectric material having a plurality of portions thereof each receiving and housing therein a different one of said members carried by said supporting and connecting means,

at least one of said portions and one of said reed switch members therein being disposed at substantially a right angle to and crossing the remaining of said portions and said members therein,

a plurality of terminal connecting means disposed in spaced series across one end of said support member each independently connecting at least one of said reeds to a conductor, and

each of said terminal connecting means comprising a pair of spaced fasteners threadedly engaging said support member, and a member conductively connecting said pair of spaced fasteners together.

9. The proximity switch-type control means in accordance with claim **8**, wherein

said magnetic operating means including a magnet with a polar axis, and

relative movement between said magnetic operating and switching means causing said magnet to move adjacent said cover in a direction substantially normal to its polar axis substantially bisecting the angle between the crossing portions of said support member.

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BERNARD A. GILHEANY, Primary Examiner

R. N. ENVALL, JR., Assistant Examiner