

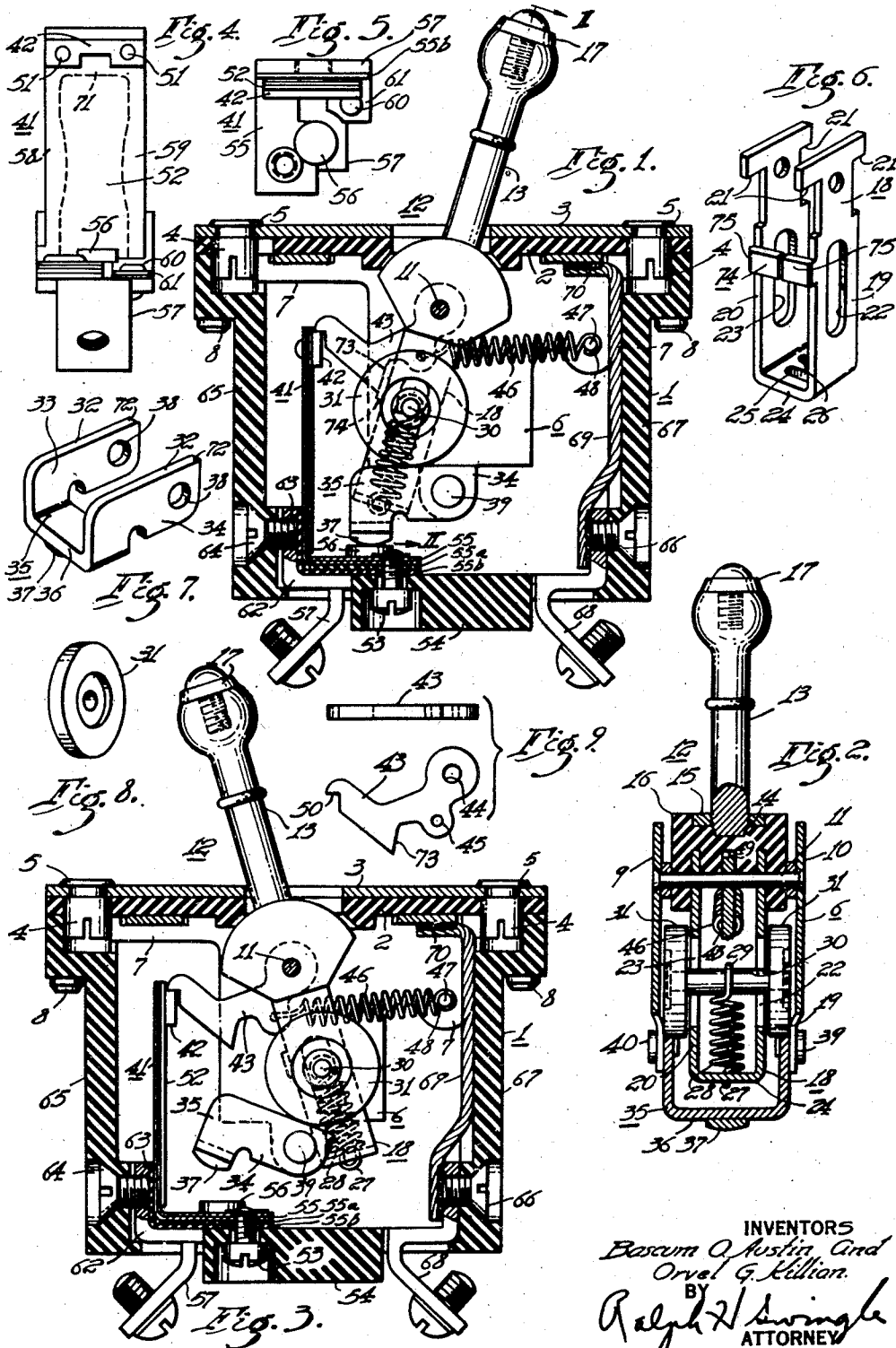
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CIRCUIT BREAKER

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CIRCUIT BREAKER

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This invention relates to improvements in circuit breakers, and although not limited thereto, the invention relates particularly to overload circuit breakers for airplanes and the like.

A primary object of the invention is to minimize the space requirements, and, consequently, the weight of such a device, while insuring trustworthy operation thereof under all conditions.

Another object is to provide a manually controllable overload circuit breaker which is non-trip free, to provide for attainment of an improved and desirable result.

Another object is to provide a circuit breaker of the aforementioned character which will withstand severe vibration without accidental tripping thereof or arcing at its contacts.

Another object is to provide a circuit breaker of improved construction embodying an operating lever and associating therewith resilient means which continually bias the contact means either in their separate or engaged positions.

Another object is to provide an improved circuit breaker of the non-trip-free type in which the contact structure is of improved construction.

Another object is to provide a circuit breaker which will perform in a normal manner under maximum flight altitude conditions.

Another object is to provide a circuit breaker which is substantially unaffected by variations in ambient temperature or pressure conditions.

Another object is to provide an overload circuit breaker, the various parts of which are much smaller and more compactly arranged than those of circuit breakers of similar capacity heretofore known.

Another object is to provide an overload circuit breaker whose frontal area is the same as that of switches, now standard in aircraft service.

Another object is to provide a manually controllable overload circuit breaker consisting of a group of elements, most of which are common to such devices having a wide range of different capacities.

Another object is to minimize the number of different parts required to afford the desired range of variation in the circuit controlling capacities of such devices.

Another object is to provide a circuit breaker which may be manually closed and/or held closed regardless of overload conditions.

Another object is to provide a stationary dust-tight enclosure for the operating elements of such a circuit breaker.

Another object is to provide novel means including a simple operating lever for operating the breaker mechanism and for simultaneously resetting the overload mechanism after tripping of the latter.

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Another object is to provide an improved circuit breaker construction of the non-trip-free type in which the construction is made very rigid by utilizing an improved frame construction upon which the several parts of the breaker may be mounted.

Another object is to provide an improved circuit breaker having improved cam means for insuring that the contacts will be either in the open or closed positions.

Further objects and advantages of our invention will be readily apparent upon a reading of the following specification taken in conjunction with the drawing in which,

Figure 1 is a vertical sectional view through an improved circuit breaker embodying our invention, the parts being shown in the closed circuit position.

Fig. 2 is a fragmentary sectional view taken substantially along the line II—II of Fig. 1.

Fig. 3 is a view similar to Fig. 1, but showing the disposition of the several parts in the open circuit position of the interrupter.

Fig. 4 is a detail view of the bimetallic arm used to provide overload protection.

Fig. 5 is a plan view of the bimetallic arm construction.

Fig. 6 is a perspective view of a detail used in the movable contact construction.

Fig. 7 is a perspective view of the movable contact.

Fig. 8 is a perspective view of the improved cam means which is employed in our invention, and

Fig. 9 collectively shows the improved trip lever of our invention.

Referring to the drawing, and more particularly to Fig. 1 thereof, the reference numeral 1 designates a casing which is preferably molded out of a suitable insulating material. The casing 1 has its upper portion enclosed by an insulating plate 2, the latter, in turn, being covered by a metallic plate 3 having self-locking nuts 4 which are rigidly secured to the casing 1. The top portions 5 of the self-locking nuts 4 are spun over the surface of the metallic plate 3. The metallic plate 3 preferably has engraved thereon the ampere and voltage capacity of the circuit breaker.

Disposed within the casing 1 is a U-shaped metallic frame 6 which has at its upper end projecting side portions 7 which are preferably placed in slots, not shown, formed in the casing 1. Rivets 8 preferably secure the plates 2 and 3 fixedly to the casing 1, and being preferably four such rivets 8 which extend through the four corners of the outer metallic plate 3.

Extending through the vertical side portions 9, 10 of the U-shaped frame 6 is a pin 11 upon which is mounted an operating lever, generally desig-

nated by the reference numeral 12. The operating lever comprises an upper handle portion 13 preferably composed of metal which has its lower end threaded at 14 to threadedly engage a curved metallic member 15, the latter having at its ends downwardly projecting hooks, not shown, which secure it into place within a molded member 16. Preferably at the upper end of the handle portion 13 is a screw 17 having a luminescent tip so as to be visible in the dark.

Also embedded partially in the molded member 16 is a U-shaped member 18 having upwardly extending leg portions 19, 20 with the upper ends thereof having offstanding lug portions 21 which serve to anchor the upper end fixedly in place within the molded member 16. The leg portions 19, 20 of the U-shaped member 18 are slotted as at 22, 23, the purpose for which will appear more clearly hereinafter. The bight portion 24 of the U-shaped member 18 has two slots 25, 26 formed therein which serve to engage the lower hook portion 27 of a tension spring 28, the upper end of which has its hook portion 29 curved about a third pin 30 which passes through the slots 22, 23 of the U-shaped member 18.

At the outer ends of the pin 30 are loosely disposed two cam rollers 31 having a configuration more clearly shown in Fig. 8. The two cam rollers 31 constantly engage the upper portions 32 of the two leg portions 33, 34 of a movable contact member of U-shaped configuration generally designated by the reference numeral 35. Preferably the bight portion 36 of the movable contact member 35 has a contact tip 37 rigidly secured thereto by spot welding.

The arms or legs 33, 34 of the movable contact 35 have apertures 38 provided therein which engage inwardly extending pins 39, 40 which pass inwardly through the side portions 9, 10 of the U-shaped metallic frame 6 in a manner more clearly shown in Fig. 2.

It will be observed that in the fully open and fully closed positions of the breaker, as shown in Figs. 1 and 3, the cam rollers 31 constitute a pair of cams which serve as resilient means for biasing the contact means in either the fully opened or fully closed positions thereof. It will be observed that the tension spring 28 constantly biases the pin 30 toward the lower extremity of the operating lever 12.

The overload release means for the circuit breaker will now be described. The overload release means is provided in the form of a bimetallic arm 41 which bends in a counterclockwise direction about its stationary portion to permit a latch portion 42 thereof to release a trip lever 43 which has a configuration more clearly shown in Fig. 9. The trip lever 43 has an aperture 44 provided therein which serves as a bearing for the pin 11. Consequently, the trip lever 43 is mounted on the same pin 11 which supports the operating lever 12 with the result that both the trip lever 43 and the operating lever 12 have the same axis of rotation.

The trip lever 43 has a second aperture 45 formed therein which serves as a seat for the lefthand end of a tension spring 46, the righthand end of which is supported by a second pin 47 which passes directly across the side portions 9, 10 of the U-shaped metallic frame 6, the latter having apertures 48 formed therein which serve as bearings for the ends of the second pin 47. Consequently, the tension spring 46 serves as basing means for biasing the trip lever 43 in a counterclockwise direction about its pivot pin

11. It will be observed that a recess 49 is provided in the molded member 16, as shown in Fig. 2, to accommodate the rotative movement of the trip lever 43. The trip lever 43 has a latch portion 50 which, in the normal operation of the breaker, engages a latch bar 42, the latter being secured by rivets 51 to the bimetallic arm 41. Preferably the rivets 51 also secure a bimetallic shield 52 composed of a suitable insulating material, such as mica. The lower end of the bimetallic arm 41 is secured in place by a screw 53 which passes upwardly through the bottom 54 of the casing 1 to threadedly engage a horizontal portion 55 of the bimetallic arm 41. Also secured as by welding to the horizontal portion 55 is a stationary contact tip 56 which cooperates with the contact tip 37 of the movable contact 35.

The bimetallic arm 41 is of bifurcated configuration as shown by the dotted lines in Fig. 4, the leg portions thereof being designated by the reference numerals 58, 59. The screw 53 passes through the horizontal portion 55 of the leg portion 58 of the bimetallic arm 41, whereas the terminal lug 57 is secured by a rivet 60 to a horizontal portion 61 of the leg portion 59 of the bimetallic arm 41. The terminal lug 57 has an L-shaped portion 62 having a threaded aperture 63 formed therein which serves as the seat for a screw 64, the latter passing through a side wall 65 of the casing 1. Two insulating plates 55a and 55b are positioned below the horizontal portion 55 to prevent shorting by the terminal lug 57.

A screw 66 passing through the opposite side wall 67 of the casing 1 secures in place a second terminal lug 68, the latter being welded to a flexible shunt 69, the upper end of which is welded as at 70 to the bight portion of the U-shaped metallic frame 6.

Thus, in the closed circuit position of the breaker the electrical circuit therethrough comprises terminal lug 68, flexible shunt 69, U-shaped metallic frame 6, pins 39, 40, side contact arms 33, 34, movable contact tip 37, stationary contact 56, leg portion 58 of bimetallic arm 41, bight portion 71 of bimetallic arm 41, leg portion 59 of bimetallic arm 41, rivet 60 to the opposite terminal lug 57 of the breaker. Thus, the current passing through the breaker passes in series through the bimetallic arm 41.

It will be observed that in the closed circuit position of the breaker, as shown in Fig. 1, the tension spring 28 biases the cam rollers 31 downwardly against the upper portions 32 of the movable contact 35 to maintain the requisite contact pressure between the movable contact tip 37 and the stationary contact tip 56. Thus, although vibration may exist, still the tension of the tension spring 28 is sufficient to maintain the proper contact pressure in the closed circuit position of the breaker as shown in Fig. 1.

It will also be noted that the trip lever 43 is provided with a shoulder 73 (Figs. 1, 3 and 9) which is engaged by an abutment 74 on the U-shaped member 18 to act as a stop for the operating lever 12 in the closed position of the circuit breaker. The abutment 74 comprises a pair of inwardly bent lug portions 75 integrally formed with the U-shaped member 18 and bent toward each other as shown more clearly in Fig. 6.

To manually effect an opening operation of the breaker, the handle 13 is rotated in a counterclockwise direction about the pin 11 to thereby raise the cam rollers 31 against the downward biasing action exerted by the tension spring 28.

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When the downward force exerted by the cam rollers 31 passes to the right of the axis of rotation of the pivot pins 39, 40 so that the cam rollers 31 are brought to bear against the end portions 72 of the movable contact 35, then there will occur a snap opening action of the movable contact 35 to cause separating upward motion thereof away from the stationary contact 56.

Thus, it will be observed that also in the open circuit position of the breaker as shown in Fig. 3, there again exists pressure exerted by the cam rollers 31 to forcibly maintain the movable contact 35 in its opened circuit position.

If, when the breaker is in the closed circuit position as shown in Fig. 1, an overload exists in the electrical circuit controlled by the breaker, the bimetallic arm 41, which carries the series current through the breaker, will flex toward the left to permit a release of the trip lever 43 to thereby permit the tension spring 46 to rotate the trip lever 43 about the pin 11 in a counterclockwise direction.

During the counterclockwise rotation of the trip lever 43, the shoulder portion 73 thereof moves the abutment member 74 carried by the movable contact assembly therewith to forcibly cause counterclockwise rotation of the operating lever 12 about the pin 11. The resulting opening operation during such an overload tripping operation is exactly the same as described above during a manually opening operation; consequently, a further description thereof appears unnecessary.

It suffices to mention that during a subsequent closing operation the handle 13 is rotated in a clockwise direction about the pin 11 to carry not only the movable U-shaped member 18, but also the trip lever 43 in opposition to the tension spring 46. This clockwise rotation of the operating lever continues until the latch portion 50 of the trip lever 43 is again latched by the latch portion 42 of the bimetallic arm 41. Should an overload still continue in the circuit controlled by the interrupter, the breaker will again be opened upon a release of the handle 13. But should it be desired to maintain the contact means closed regardless of overload conditions, such a result may be obtained by forcibly maintaining the handle 13 in its closed position as shown in Fig. 1.

From the foregoing description, it will be apparent that the mechanism is hence non-trip free in operation inasmuch as the contact structure may be manually maintained closed regardless of overload conditions existing in the circuit controlled by the breaker.

It will be observed that different ampere capacities of the breaker may be obtained merely by changing only the bimetallic arm 41, the rest of the contact mechanism being the same for all current ratings. Thus, by merely changing the bimetallic arm 41 to one of a different load rating, the breaker may be thus adapted for different current carrying capacities.

It will also be apparent from the foregoing description that the operating mechanism is extremely simple and compact in structure and provides the requisite operating pressure in both the opened and closed circuit positions of the breaker. It will also be apparent that there are few parts employed and that they may be formed from sheet metal strips stamped and bent to the proper configuration.

Furthermore, the breaker construction is rigid inasmuch as the U-shaped metallic frame 6 being

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an integral unit fixedly supports in place the several parts of the operating mechanism.

It will also be noted that the assembly of the breaker is facilitated by the fact that the operating lever 12 may be separately assembled and easily positioned into place within the U-shaped metallic frame 6. The movable contact 35 is also simple in construction and may easily be mounted upon the pins 39, 40, the latter being separately riveted in place on the leg portions 8, 10 of the metallic frame 6.

It will further be noted that the cam roller shaft 30 may easily move up and down in the slots 22, 23 during the opening and closing positions of the interrupter because of the fact that the cam rollers 31 are freely mounted on the cam roller shaft 30 and configuration is not changed during long operational life since new surface portions of the cam roller 31 constantly come into place. Also it will be observed that mechanical means are provided for producing pressure to open and close the breaker using a tension spring 28 which travels with the operating lever arm and is not swung around a fixed point which would result in wear of the spring hook.

Although we have shown and described a specific structure, it is to be clearly understood that the same was merely for the purpose of illustration and that changes and modifications may readily be made therein by those skilled in the art without departing from the spirit and scope of the appended claims.

We claim as our invention:

1. In a circuit breaker, an operating lever, means pivotally mounting the operating lever, said operating lever carrying two slotted leg portions, a pin passing through the slots in said leg portions, a pair of cam rollers mounted on said pin, a tension spring biasing said pin and said cam rollers toward one extremity of said operating lever, contact means including a stationary contact and a movable contact of U-shaped configuration, means pivotally mounting the movable contact through the leg portions thereof, said spring urging said rollers into engagement with said leg portions to cause said movable contact to be rocked to open and closed circuit positions in response to rocking movement of said operating lever, a trip lever mounted for rotative movement, biasing means to bias the trip lever into rotative movement, and overload release means to latch the trip lever in a normally stationary position, said trip lever when released moving said operating lever to the open circuit position.

2. In a circuit breaker, a U-shaped frame, a pin extending across the frame, an operating lever pivotally mounted on said pin and movable to open and closed positions, a trip lever pivotally mounted on said pin, a second pin extending across the frame, a tension spring having one end secured to said second pin and having its other end secured to the trip lever to bias said lever to tripping position, the lower portion of the operating lever having two slotted legs, a third pin extending through the slots in the legs, two cam rollers mounted on the ends of said third pin, the lower ends of the slotted legs being connected by a bight portion, a second tension spring having one end secured to the bight portion and having its other end secured to the third pin, pin means mounted by the frame, a bifurcated movable contact pivotally mounted on said pin means, a stationary contact cooperating with said movable contact, the legs of said movable contact extending on either side of the lower

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end of said operating handle and providing two substantially straight portions for receiving said cam rollers, said second spring urging said rollers into engagement with said straight portions of said movable contact to bias said movable contact to open position and to provide contact pressure when said movable contact is in closed position in accordance with the respective positions of said operating lever, and electroresponsive means normally restraining said trip lever and operable in response to overload current to release said trip lever, said trip lever when released actuating said operating lever to open position.

3. In a circuit breaker, a U-shaped frame, a pin extending across the frame, an operating lever pivotally mounted on said pin and movable to open and closed positions, a trip lever pivotally mounted on said pin, a second pin extending across the frame, a tension spring having one end secured to said second pin and having its other end secured to the trip lever to bias said trip lever to tripping position, the lower portion of the operating lever having two slotted legs, a third pin extending through the slots in the legs, two cam rollers mounted on the ends of the third pin, the lower ends of the slotted legs being connected by a bight portion, a second tension spring having one end secured to the bight portion and having its other end secured to the third pin, a bifurcated movable contact pivotally mounted on said frame, a stationary contact cooperating with said movable contact, the legs of said movable contact extending on either side of the lower end of said operating handle and providing two substantially straight portions for receiving said cam rollers, said second spring urging said rollers into engagement with said straight portions of said movable contact to bias said movable contact to open position and to provide contact pressure when said movable contact is in closed position in accordance with the respective positions of said operating lever, and current responsive means including a bimetallic arm to normally latch the trip lever against movement, said current responsive means being operable in response to overload current to release said trip lever to permit the latter to actuate said operating lever to open position.

4. A circuit breaker comprising a box-like casing of insulating material, a frame in said casing including at least a pair of spaced metal plates, an operating lever pivotally mounted between said plates and having a portion extending exteriorly of said casing, a trip lever pivotally mounted on a common axis with said operating lever, a tension spring having one end secured to said frame and having its other end secured to said trip lever to bias said trip lever to tripping position, the lower portion of the operating lever having two slotted legs, a pin extending through the slots in said legs, two cam rollers mounted on the ends of said pin, the lower ends of the slotted legs being connected by a bight portion, a second tension spring having one end secured to said bight portion and having its other end secured to said pin, a preformed movable contact member of integral construction comprising a pair of parallel arm portions joined at one end by a transverse portion, means pivotally mounting the other ends of said arms to said frame, a contact tip carried by said transverse portion, a stationary contact carried by one wall of said casing for cooperation with said contact

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tip, said parallel arm portions having substantially straight upper surfaces extending to either side of their pivotal mounting for receiving said cam rollers, said second spring biasing said rollers into engagement with said straight surfaces to cause said contact member to be rocked about its pivotal mounting as said rollers traverse said surfaces from one side of said mounting to the other in response to oscillating movement of said operating lever and thereby effect opening and closing movement of said movable contact member with a snap action, and current responsive means including a bimetallic arm to normally latch the trip lever in predetermined position and operative to release said trip member upon the occurrence of overload conditions, and an abutment member carried by the operating lever and actuated by the trip lever when the latter is released by the bimetallic arm to move said operating lever to the open circuit position.

5. A circuit breaker comprising a box-like casing of insulating material, a frame in said casing including at least a pair of spaced metal plates, an operating lever pivotally mounted between said plates and having a portion extending exteriorly of said casing, the lower portion of the operating lever having two slotted legs, a pin extending through the slots in said legs, two cam rollers mounted on the ends of said pin, the lower ends of the slotted legs being connected by a bight portion, a tension spring having one end secured to said bight portion and having its other end secured to said pin, a preformed movable contact member of integral construction comprising a pair of parallel arm portions joined at one end by a transverse portion, means pivotally mounting the other ends of said arms to said frame, a contact tip carried by said transverse portion, and a stationary contact carried by one wall of said casing for cooperation with said contact tip, said parallel arm portions having substantially straight upper surfaces extending to either side of their pivotal mounting for receiving said cam rollers, said spring biasing said rollers into engagement with said straight surfaces to cause said contact member to be rocked about its pivotal mounting as said rollers traverse said surfaces from one side of said mounting to the other in response to oscillating movement of said operating lever and thereby effect opening and closing movement of said movable contact member with a snap action.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
596,457	Hailey	Dec. 28, 1897
689,929	Suren	Dec. 31, 1901
776,521	Levin	Dec. 6, 1904
1,605,910	Appleton et al.	Nov. 9, 1926
2,214,695	Jennings	Sept. 10, 1940
2,267,203	Krieger	Dec. 23, 1941
2,342,945	Krieger	Feb. 29, 1944
2,416,169	Freese	Feb. 18, 1947

FOREIGN PATENTS

Number	Country	Date
406,437	Great Britain	Mar. 1, 1934