May 10, 1960 R. E. LARKIN 2,936,347

ELECTRIC SWITCH

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Fig. 1

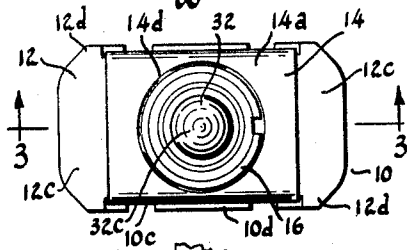

Fig. 2

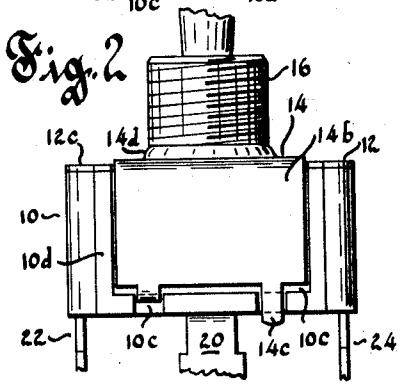

Fig. 3

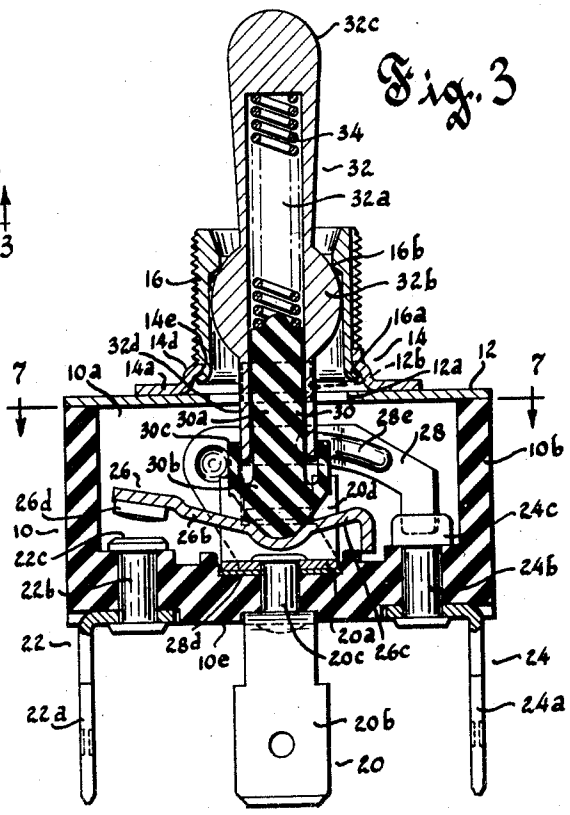

Fig. 4

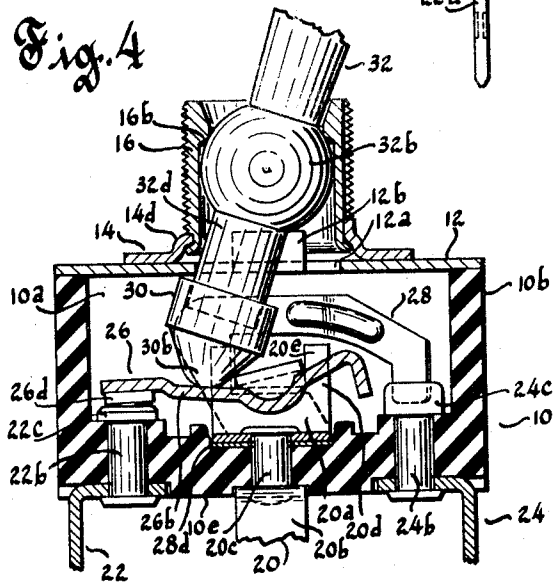

Fig. 5

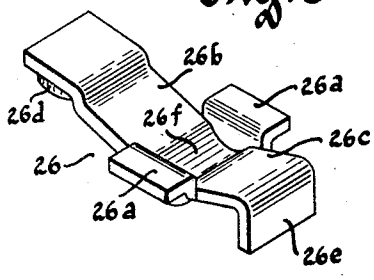

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Fig. 6

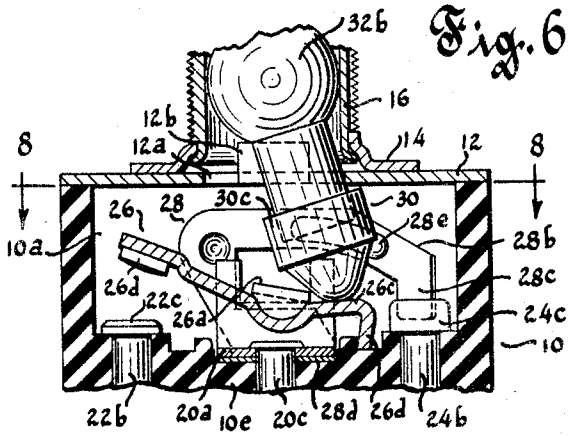


Fig. 7

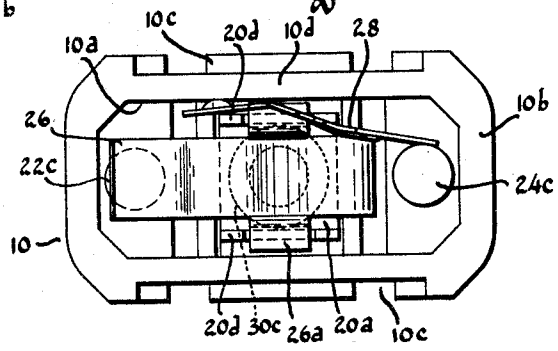
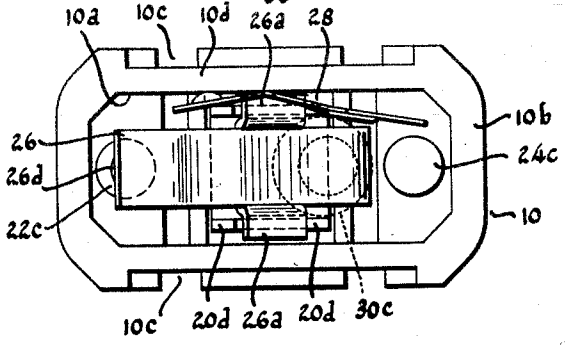


Fig. 8



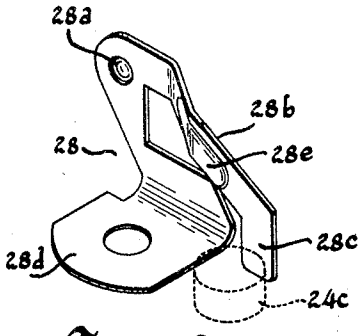


Fig. 9

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ELECTRIC SWITCH

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Application October 24, 1958, Serial No. 769,376

6 Claims. (Cl. 200—6)

This invention relates to electric switches and more particularly to switches of the toggle actuated type.

While not limited thereto, the switches of the present invention are particularly adapted for coordinately controlling projection lamps and ventilating fans in movie and slide projectors.

A primary object of the invention is to improve and simplify the details of construction and assembly of the parts and the operating characteristics of the aforementioned type of switches.

A more specific object is to provide a novel and simple form of switch arrangement having two movable switch members combined with a common actuating member operable to selectively close or open either one or the other of the two switches, or to close and open both switches simultaneously.

The accompanying drawings illustrate preferred embodiments of the invention which will be hereinafter described in detail, it being understood that the embodiments illustrated are susceptible of various modifications without departing from the scope of the claims.

In the drawings:

Figure 1 is a top plan view of an electric switch constructed in accordance with my invention;

Fig. 2 is a side elevational view of the switch shown in Fig. 1;

Fig. 3 is a vertical sectional view to larger scale taken along lines 3—3 of Fig. 1;

Fig. 4 is a fragmentary view, partly in vertical section and partly in side elevation illustrating the position of the respective components with the actuating lever in its extreme right-hand position;

Fig. 5 is a perspective view illustrating the details of a part of the switch shown in Fig. 3;

Fig. 6 is a fragmentary view partly in vertical section and partly in side elevation illustrating the position of the respective components with the actuating lever in its extreme left-hand position;

Fig. 7 is a top plan view taken on line 7—7 of Fig. 3 showing the position of a part of the switch by broken lines;

Fig. 8 is a top plan view taken on lines 8—8 of Fig. 6 showing the position of a part of the switch by broken lines; and

Fig. 9 is a perspective view of a part of the switch shown in Fig. 3.

Referring to the drawings, the electric switch shown in Fig. 1 includes a casing consisting of a box like insulated switch base **10** having an upwardly opening recess **10***a* which is substantially closed by an overlying rectangular cover plate **12**. The cover plate **12** is provided with a centrally located elongated rectangular opening **12***a* and a pair of upwardly extending lugs **12***b* situated on opposite sides of the opening **12***a* and parallel to the longitudinal dimension of the cover plate **12**. The end portion **12***c* of cover plate **12** is further provided with laterally extending ears **12***d* which when assembled on base **10** coincide with the top outer marginal surfaces of the end

walls **10***b* of base **10**. The base **10** has shallow external recesses **10***c* located in the outer mid portions of its side walls **10***d* to accommodate a switch frame **14**. The switch frame **14** is punched and stamped from sheet metal and is substantially saddle-shaped. When assembled on the base **10** as shown in Fig. 2, the top portion **14***a* of the switch frame **14** substantially overlies the cover plate **12** and provides means of securing cover plate **12** to the base **10**. The depending leg portions **14***b* of switch frame **14** interfit with the extending ears **12***d* of cover plate **12** and cooperate to prevent endwise displacement of the cover plate **12** relative to the switch frame **14**. The depending leg portions **14***b* are positioned in respective shallow recesses **10***c* of the side walls **10***d* of switch base **10** and thereby prevent endwise displacement of the switch frame **14** relative to switch base **10**. Each of the leg portions **14***b* is provided with a pair of integral downwardly projecting lugs or tongues **14***c*, the ends of which are bent inwardly into engagement with the lower surface of switch base **10** to secure switch frame **14** and cover plate **12** in assembled relationship to switch base **10**.

As best shown in Fig. 3 the top portion **14***a* of switch frame **14** is provided with an upwardly bulged central portion **14***d* which in turn is provided with a circular opening **14***e* to accommodate the reduced lower end **16***a* of an exteriorly threaded metal bushing **16**. The reduced end **16***a* is spun outwardly as shown to rigidly and permanently connect the bushing **16** to the switch frame. Bushing **16** is formed at its upper end with an inwardly projecting annular flange **16***b* which permits upward insertion of an actuating lever **32** and provides a bearing surface for the spherical portion **32***b* of lever **32**.

The aforedescribed lugs **12***b* extend upwardly from cover plate **12** into the lower end of bushing **16** when the cover plate **12** and switch frame **14** are assembled on base **10** and provide means for guiding and limiting the oscillatory motion of actuating lever **32** to a single plane parallel to the side walls **10***b* of base **10**.

The switch mechanism comprises a fixed common terminal assembly **20** secured midway of the longitudinal dimension of the bottom wall **10***e* of base **10**, fixed terminal assemblies **22** and **24** on opposite sides of terminal **20**, a tiltable bridging contactor **26**, a flexible contactor finger **28**, a spring biased contactor operating plunger **30**, and a manually operated actuating lever **32**. The common terminal assembly **20** includes a U-shaped pivot member **20***a* and a lug **20***b* which are electrically interconnected and secured to the upper and lower surfaces, respectively, of the bottom wall **10***e* of the base **10** by a rivet **20***c*. The bridging contactor **26** is interposed between the upwardly extending laterally spaced arms **20***d* of the U-shaped member **20***a* and the substantially rectangular upwardly opening slots **20***e* in arms **20***d* accommodate the respective laterally extending wing portions **26***a* of the bridging contactor **26** to provide a pivotal support for the latter and to prevent its endwise displacement upon rocking or tilting of the bridging contactor **26**.

As shown in Fig. 3, the left-hand stationary contact assembly **22** includes a lug **22***a* which is riveted to the outside of the bottom wall **10***e* of base **10** by a rivet **22***b* having an upset head seated against the inner surface of the bottom wall **10***e* of base **10** to provide a stationary contact **22***c*. The right-hand stationary contact assembly **24** includes a lug **24***a* which is secured to the exterior of the bottom wall **10***e* of base **10** by a rivet **24***b* having an upset head seated against the inner surface of the bottom wall **10***e* of base **10** to provide a stationary contact post **24***c*.

As shown in Fig. 5, a tiltable bridging contactor **26** formed of punched and stamped sheet metal is provided

with extended arms 26*b* and 26*c*. Arm 26*b* is provided with a contact tip 26*d* adapted to engage stationary contact tip 22*c* upon tilting of bridging contactor 26. The end portion 26*e* of arm 26*c* is bent downwardly substantially perpendicularly to arm 26*c* to form a stop or abutment for engagement with the interior surface of the bottom wall 10*e* of base 10 to limit the degree of opening of contact tips 22*c* and 26*d*, respectively.

As best shown in Fig. 9 finger contactor 28 consists of a thin sheet of stamped bronze, copper, or other material of good electrical conductivity. Contactor 28 is used to complete an electrical circuit between the common terminal assembly 20 and the fixed terminal assembly 24. Contactor 28 has a rigid body portion 28*a*, an integral flexible arm portion 28*b*, an integral downwardly depending contact tip 28*c* and an integral mounting tab 28*d* to secure the contactor 28 to the bottom wall 10*e* of base 10. As shown in Fig. 7, the body portion 28*a* of the finger contactor 28 is disposed between one upwardly extending spaced arm 20*d* of the U-shaped pivot member 20 and the adjacent side wall 10*d* of base 10 and is coplanar with said sidewall. The mounting tab 28*d* which is bent perpendicularly to the body portion 28*a* projects inwardly into the recess 10*a* and lies parallel to the bottom wall 10*e* of base 10. As shown in Fig. 3, the rivet 20*c* passes through aligned openings in the bottom wall 10*e* of base 10, the mounting tab 28*d*, and the overlying U-shaped pivot member 20*a* thereby securing the mounting tab between the U-shaped pivot member and the bottom wall 10*e* of base 10 and electrically interconnecting the finger contactor 28 and terminal assembly 20. As shown in Fig. 9, the flexible arm portion 28*b* of finger contactor 28 is bent at an angle to the body portion 28*a*; and, within the cavity 10*a* of base 10, extends inwardly and downwardly toward stationary contact post 24*c*. The flexible arm portion 28*b* is provided with a depending contact tip 28*c* at its free end and the former is bent in the aforedescribed manner to such a degree that the resulting self-bias of the arm portion 28*b* normally carries the integral contact tip 28*c* into tangential engagement with stationary contact post 24*c* to complete an electrical circuit between terminal assembly 20 and terminal assembly 24. The flexible arm portion 28*b* is further provided with an embossed cam 28*e* projecting laterally toward the center of the base 10 and extending along the mid portion of the length of arm 28*b* to strengthen the arm 28*b* and to accelerate the separation of contact tip 28*c* from stationary contact post 24*c* as the contactor operating plunger 30 slides over the cam 28*e* and forcibly bends the contactor finger 28 out of the path of oscillatory movement of plunger 30 toward the side wall 10*d* of base 10.

The contactor operating plunger 30 is molded from a suitable insulating material and is provided with a cylindrical shaft 30*a* and an integral bullet-shaped tip 30*b* having a diameter approximately twice that of the shaft 30*a*. The bullet-shaped tip is provided with a hollow cylindrical top portion 30*c* and a depending solid conical section 30*d*. The contactor operating plunger 30 is slidably disposed in a downwardly opening recess 32*a* in the actuating lever 32 and is continuously biased downwardly into engagement with bridging contactor 26 by a coiled compression spring 34. The latter is held under compression between the top of recess 32*a* and the end of shaft 30*a*. The spring 34 also biases the actuating lever 32 upwardly causing the spherical portion 32*b* of said lever to bear upon the hereinbefore mentioned projecting annular flange 16*b* of bushing 16.

The actuating lever 32 comprises an integral machined metal member having a bat-shaped handle 32*c*, a spherical portion 32*b* and a reduced cylindrical shank portion 32*d* which is adapted to slidably carry contactor operating plunger 30. In the assembled relation shown in Fig. 3, the handle 32*c* of actuating lever 32 is inserted upwardly through the bushing 16, the spherical portion 32*b* is disposed within the bushing 16, and the depending shank portion 32*d* extends downwardly through the opening 12*a* in cover plate 12 into the cavity 10*a* of base 10.

Assuming that the actuating lever 32 is in its center position as shown in Fig. 3, the conical tip 30*d* of contactor operating plunger 30 is biased downwardly into engagement with the center portion 26*f* of bridging contactor 26 by compression spring 34, causing the arm portions 26*b* and 26*c* of the bridging contactor 26 to assume a substantially parallel relationship to the bottom of base 10. Thus the contact tips 22*c* and 26*d* are separated and the circuit between the common terminal 20 and the left-hand fixed terminal 22 is open. However, the plunger 30, in its center position (as shown in Fig. 7) allows the self-biased contactor finger 28 to engage the contact post 24*c* and complete a circuit between common terminal 20 and the fixed right-hand terminal 24. As the actuating lever 32 is moved toward its clockwise extreme position as shown in Fig. 4, the contactor operating plunger 30 slides over the left-hand arm 26*b* of the bridging contactor 26 causing said contactor to tilt about a pivot point provided by the cooperation of the marginal surfaces of the rectangular slots 20*e* in the upwardly extending arms 20*d* of the U-shaped pivot member 20*a* and the laterally extending wing portions 26*a* of the center portion of the bridging contactor 26. When actuating lever 32 reaches its clockwise extreme position the spring biased plunger 30 forces the movable contact tip 26*d* downwardly into engagement with fixed contact tip 22*c* thereby completing a circuit between common terminal 20 and the left-hand terminal 22. However, the flexible contactor finger 28 is not affected by the above described movement of the actuating lever and remains in engagement with the right-hand fixed contact 24*c*, thus providing a completed circuit between common terminal 20 and the right-hand terminal 24.

Operation of the actuating lever from its clockwise extreme position back to its center position as shown in Fig. 2, causes the plunger 30 to slide over the center portion 26*f* of bridging contactor 26 which in turn causes the left-hand arm 26*b* of said contactor to pivot upwardly out of engagement with fixed contact 22*c*. As the actuating lever 32 is moved toward its counterclockwise extreme position (as shown in Figs. 6 and 8) the plunger 30 slides over the right-hand arm 26*c* of bridging contactor 26 causing its depending end portion 26*d* to be tilted downwardly to abut the bottom wall 10*e* of base 10 and bridging contactor contact tip 26*d* to be moved upwardly thus increasing its separation from fixed contact tip 22*c*. Simultaneously, the outer wall of the cylindrical portion 30*c* of the bullet-shaped plunger tip 30*b* tangentially engages and slides over the embossed cam 28*e* on the arm 28*b* of the finger contactor 28 deflecting the self-biased flexible arm portion 28*b* and its contact tip 28*c* toward the adjacent side wall 10*d* of base 10, thereby disengaging the finger contactor contact tip 28*c* from the left-hand stationary contact post 24*c*.

The operational characteristics of the described switch permit selective completion and interruption of electrical circuits whereby the actuating lever 32 may be operated to its clockwise extreme position as viewed in Fig. 4 to provide a completed circuit between the common terminal 20 and both the fixed terminals 22 and 24. With the actuating lever 32 in its center position as shown in Fig. 3, the circuit between the common terminal 20 and the left-hand fixed terminal 22 is interrupted while the circuit between the common terminal 20 and the right-hand fixed terminal 24 remains completed. Finally, both circuits are interrupted as the actuating lever is moved to its extreme counterclockwise position as shown in Fig. 6. Thus the switch provides three operating conditions: off, one circuit completed, and two circuits simultaneously completed. The described switching arrangement provides a protective interlock whereby the circuit betwen the left-hand fixed terminal and the common terminal cannot be completed unless the circuit between the right-hand fixed ter-

minal and the common terminal is also completed. Such a switching arrangement could be advantageously applied to a moving picture or slide projector, wherein the switch for a high wattage projection lamp could not be operated to circuit completing condition without concurrent operation of a ventilating fan switch to circuit completing condition, thereby preventing deleterious overheating of the projector.

I claim:

1. In an electric switch, in combination, a hollow insulating base, three spaced apart contacts mounted in said base on the bottom wall thereof, a first contactor movable about an axis parallel with said bottom wall to complete a circuit between a first and a second of said contacts, a second contactor normally completing a circuit between said first contact and the third of said contacts and having a portion secured to said first contact and a portion movable about an axis perpendicular to said bottom wall of said base to interrupt the last mentioned circuit, and means including a member oscillatable about an axis parallel with the first mentioned axis operable to move said first and second contactors as aforementioned selectively.

2. In an electric switch, in combination, an insulating base having an upwardly opening recess therein, three spaced apart stationary contacts carried by said base, a tiltable contactor loosely mounted on one of said stationary contacts and pivotally operable about an axis parallel with the bottom surface of said base to engage a second of said stationary contacts, a second contactor comprising a spring metal member secured to said one contact and having a portion thereof normally biased into lateral engagement with the third of said stationary contacts and movable against its bias about an axis perpendicular to the bottom surface of said base to disenage from said third contact, and operating means including a member oscillatable about an axis parallel with the bottom surface of said base to selectively operate said first and second contactors as aforementioned.

3. The combination according to claim 2, wherein said means for operating said tiltable contactor and said spring metal member comprises a plunger member slidably carried within a downwardly opening axial recess in said oscillatable member and biased downwardly into engagement with said tiltable contactor by a spring disposed in the last mentioned recess.

4. The combination according to claim 2, wherein said spring metal member comprises an integral mounting tab electrically interconnected with said one of said stationary contacts, an integral body portion bent perpendicularly to said mounting tab and extending upwardly toward the top of said recess, and an elongated integral arm portion extending from said body portion bent inwardly toward the longitudinal axis of said base and engaging with said third of said contacts.

5. The combination according to claim 3, wherein said plunger member comprises an elongated member of suitable insulating material having a shank portion disposed within said recess in said actuating lever and a substantially bullet-shaped tip integrally formed on its lower extreme, comprising a cylindrical portion the circumferential walls of which tangentially engage said spring metal member upon movement of said oscillatable member to force said spring metal member to move away from said

third contact and further comprising a depending conical portion for continuously engaging said tiltable member as said plunger is carried over said tiltable member by pivoting said oscillatable member.

6. In an electric switch, in combination, an insulating base having an upwardly opening recess therein, a first stationary contact secured to the inside bottom wall of said base midway of its longitudinal dimension, a second stationary contact secured to said wall of said base at one longitudinal extreme, a third stationary contact secured to said wall of said base at its opposite longitudinal extreme, tiltable contactor loosely and pivotally supported by said first stationary contact providing means for completing an electrical circuit between said first and said second stationary contacts whereby said contactor is pivoted about said first stationary contact into engagement with said second stationary contact about an axis parallel to said bottom wall of said base, an elastically deformable finger-type contactor composed of a metal of good electrical conductivity having an integral mounting tab, said tab being positioned between said first contact and said base and electrically interconnected to said first contact, and having an integral body portion bent perpendicularly to said mounting tab and extending upwardly toward the opening of the aforementioned recess, and further having an elongated integral arm portion bent inwardly toward the longitudinal axis of said base and being normally biased by its elastic restoring energy to a closed position in which the free end of said arm portion engages said third stationary contact, and being pivotable about an axis perpendicular to that of said tiltable contactor, a pivotally operable actuating lever extending downwardly into said base comprising an elongated metal member having a downwardly opening axial recess and providing means for positioning said finger contactor and said tiltable contactor in relation to their respective associated stationary contacts, a contactor actuating plunger slidably carried in said recess of said actuating lever and continuously biased downwardly into engagement with the aforementioned tiltable contactor by a compression spring member carried in said recess of said actuating lever, and having a shank portion disposed in said recess to engage said spring member and a substantially bullet-shaped tip on the lower extreme comprising an integral conical portion for engaging said tiltable contactor and an integral cylindrical portion the circumferential walls of which tangentially engage the finger contactor upon operation of said actuating lever thereby forcing said finger contactor to move away from said third stationary contact against the self-bias created by bending said arm portion of said finger contactor, and a switch frame mounted on said base for pivotally supporting said actuating lever.

References Cited in the file of this patent

UNITED STATES PATENTS

2,073,529	Sambelson	Mar. 9, 1937
2,190,342	Smith	Feb. 13, 1940
2,352,936	Bryant	July 4, 1944
2,416,897	Brady	Mar. 4, 1947
2,647,177	Huck	July 28, 1953

FOREIGN PATENTS

399,369	Italy	Oct. 24, 1942