March 3, 1970 A. BLEIBTREU 3,499,135

SWITCHING DEVICE FOR OPENING NON-CURRENT CARRYING CIRCUITS

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FIG. 1

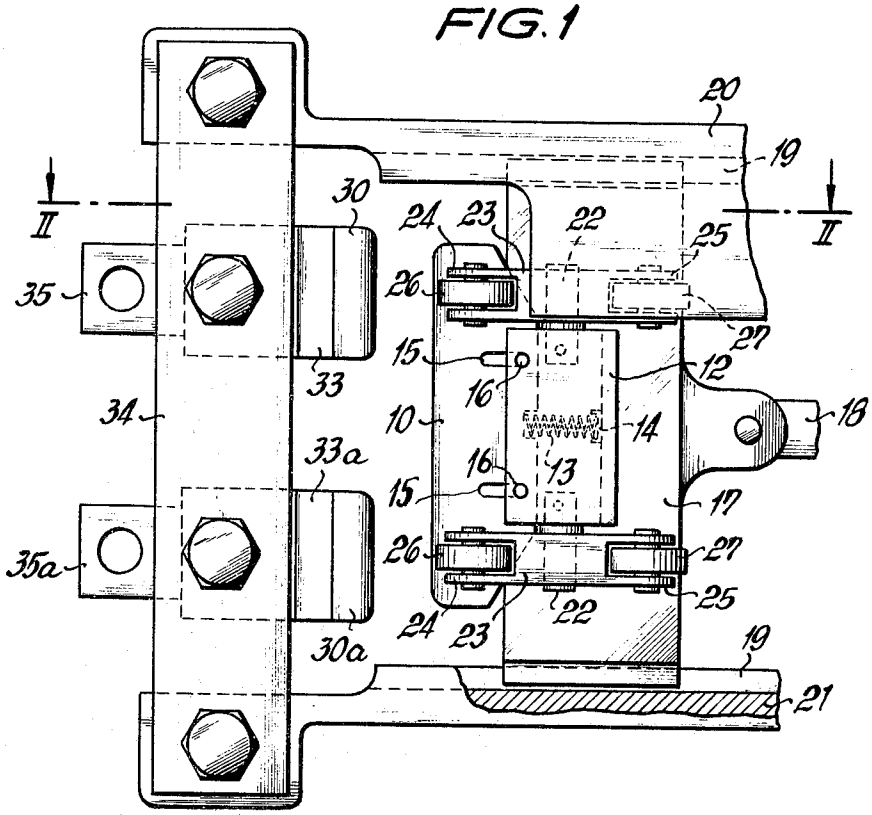

FIG. 2

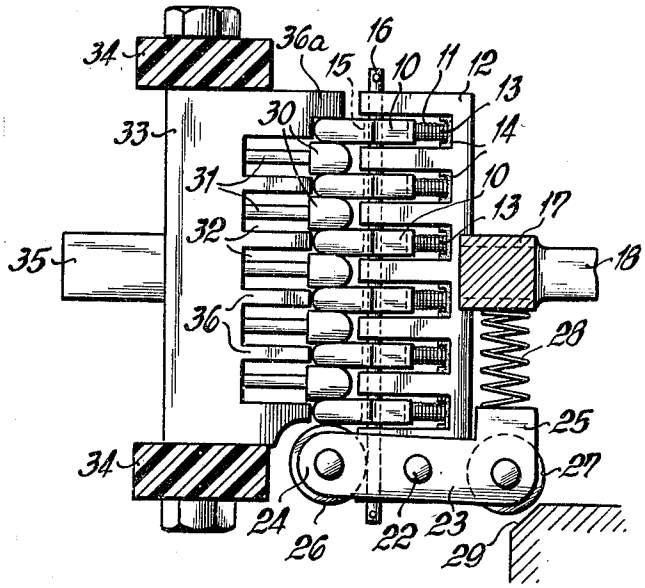

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FIG. 3

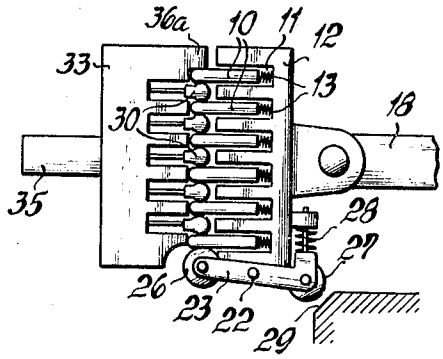


FIG. 4

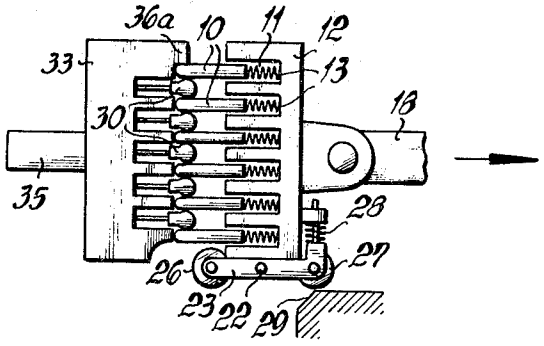
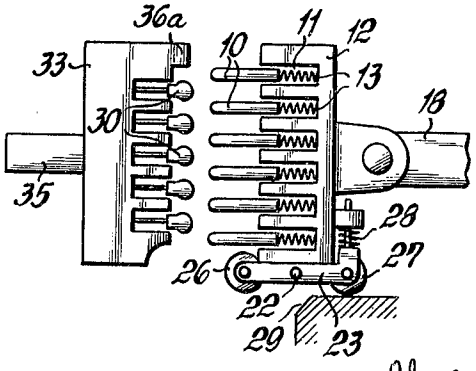


FIG. 5



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SWITCHING DEVICE FOR OPENING NON-CURRENT CARRYING CIRCUITS

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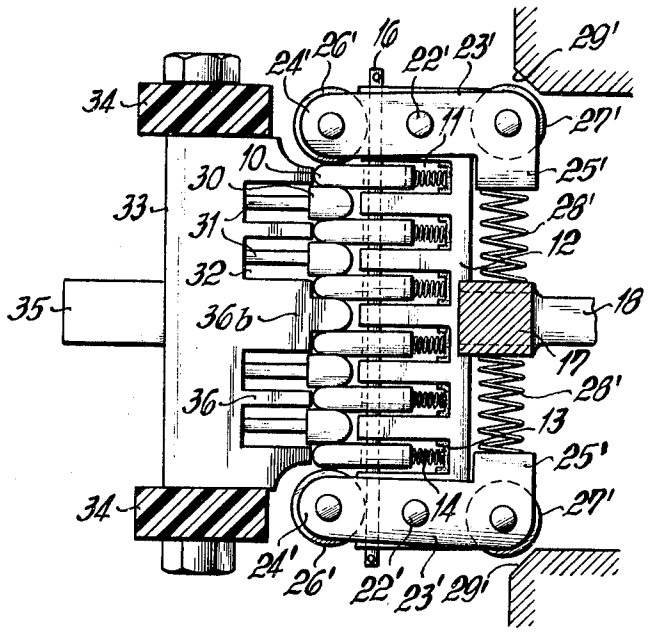
FIG.6



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United States Patent Office 3,499,135 Patented Mar. 3, 1970

3,499,135

SWITCHING DEVICE FOR OPENING NON-CURRENT CARRYING CIRCUITS

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Filed Feb. 14, 1968, Ser. No. 705,359
Claims priority, application Germany, Mar. 7, 1967, M 73,066
Int. Cl. H01h 1/50, 9/00
U.S. Cl. 200—170 11 Claims

ABSTRACT OF THE DISCLOSURE

The device includes stacks of interleaving contacts each contact of each stack being arranged in a separate chamber formed by a pair of relatively movable contact supports. Transverse contact pressure is applied and released by spring biased cam controlled levers pivotally supported by one of the aforementioned contact supports.

BACKGROUND OF INVENTION

Disclosed below is an improvement of the switching device according to U.S. Patent 3,310,640 to A. Bleibtreu, Mar. 21, 1967, High Current-Carrying Capacity Switching Devices Requiring Small Contact Pressures.

There is an urgent need for disconnect type switches including contact means establishing many parallel current paths to be capable of carrying large currents. The contact pressure in such disconnect type switches is supposed to be invariable and the entire switch structure extremely compact. This invention based on the structure of the above referred-to patent meets the above requirements in a better and a more complete way than any known prior art structure having the same objects.

SUMMARY OF THE INVENTION

A switching device embodying this invention includes a first stack of superimposed spaced contacts, and a first contact support defining recesses open on one side and each receiving one contact of said first stack of contacts. Said first contact support supports a plurality of spring means biasing each contact of said first stack of contacts toward said open side of said recesses. The structure further includes means providing a limited freedom of outward motion for the contacts of said first stack of contacts relative to said first contact support, and limiting the outward motion of the contacts of said first stack of contacts from said recesses of said first contact support. The structure further includes spring-biased pivotally supported lever means jointly movable with said first contact support which lever means include one lever arm tending to exert transverse pressure upon said first stack of contacts and another lever arm operable against spring bias. The aforementioned another lever arm is engageable and operable by fixed cam means to render said spring bias ineffective. The structure further includes a second stack of superimposed spaced contacts arranged in interleaving relation to the contacts of said first stack of contacts. The contacts of said second stack of contacts are arranged in registry with recesses defined by a second contact support. These are open at one side. The structure further includes contact pressure bracing means integral with said second support for bracing the contacts of said first stack of contacts and the contacts of said second stack of contacts against the spring bias of said lever means. In addition to the above the structure includes operating means for moving said first contact support relative to said second support to cause selective engagement and disengagement of the contacts of said first stack of contacts and of the contacts of said second stack of contacts and to cause selective disengagement of said another lever arm from said fixed cam means and engagement of said another lever arm by said fixed cam means.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation of a switching device embodying the present invention in the open position of its contacts;

FIG. 2 is a section along II—II of FIG. 1 showing the structure of FIG. 1 in its closed position;

FIG. 3 is a diagrammatic representation of a simplified version of the structure of FIGS. 1 and 2 seen from the same side of FIG. 1 and showing its contacts in their closed position;

FIG. 4 shows the structure of FIG. 3 in the same fashion as FIG. 3 but shows the contacts thereof in semi-separated position;

FIG. 5 shows the structure of FIG. 3 in the same fashion as FIG. 3 but shows the contact thereof when entirely separated; and

FIG. 6 is a section taken in the same way as FIG. 2 of a modification of the structure shown in FIGS. 1 and 2.

DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

Referring to FIGS. 1 and 2, contacts **10** are formed by metal laminae having a predetermined radius at the left ends thereof (see FIG. 2) and arranged in recesses or grooves **11** of a contact support **12** which is shaped in comb-like fashion defining a system of parallel grooves or recesses **11**. These are open at one side and separated by parallel partitions. There is a predetermined clearance between contacts **10** and the aforementioned partitions which define recesses or grooves **11**. The bottom of each recess or groove **11** is provided with a substantially cup-shaped spring support **14** of insulating material. Helical springs **13** are interposed between contacts, or contact fingers **10** and spring supports **14**, the latter insulating the contacts, or contact fingers **10** from contact support **12**. Each contact **10** is provided with contact guiding slots **15** and pins **16** project transversely across the planes defined by contacts **10** and are arranged inside of slots **15**. The axially outer ends of pins **16** and a number of intermediate points thereof are supported by contact support **12** which is provided with bores for receiving pins **16**. Thus contacts **10** are secured to contact support **12** but movable relative to contact support **12** in the direction of slots **15**. Contact support **12** is, in turn, supported by a substantially U-shaped contact-support-holder **17** to which operating rod **18** is pivotally connected. Reference numerals **20** and **21** have been applied to indicate an upper frame plate and a lower frame plate each provided with groove means **19**. Contact-support-holder **17** engages groove means **19** and is slidably movable relative to frame plates **20**, **21** under the action of operating rod **18**. Thus plates **20**, **21** form a pair of ways for rectilinear movement of parts **10**, **12** and **17**. Numeral **22** has been applied to indicate a shaft mounted on contact support **12** and supporting a pair of levers **23**. Each of levers **23** has two arms **24**, **25**. Arms **24** support adjacent the end thereof remote from shafts **22** rollers **26** and arms **25** support adjacent the end thereof remote from shafts **22** rollers **27**. One end of helical contact springs **28** rests against the right arms **25** of levers **23** (see FIG. 2), while the opposite end of these springs rest against contact-support-holder **17**. Thus—as seen in FIG. 2—levers **23** are both spring biased in clockwise direction and pivotable in planes parallel to the forces that may be transmitted by operating rod **18** to contact-support holder **17**. Movements of contact-support-holder **17** under the action of operating rod **18** result in engagement of rollers **27** by cam surfaces **29** and consequently in a posi-

tive control of levers **23**, i.e. a pivotal movement thereof about shafts **22** against the bias of springs **28** in counterclockwise direction.

Movable contacts **10** cooperate with fixed contacts **30** and **30***a*. As seen in FIG. 1, fixed contacts **30** and **30***a* are arranged at different levels and can be conductively interconnected by movable contacts **10**. As clearly shown in FIG. 2, movable contacts **10** and fixed contacts **30** interleave, and the same applies in regard to contacts **10** and contacts **30***a*, contacts **30** and **30***a* being arranged in superimposed registering pairs. Contacts **30**, **30***a* are arranged adjacent the open end of recesses or grooves **32** formed by a pair of contact supports **33** and **33***a*, respectively, of which each is shaped in comb-like fashion. In the closed position of the switch the outer end of contacts **10** abut against partitions **36** separating grooves or recesses **32**. Contacts **30** and **30***a* are preferably formed by caps or cap-like structures. There is a predetermined clearance between contacts **30** and **30***a* and the contact receiving recesses or grooves **32** of contact supports **33** and **33***a*. Each contact **30**, **30***a* is supported by a flexible lead **31**, e.g. a strip of metal, in each of grooves **32** conductively connecting the respective contact with the respective support **33**, **33***a*. Contacts **30** and **30***a* are provided with terminals **35** and **35***a*, respectively, and are supported by insulating members **34**. The upper ends and the lower ends of insulating members **34** are affixed to the upper frame plate **20**, and to the lower frame plate **21**, respectively.

Referring now more particularly to FIG. 3 showing a simplified version of the switch of FIGS. 1 and 2 in its closed position, movable contacts **10** and fixed contacts **30** are interleaving, and the biasing springs **13** of contacts **10** are compressed by virtue of the fact that the ends of contacts **10** immediately adjacent contacts **30** abut against the partitions **36** of contact support **33**. Roller **27** of lever **23** has parted from cam **29**, thus allowing spring **28** to pivot lever **23** about shaft **22** in clockwise direction and to cause engagement under pressure of contacts **10** and **30**. The last or uppermost partition **36***a* of contact support **33** forms a brace receiving the pressure exerted by spring **28** and transmitted to it by the intervening contacts **10** and **30**.

Assuming now that contact support **12** is being moved from left to right, as indicated in FIG. 4 by an arrow, this causes springs **13** to expand while contacts **10** and **30** remain in the interleaving position thereof. When roller **27** engages cam **29** lever **23** is pivoted about shaft **22** in counterclockwise direction against the action or bias of spring **28**. At this point of time contacts **10** and **30** are still interleaving, but are not under transverse pressure any longer.

Continued movement of contact support **12** from left to right as seen in FIGS. 4 and 5 results in separation of contacts **10** from contacts **30** (and also from contacts **30***a* considering the structure of FIGS. 1 and 2). In the position of FIG. 5 contacts **10** have been moved by springs **13** from right to left relative to contact support **12**. Though contacts **10** now project outwardly from contact support **12**, they are firmly connected to the latter by means of slots **15** and rods **16** shown in FIG. 1. FIG. 5 shows the cooperating contacts **10**, **30** in fully open positions.

FIGS. 5, 4 and 3 also illustrate the sequence of steps involved in closing the switch. When the switch is being closed, first contacts **10** and **30** are caused to interleave, and thereafter roller **27** parts from cam **29** allowing levers **23** to pivot in clockwise direction about shaft **22**, thus causing spring **28** to establish transverse pressure between contacts **10** and contacts **30**.

It will be apparent from the foregoing that the structure of FIGS. 3 to 5, inclusive, differs from the structure of FIGS. 1 and 2 by the omission of fixed contacts **30***a* and the omission of one of the two spring biased levers **23** and one of cams **19**. Thus the structure of FIGS. 3 to 5, inclusive, is—as mentioned above—a simplified version of the structure of FIGS. 1 and 2.

In FIG. 6 the same reference characters as in FIG. 2 have been applied to designate like parts. Hence FIG. 6 calls but for a specific description inasmuch as the structure of FIG. 6 differs from that of FIGS. 1 and 2. The structure of FIG. 6 is intended for applications requiring a particularly large number of cooperating interleaving contacts or, in other words, intended to carry particularly large currents. While levers **23** of FIG. 2 pivot in the same sense—clockwise during a closing stroke of operating rod **18** and counterclockwise during an opening stroke of operating rod **18**—levers **23'** of the structure of FIG. 6 supported by shafts **22'** pivot simultaneously in opposite directions during both the closing stroke and the opening stroke of movable contacts **10**. Their opposite bias is imparted to levers **23'** by helical springs **28'** and rollers **27'** of levers **23'** cooperate with fixed abutments **29'**. The fixed contact support **33** of the structure of FIG. 6 includes a center partition **36***b* having a pair of opposite bracing surfaces. All contacts **10**, **30** to one side of partition **36***b* are pressed by one of rollers **26'** on one of pivotable levers **23'** pivotable about one of shafts **22'** against one side of partition **36***b*, and all contacts **10**, **30** to the other side of partition **36***b* are pressed by the other of rollers **26'** on the other of levers **23'** pivotable about the other of shafts **22'** against the other side of partition **36***b* of the structure of FIG. 6. Partition **36***b* thus performs, in essence, the same function as partition **36***a* of the structure of FIG. 2, but since in the structure of FIG. 6 contacts **10**, **30** are subdivided into two groups movable by separate springs **28'** against separate bracing surfaces, the number of interleaving contacts forming a contact stack may be larger in the case of FIG. 6 than in the case of FIG. 1.

It will be apparent from the above that movement of rod **18** of the structure of FIG. 6 from the position thereof shown therein to the right results in collapse of the transverse pressure between contacts **10** and **30**, and subsequent separation of contacts **10** from contacts **30**. Movement of rod **18** in the opposite direction results first in interleaving engagement of contacts **10** and **30**, and subsequent establishment of transverse contact pressure between contacts **10** and **30**.

A significant distinction between the structure of FIGS. 1 and 2 and the structure of FIG. 6 consists in the fact that in the structure of FIGS. 1 and 2 the movable front contact **10** is engaged by a pair of rollers **24** rather than but one single roller. One roller **24** engages the aforementioned contact **10** adjacent its lower end, and the other roller **24** engages the aforementioned contact **10** adjacent its upper end. This is conducive to good or even distribution of contact pressure.

It will be understood that I have illustrated and described herein several preferred embodiments of my invention, and that various alterations may be made in the details therof without departing from the spirit and scope of the invention.

I claim as my invention:

1. A switching device including:

(a) a first stack of superimposed spaced contacts;

(b) a first contact support defining recesses open on one side and each receiving one contact of said first stack of contacts;

(c) a plurality of spring means supported by said first contact support biasing each contact of said first stack of contacts toward said open side of said recesses;

(d) means providing a limited freedom of outward motion for the contacts of said first stack of contacts relative to said first contact support and limiting the outward motion of the contacts of said first stack of contacts from said recesses of said first contact support;

(e) spring biased pivotally supported lever means jointly movable with said first contact support, said

lever means including one lever arm tending to exert transverse pressure upon said first stack of contacts and another lever arm operable against spring bias;

(f) fixed cam means engaging and operating said another lever arm to render said spring bias ineffective;

(g) a second stack of superimposed spaced contacts arranged in interleaving relation to the contacts of said first stack;

(h) a second contact support defining recesses open on one side each in registry with one contact of said second stack of contacts;

(i) contact pressure bracing means integral with said second contact support for bracing the contacts of said first stack of contacts and the contacts of said second stack of contacts against the spring bias of said lever means; and

(j) operating means for moving said first contact support relative to said second contact support to cause selective engagement and disengagement of the contacts of said first stack of contacts and of the contacts of said second stack of contacts and to cause selective disengagement of said another lever arm from said fixed cam means and engagement of said another lever arm by said fixed cam means.

2. A switching device as specified in claim 1 wherein each contact of said first stack of contacts is formed by a metal lamina, and wherein each contact of said second stack of contacts is formed by a contact cap and a flexible metal ribbon supporting said cap on one end thereof and supported on the other end thereof by said second contact support.

3. A switching device as specified in claim 1 wherein said second stack of contacts includes registering pairs of superimposed contacts, and wherein said first stack of contacts is arranged to conductively interconnect said registering pairs of superimposed contacts.

4. A switching device as specified in claim 1 wherein the contacts of said first stack of contacts are formed by metal laminae having slots, and wherein the freedom of motion of said metal laminae relative to said first contact support is limited by rods supported by said first contact support and projecting transversely through said slots in said metal laminae.

5. A switching device as specified in claim 1 including

(a) a substantially U-shaped support supporting said first contact support and operable by said operating means, and

(b) a pair of spaced frame plates sandwiching said substantially U-shaped support, in sliding engagement with said substantially U-shaped support and forming a pair of ways for said substantially U-shaped support.

6. A switching device as specified in claim 1 including

(a) a shaft supported by said first contact support and supporting said spring-biased lever means; and

(b) a pair of rollers supported by said spring biased lever means, one of said pair of rollers supported by said one lever arm and tending to exert transverse pressure upon the contacts of said first stack of contacts and upon the contacts of said second stack of contacts, and the other of said pair of rollers supported by said another lever arm and arranged to cooperatively engage said fixed cam means upon operation of said operating means in switch opening direction.

7. A switching device as specified in claim 6 including

(a) a pair of shafts both supported by said first contact support and a pair of separate spring-biased lever means each supported by one of said pair of shafts, each of said pair of spring-biased lever means biased in the same sense; and

(b) two pairs of rollers each pair supported by one of said pair of separate spring biased lever means, one roller of each of said two pairs of rollers arranged to engage one contact of said first stack of contacts situated at one end of said first stack of contacts adjacent opposite ends of said one contact, and said one roller of each of said two pairs of rollers tending to apply pressure upon said one contact in the direction from said one contact to the contact of said first stack of contacts situated at the other end of said first stack of contacts.

8. A switching device as specified in claim 7 wherein said second contact support forms an abutment bracing said contact of said first stack situated at said other end of said first stack of contacts.

9. A switching device as specified in claim 6 including

(a) a pair of shafts supported by said first contact support and a pair of separate spring-biased lever means each supported by one of said pair of shafts, each of said pair of spring-biased lever means spring-biased in an opposite sense; and

(b) two pairs of rollers each pair supported by one of said pair of separate spring biased lever means, one roller of each of said two pairs of rollers arranged to engage a contact of said first stack of contacts situated at one of the ends of said first stack of contacts.

10. A switching device as specified in claim 9 wherein said second contact support forms adjacent the center thereof a pair of abutments engageable by contacts of said first stack of contacts and bracing said contacts of said first stack of contacts.

11. A switching device as specified in claim 1 wherein said recesses in said second contact support are separated by partitions forming abutments engageable by the contacts of said first stack of contacts and tending to compress said plurality of spring means in the closed position of said switching device.

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U.S. Cl. X.R.

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