Aug. 19, 1958 E. H. HAHN, JR 2,848,575

ELECTRIC SWITCH

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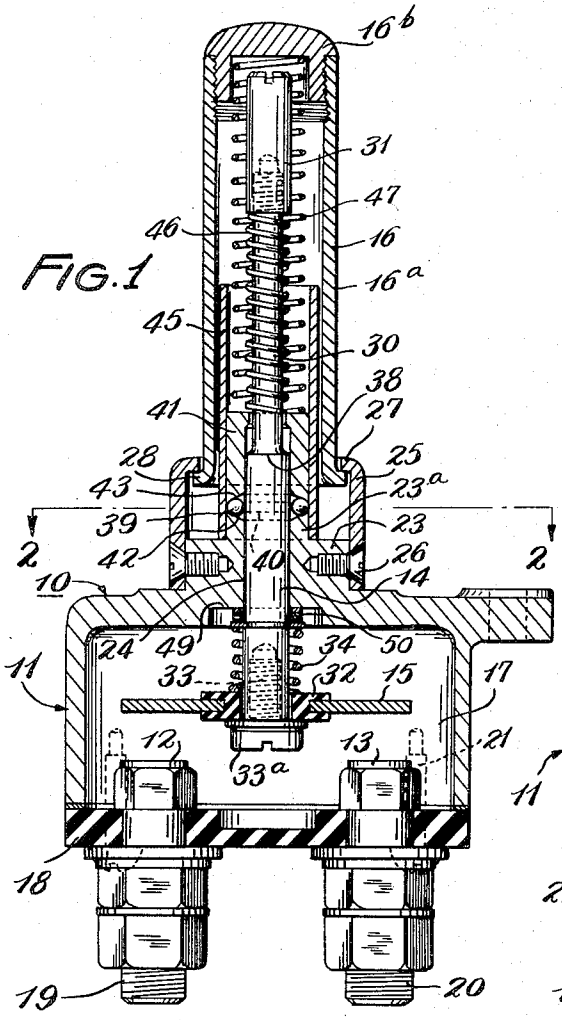

FIG. 1

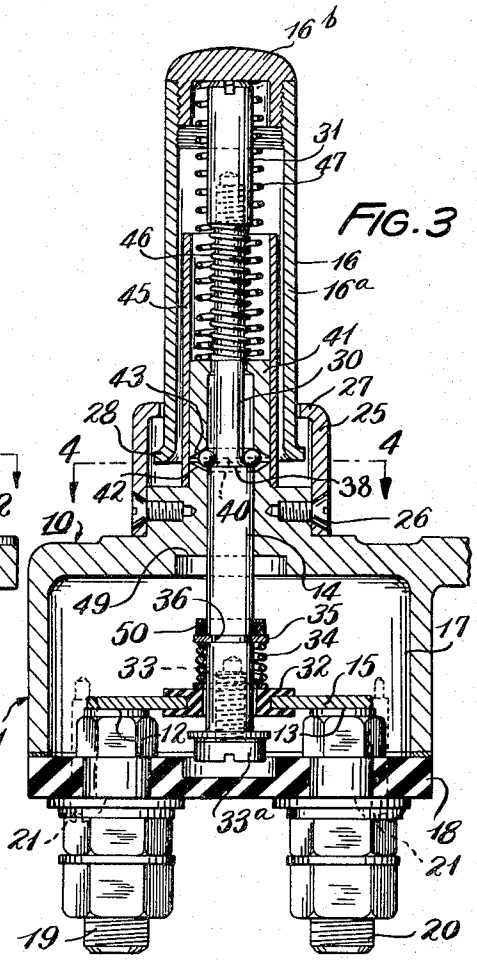

FIG. 3

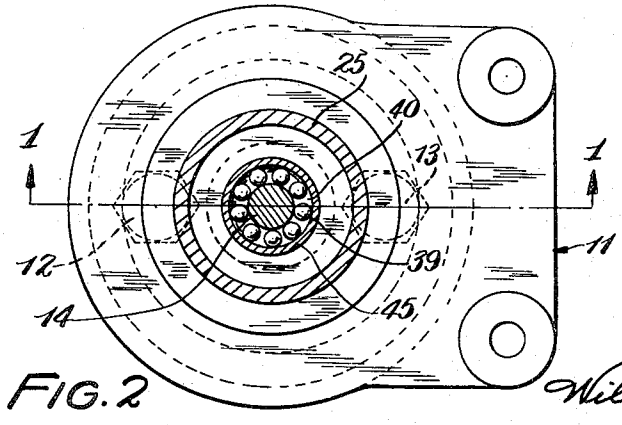

FIG. 2

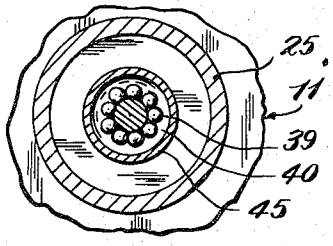

FIG. 4

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ELECTRIC SWITCH

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10 Claims. (Cl. 200—77)

This invention relates to electric switches, and as one of its objects, aims to provide a novel quick opening switch which will be of a simple, practical and economical construction. The switch construction of the present invention is applicable to various uses where a fast breaking action is desirable between the contacts and, by way of example, the novel construction is herein disclosed as embodied in a manually operable starter switch.

Another object of this invention is to provide a novel quick-break electric switch having a movable shaft and spring means for transmitting motion to a movable contact means and in which clutch means responsive to the loading of the spring means controls shaft movement in the switch opening direction so as to produce the desired quick break between the contacts.

A further object is to provide such a quick-break electric switch in which the movement of the shaft is a linear movement and in which the clutch means is contractible and expandable for holding or releasing the shaft.

As still another object, this invention provides such a novel quick-break switch in which the clutch means comprises shoulder means on the shaft and an annular group of balls contractible into holding engagement with the shoulder means.

Additionally, this invention provides a quick-break switch of the character above indicated, in which the group of balls is contractible into holding engagement with the shaft in response to loading of the spring means and is expandable to release the shaft in response to a partial unloading of the spring means.

The invention can be further briefly summarized as consisting of certain novel combinations and arrangements of parts hereinafter described in detail, and particularly set out in the claims hereof.

In the accompanying sheet of drawings forming a part of this specification,

Fig. 1 is an axial sectional view of a quick-break electric switch embodying the present invention, the view being taken as indicated by section line 1—1 of Fig. 2 and with the switch in its open condition.

Fig. 2 is a transverse sectional view taken on the section line 2—2 of Fig. 1;

Fig. 3 is an axial sectional view similar to that of Fig. 1, but showing the switch in its closed condition; and

Fig. 4 is a partial transverse sectional view taken on section line 4—4 of Fig. 3.

Referring now to the drawings in greater detail, the electric switch **10** comprises in general a housing **11** having a pair of stationary contacts **12** and **13** therein, a movable shaft **14** carrying a movable contact **15**, and an actuating member **16** engageable with the shaft for imparting switch closing movement thereto.

The housing **11** is provided on one side thereof with a contact chamber **17** which is closed by an insulating cover **18** having the stationary contacts **12** and **13** mounted thereon. Projecting stem portions of the stationary contacts **12** and **13** form external terminals **19** and **20**

on the cover **18**. The cover is secured in place on the housing as by suitable screws **21**.

On the other side thereof the housing **11** is provided with an axial boss **23** having a guide passage **24** extending therethrough and communicating with the chamber **17**. A retaining member **25** mounted on the boss **23** by means of suitable connecting screws **26** is provided at the outer end thereof with an inturned annular lip **27**. The retaining member **25** cooperates with the actuating member **16** in a manner to be explained hereinafter.

The actuating member **16** comprises a sleeve portion **16***a* disposed in a surrounding substantially coaxial relation to the shaft **14** and a closure cap **16***b* threadedly engaged in the outer end of the sleeve portion. At the inner end thereof the actuating member **16** is provided with an out-turned annular flange **28**. The flanged inner end of the actuating member **16** is located in the retaining member and is axially movable in the latter. The actuating member **16** is connected with the housing **11** by the retaining member **25** and the flange **27** of the latter is engageable by the flange **28** for limiting outward axial movement of the actuating member.

The shaft **14** is axially slidable in the guide passage **24** of the housing **11** and is provided with a relatively reduced outer stem portion **30** having a head or nut **31** on the outer end thereof. The inner end of the shaft **14** extends into the contact chamber **17** and supports the movable contact **15** in bridging relation to the stationary contacts **12** and **13**. The movable contact **15** is mounted on the shaft **14** by means of an insulating bushing **32** which is slidable on the shaft and retained on the latter by the head **33***a* of a screw **33** which is engaged in an end opening of the shaft. A contact spring **34** surrounding the shaft **14** is disposed between the bushing **32** and a spring seat formed by a snap ring **35** engaged in an annular groove **36** of the shaft.

Movement of the shaft **14** in a downward or switch-closing direction causes the movable contact **15** to engage the stationary contacts **12** and **13** for closing of the switch. Continued movement of the shaft **14** in the switch-closing direction causes the shaft to slide through the bushing **32** and is resisted by the contact spring **34**. If the movement of the shaft **14** in the switch-closing direction continues to the point where the contact spring **34** is compressed to a solid condition, this spring will then act as a stop for terminating the switch-closing movement of the shaft. The switch-closing movement is imparted to the shaft **14** by the actuating member **16**, whose cap portion **16***b* is engageable with the head **31** of the shaft.

In accordance with this invention, the switch **10** is provided with clutch means which becomes effective on the shaft **14**, when the latter has moved the contact **15** into engagement with the contacts **12** and **13**, and temporarily retains the shaft in a position corresponding with the closed condition of the contacts. This clutch means is here shown as comprising an annular shoulder **38** formed on the shaft **14** and facing in a direction away from the movable contact **15**, and a contractible and expandable annular group of balls **39** engageable with such shoulder.

The annular group of balls **39** is contained in an annular groove **40** surrounding the shaft **14** and formed between the adjacent ends of a boss extension **23***a* and a thrust sleeve **41**. The side walls of the groove **40** are defined by the axially opposed annular bevels **42** and **43** which are formed, respectively, on the boss extension **43** and the sleeve **41**. The balls **39** are provided in suitable number such that when they are moved into a contracted condition adjacent the shoulder **38** they will constitute a substantially closed annular ring, as shown in Fig. 4.

A guide sleeve **45** extending substantially coaxially of the shaft **14** and mounted on the boss extension **23** forms a retainer for the annular group of balls **39**. The sleeve **41** is axially slidable in the guide sleeve **45** with the annular bevel **43** of its inner end presented to the group of balls **39**. The actuating member **16** is disposed around the sleeve **45** and is guided on the latter externally thereof.

An inner spring **46** surrounding the stem portion **30** of the shaft **14** and disposed between the head **31** and the sleeve **41** urges the latter in an inward axial direction. An outer spring **47** also surrounding the stem portion **30** of the shaft **14** is disposed between the sleeve **41** and the cap portion **16***b* of the actuating member **16**. From the location just described for the inner and outer springs **46** and **47** it will be observed that these springs are housed within the actuating member **16**.

In the actuation of the switch **10**, an axial movement imparted to the actuating member **16** will cause loading of the springs **46** and **47** and will bring the cap portion **16***b* into engagement with the head **31** of the shaft **14**. Further movement of the actuating member **16** will cause axial movement of the shaft **14** to close the switch contacts and to move the clutch shoulder **38** to a position slightly beyond, and axially inward of, the annular group of balls **39** as represented in the closed condition of the switch shown in Fig. 3. When the shaft has been moved to this position, the pressure of the springs **46** and **47** will be effective on the clutch balls **39** through the bevels **42** and **43** to contract the group of balls into a holding engagement with the annular shoulder **38**. The engagement of the balls **39** with the shoulder **38** temporarily retains the switch in its closed condition until a predetermined extent of outward axial movement of the actuating member **16** has taken place.

When opening of the switch **10** is desired, the actuating force applied to the member **16** is released, whereupon the outer spring **47** imparts outward axial movement to the actuating member and as the result of which this spring becomes partially unloaded. While the actuating member **16** is being moved outwardly by the spring **47**, the inner spring **46** and the contact spring **34** are both exerting forces on the shaft **14** tending to move the latter in an outward or switch-opening direction. Such outward movement of the shaft is temporarily prevented by the clutch balls **39**, but when the outer spring **47** has been unloaded to a sufficient extent the sleeve **41** will permit the balls to be wedged outwardly by the shoulder **38**, thereby releasing the shaft for a quick outward movement thereof by the springs **34** and **46**. This quick outward movement of the shaft **14** causes the desired quick-break opening movement of the movable contact **15**.

The switch-opening outward movement of the shaft **14** is limited by a suitable stop provided on the housing **11** and which is here shown as comprising the annular abutment face **49** surrounding the guide passage **24**. By the time that the movable contact **15** disengages the stationary contacts **12** and **13** the contact spring **34** will be in its expanded condition, and the further outward movement of the shaft under the influence of the inner spring **46** will bring the stop washer **35** of the shaft **14** to a final position adjacent to, or in engagement with, the abutment face **49**. If desired, a group of washers **50** made of fiber or other suitable material can be provided on the shaft **14** adjacent the stop washer **35** to constitute a bumper or a cushioning means for engagement with the face **49**.

From the accompanying drawing and the foregoing detailed description, it will now be readily understood that this invention provides a quick-break electric switch which is of a simple and highly practical form, embodying a construction comprising a relatively small number of parts adapted to be economically produced and easily assembled. It will be understood further that contractible and expandable clutch means embodied in the switch is effective on the movable shaft thereof for

holding or releasing the shaft in response to the action of the spring means and the movement of the actuating member. Additionally, it will be understood that when the clutch means is in the form of an annular group of balls as here provided, it will operate efficiently throughout a long period in a uniformly satisfactory manner.

Although this novel quick-break electrical switch has been illustrated and described here to a somewhat detailed extent, it will be understood, of course, that the invention is not to be regarded as being limited correspondingly in scope, but includes all changes and modifications coming within the terms of the claims hereof.

Having thus described my invention, I claim:

1. In an electric switch, a housing having a guide passage therein, stationary contact means in said housing, a shaft axially movable in said guide passage, movable contact means engageable with and disengageable from said stationary contact means by switch closing and switch opening axial movements of said shaft, actuating means for imparting the switch closing axial movement to said shaft, spring means subject to loading in response to the switch closing actuation of said shaft and to partial unloading during movement of said actuating means in the switch opening direction, said shaft having a shoulder thereon, contractible means engageable with said shoulder for temporarily restraining said shaft against switch opening movement thereof, and bevel means responsive to the loading of said spring means and being axially shiftable by the latter for contracting said contractible means into such restraining engagement with said shoulder, said contractible means being expandable by said shoulder in response to the partial unloading of said spring means for releasing said shaft for a quick switch opening actuation of the shaft by said spring means.

2. An electric switch as defined in claim 1 in which said shoulder faces away said contact means, and in which said contractible means comprises an annular group of balls.

3. In an electric switch, a housing having a guide passage therein, stationary contact means in said housing, a shaft axially movable in said guide passage, movable contact means engageable with and disengageable from said stationary contact means by switch closing and switch opening axial movements of said shaft, said shaft having a shoulder thereon facing away from said contact means, means defining a groove surrounding said passage including an anular bevel forming a side wall of the groove, an annular group of balls in said groove, actuating means for imparting switch closing movement to said shaft, and spring means subject to loading during the switch closing actuation of said shaft and to partial unloading during movement of said actuating means in the switch opening direction, said group of balls being contractible into holding engagement with said shoulder by said bevel in response to the switch closing movement of said shaft and the loading of said spring means, said group of balls being expandable by said shoulder in response to the partial unloading of said spring means for releasing said shaft for a quick switch opening actuation of the latter by said spring means.

4. An electric switch as defined in claim 3 which includes an axially movable sleeve surrounding said shaft, and in which said bevel is on the end of said sleeve presented toward said groove.

5. An electric switch as defined in claim 3 in which a guide sleeve connected with said housing and extending substantially coaxially of said shaft comprises a retainer for said group of balls, and in which a thrust sleeve is slidable in said guide sleeve, said bevel being on the end of said thrust sleeve presented toward said groove.

6. In an electric switch, a housing having a guide passage therein, stationary contact means in said housing, a shaft axially movable in said guide passage, movable contact means engageable with and disengageable from said stationary contact means by switch closing and

switch opening axial movements of said shaft, said shaft having a shoulder thereon facing away from said contact means, means defining a groove surrounding said passage including a pair of divergent annular bevels forming side walls of the groove, an axially movable sleeve surrounding said shaft and carrying one of said bevels, an annular group of balls in said groove, a hollow actuating member disposed in a substantially coaxial surrounding relation to said shaft and being movable relative to said housing for imparting switch closing movement to said shaft, and spring means in surrounding relation to said shaft and subject to loading during the switch closing movement of said shaft and to partial unloading during movement of said actuating member in the switch opening direction, said group of balls being contractible into holding engagement with said shoulder by said bevels in response to the switch closing movement of said shaft and the loading of said spring means, said group of balls being expandable by said shoulder in response to the partial unloading of said spring means for releasing said shaft for a quick switch opening actuation of the latter by said spring means.

7. An electric switch as defined in claim 6 in which said shaft and actuating member have cooperating engageable portions, and wherein said actuating member has an initial position in which said engageable portions are in a spaced-apart relation.

8. An electric switch as defined in claim 6 in which an axial guide tube connected with said housing and surrounding said shaft forms a retainer for said group of balls, and in which said sleeve has a guided axial movement along the inside of said tube and said actuating member has a guided axial movement along the outside of said tube.

9. An electric switch as defined in claim 6 in which said shaft has a head thereon, and in which said spring means comprises a first spring disposed between said sleeve and said head and a second spring disposed between said sleeve and said actuating member.

10. An electric switch as defined in claim 6 in which said shaft has a head thereon and in which said spring means comprises a contact spring interposed between said shaft and said movable contact means and other spring means housed in said actuating member and seated against said sleeve, said other spring means comprising a first spring disposed between said sleeve and said head and a second spring disposed between said sleeve and said actuating member.

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