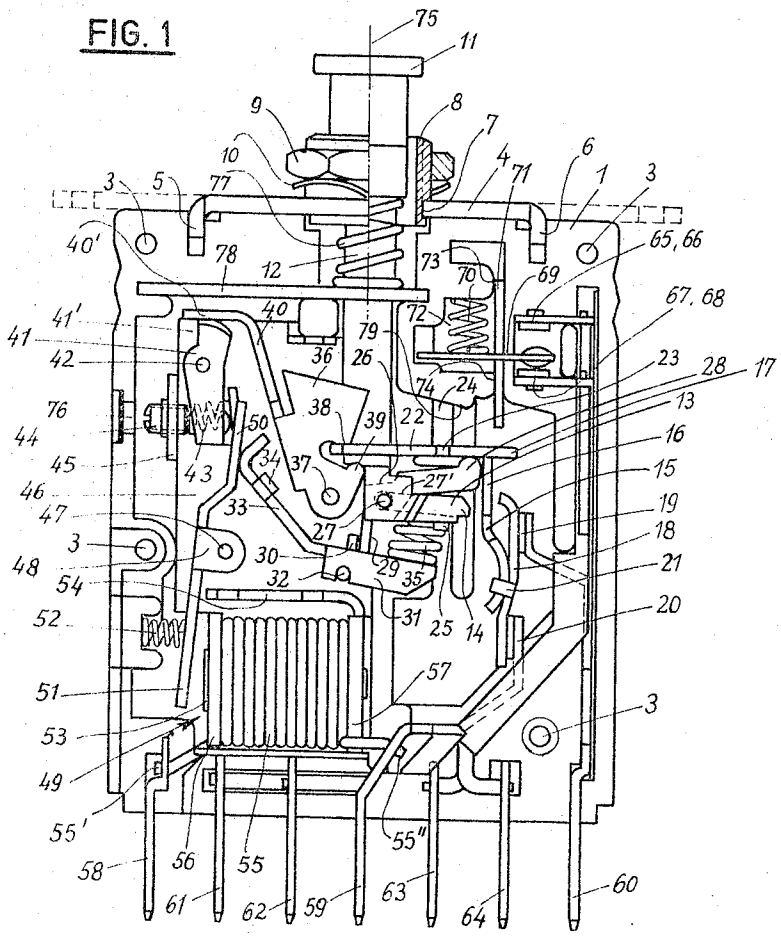
Feb. 28, 1967 J. ELLENBERGER 3,307,122

HIGH-SPEED PUSHBUTTON-CONTROLLED OVERLOAD CIRCUIT BREAKER

Filed June 28, 1965

3 Sheets-Sheet 1

FIG. 1



INVENTOR:

JAKOB ELLENBERGER

BY:

McGlew and Toren

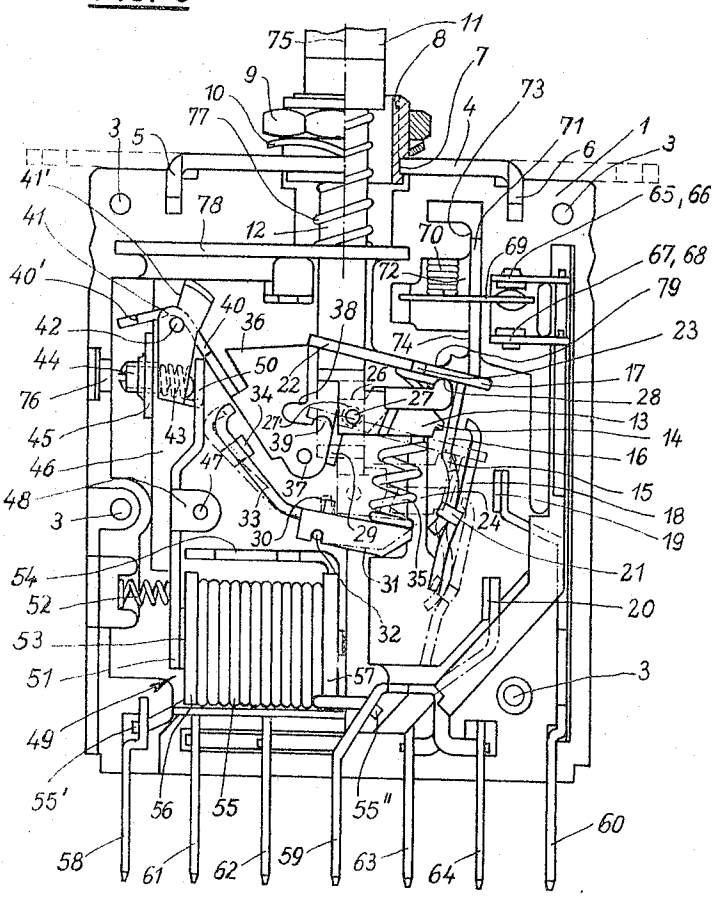
ATTORNEYS

Feb. 28, 1967 J. ELLENBERGER 3,307,122

HIGH-SPEED PUSHBUTTON-CONTROLLED OVERLOAD CIRCUIT BREAKER

Filed June 28, 1965 3 Sheets-Sheet 2

FIG. 3



INVENTOR:

JAKOB ELLENBERGER

By:

McGlew and Tuttle

ATTORNEYS

Feb. 28, 1967 J. ELLENBERGER 3,307,122

HIGH-SPEED PUSHBUTTON-CONTROLLED OVERLOAD CIRCUIT BREAKER

Filed June 28, 1965 3 Sheets-Sheet 3

FIG. 2

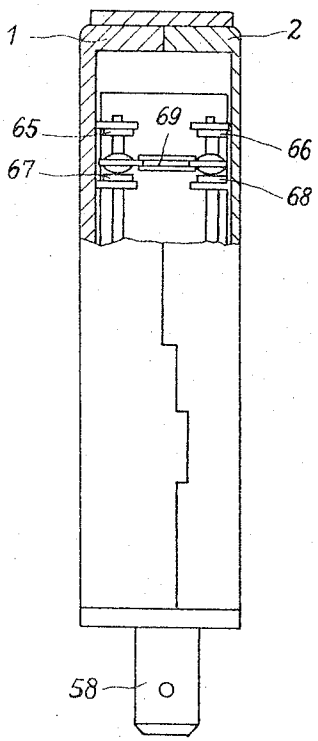
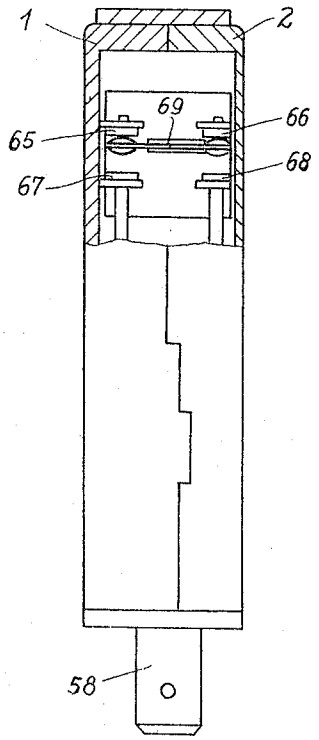


FIG. 4



INVENTOR:

JAKOB ELLENBERGER

By: McGlew and Toren

ATTORNEYS

United States Patent Office 3,307,122
Patented Feb. 28, 1967

3,307,122

HIGH-SPEED PUSHBUTTON-CONTROLLED OVERLOAD CIRCUIT BREAKER

Jakob Ellenberger, Altdorf, near Nurnberg, Germany, assignor to Ellenberger & Poensgen G.m.b.H., Altdorf, near Nurnberg, a firm of Germany

Filed June 28, 1965, Ser. No. 467,630
Claims priority, application Germany, June 30, 1964, E 27,313
8 Claims. (Cl. 335—17)

The present invention relates to a pushbutton-controlled overload circuit breaker, especially for the protection of semiconductors, for example, transistors, which is provided with a trip-free release, with an electromagnet for releasing it electromagnetically, and with a slidable as well as pivotable contact bridge. When the pushbutton is being depressed so as to switch the circuit breaker to its on position, a detent on a control rod which is rigidly secured to the pushbutton engages with a stop on the contact bridge and thereby takes along the latter, while when the circuit breaker is being switched off, this contact bridge engages with an inclined surface and is thereby pivoted to an inclined poistion in which the stop of this bridge is located within the path of movement of the detent on the control rod. The overload circuit breaker is further provided with signal contacts for indicating its on and off positions.

There is an overload circuit breaker of the above-mentioned type already known in which the contact bridge forms an angular lever which, when moved to its on position, is held in that position by a detent on a bimetal strip which is provided for the thermal release of the circuit breaker. The release of this circuit breaker occurs relatively slowly. This is due to the fact that, when thermally released, the bimetal strip is bent rather slowly and, when released electromagnetically, this bimetal strip must also be bent by the armature of the electromagnet. Furthermore, the control element for the signal contacts of this circuit breaker is secured to the control rod which is rigidly connected to the pushbutton, so that when a trip-free release occurs, that is, when the pushbutton is held down or is stuck in its on position, the signal circuit will indicate that the contact bridge is in its on position, although actually it has already been moved to its off position.

It is an object of the present invention to provide an overload circuit breaker of the type as first described above which overcomes the above-mentioned disadvantages and is capable of switching off within a few milliseconds if a relatively small excess current occurs, for example, one amounting to 1.1 to 1.2 times the rated current. Another object of the invention is to provide this circuit breaker of such a design that it may be built of such small dimensions that it may be installed and electrically connected in a very simple manner at any desired point of the apparatus which it is intended to protect. Another object of the invention is to design this circuit breaker so that the off position of its contact bridge will be correctly indicated even if a trip-free release has occurred.

For attaining these objects, the invention provides that the contact bridge is secured to one arm of an angular bracket which is provided with the mentioned stop and to which the contact bridge is preferably connected in a manner so as to be slightly pivotable thereon. This bracket carrying the contact bridge is both pivotably and slidably mounted and, when the circuit breaker is being switched off, its other arm is pressed against the inclined surface within the housing. This other arm of the bracket is adapted to act upon the control element for the signal contacts, which controlled element is preferably provided in the form of an auxiliary contact bridge. When

the main contact bridge is in its on position, this other bracket arm is arrested in a fixed position by a locking pawl which, in its locking position, engages a locking lever at a point located radially to the pivot axis of the latter. This locking lever is pivotable by the armature of the electromagnet which serves as a quick-release of the circuit breaker. By mounting the main contact bridge on one arm of the angular bracket, the advantage is attained according to the invention that the fixed contacts which are to be connected to each other by this contact bridge may be mounted at one side of the switch mechanism so that the movable parts thereof may be easily inspected. Since the locking pawl engages the locking lever in a direction radially to the pivot axis of the latter, the further advantage is attained that a very small force will suffice to pivot this locking lever to its inactive position and thereby to effect the release of the circuit breaker. This small force which the electromagnet has to produce only needs to amount to 20*g*. The electromagnet which effects a very quick release of the circuit breaker may therefore be made of a relatively small size which, in turn, means that the circuit breaker according to the invention may likewise be made of a small size. The release of the circuit breaker occurs at an excess current which is approximately 1.1 to 1.2 times the rated current. If the excess current amounts to 1.2 times the rated current, the release will occur within 20 milliseconds, and if it amounts to twice the rated current, the release will occur within 5 milliseconds. It is therefore evident that, if the circuit breaker according to the invention is employed for protecting semiconductors, for example, transistors, they will be safely protected from being heated excessively. The characteristic of the overload circuit breaker according to the invention corresponds to that of the known types of high-speed safety fuses. It has, however, the considerable advantage over these fuses that it does not react to transient peaks which last for a period of less than 5 milliseconds and which wear out these high-speed fuses within a short time. The electromagnet of the circuit breaker according to the invention is designed so that its transit time permits very short transient peaks to be taken up without causing undesired switch operations. The new circuit breaker also has the advantage that the operating positions of the main contact bridge will at all times be correctly indicated, even if a trip-free release occurs, since the control element of the signal contacts is acted upon by the bracket which carries this contact bridge.

In order to facilitate the pivoting movements of the armature of the electromagnet, this armature is provided, in a manner known as such, in the form of a two-armed lever which is pivotable approximately at its center of gravity. Another feature of the invention consists in providing the circuit breaker with a pair of springs which act upon both arms of the armature of the magnet in order to render the circuit breaker as insensitive as possible to shocks, impacts, and vibrations so as to permit its use especially in vehicles and for preventing the armature from vibrating if the magnet is operated with alternating current. These springs insure that the torques which occur in the two arms of the armature will counteract each other. One of these springs maintains the locking lever at all times in engagement with one of the arms of the armature so as to render this lever insensitive to shocks and vibrations. The tension of this spring may be varied by means of a setscrew so as to permit the circuit breaker to be adjusted so as to compensate for differences in mechanical friction and magnetic influences.

In order to simplify the manufacture of the circuit breaker, the contact bridge may be stamped of sheet metal and provided substantially at the center between its two contact points with a fingerlike projection on each lateral

side thereof. These two fingerlike projections are bent around the associated arm of the bracket in a manner so as to secure the contact bridge thereto and to permit the contact bridge to pivot slightly relative to the bracket. This small pivotability has the advantage that, when the circuit breaker is switched on, the contact bridge will adjust itself automatically to the position of the associated fixed contacts so as to insure that the contact bridge will always properly engage with these contacts at a uniform contact pressure. For accurately guiding the bracket which carries the contact bridge, and for also guiding the projecting detent of the control rod, the arm of this bracket which faces the locking pawl and the detent on the control rod may be provided with opposite projections which engage into the same guide grooves in the walls of the housing.

Similarly to the known circuit breaker as previously described, the overload circuit breaker according to the invention is also provided with a compression spring for effecting its trip-free release. According to the invention, however, one end of this spring acts upon the arm of the contact-bridge bracket which faces the locking pawl, while its other end acts upon a release lever which is pivotable to a limited extent and acts upon the armature. If therefore the pushbutton is held in its on position either by being stuck for some reason or by being held down by hand, and if then the locking pawl is released because of the pivoting of the armature and the locking lever, the bracket and the contact bridge thereon will be moved by this compression spring to the off position.

Another feature of the invention consists in designing the circuit breaker so as to permit the pushbutton for switching on the circuit breaker also to be used for manually switching it off. For this purpose, the invention provides the release lever with an arm on which engages one arm of an angular lever which is pivotably mounted on the lower end of the control rod and the other arm of which engages the arm of the contact-bridge bracket which is adapted to be held by the locking pawl. This engagement occurs under the action of a spring, preferably a torsion spring which is mounted on the pivot pin of the angular lever. If the circuit breaker is to be manually released, the pushbutton is pulled out for a certain distance from the housing of the circuit breaker. Since at this time the contact-bridge bracket is held in a fixed position by the locking pawl, it remains in its on position. However, the angular lever which is pivotably mounted on the lower end of the control rod will then be pivoted so that its other arm pivots the release lever which, in turn, pivots the armature and thereby also causes the locking lever to be pivoted so as to disengage the locking pawl so that the latter will then pivot to its inactive position and thereby release the bracket and the contact bridge thereon, which latter will then be moved by the compression spring to its off position.

In order to simplify the assembly of the circuit breaker, the electromagnet, the setscrew for adjusting the spring which acts upon the armature, and the pivot pins for the armature, the locking lever, the locking pawl, and the release lever are mounted on the walls of a casing of a non-magnetic or diamagnetic metal which, in turn, is mounted in the housing of the circuit breaker which consists of insulating material and is divided into halves which may be secured to each other after all of the parts of the circuit breaker are installed therein. On the outer side of this housing from which the pushbutton projects, there is secured a metal bar which is connected, preferably riveted, to a bushing for guiding the pushbutton. The two ends of this metal bar are bent over at an angle and are inserted into corresponding recesses in the two parts of the housing so as to lock the bar in a fixed position to the housing. The bushing may be provided with an external screw thread and with nuts for mounting the circuit breaker on a control panel or any other suitable

support. Either in addition to or instead of using the bushing as a mounting element for the circuit breaker, it is also possible to employ the metal bar for this purpose by extending its two ends laterally beyond the housing and by screwing them to a control panel or other support.

In order to provide still further possibilities of mounting the circuit breaker and for also electrically connecting it in different manners, the outer ends of its terminal strips are made in the form of plug pins. These plug pins may therefore be used for electrically connecting the circuit breaker and, if desired, also for mounting it. The terminal strip which is connected to the coil of the electromagnet and to one main contact is mounted at the center of the side of the housing opposite to the pushbutton, while two terminal strips which are connected to the other fixed contact and to the other end of the coil, respectively, are mounted at both sides of the central strip. Between these central and outer terminal strips and symmetrically to the central strip, the housing is provided with two further pairs of terminal strips which are connected to the auxiliary contacts. All of the terminal strips are spaced at equal distances from each other. This arrangement of the terminal strips has the advantage that the circuit breaker according to the invention may be plugged in two different positions, which are turned at an angle of 180° to each other about the central longitudinal or plug-in axis of the circuit breaker, into the plug sockets.

These and numerous additional features and advantages of the present invention will become further apparent from the following detailed description which is to be read with reference to the accompanying drawings, in which—

FIGURE 1 shows an elevation of the inside of an overload circuit breaker according to the invention in its on position, after one half of the housing has been removed;

FIGURE 2 shows the circuit breaker as seen from the left side of FIGURE 1 with its housing partly in section along a vertical plane in front of the auxiliary contact bridge;

FIGURE 3 shows the same circuit breaker as shown in FIGURE 1, but in its off position; while

FIGURE 4 shows a view similar to FIGURE 2, but with the auxiliary contact bridge in a different operating position.

As illustrated in the drawings, the overload circuit breaker according to the invention comprises a housing which is divided into two halves **1** and **2** each of insulating material and which may be connected to each other by means of rivets, preferably hollow rivets, which are inserted into bores **3**. The two halves of the housing are provided with corresponding recesses into which the two arms **5** and **6** of a metal bar **4** are inserted in a manner so that, after the two parts **1** and **2** of the housing are connected to each other, this metal bar **4** can no longer be withdrawn in the upward direction, as seen in FIGURE 1. Bar **4** is provided with a bore **7** into which is inserted a threaded bushing **8** which is riveted at its lower end to the bar **4**, while its upper end carries a nut **9** and, underneath the latter, a corrugated spring washer **10**. Sleeve **8**, nut **9**, and washer **10** serve for securing the circuit breaker in the particular place where it is to be installed. Either instead of or in addition to being provided with the two arms **5** and **6**, the metal bar **4** may also be extended at both ends beyond the housing **1**, **2** so as to serve as a mounting element. In such a case, the bushing **8** does not need to be threaded and the nut **9** and the washer **10** may be omitted.

Bushing **8** surrounds a pushbutton **11** which is integrally connected to a control rod **12**, of insulating material, which is provided on its lower end with a laterally projecting part **13** which has a detent **14** thereon which is adapted to engage into an aperture **15** in one arm **16** of an angular bracket **17** which carries a contact bridge **18**.

Near the center between its two contact points which, in the on position of the contact bridge 18, as shown in FIGURE 1, are in engagement with the two fixed contacts 19 and 20, this bridge is provided on each side with a fingerlike projection 21 which is bent around the bracket arm 16. This part of the arm 16 and also of the contact bridge 18 is formed with a curved shape so that the contact bridge 18 can carry out a limited rolling or pivoting motion on the arm 166 in the clockwise or counterclockwise direction. This small pivotability of the contact bridge 18 insures that, when it is moved to the on position, it will always make a proper connection with the two fixed contacts 19 and 20 and engage the latter at a uniform contact pressure.

The other arm 22 of the bracket 17 has on its opposite sides a pair of projections 23 which engage into corresponding guiding grooves 24 in the two parts 1 and 2 of the housing. The projecting part 13 on the lower end of the control rod 12 is likewise provided with lateral projections 25 which engage into the guiding grooves 24.

The lower end of the control rod 12 carries on the projecting part 13 an angular lever 26 which is pivotably mounted thereon by a pin 27. Under the action of a torsion spring 27' which is mounted on the pivot pin 27, the arm 28 of lever 26 engages the arm 22 of bracket 17, while the other arm 29 of this lever engages a stop projection 30 on a release lever 31 the lower side of which is provided with a recess to permit the lever to be fitted from above over its pivot pin 32. The arm 33 of this lever 31 engages a fixed stop 34. The other arm of lever 31 carries a compression spring 35, the upper end of which acts upon the lower side of the arm 22 of the contact-bridge bracket 17. This compression spring 35 permits the trip-free release of the circuit breaker.

When the circuit breaker is switched on and is thus in the position as shown in FIGURE 1, the contact-bridge bracket 17 is held in a fixed position by a locking pawl 36 which is pivotably mounted on a pin 37 and the detent 38 of which engages the left end of the arm 22 of bracket 17. Pawl 36 is further provided with a projection 39 which is pressed downwardly by the arm 22 of bracket 17 when the circuit breaker is being switched on, so that the pawl 36 is thereby pivoted in the clockwise direction to the locking position as shown in FIGURE 1. Pawl 36 has an arm 40 which rests on a locking lever 41 at a point which is located radially to the pivot pin 42 of this lever. This locking lever 41 is acted upon by a compression spring 43, the tension of which is adjustable by a set-screw 44 which is screwed into a part 45 of a metallic casing 46 and may be reached by a screw driver through an opening 76 in the housing 1, 2. Casing 46 may consist of brass, and has two parallel walls of which only the wall 46 is shown in which the pivot pins 32, 37, and 42, of the release lever 31, of the locking pawl 36, and of the locking lever 41, respectively, are mounted. These casing walls further carry a pivot pin 47 on which is pivotably mounted the armature 48 of an electromagnet 49 which is made in the form of a two-armed lever. Arm 50 of this armature 48 engages the locking lever 41, while its other arm 51 is acted upon by a compression spring 52. The electromagnet 49 further comprises a magnet core 53, a magnet yoke 54, and a magnet coil 55. The magnet core 53 is mounted in transverse parts 56 and 57 of the metallic casing 46, and its right end is riveted together with the casing part 57 and the magnet yoke 54. The parts 48, 53, and 54 consist of soft iron. When the armature 48 is in its attracted position, as shown in FIGURE 3, the magnetic circuit of the magnet core 53 and the magnet yoke 54 is closed almost entirely by the armature arm 51, except for small air gaps.

One end 55' of the magnet coil 55 is electrically connected to a terminal strip 58, while its other end 55'' is electrically connected, for example, soldered or welded, to a central terminal strip 59 which is also connected to the fixed contact 20. The other fixed contact 19 is connected to a terminal strip 60. The two terminal strips 58 and 60 are equally spaced from the central terminal strip 59. Between the terminal strips 58, 59, and 60 there are two further pairs of terminal strips 61, 62 and 63, 64. The terminals 61 and 64 are electrically connected to a pair of auxiliary contacts 65 and 66, while the terminals 62 and 63 are connected to another pair of auxiliary contacts 67 and 68. The auxiliary contacts 65, 66 and 67, 68 of the two pairs may be interconnected by an auxiliary contact bridge 69. When the circuit breaker is in the position as shown in FIGURES 1 and 2, the auxiliary contacts 67 and 68 are connected to each other by the contact bridge 69 which is held in this position by a compression spring 70. When the circuit breaker is in its off position, as shown in FIGURE 3, the arm 22 of bracket 17 presses the auxiliary contact bridge 69 against the auxiliary contacts 65 and 66. Contact bridge 69 is secured to a slide member 71 which is slidably guided within a corresponding recess 72 in each housing parts 1 and 2. The housing projections 73 and 74 project into the recess 72 and serve as abutments for the slide member 71. The compression spring 70 is likewise inserted into the recess 72 and it acts at one end upon the projection 73 and at the other end upon the auxiliary contact bridge 69.

The outer ends of all of the terminal strips 58 to 64 are made in the form of plug pins. The terminal strips 61, 62 and 63, 64 are disposed symmetrically at both sides of the central terminal strip 59, and all terminal strips are preferably spaced at equal distances from each other. This permits the circuit breaker to be plugged into corresponding plug sockets of a socket strip either in the position as shown in FIGURE 1 or in the reverse position in which the circuit breaker is turned 180° about its central axis 75.

The manner of operation of the overload circuit breaker as just described is as follows:

If an excess current of a strength of 1.1 to 1.2 times the rated current occurs when the circuit breaker is in its on position, as illustrated in FIGURE 1, the electromagnet 49 pulls up the armature 48 which then pivots the locking lever 41 in the clockwise direction so that the upper end of the latter will slide for a short distance along the lower side of the arm 40 of the locking pawl 36 until the edge 41' of pawl 41 reaches the inner edge 40' of a slot in the arm 40 of pawl 36 so that the arm 40 of the locking pawl 36 will then be released from the locking lever 41. This immediately permits the locking pawl 36 to pivot in the counterclockwise direction over the locking lever 41 as the result of the upward pressure of the bracket arm 22 against the detent 38, until the arm 40 of pawl 36 engages the pivot pin 42 of the locking lever 41, as illustrated in FIGURE 3, and the end of arm 22 slides free of the detent 38. This occurs under the combined action of the compression spring 35 and the release spring 77 which is mounted on the upper part of the control rod 12 and acts at one end upon the pushbutton 11 and at its other end upon an insulating plate 78 which is inserted into the housing 1, 2. Near the end of this upward movement of the control rod 12 and the bracket 17, the arm 22 of the bracket engages an inclined surface 79. When the circuit breaker is in its off position as shown in FIGURE 3, the detent 14 on the projecting part 13 of the control rod is located within the path of movement of the lower edge of the aperture 15 in the arm 16 of bracket 17 so that, when the circuit breaker is again switched on, the detent 14 will engage with this lower edge and take along the bracket 17 and move the same, together with the contact bridge 18, downwardly.

The circuit breaker as illustrated may also be switched off by hand. This may be done by pulling the pushbutton 11 for a certain distance out of threaded bushing 8. The arm 28 of the angular lever 26 then presses against the lower side of the arm 22 of bracket 17 so that the lever

26 is pivoted about its axis 27 and its arm 29 is thereby pressed against the projection 30 on the release lever 31 and the latter is pivoted in the counterclockwise direction against the action of the compresion spring 35 so that the armature 48 will be pivoted which, in turn, pivots the locking lever 41 in the clockwise direction until its left edge 41' passes beyond the edge 40' of the slot in the arm 40 so that the latter can then pivot downwardly to the position as shown in FIGURE 3 and the circuit breaker will thus be switched off in the same manner as previously described.

When the contact bridge 18 is in its on position as shown in FIGURE 1, the compression spring 70 presses the auxiliary contact bridge 69 against the pair of contacts 67 and 68, while in the off position as shown in FIGURE 3, the arm 22 of bracket 17 presses the slide member 71 and the auxiliary contact bridge 69 thereon, against the action of spring 70, against the pair of auxiliary contacts 65 and 66. The circuit of the terminal strips 61, 62 and 63, 64 for the auxiliary contacts 65, 66 and 67, 68 may be connected to optical or acoustical means for indicating whether the circuit breaker is in its on or off position.

When the pushbutton 11 is being depressed for switching on the circuit breaker, the detent 14 on the projecting part 13 of the control rod engages into the aperture 15 in the bracket 17 and takes the latter along together with the contact bridge 18. The left end of the arm 22, as shown in FIGURE 3, then presses against the projection 39 and thereby pivots the pawl 36 in the clockwise direction. At the same time, the compression spring 35 is also compressed. When the pushbutton 11 is fully depressed into the housing 1, 2, the parts which are connected to the control rod 12 will be in the position as indicated in dot-and-dash lines in FIGURE 3. When the finger is taken off the pushbutton 11, the left end of the arm 22 of bracket 17 engages the detent 38 of pawl 36 and the arm 40 of this pawl is thereby moved into engagement with the locking lever 41. As soon as the bracket 17 is then released from the detent 14, the compression spring 35 pivots the bracket 17 in the counterclockwise direction and thereby moves the contact bridge 18 rapidly into engagement with the fixed contacts 19 and 20. The circuit breaker is thus switched on with a snap action. It is also switched off with a snap action by the combined action of the release spring 77 and the compression spring 35, and at a trip-free release it is switched off by the compression spring 35.

When the circuit breaker is switched on, there is no connection between the pushbutton 11 or the control rod 12 and the bracket 17 or the contact bridge 18. Therefore, when the pushbutton 11 is being depressed when the circuit breaker is already in the on position, this position cannot be changed and the trip-free release, which is effected by the compression spring 35, will therefore not be affected by any actuation of the pushbutton 11. The compression spring 35 is made of such a strength that it will produce a contact pressure of approximately 1000 g. between the contact bridge 18 and the fixed contacts 19 and 20.

Since the end 55'' of the magnet coil 55 is connected to the terminal strip 59, this coil may be separately energized. The main circuit between the terminal strips 59 and 60 may then be loaded with a higher current than the rated current.

When the circuit breaker is in its on position, as shown in FIGURE 1, the pushbutton 11 will be pressed upwardly by the release spring 77 only until a state of balance occurs between this spring 77 and the torsion spring 27' on the pivot pin 27. This balance will be overcome when the pushbutton 11 is pulled outwardly for the purpose of manually releasing the circuit breaker.

Although my invention has been illustrated and described with reference to the preferred embodiment thereof, I wish to have it understood that it is in no way limited to the details of such embodiment but is capable of numerous modifications within the scope of the appended claims.

Having thus fully disclosed my invention, what I claim is:

1. A pushbutton-controlled overload circuit breaker having a housing, electromagnetic releasing means and trip-free releasing means within said housing, an abutment member in said housing having an inclined surface, a pushbutton guided in and projecting from said housing, a control rod rigidly secured to said pushbutton, a detent on the lower end of said control rod, an angular bracket pivotable and slidable within said housing and having two arms, a catch on the first bracket arm and associated with said detent, a pair of fixed contacts in said housing, a contact bridge mounted on said first arm so as to be slightly pivotable thereon and adapted to connect said contacts to each other, the second bracket arm being pressed against said inclined surface when the circuit breaker is being switched off, whereby said bracket and said contact bridge thereon are pivoted to an inclined position in which said detent is in alignment with said catch so that when said pushbutton is depressed, said detent will engage with said catch and take along said bracket and the contact bridge thereon, a locking pawl pivotably mounted in said housing and, when said pushbutton is being depressed, adapted to be engaged by said second bracket arm and thereby to be pivoted to a locking position in which said pawl locks said bracket in a fixed position, said electromagnetic releasing means comprising an electromagnet having a coil, and an armature pivotably mounted in said housing, a locking lever pivotably mounted in said housing, said armature when pulled up by said electromagnet adapted to pivot said locking lever from one position in which it holds said pawl in said locking position to another position in which it releases said pawl so as to permit said pawl to disengage from said second bracket arm, signal contacts in said housing for indicating when said contact bridge is located in its on off positions, and a control member guided in said housing and adapted to be moved by said second bracket arm for operating said signal contacts, and release means responsive to outward movement of the pushbutton to open the circuit breaker.

2. An overload circuit breaker as defined in claim 1, in which said armature forms a two-armed lever pivotably mounted substantially at its center of gravity, and a pair of springs acting upon the respective arms of said armature so that the torques on said two arms will counteract each other, one of said springs maintaining said locking lever in engagement with said armature, and a setscrew for adjusting the tension of said one spring.

3. An overload circuit breaker as defined in claim 1, in which said contact bridge is stamped of sheet metal and has two contact points thereon and a pair of finger-like projections at the opposite sides of said bridge at a point substantially at the center between said contact points, said projections being bent around said first bracket arm so as to secure said bridge to said arm in a manner so as to allow said bridge to move slightly relative to said bracket arm.

4. An overload circuit breaker as defined in claim 1, in which said housing is divided into two separate parts adapted to be secured to each other when the other elements of said circuit breaker are installed therein, said housing parts having substantially parallel side walls and a pair of guide grooves in said walls opposite to each other, said second bracket arm and said detent on the end of said control rod each having a pair of opposite projections, both of said pairs engaging into and slidable along said guide grooves.

5. An overload circuit breaker as defined in claim 2, further comprising a release lever having two arms pivotably mounted in said housing and adapted to pivot for a limited extent and to act upon said armature, said trip-free releasing means comprising a compression spring

having one end acting upon said second bracket arm and the other end acting upon said release lever.

6. An overload circuit breaker as defined in claim 5, in which said release means comprises an angular lever having two arms, and a pivot pin for pivotably mounting said angular lever on the lower end of said control rod, one of said lever arms engaging one of the arms of said release lever and the other lever arm engaging said second bracket arm, and a torsion spring mounted on said pivot pin of said angular lever and tending to press said one arm of said angular lever against said second bracket arm.

7. An overload circuit breaker as defined in claim 5, further comprising a casing of non-magnetic metal within said housing, pivot pins for pivotably mounting said armature, said locking lever, said pawl, and said release lever, said casing having wall portions, said electromagnet, said setscrew, and said pivot pins being mounted on said wall portions of said casing.

8. An overload circuit breaker as defined in claim 1, further comprising terminal strips mounted in said housing and having ends projecting therefrom and forming plug pins, one of said terminal strips being centrally disposed to the other terminal strips and being connected to one end of said magnet coil and to one of said fixed contacts, the outermost terminal strips being connected to the other fixed contact and to the other end of said coil, respectively, and a pair of terminal strips between each of said outer strips and said central strip and connected to said signal contacts, all of said plug pins on said terminal strips being equally spaced from each other.

References Cited by the Examiner

UNITED STATES PATENTS

2,895,028	7/1959	Ellenberger	200—116 X
2,969,443	1/1961	Barden et al.	200—168 X
3,217,125	11/1965	Brackett	200—88 X

BERNARD A. GILHEANY, *Primary Examiner.*

R. N. ENVALL, *Assistant Examiner.*