May 1, 1962 J. J. GRIBBLE ETAL 3,032,624

CONTROL MECHANISM

Filed July 31, 1958 3 Sheets-Sheet 1

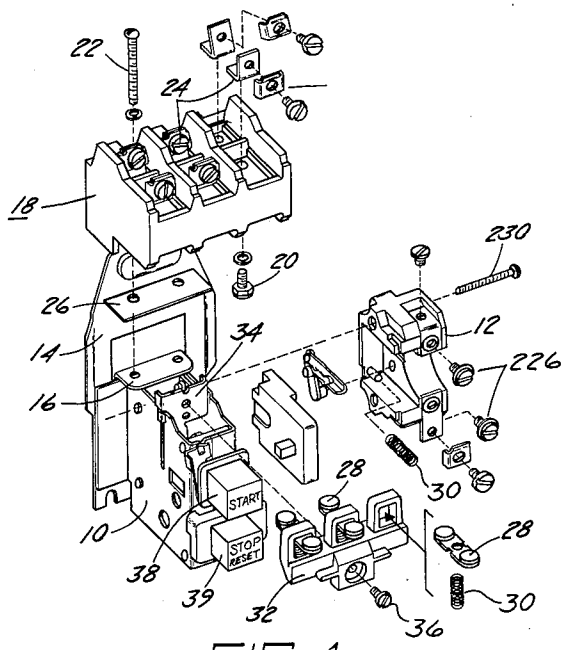


FIG. 1

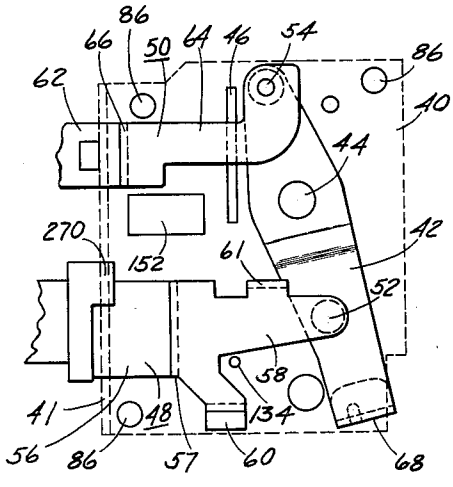


FIG. 2

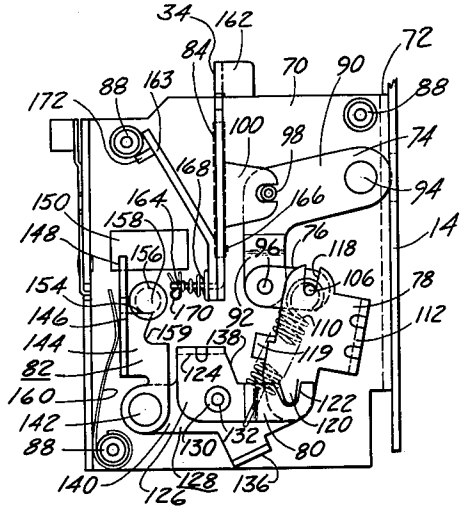


FIG. 3

INVENTOR.
JOSEPH J. GRIBBLE
KENNETH J. MARIEN
BY

May 1, 1962 J. J. GRIBBLE ETAL 3,032,624

CONTROL MECHANISM

Filed July 31, 1958 3 Sheets-Sheet 2

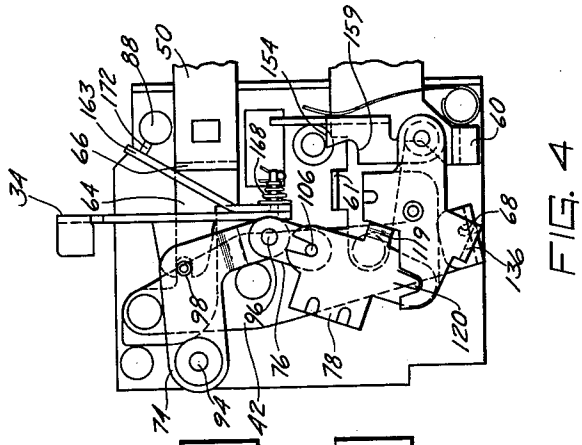


FIG. 4

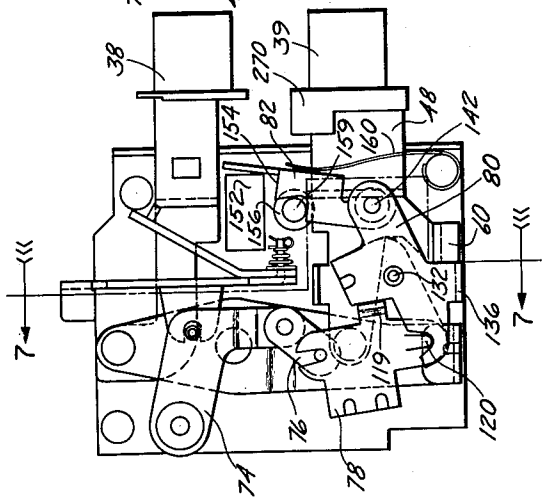


FIG. 5

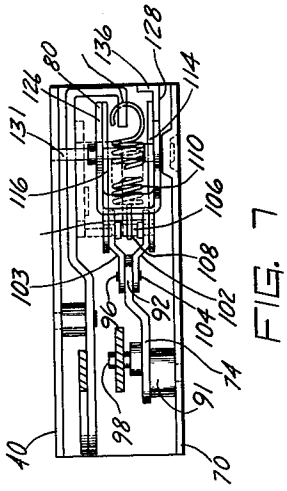


FIG. 7

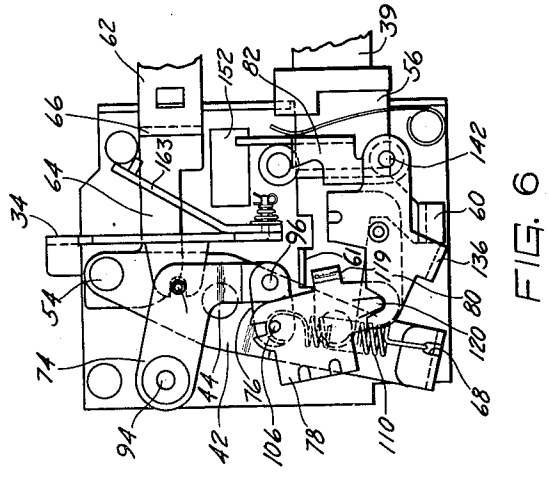


FIG. 6

INVENTOR.
JOSEPH J. GRIBBLE
KENNETH J. MARIEN
BY

William H. Schmeling

May 1, 1962 J. J. GRIBBLE ETAL 3,032,624

CONTROL MECHANISM

Filed July 31, 1958 3 Sheets-Sheet 3

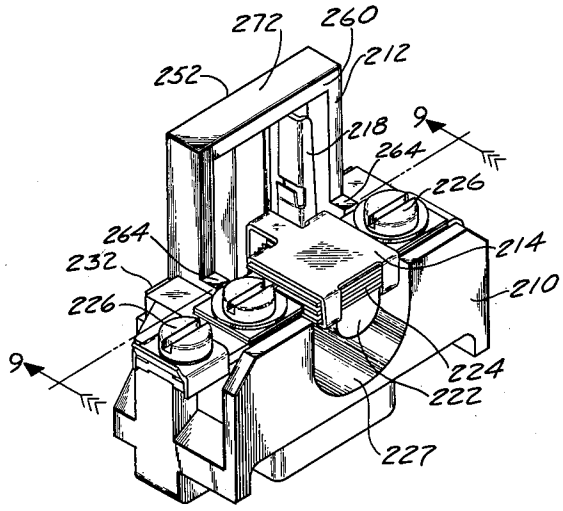


FIG. 8

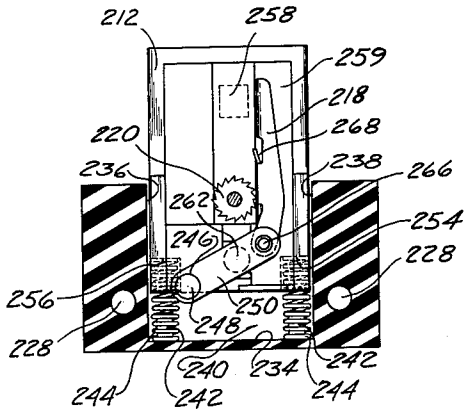


FIG. 9

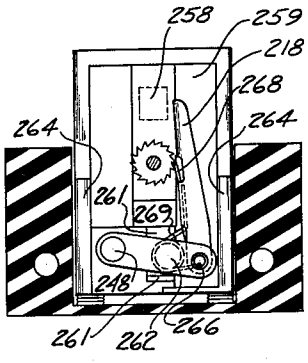


FIG. 10

INVENTOR.
JOSEPH J. GRIBBLE
KENNETH J. MARIEN
BY
William A. Schmeling

United States Patent Office 3,032,624 Patented May 1, 1962

3,032,624

CONTROL MECHANISM

Joseph J. Gribble, Fox Point, and Kenneth J. Marien, Milwaukee, Wis., assignors to Square D Company, Detroit, Mich., a corporation of Michigan

Filed July 31, 1958, Ser. No. 752,251
17 Claims. (Cl. 200—71)

This invention relates to snap acting control mechanisms and is more particularly concerned with the mechanism which will selectively reciprocate an output lever with a snap acting movement in response to linear movements of a pair of actuating elements.

This invention is also concerned with an improved overload device which is suited to be used with the actuating mechanism according to the present invention.

The device according to the present invention is particularly useful as an actuating mechanism for devices such as manually operated motor starters and the like; and when used in connection with motor starters, it will cause the movable contacts to be actuated with a snap action to either circuit making or breaking positions. This will defeat any attempt to partly depress the stop or start buttons of the starter to thereby "jog" the starter which causes a premature failure of the contacts of the device as when the contacts are moved between the slightly closed and slightly separated position during "jogging."

The actuating mechanism of the present invention is preferably formed of two sub-assemblies, one of which includes the actuating levers and the other includes the toggle mechanism which is actuated by the actuating levers. Positioned between the two sub-assemblies and slidable therebetween is an output lever that is actuated by the toggle mechanism. The device is particularly characterized by the use of a single spring to provide the force necessary for actuating the toggle mechanism and moving the toggle linkage to the tripped position. The output lever of the device is provided with a latch which is released by one of the linearly movable actuators. The release is arranged to permit the toggle spring to be stretched and thus have a considerable amount of energy stored therein before the release is effected. When this arrangement is utilized, the stored energy in the spring will assure movement of the contacts to a closed position. Another feature of the present invention is that the device can be used either with or without overload devices. When overload devices are attached to the actuating mechanism and the parts thereof are moved to the tripped position, the buttons of the actuating mechanism will be in alignment to visually indicate that the device has been tripped. Further, during movement to the tripped position, the pivot of the toggle is retracted and the toggle is partly folded. This arrangement will provide sufficient movement of the output lever to assure opening of the contacts. The device according to the present invention is further simple to assemble and includes the use of rollers in the latch means to considerably reduce the force of friction when the latches and released.

It is an object therefore of the present invention to provide a new and novel manual motor starter which will accomplish the results above indicated.

A further object of the present invention is to provide a latch on the output lever of a contact actuating mechanism for a motor starter, so the spring which actuates a foldable toggle mechanism will be stretched and have potential energy stored therein which is released as kinetic energy to assure movement of the contacts to a circuit closing position when the start button is depressed. This is accomplished by having the lever connected with the start button engage and release the latch after the spring has been stretched.

In carrying out the above objects it is another object of the present invention to use the same spring for actuating the toggle and for moving the toggle to a tripped position wherein the contacts of the starter are in the circuit opening position and to arrange the parts of the mechanism so the tops of the buttons which are used to actuate the toggle mechanism are aligned or are in the same plane when the device is in the tripped position.

A still further object is to support a portion of the toggle actuating mechanism of the device according to the present invention on a retractable pivot and to use one spring to provide the actuating force for the toggle and to retract the pivot.

Another object of the present invention is to not only retract the toggle pivot but also to partly fold the levers of the toggle when the device according to the present invention is actuated to the tripped position.

And another object of the present invention is to assemble the snap acting device according to the present invention of two basic sub-assemblies, one of which wholly supports the actuating lever mechanisms and the other of which wholly supports the toggle mechanism which mechanisms are connected by a single spring and which sub-assemblies cooperate to maintain an output lever of the device in position.

A further object of the present invention is to provide a manual starter which may be operated with or without current overload devices but when overload devices of the type to be described are used with the starter actuating mechanism according to the present invention, the mechanism will operate trip free and cannot be operated to cause contact closure unless the condition responsive element is present and properly conditioned to permit the mechanism to be operated.

Further objects and features of the invention will be readily apparent to those skilled in the art from the specification and appended drawing illustrating certain preferred embodiments in which:

FIG. 1 is an exploded view showing the components of a manual starter incorporating the devices according to the present invention.

FIG. 2 is a plan view of a subassembly of the actuating device according to the present invention.

FIG. 3 is a plan view of another subassembly which is used with the subassembly shown in FIG. 2 to complete the actuating device shown in FIG. 1.

FIG. 4 is a plan view showing the parts of the actuating device according to the present invention in the actuated position.

FIG. 5 is a plan view showing the parts of the actuating device in FIG. 4 in the tripped position.

FIG. 6 is a plan view showing the parts of the actuating device in FIG. 4 in the de-actuated position.

FIG. 7 is an end view of the device taken along the lines 7—7 in FIG. 5.

FIG. 8 is a perspective view showing the overload device according to the present invention as used with the device in FIG. 1.

FIG. 9 is a plan view taken along lines 9—9 in FIG. 8 with the overload device parts in a tripped position.

FIG. 10 is a view taken along line 9—9 in FIG. 8 with the parts of the device in the latched position.

In FIG. 1 of the drawings an exploded view of a manually operated starter incorporating the mechanical actuating device **10** and the overload device **12** according to the present invention is shown. The manually operated starter preferably includes a support plate **14** which is formed as shown to have a projecting ledge **16** that has threaded openings therein. A support **18** for the stationary contacts **20** preferably is formed of a molded insulating material. The stationary contacts **20** may consist of suitably headed screws, as shown, which ex-

tend upwardly through the support 18 to threadedly engage the wire connectors 24. The support 18 is secured to the ledge 16 by means of screws 22 which extend through suitably located openings in the support 18 and an insulating sheet 26 into the threaded openings in the ledge 16. The movable contacts 28 are resiliently carried by springs 30 on a contact carrier 32 which may be formed of insulating material. These movable contacts 28 are arranged to engage the stationary contacts 20 on the stationary contact support 18. The contact carrier 32 is securable to an output lever 34 of the mechanism 10 by means of a screw 36. When the start button 38 is depressed, the mechanism 10 will cause the output lever 34 to move upwardly with a snap action and move the contacts 28 into engagement with the contact 20. When the stop button 39 is depressed, the mechanism 10 will cause the output lever 34 and the contact carrier 32 which carries the movable contacts 38 to move out of engagement with the contacts 20 with a snap action. The device 10 may also be used with an overload device 12 which will be hereinafter described. When the overload device is suitably secured in position, and the current flow through the overload element shown in FIGS. 8–10 exceeds a predetermined value, a release of certain of the levers in the mechanism 10 will occur and the output lever 34 will be moved downwardly with a snap action. When the overload device is actuated, the parts of the actuating mechanism will be in a tripped position and the start and stop buttons will have their top surfaces in alignment as shown in FIG. 5.

In FIGS. 2 and 3 of the drawings the subassemblies of the actuating device 10 are shown wherein FIG. 2 shows the actuating lever assembly and FIG. 3 shows the toggle mechanism assembly. The output lever assembly includes a plate-like frame 40 having a flange 41. A master lever 42 is pivoted at 44 on the frame 40 which is slotted as at 46 to position the output lever 34. The flange 41 has notches therein to guide the stop lever assembly 48 and the start lever assembly 50 which are each pivoted on the master lever at pivots 52 and 54 respectively. The stop lever assembly 48 has a stem portion 56 which is slidable in one of the notches in the flange 41 and has a stop-reset button 39 secured thereto. The stop lever assembly 48 also is angled at 57 to provide a portion 58 which is connected to the pivot 52. Extending from the portion 58 are lugs 60 and 61, the purpose of which will be hereinafter described. The start lever assembly 50 has a stem portion 62 which is separated from the actuating portion 64 by an angled portion 66. The stem portion 62 has the start button 38 secured thereto and is slidable in the other notch in flange 41. The actuating portion 64 which extends in a plane that is parallel and spaced from the plane of the stem portion 62 is pivoted to master lever 42 at 54. The master lever 42 is provided with an extending lug which is slotted to provide a spring anchor 68, the purpose of which will be hereinafter set forth.

The toggle mechanism assembly shown in FIG. 3 includes a plate-like frame 70 having a flange 72, an actuating lever 74, a toggle link 76, a toggle lever 78, a pivot lever 80, and a pivot latch lever 82, each of which will be separately described.

The plate-like frame is provided with a slot 84 which cooperates with the slot 46 to position the output lever 34 when the assembly shown in FIGS. 2 and 3 are connected to each other by means of screws, not shown, which extend through openings 86 in plate 40 into the threaded posts 88 which are secured to plate 70.

The actuating lever 74 is provided with lever arms 90 and 92 which are angled as shown. The arm 90 has a hub portion 91 (see FIG. 7), which maintains the arm 90 spaced from the frame 70 and is pivoted on plate 70 at 94. The arm 92 is pivoted on the toggle link 76 at 96. Upstanding at the juncture of arms 90 and 92 is a pivot pin 98 which receives a slot in a lug 100 on the output lever 34.

The toggle link 76 comprises a pair of identical levers 102 and 103 which are secured by a pivot pin 104 on opposite sides of the arm 92 as in FIG. 7. The levers are shaped and have openings therein to journal a pin 106 which has its ends extending exterior to the levers 102 and 103 to provide a pivot axis for the toggle lever 78. The pin 106 also has a groove 108 intermediate its ends to provide an anchor for one end of the spring 110 which has its other end received in the spring anchor 68 in lever 42 when the subassemblies are secured together.

The toggle lever 78 essentially consists of a U-shaped part having a bight portion at 112 and a pair of parallel arms 114 and 116 extending therefrom. The arm 114 which is disposed adjacent the frame 70 has a lug 119 extending to be engaged by the pivot lever 80 as will hereinafter be explained. Each of the arms 114 and 116 are provided with oppositely extending extensions which incorporate points of pivot for the toggle lever 78. The extensions in arms 114 and 116 include slots 118 which are arranged to receive the extending portions of pin 106 to provide a pivot connection with toggle link 76. The other extensions on arms 114 and 116 are provided with U-shaped struck-out portions 120 which are arranged to be received in U-shaped notches 122 in pivot lever 80 to provide a point of pivot for toggle lever 78 on the pivot lever 80.

The pivot lever 80 is also formed of a U-shaped metal part having a bight portion 124 which connects arm portions 126 and 128. The arm portions 126 and 128 are provided with the U-shaped notches 122 which are located as shown to provide spaced points of pivots for toggle lever 78. Each of the arm portions 126 and 128 are provided with aligned openings 130 which are arranged to receive a pin 132. The pin has one end secured to frame 70 and has another end 131 (see FIG. 7) projecting from the arm portion 126. The portion 131 of pin 132 extending from the lever 126 is provided with a collar to maintain the pivot lever 80 on the frame 70 when the pin 132 is secured to frame 70. The portion 131 of the pin also extends to be received in a suitably located opening 134 in frame 40 to provide a two-point support for the pivot lever 80 when the subassemblies shown in FIGS. 2 and 3 are assembled as in FIG. 7. The arm 128 is provided with a downwardly extending lug 136 which is angled as shown in FIG. 7. The purpose of lug 136 will be hereinafter explained. The arm 128 also has a portion 138 engageable by the lug 119 and has a portion 140 extending to provide a point of securement for a pivot pin 142 which connects the pivot lever 80 to the latch lever 82.

The latch lever 82 has a main body portion 144 pivotally secured on one end to pivot pin 142. Extending from the portion 144 at right angles thereto is a flange 146 which is provided with a projecting lug 148. The flange 146 extends to be exposed through an opening 150 in frame 70 while the lug 148 extends to be exposed through opening 152 in frame 40. The lug and flange portions thus exposed by the openings 150 and 152 are provided for use with overload mechanisms which will be later explained in detail. The end of portion 144 remote from pivot pin 142 is provided with a ledge 154 which in the normal position of the device is hooked behind a roller 156 secured to frame 70 by a pin 158. Positioned adjacent the ledge 154 is a curved notch 159 which will also engage the roller when the latch lever 82 is moved to the tripped position as will be hereinafter explained. The latch lever is maintained in the normal untripped position by a leaf spring 160 which has one end coiled about the post 88 as shown and its other end in engagement with ledge 154. The intermediate portion of the spring 160 is in engagement with flange 72 of frame 70.

Before proceeding to an explanation of the above described device, the structural details of the output lever **34** will be set forth. The lever **34** is formed of a flat plate to have the lug **100** extending from one surface which lug is slotted to receive pivot pin **98**. The lever **34** may also be provided with ears **162** which will engage the frames **40** and **70** to act as stops to limit the travel of lever **34** downwardly to the Off position. The width of the lever is sufficient so portions thereof will be received in slots **46** and **84**. Extending from the opposite face of the lever **34** from which lug **100** extends is a latch means which comprises a flat metal part **163** having a notched end to straddle a lug **164** extending from lever **34**. The part **163** also has a lug **166** extending through an opening in lever **34** to provide a point of pivot for part **163** on lever **34**. Bearing against the part **163** and surrounding lug **164** is a coil spring **168** which is maintained under compression by the clip **170** secured to lug **164**. It is clear that the above arrangement of parts will permit the latch to rock on lever **34** against the bias of spring **168**. The part **163** also has a lug **172** adjacent its free end which lug will engage the post **88** as shown in FIG. 3.

As heretofore set forth, the device is assembled by joining the subassemblies shown in FIGS. 2 and 3 in position as shown in FIGS. 4–7. With the above parts in mind, the function of the device will now be described.

When the parts of the device are in the position shown in FIG. 4, the device will be in the actuated position which occurs when the start button **38** is depressed to cause the lever **34** to be moved to the extended or actuated position. If the right hand side of the sheet on which FIG. 4 is shown is considered as the bottom of FIGS. 4–6 then it will be noted that the lever **64** has been moved to cause the spring anchoring portion **68** to be moved to the right. This will have caused the toggle mechanism to trip and cause the pivots **120**, **106**, and **96** to be in substantial alignment causing the pivot **98** to move upwardly and thereby move the output lever upwardly.

When the parts of the device are in the position shown in FIG. 4 and the stop and reset button **39** is depressed, the spring anchoring portion **68** of the master lever **42** will be moved to the left, past the center line through pivots **106** and **120**. When this occurs, the toggle spring **110** will cause the toggle link **76** and toggle levers **78** to move to the position shown in FIG. 6 to shorten the toggle linkage. This will cause the actuating lever **76** to move on its pivot **94** and move the pin **98** downwardly to cause the retraction of the output lever **34**. In this connection it is to be noted that the lug **119** on the toggle lever **78** will also aid in the folding of the toggle when the lug engages a portion of the toggle lever **78** when the stop button **39** is actuated. The engagement of lug **61** on the stop stem with the toggle lever **78** will aid the toggle spring to fold the toggle lever and links to assure the opening of the contacts **20**.

When the start button **38** is depressed to move the parts from the position shown in FIG. 6 to the position shown in FIG. 4, the initial movement of the lever assembly **50** to the left will merely cause the toggle to be partly actuated without movement of lever **34**. This is accomplished by means of the latch **163**. During initial movement of the lever assembly **50**, the master lever **42** will be moved to the right so that the anchoring portion **68** of the spring will pass through the center line dictated by pivots **96** and **120**. As the anchor **68** passes over this center line, the pivot point **106** will be retained in the position shown in FIG. 6 and the spring will be stretched to store potential energy therein. When the lever **42** has almost reached the position shown in FIG. 4, the bent portion **66** of lever **50** will engage the part **163** to move the part **163** to the left as in FIG. 4, to release the engagement of lug **172** with post **38**. In this connection it is to be noted that the lever **163** will be pivoted against the bias of spring **168**. When the lug **172** is released from its engagement with the post **88**, the potential energy accumulated in spring **110** will be immediately released so that the toggle linkage will move to the position shown in FIG. 4 to cause the lever **74** to move the lever **34** to its actuated position.

It is to be noted that the device according to the present invention may be used with or without the overload devices which will be hereinafter described. If an overload device is attached to the device, upon occurrence of a predetermined condition, the overload device will cause the parts of the actuating mechanism to move to the position shown in FIG. 5 in a manner as will be hereinafter described.

When the start button **38** of the device is actuated to cause the output lever **34** to be moved to the position shown in FIG. 4, when the overload mechanism is actuated, a projection of the overload device which extends through one of the openings **150** or **152** will cause the latch lever **82** to be moved to the right from the position shown in FIGS. 4 and 6 to the position shown in FIG. 5. This actuation of the latch lever will cause the ledge portion **154** to move from its engagement with the roller **156** to permit the notched portion **159** to move into engagement with the roller. It is to be seen that when this occurs the pivot **142** will be moved upwardly, thereby causing the pivot lever **80** to be rotated on its pivot **132** to cause the pivot **120** to move downwardly to a retracted position. Simultaneously, as the above occurs, the pivot lever **80** will engage the lug **119** on the toggle lever **78** to cause the toggle linkage to be partly folded to the position shown in FIG. 5. It is to be noted that as the pivot **120** is moved downwardly and as the toggle linkage is partly folded, the toggle lever **78**, the toggle links **76** and the actuating lever will likewise be moved downwardly to cause the output lever **34** to be returned to the position shown in FIGS. 5 and 6 without completely folding the toggle as shown in FIG. 6. When the parts are in the position shown in FIG. 5, the actuation of the start button will have no effect upon the device as the lug **119** will maintain the toggle partly folded so when the master lever is moved to the position shown in FIG. 4, an increased tension on the spring **110** will more firmly maintain the pivot **120** in the position shown in FIG. 5. Thus the device cannot be actuated while it is in the tripped position.

The parts can be restored to the position shown in FIG. 6 or in the de-actuated position, when the stop-reset button **39** is depressed to move the lever assembly **48** to the left. Movement of lever assembly **48** to the left will cause lug **60** to engage lug **136** to rotate the pivot lever **80** clockwise on its pivot **132** to the position shown in FIG. 6. The movement of pivot lever **80** will cause the latch lever **82** to be moved downwardly to position ledge **154** behind roller **156** where it is held by the bias of spring **160**. When the parts are returned to the position in FIG. 6, further depression of the start button will cause an operational sequence above described.

The overload mechanism **12** connected to the device as in FIG. 1, is most clearly shown in FIGS. 8–10 of the drawings. The device mainly comprises a base **210**, a slider **212**, a condition responsive element **214** and a latch means including a lever **218**.

The condition responsive element **214** per se does not in itself constitute one of the features of the present invention and may be of the type disclosed in Patent 1,755,231, dated April 22, 1930, which is assigned to the assignee of the present invention. The condition responsive to element **214** has a ratchet wheel **220** carried on a shaft. The shaft is normally held in a fixed position in a bearing **222** by fusible solder which when heated in response to excess current passing through a heater element **224** becomes liquid to permit the shaft and wheel **220** to rotate. The condition responsive element is secured to the base **210** by screws **226** which are also used to secure the connectors for terminal ends of wires.

The base 210 preferably is formed of suitable molded insulated material and has an arcuate opening 227 to receive the bearing 222 portion of the condition responsive device 214. The bores 228 are arranged to accommodate the screws 230 to secure the overload mechanism 12 to the outer faces of frames 40 and/or 70 so the face 232 of base 210 is positioned against these frames.

The face 232 has a rectangular opening therein which has a bottom wall 234, side walls 236 and 238 and a rear wall 240. Extending upwardly from the bottom wall 234 are projections 242 which position springs 244. The rear wall 240 has an opening 246 therein to provide a pivot bearing for a circular projection 248 extending from 250 which forms a portion of the latch means.

The slider 212 is generally rectangular and preferably formed of a suitable molded insulating material. The slider 212 is sized to be slidably received in the opening presented between the side walls 236 and 238. The face 252 which is positioned adjacent the frames 40 and/or 70, is substantially flat and flush with the face 232 when the slider 212 is positioned in the base 210. The face 252 is provided with notches 254 and 256 providing seats for springs 244. The face 252 also has a rectangular boss 258 projecting therefrom which extends through openings 150 and/or 152 when the overload mechanism 12 is secured to frames 40 and/or 70 respectively.

The face 260 of slider 212 positioned adjacent the rear wall 240 is provided with a rectangular recess 259 wherein a pair of spaced bosses are located. These bosses 261 are arranged to embrace a circular projection 262 on lever 250. The face 260 is also provided with raised portions 264 which slidingly engage the rear wall 240 to facilitate the sliding engagement between the slider 212 and the base 210.

The latch means includes the lever 218 and the lever 250. The lever 250 is preferably formed of a molded insulating material to have the projection 248 on one end, an opening which receives a rivet 266 that pivotally secures the lever 218 to the other end of the lever 250, and the projection 262 which is positioned intermediate the projection 248 and rivet 266.

The lever 218 has a flange portion, which is struck out to provide the latch tooth 268, is arranged to engage the teeth on the ratchet wheel 220. A spring 269 coiled about lug 262 has its respective ends secured secured to the rivet 266 and the lever 218 to constantly urge the lever 218 to the position shown in FIG. 10.

With the above parts in mind, the operation of the overload device 12 will now be explained.

When the overload device 12 is secured to either or both sides of the actuating mechanism 10 by the screws 230, the projections 258 will extend through the openings 150 and 152. When the condition responsive device 12 is in the unlatched or tripped position, the projection 258 will be adjacent the left side of notch 150 where it will engage the lever 148 to move the toggle mechanism to the trip position as heretofore described. When the device is to be reset, that is, when the latch means including lever 218, is to be moved to the latch position with respect to the ratchet wheel 220, the stop-reset button 39 is depressed and the downwardly extending projections 270 formed on opposite sides of the button 39 are moved to engage the top surface 272 of the slider 212 and move the slider downwardly against the force of springs 244. The downward movement of the slider, because of the connection afforded by the bosses 261 and the circular projection 262, will cause the lever 250 to be moved downwardly on its pivot bearing 248. This downward movement of lever 250 will in turn cause the lever 218 to move downwardly to a position wherein the ratchet tooth 268 engages one of the teeth on the ratchet wheel 220. In this connection it is to be noted that the lever 250 is pivoted at one of its ends in opening 246. The point of application of force moving the lever downwardly, is impressed on the projection 262 which is located intermediate the rivet 266 which provides a pivot for lever 218 and the projection 248. This constitutes a third class lever arrangement to cause a differential movement between the lever 218 and the slider 212. Thus the distance travelled by the slider 212 during the actuation of the movement to the reset position will appear as an increased movement of lever 218 to cause the latching between the tooth 268 and the ratchet wheel 220 to occur with a minimum travel of the slider 212.

When the current flow through the heater unit 224 exceeds a predetermined value, the solder in hub 222 will melt and the ratchet wheel will be free to rotate, thereby releasing the latch lever 218 to permit the slider 212 to be moved upwardly because of the force exerted by the springs 244. The upward movement of the slider will cause the boss 258 to move the lever 148 to the left as in FIG. 3 to permit the toggle mechanism shown in FIGS. 2 and 3 to move to the trip position.

One of the features of the present invention is that in the event the condition responsive element 214 is removed from the base 210, the lever 218 will be constantly urged upwardly or toward the tripped position. Thus the toggle mechanism of the device 10 will be constantly tripped when an overload device 12 is mounted on mechanism 10 and one of the condition responsive elements 214 are removed. However, in the event that the overload mechanism 12 is completely removed, the device 10 can be actuated to the start and stop positions without movement to the trip position. This means that when the overload mechanisms 12 are attached to the mechanism 10, the device will be trip-free and removal of the condition responsive element 214 will automatically cause the device 10 to actuate the contacts 20 to the open circuit position.

While certain preferred embodiments of the invention have been specifically disclosed, it is understood that the invention is not limited thereto, as many variations will be readily apparent to those skilled in the art and the invention is to be given its broadest possible interpretation within the terms of the following claims.

What is claimed is:

1. In a device of the character described, the combination comprising; a longitudinally movable output lever, a pivot normally maintained in a predetermined position, a foldable toggle mechanism having a plurality of interconnected levers including a lever connected with the output lever and a lever pivoted on the pivot, said toggle levers being arranged for longitudinally moving the output lever to a retracted position when the levers are in a folded position and for moving the output lever to an extended position where the levers are in an extended position, a first reciprocal means for engaging and actuating the toggle mechanism for moving the levers thereof to a folded position, a second reciprocal means for actuating the toggle mechanism for moving the levers thereof to the extended position, and means for releasing the pivot and bodily moving the levers of the toggle mechanism and simultaneously moving the levers to a partly folded toggle position for retracting the output lever while said means has moved the toggle levers to the extended position.

2. The combination as set forth in claim 1 wherein a single spring supplies the force for moving the toggle levers and the first and second reciprocal means and for moving the pivot to a retracted position.

3. The combination as set forth in claim 1 wherein the means for moving the toggle mechanism levers to the extended and folded positions includes a pair of buttons which are movable to achieve the functions indicated and wherein the buttons are aligned when the pivot is retracted and the toggle levers are partly folded.

4. The combination as set forth in claim 1 wherein a single spring forces the lever into the pivot and supplies the force for actuating the toggle and retracting the pivot and wherein the means for moving the toggle mechanism

levers to the extended and folded positions includes a pair of levers each having an actuating button on one end and connected with an actuating lever on the other ends said buttons and levers being arranged so the buttons are aligned when the pivot is moved by the spring to the retracted position.

5. The combination as recited in claim 4 wherein the means for normally maintaining the pivot in a predetermined position includes a two position latch member.

6. The combination as recited in claim 5 wherein the two position latch member is engageable by a spring biased lever which is biased to release the two position latch member and wherein a condition responsive device operatively maintains the spring biased lever in a non releasing position with the two position latch member.

7. In a device of the character described, the combination comprising; a pair of subassemblies, each including an L-shaped side plate having an elongated notch therein, one of said subassemblies including a plurality of actuating levers with one of said levers having a spring anchoring portion thereon and being pivotally mounted on the side plate of its subassembly and independent of the side plate of the other subassembly and the remaining levers being pivotally carried on the said one lever and guided by the side plate and wherein the other such assembly has a foldable toggle mechanism mounted on the side plate of the other subassembly independently of the side plate of the first mentioned subassembly, said toggle mechanism having a spring anchor portion and an actuating lever portion for moving an output lever which is guided in the notches in both of the side plates when the subassemblies are connected to each other with a spring secured in the anchors of the subassemblies.

8. In a manual starter, the combination comprising; a support plate, a stationary contact support mounted on the plate, a yoke carrying movable contacts arranged to engage the stationary contacts carried on the support a toggle mechanism; said toggle mechanism including; an output lever connected to the yoke, a foldable toggle including a pair of levers pivotally connected end to end with one of said levers having its other end pivotally connected to the output lever and the other of said pair of levers having its other end positioned in a pivot that is positionable in both an actuating and a tripped position, a pair of reciprocal input levers for actuating the toggle mechanism and moving the output lever with a reciprocal motion, a single extensible spring connected to the toggle mechanism for causing the reciprocal motion to occur with a snap action, releasable means for normally maintaining the pivot in the actuating position, a second means for releasing the releasable means to permit the spring to move the pivot to the tripped position, and a condition responsive means for normally maintaining the second means in a non-releasing position.

9. The combination as recited in claim 8 wherein the toggle mechanism is positioned between a pair of side plates and the releasable means and the second means are parts of overload devices mounted on either of the side plates.

10. The combination as recited in claim 9 wherein the releasable means of the overload device extends through an opening in the side plate to which the overload device is secured and wherein the overload device includes a base, a slider movable on the base, a condition responsive element having a ratchet wheel and a third class lever means movable by the slider and pivoted on the base and arranged to engage the ratchet wheel.

11. The combination as recited in claim 9 wherein one of the input levers engages the releasable means for resetting the overload device.

12. In a device of the character described, the combination comprising; a pair of side plates adapted to be connected to each other to provide an enclosure, a spring actuated foldable toggle mechanism pivotally and solely carried by one of the plates, a two button actuating mechanism for the toggle mechanism solely carried by the other of the plates, a single spring interconnecting said mechanisms for actuating the toggle mechanisms in response to movement of an actuating member and a single output lever slidably positioned between both plates when said plates are assembled, said lever being connected to the toggle mechanism and arranged to be moved reciprocally with a snap action by the toggle mechanism when the toggle mechanism is actuated by either of the buttons of the actuating mechanism.

13. The combination as recited in claim 12 wherein the spring is positioned between the actuating mechanism and the toggle mechanism and the output lever carries a latch which is released after the spring has been stretched by the actuating lever.

14. The combination as recited in claim 12 wherein the toggle mechanism is supported on a movable pivot and the pivot is normally held in a fixed position by a latch and is moved to a retracted position by the spring when the latch is released.

15. The combination as recited in claim 14 wherein the actuating mechanism includes a pair of depressible buttons, the tops of which are aligned when the pivot is retracted.

16. The combination as recited in claim 15 wherein an overload device which may be mounted to either side plate is arranged to release the latch.

17. An overload device comprising; a base, a slider movable in a recess in the base, resilient means positioned in the recess and arranged for constantly urging the slider in one direction in the recess, a condition responsive means having a normally non-rotatable ratchet wheel which is rendered rotatable in response to a predetermined condition of said means, a lever having one end pivoted on the base and a midportion pivoted on the slider, a locking lever movable axially with the slider and having one end pivotally mounted to the other end of the lever and having a portion intermediate its ends engageable with the ratchet wheel for preventing movement of the slider by the resilient means during periods when the ratchet wheel is non-rotatable and permitting movement of the slider when the ratchet wheel rotates and a second portion at its other end exposed to the exterior of the device for manually releasing the slider independently of the ratchet wheel.

References Cited in the file of this patent

UNITED STATES PATENTS

1,045,773	Cole	Nov. 26, 1912
1,292,140	Sutherland	Jan. 21, 1919
1,755,231	Valkenberg	Apr. 22, 1930
2,129,592	Schleicher	Sept. 6, 1938
2,134,593	Wulsten	Oct. 25, 1938
2,175,762	Raney	Oct. 10, 1939
2,197,200	Werner	Apr. 16, 1940
2,222,209	Werner	Nov. 19, 1940
2,223,531	Putnam	Dec. 3, 1940
2,248,387	Rosing	July 8, 1941
2,294,838	Dorfman	Sept. 1, 1942
2,306,244	Butler	Dec. 22, 1942
2,473,901	Pierce	June 21, 1942