Sept. 10, 1957 F. R. EDGARTON 2,806,104

ELECTRIC SWITCH

Filed Jan. 14, 1955 2 Sheets-Sheet 1

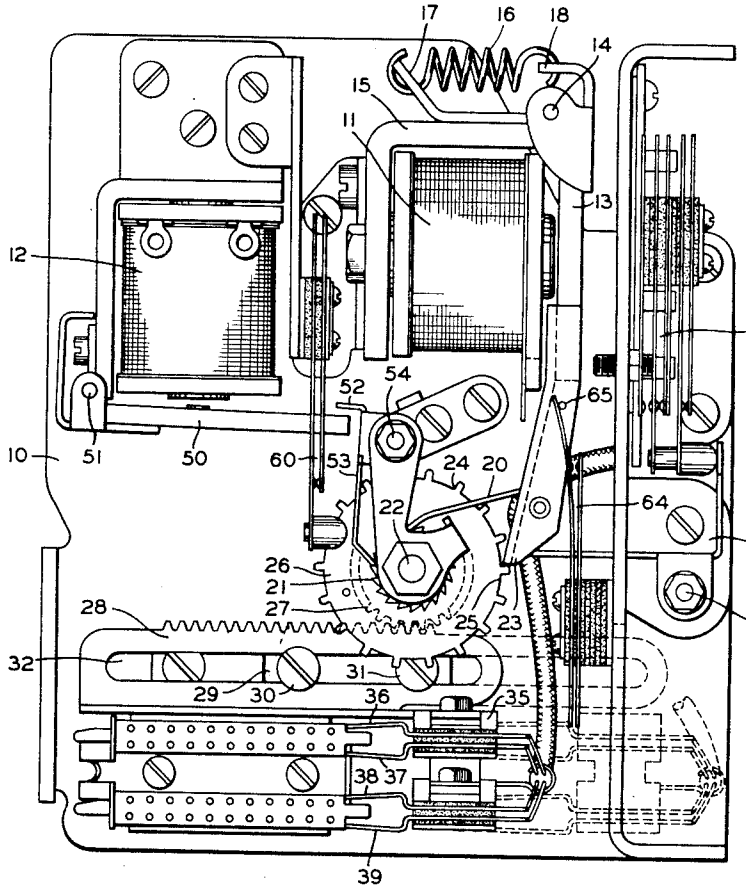



Fig. 1

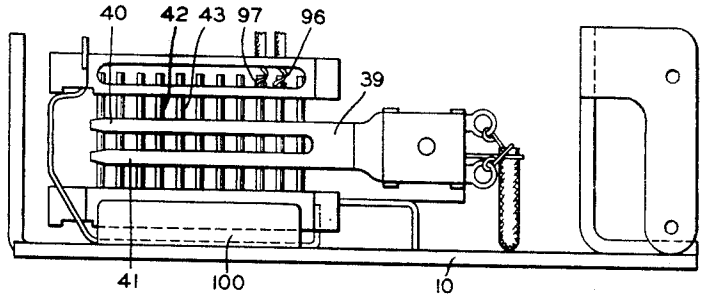



Fig. 2

INVENTOR.
FRANK R. EDGARTON
BY
Francis E Blake
ATTORNEY

Sept. 10, 1957 F. R. EDGARTON 2,806,104

ELECTRIC SWITCH

Filed Jan. 14, 1955 2 Sheets-Sheet 2

Fig. 4

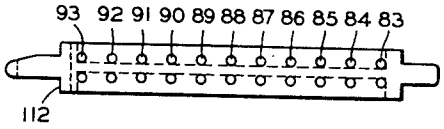



Fig. 3

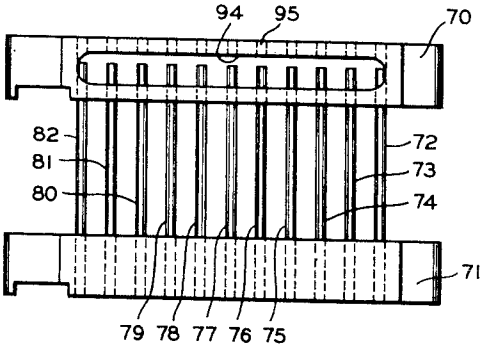



Fig. 5

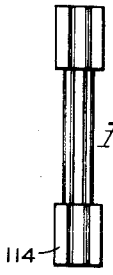



Fig. 7

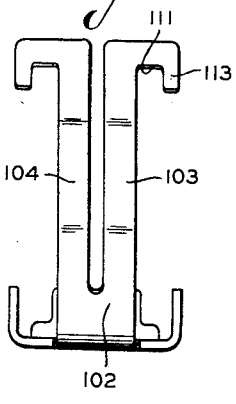



Fig. 6

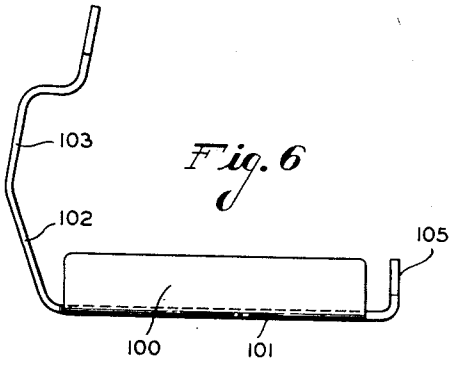



Fig. 8

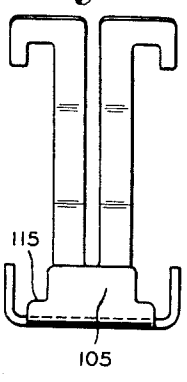



Fig. 9

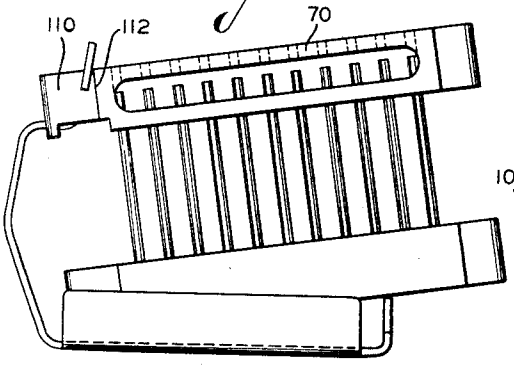
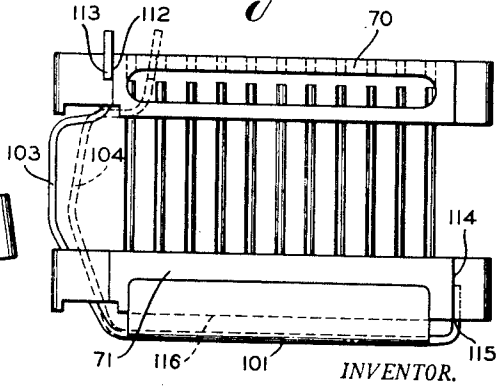



Fig. 10




INVENTOR.
FRANK R. EDGARTON
BY
Francis E. Blake
ATTORNEY

United States Patent Office 2,806,104 Patented Sept. 10, 1957



2,806,104

# ELECTRIC SWITCH

Frank R. Edgarton, Webster, N. Y., assignor, by mesne assignments, to General Dynamics Corporation, a corporation of Delaware

Application January 14, 1955, Serial No. 481,908

3 Claims. (Cl. 200—104)

The present invention relates to electric switch constructions.

Many different forms of multi-contact electric switches are used in the telephone industry. Many of such switches may include one or more movable switch brushes, each adapted to successively engage selected ones of a plurality of relatively fixed electric contact elements as the brush or brushes are moved. The plurality of contact elements are generally grouped in so-called contact banks that are positioned in the path of movement of the switch brushes that are adapted to successively and selectively engage respective ones of the contact elements. Prior to this invention the banks of contact elements were more or less permanently secured to the switch structure in the positions to be engaged by the switch brushes as the switch brushes are moved. Such an arrangement is sometimes inconvenient when wiring the switch in a particular circuit since it requires the entire switch assembly to be handled when making the electrical connections to the switch contacts.

It is a principal object of the present invention to provide an improved multi-contact switch.

It is another object of the present invention to provide an improved multi-contact switch having a removable contact bank assembly.

In a preferred embodiment of the invention, a plurality of removable contact banks are provided to be each associated with a respective one of a plurality of movable switch brushes adapted to be moved in step-by-step fashion to successive contact positions in an arrangement similar to either of the so-called minor switches or rotary switches although it should be understood that the removable contact bank feature of the invention may be incorporated with other types of multi-contact switches having various modes of operation.

Further objects, features, and the attending advantages of the invention will be apparent with reference to the following specification and drawings in which:

Fig. 1 is a top plan view of a so-called minor switch embodying the invention,

Fig. 2 is a fragmentary end view of the switch as seen from the lower end of Fig. 1 of the drawings,

Fig. 3 is a side elevation of the contact bank used with the switch of the invention,

Fig. 4 is a top plan view of the contact bank shown in Fig. 3,

Fig. 5 is an end view of the right hand end of the contact banks as was shown in Fig. 3,

Fig. 6 is a side elevation of the contact bank clip structure,

Fig. 7 is an end view taken to the left of Fig. 6,

Fig. 8 is an end view taken to the right of Fig. 6,

Fig. 9 is a view showing the contact bank about to be inserted in the clip structure, and

Fig. 10 is another view showing a contact bank as received and supported in the clip structure.

Referring to Figures 1 and 2 of the drawings, the electric switch elements are all mounted on a frame



member **10** formed as a stamping from suitable sheet metal. A switch operating drive magnet **11** of the electric coil type and a switch release magnet **12**, also of the electric coil type, are mounted in the positions as shown. The drive magnet **11** has an armature **13** pivoted at **14** on a pivot extending in a plane at right angles to the general plane of the frame member **10**. The armature **13** and pivot **14** are secured to the magnet frame **15** which, in turn, is secured to the switch frame **10** in any suitable fashion. A coil spring **16** is connected at one end to a frame member **17** secured to the magnet frame **15**, and is joined at the other end **18** to a portion of the armature **13** in a manner to normally pivot the armature **13** about the pivot point **14** in a counterclockwise direction away from the magnet **11**. The other end of the armature **13** is provided with a driving pawl **20** adapted to engage a ratchet cog **21** secured on a switch drive shaft **22**. The switch drive shaft **22** is journaled for rotation on the base member **10** and extends perpendicularly to the general plane member **10**. The armature **13** also has an escapement portion **23** adapted to engage projections, such as shown at **24** and **25**, of a switch positioning cog member **26** which is likewise secured to the switch drive shaft **22**. The drive gear **27** is also secured to the switch drive shaft **22** and engages the rack gear arm **28** in a manner such that the counterclockwise rotation of the drive shaft **22** will cause the gear rack arm **28** to move in a direction to the right of the drawings.

The rack arm **28** is slidably journaled upon a suitable frame member **29** having studs **30** and **31** received within the slot **32** of the rack member **28**. As the drive magnet **11** is alternately energized and deenergized, the lever arm **13** is alternately drawn towards the magnet **11** to the position shown in the drawings, and then released to cause the driving pawl **20** and escapement member **23** to impart step-wise counterclockwise rotation to the switch drive shaft **22**, as should be readily understood. The resulting step-wise movement of the rack arm **28** is thus controlled to be moved in uniform incremental amounts as determined by the spacing between the cog members **24** and **25**.

The rack member **28** is provided with an integral bracket **35** upon which is supported in insulated relation a plurality of switch contact brushes, such as the four brushes shown at **36**, **37**, **38** and **39**. As more clearly shown by the end view of Fig. 2, each brush member, such as the brush member **39**, is formed with bifurcated spring portions **40** and **41** which are shaped to provide contact at their end portions only with a respective one of the bare wire contacts **42** or **43**, etc., as the rack **28** and switch brushes are moved to the right of the drawings in response to the stepping operation of the switch drive mechanism including the magnet **11** and associated ratchet mechanism.

In order to release the switch for return of the switch brushes to their normal position as shown in solid lines, the switch release magnet **12** is energized to pivot its armature **50** about the pivot point **51** in a counterclockwise direction. The free end of the armature **50** engages an upstanding end **52** of the release pawl **53** which is pivoted at **54** to the main switch frame **10**. The counterclockwise movement of the release magnet armature **50** causes a clockwise movement of the release pawl **53** to disengage the release or retaining pawl from the ratchet **21**. A biasing coil spring (not shown) is connected between the switch drive shaft **22** and the frame **10** in a manner to rotate the switch drive shaft **22** in a clockwise direction and return the gear rack **28** and the switch carriage **35** and brushes **36—39** to their normal solid line positions whenever the retaining pawl **53** is disengaged from the ratchet gear **21**. Of course, a suit-

able stop mechanism, not shown in detail, is provided to limit the movement of the switch carriage to the left of the drawing to the solid line position as shown.

Contact springs, generally shown at **60**, are provided to be opened each time the release magnet **12** is energized in a manner to cause the retaining pawl **53** to be moved clockwise for releasing and restoring the switch to normal. Similarly, a plurality of contact springs, generally shown at **61**, are provided to be operated by the lever mechanism **62** that is pivoted at **63** on the frame **10** and adapted to be operated by the escapement end **23** of the drive magnet armature **13**. In addition, contact springs, generally shown at **64**, are also provided to be opened each time the drive magnet armature **13** is attracted by the drive magnet **11** as controlled by the pin **65** engaging one of the springs of the contact assembly **64**. All of the various contact spring assemblies **60**, **61** and **64** are provided for specialized circuit functions which do not form a part of the present invention and may be added or omitted to the present switch structure without departing from the spirit of the invention.

As has been earlier described, the movable switch brushes, such as any one of the brushes **36–39**, are adapted to selectively engage respective ones of a plurality of bare wire switch bank contacts, such as shown at **42** and **43**. In the illustrated embodiment of the invention, the bare wire contacts are arranged in groups of eleven aligned in a plane corresponding to a plane movement of the respective ones of the switch brushes **36–39**. According to the invention, the contact assemblies are removable from the main switch structure and may be wired into electrical circuits while separate from the general switch mechanism. The contact bank assembly is more clearly shown in Figures 3–5 of the drawings and consists of a pair of arms **70—71** of insulating material in which may be supported, as by molding, for example, the bare wire contacts **72—82** and **83—93**. In the preferred form of the invention being described, it is apparent that bare wire contacts **72—82** are aligned in one plane and bare wire contacts **83—93** are aligned in a second parallel plane. Since the switch being described is provided with a specific number of movable switch brushes, namely, four, two contact bank assemblies, such as those shown in Figures 3–5 of the drawings, are adapted to be removably supported on the switch frame **10** in the path of movement of the switch brushes **36—39**. It will be noted that the upper insulating arm **70** is provided with a cutout portion **94** and that the bare wire contacts do not extend all of the way through the cutout portion **94**. This enables connecting wires to be inserted through suitable apertures, such as shown at **95**, and connected to the free end of the bare wire contact in a manner shown more clearly at **96** and **97** by Fig. 2 of the drawings.

Means is provided for removably supporting two of the contact bank assemblies, previously described in connection with Figs. 3–5 of the drawings, in the path of movement of the switch brushes **36—39**. In the drawings there is illustrated for this purpose a clip structure **100**, shown in detail in Figs. 6–8 of the drawings, comprising a base portion **101** having an upstanding end portion **102** bifurcated into two spring clip arms **103** and **104**. The other end of the clip **100** is provided with an upstanding end portion **105**. As shown more clearly in Figures 9 and 10 of the drawings, the removable contact bank assembly is inserted in the clip structure by passing the upper end **110** of the insulating arm **70** under a hook portion, such as hook **111**, of the bifurcated spring portion **103**. A shoulder **112** molded or otherwise formed on the upper arm **70** of the contact bank assembly engages a depending portion **113** of the hook **111** and as the contact bank assembly is inserted in the clip by moving it in the direction to the left of Fig. 9 of the drawings, the spring arm **103** is deformed from the dotted position shown in Fig. 10 to the position shown in solid lines in Fig. 10 of the drawings. When the contact bank assembly has been moved to the position generally shown by Fig. 10 of the drawings, the lower shoulder **114** of the lower insulating arm **71** is received on the shoulder portions **115** of the upstanding clip portion **105**. Thus, in such manner, the removable contact bank assembly is supported at two points, namely, the clip shoulder **115** engaging the bottom of the insulated arm **71** adjacent the shoulder **114** and also engaging the shoulder **112** at the upper diametrically opposed end of the bank assembly on the insulated arm **70**. It will be noted, as shown in Fig. 3 of the drawings, that each of the bare wire contacts extends through the insulated support **71** to its lower surface and in order to prevent shortcircuits, the contact bank assembly must be supported in the spring clip in a manner to space the lower surface **116** of the contact assembly from the base **101** of the spring clip or the switch base frame **10**. The spring clip of the invention accomplishes this function by supporting the lower right hand end of the insulated arm **71** upon the clip shoulder **115** together with the action of the end portion **113** of the spring arm **103** in engaging the shoulder **112** on the upper insulating arm **70**. It should be apparent that any effort to pivot the contact bank assembly about the shoulder portion **115** in a manner to cause any portion of the lower surface **116** of the insulating arm **71** to engage the base portion **101** of the spring clip would be resisted by the spring tension of the clip arm **103** as applied to the portion **113** engaging the shoulder **112**. Thus, in such manner, the removable contact bank assembly is supported at opposite ends by the spring clip with the lower surface **116** of the insulating arm **71** spaced from the base **101** of the spring clip and the switch frame **10**.

It should be understood that various modifications may be made in the form of the spring clip assembly for removably supporting the contact bank elements in the path of movement of the switch brushes without departing from the spirit of the invention. For example, nonresilient supporting means may be employed to removably support the contact bank assembly in the spaced relation to the switch frame in a manner to be engaged by the switch brushes as the switch brushes are moved during operation of the switch. Various modifications may be made within the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. A switch comprising, a frame, a movable switch brush mounted on said frame, a contact bank assembly including a pair of spaced apart insulating arms, a plurality of spaced apart bare wire contact elements having respective ends terminating at and embedded in respective ones of said arms and extending transversely between said arms, and supporting means mounted on said frame for removably holding and positioning said contack bank assembly for engagement of said bare wire contacts by said brush as said brush is moved, said supporting means including clip means having respective elements thereof positioned to apply pressure between an end of one of said arms and the diametrically opposite end of the other arm to removably retain the portions of the arms adjacent the ends of the bare wire contacts in a spaced position with relation to the remainder of the supporting means and said frame.

2. The switch defined in claim 1, wherein said one arm includes a first shoulder extending from said end thereof, wherein said other arm includes a second shoulder extending from said diametrically opposite end thereof, and wherein said supporting means includes a longitudinal base portion forming a guide for receiving said one arm, an upstanding portion disposed at one end of said base portion which includes a third shoulder for seating said end of said one arm in spaced relationship

with said base portion and said frame and which further includes an extension oriented to abut said first shoulder, a spring arm having one end thereof attached to the other end of said base portion and having its distal end oriented to abut and apply force to said second shoulder, whereby said first shoulder is urged against said extension of said upstanding portion and said assembly is maintained in spaced relationship with respect to said base portion and said frame.

3. The switch defined in claim 2, wherein said other arm includes longitudinal slot cut therethrough, one end of each of said bare wire contact elements terminating within said slot, and the portion of said other arm above said slot having a plurality of apertures therein oriented in cooperative relationship with the respective bare wire



contact elements, to thereby enable connecting wires to be inserted.

**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 2,136,612 | Dunbar | Nov. 15, 1938 |
| 2,148,824 | Lienzen | Feb. 28, 1939 |
| 2,226,666 | Lienzen | Dec. 31, 1940 |
| 2,239,329 | Lindstrom | Apr. 22, 1941 |
| 2,767,352 | Sengebusch | Oct. 16, 1956 |

FOREIGN PATENTS

| | | |
|---|---|---|
| 208,454 | Switzerland | May 1, 1940 |