Aug. 18, 1964 B. MISHELEVICH ETAL 3,145,067

POSITION-AND-LOCK JACK

Filed May 25, 1962

Fig. 1.

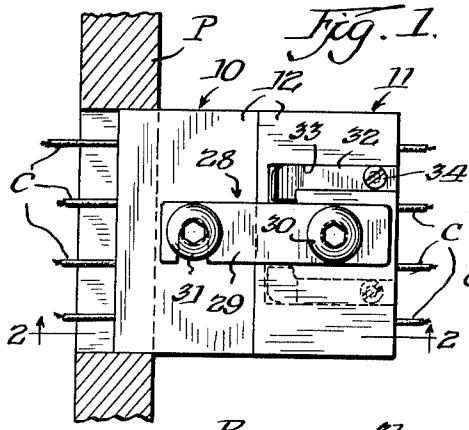


Fig. 4.

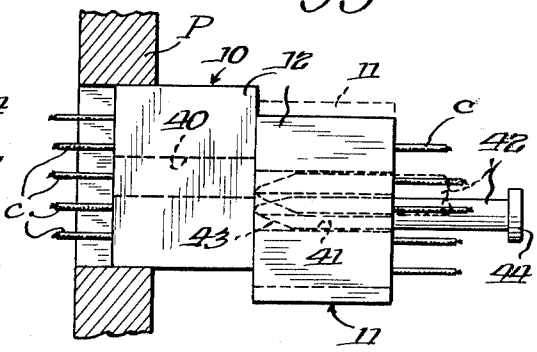


Fig. 2.

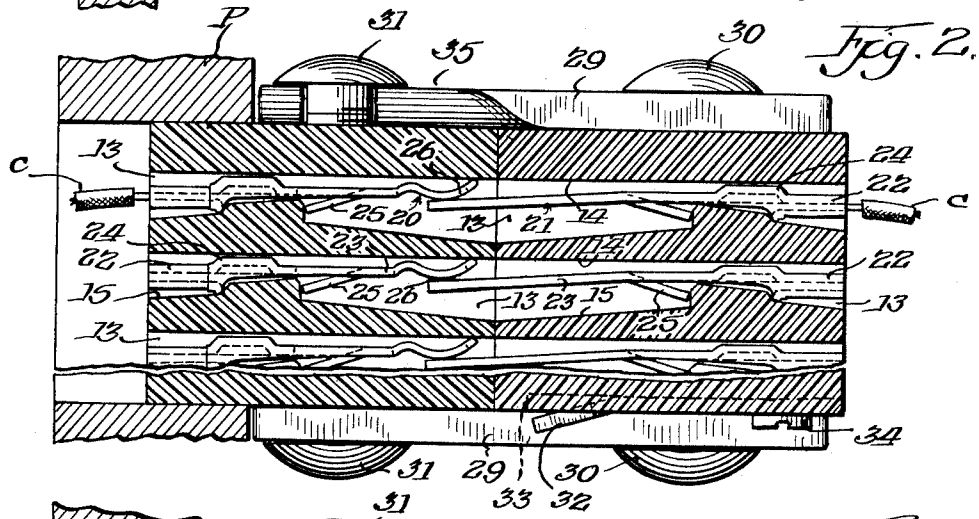
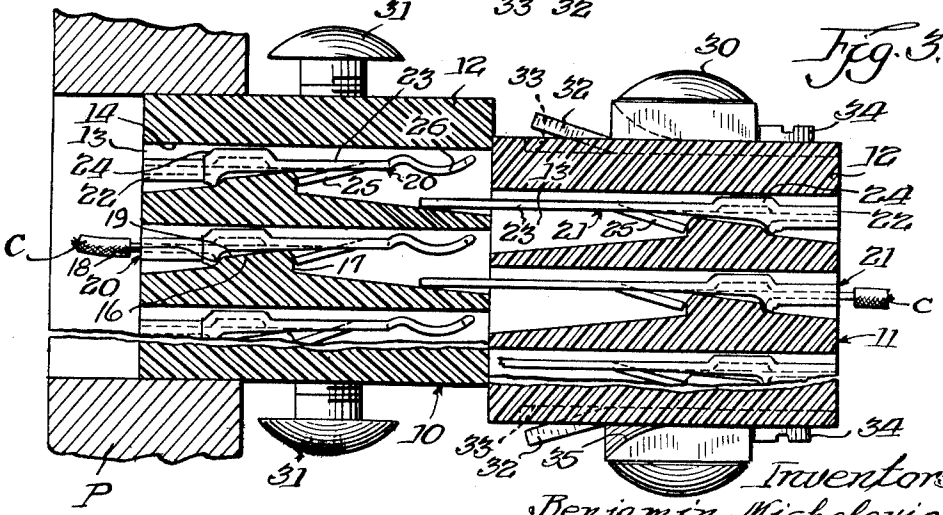


Fig. 3.



Inventors.
Benjamin Mishelevich, &
Donald D. Rinehart.
By Brown Jackson Boettcher & Dunner
Attys.

United States Patent Office 3,145,067 Patented Aug. 18, 1964

3,145,067

POSITION-AND-LOCK JACK

Benjamin Mishelevich and Donald D. Rinehart, Galion, Ohio, assignors to North Electric Company, Galion, Ohio, a corporation of Ohio

Filed May 25, 1962, Ser. No. 197,716
2 Claims. (Cl. 339—75)

The present invention relates to multiple jacks, and more particularly to jacks of the type in which the contacts are first positioned in engageable relation and then moved in a body to establish good electrical contact, and locked in the closed-contact relation.

Electrical jacks commonly involve the exertion of a certain force in insertion and extraction of the movable contact element or elements, whether the jack be of the single or multiple type, due to the friction and resilient pressure employed to assure good contact between the contacts or terminals. Such force is of little importance when jacks employing only a pair or a few pairs of contacts or terminals are considered, but mounts to a high level when jacks with a great multiplicity of contacts are involved. In the latter case, the force required to interengage or separate the jack parts may become a problem of considerable proportions.

By the present invention, there is provided a jack construction which requires substantially zero insertion or extraction force, and yet provides for good, tight electrical contact between the terminals of all the pairs of terminals or contacts. This is accomplished by mounting the cooperable terminals or contacts in a pair of blocks in such manner that the contacts of the two blocks may be disposed in overlapping relation by movement of the blocks relatively toward each other to effect insertion or relatively away from each other to effect separation, but with the contacts of each pair in offset or substantially non-contacting relation so that no friction or resilient resistance must be overcome. Further movement of the blocks in a direction normal to the approaching or inserting movement brings the contacts into the desired engagement, suitable means being provided to effect such additional movement in a simple and easy manner. For separation, the blocks are first moved in a direction opposite to the contact-effecting movement, so as to bring the contacts into the offset or non-contacting position, and then moved away from each other.

It is desirable in most cases to secure the contacts removably in the blocks, so that they may readily be removed and replaced in the event of damage thereto, or breaking of the conductor connected to any of the contacts or terminals, or for inspection or other reasons. The invention provides structure by which the terminals are securely fastened in the blocks, yet may be easily released and removed without damage or deformation, and even more easily resecured in place. The jack construction according to the invention furthermore provides for a wiping action of the contacts, so as to maintain a clean, bright contact area on each. The invention also allows of the blocks for both male and female terminals to be identical, resulting in lower costs and greater simplicity and ease of assembly, since either type of terminal may readily be secured in place in any block. The terminals preferably are formed with a crimping portion at one end for connection with their respective conductors, which is utilized for securement in the blocks.

It is an important object of the invention to provide a simple jack construction allowing substantially zero insertion and extraction force even with a great multiplicity of pairs of terminals, of the order of hundreds.

Another object is the provision of a multiple jack structure employing blocks of identical construction for both parts of the jack.

Another object is the provision of a multiple jack structure in which the terminals are removably secured in the contact-carrying blocks.

A further object is the provision of terminals in a jack structure arranged in pairs and brought into contacting relation by movement transversely of their planes yet having a wiping action.

It is also an object of the invention to provide a jack structure in which the terminals are formed for crimped connection to the respective conductors to facilitate removable securement of the terminals in the respective blocks.

Another object is the provision of means for effecting relative movement of the two parts of a multiple jack to move the terminals of the respective pairs toward and from each other in a transverse direction to and from contact-closing position.

Other and further objects, advantages and features of the invention will be apparent to those skilled in the art from the following description, taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a plan view of a position-and-lock jack incorporating the invention in operative position, mounted on a panel or the like;

FIGURE 2 is a broken vertical sectional view on an enlarged scale, taken substantially as indicated by the line 2—2 of FIGURE 1;

FIGURE 3 is a view similar to FIGURE 2, but with the two blocks or parts of the jack in inserted but non-conductive relation; and

FIGURE 4 is a somewhat diagrammatic view similar to FIGURE 3, but in elevation, showing different means for moving the blocks to the position of FIGURE 2 and holding the blocks in that position.

Referring to the drawings, there is shown a multiple-contact electrical jack mounted on a panel P or like support and comprising a female jack block or part 10 and a male part or block 11. Each of the jack parts comprises a block 12 of a suitable insulating material having a plurality of passages 13 extending therethrough. Each passage 13, as best shown in longitudinal section in FIGURES 2 and 3, has a substantially flat upper surface or wall 14 and a lower surface or wall 15 the outer portions of which may slope slightly upwardly to an intermediately located projection 16 defined by a substantially vertical abutment surface 17 directed toward one end of the passage and a sloping abutment surface 18 facing the other end of the passage, with a top surface 19 sloping downwardly from the upper end of surface 17 to the surface 18. The passages are substantially identical, and of substantially rectangular cross section adjacent either end. In the present case, each block 12 is provided with twenty passages, arranged in four rows of five each.

In each passage 13 of the block 12 of female jack part 10 there is secured a female contact or terminal 20, and similarly in each of the passages of the block 12 of male part or block 11 there is removably mounted a contact or terminal 21. The terminals 20 and 21 are of resilient construction and substantially identical except for the contacting end portions thereof, as appears from the drawings and the following explanation. Each of the terminals 20 and 21 has an initially channel-section connecting end portion 22 crimped on one end of a conductor C to provide a good mechanical and electrical connection with the conductor, as is known in this art. Extending substantially in the plane of the bottom of this channel-section crimping portion is a blade portion 23, a spacing embossment 24 being pressed from the terminal adjacent the juncture of the blade portion and the bottom of the channel portion, projecting in the direction opposite that of the sides or wings of the channel portion. Struck from the blade portion 23 is a tongue 25 bent out of the

plane of the blade portion in the same direction as the crimping channel side portions, the free end of the tongue being directed toward the crimping end portion and spaced therefrom by the longitudinal dimension of the projection 16 in the passage 13 of the block. The blade portion 23 of the male terminal is substantially flat and straight, and of a length such that the overall length of the terminal 21 is greater than the length of the passage 13, so that the free end portion thereof projects out of the block 11. The blade portion of the female terminal 20 is relatively short, so as to be disposed interiorly of the block passage, and has its end curved as shown at 26, or similarly formed to provide a boss or protrusion extending out of the plane of the blade portion to the same side thereof as the side portions of the crimping channel end portion.

As will be clear from FIGURES 2 and 3, the terminals 20 and 21 are secured in the passages of the respective blocks 12 by movement longitudinally of the passages. Each terminal is pushed through the passage contacting end first, until the inner ends of the side portions of the channel-section connecting end 22 of the terminal engage the abutment surface 18 of the projection 16 into the passage to prevent further movement. During movement of the terminal into the passage, the tongue 25 rides over the projection surface 19, being pressed thereby to a position sufficiently retracted from its outspring or projected position to allow the terminal blade portion to move past the projection 16. As the end portion 22 engages the projection 16, the tongue 25 moves clear of the projection to spring to its outwardly bent or projecting position, so that its free end engages with the abutment surface 17 and prevents reverse movement of the terminal. The projection or embossment 24 engages with the upper surface 14 of the passage to prevent any possibility of the crimping end portion 22 of the terminal riding over the passage projection 16. The terminals are securely held in place in the respective passages 13, but may readily be removed by means of a suitable tool which is inserted through the passage end to engage the tongue 25 of a terminal to be withdrawn. The tongue is forced by the tool to a position sufficiently retracted to pass over the projection 16 as the terminal is urged back out of the passage.

As will be apparent particularly from FIGURE 3, the blade portions of the terminals 20 and 21 are of such relative lengths as to be disposed in longitudinally overlapped relation upon relative movement of the jack parts or blocks 10 and 11 toward each other to dispose the terminals 21 with the contacting end portions thereof extending into the passages of the block 10. The terminals, however, are so located relative to the vertical dimension of the passages that they may be offset or substantially out of contact in such overlapped condition. This permits the blocks to be moved toward and from each other to engage the projecting end portions of the terminals 21 in the passages of the block 10, or to withdraw the same therefrom, without requiring any force to overcome friction or any resilient pressure between the terminals. It is to be noted that the blade portion of terminal 21 is spaced from the bottom wall 15 of the passage. It will be evident that the terminals may be connected to the conductors C otherwise than by crimping as specifically disclosed. In such case, of course, the crimping end portions 22 cannot be utilized to engage the passage projections 16 in securement of the terminals in the blocks 12, but obviously the terminals may be provided in other ways with projection or abutment means to achieve the same result.

From the position of the blocks and terminals illustrated in FIGURE 3, the parts may be moved either to the closed-contact position of FIGURES 1 and 2, or to a separated position. The separated or extracted position is simply achieved by merely moving the block 11 away from the block 10, thus withdrawing or extracting the terminals 21 from the passages 13 of the block 10. From this separated position, as already explained, the terminals 21 may be inserted in the block 10 by movement of the block 11 toward the block 10 to dispose the terminals 21 in overlapping but offset relation to the respective terminals 20. To bring the terminals 20 and 21 into electrically conducting relation, that is, to the closed-contact position of FIGURE 2, the block 11 is moved upwardly relative to the block 10 from the inserted position of FIGURE 3, as viewed in FIGURES 2 and 3, until the passages 13 of the respective blocks are brought into registration and the respective upper and lower surfaces of the blocks are substantially flush. To accomplish this, suitable means are provided to effect relative movement of the blocks in the direction of the offset of the terminals of the several pairs, or transversely of the planes of the terminals. Means are also provided to hold or lock the blocks in the closed-contact position, such means, preferably, for the sake of simplicity and cheapness, also holding the blocks in such position.

The block moving and locking means is illustrated in FIGURES 1 to 3 as comprising identical or duplicate combined camming and locking structures, generally designated 28, on the top and bottom of the blocks. Each of these structures 28 comprises a latch 29 in the form of a hook pivoted on the block 11 as by a headed fastener 30, and arranged to swing to a position overlying the block 10 for engagement with a catch 31, such as a headed fastener similar to the fastener 30, projecting from block 10, as shown in FIGURES 1 and 2. Spring detent means is provided to hold the latch 29 against disengagement from the catch 31, in the form of a resilient metal strip 32 disposed in a recess 33 in the surface of the block 11 adjacent the latch 29, as best shown in FIGURE 1. The strip is bent to have one end project out of the recess 33 into the path of the latch 29 between the pivot 30 and catch 31, and is secured to the block by a screw 34 or the like adjacent its other end, which may also serve as a stop for the latch. As the latch 29 is swung to engage with the catch 31, it depresses the spring detent 32 and rides thereover and over the surface of the block 10, camming the block 11 to move upwardly relative to the block 10 to effect the closed-contact position. It should be noted, however, that in the present case manual force may be applied directly to the blocks to effect the initial movement of the block 11 relative to the block 10, the camming action of the latch 29 then being employed after the terminals of the several pairs come into contact, so as to facilitate overcoming the resilient resistance of the terminals 21 as they become stressed after engaging the terminals 20. The portion of the latch which overlies the block 10 in the latching position is beveled as shown at 35 to provide for the camming action of the latch as it is pivoted into engagement with the catch 31. As the latch comes into engagement with the catch, it rides off the bent end of the detent 32, which springs out of the recess 33 sufficiently to block return or disengaging movement of the latch, and thus assures that the blocks will be retained in the closed-contact position of FIGURES 1 and 2 against unintended release.

When it is desired to separate the two parts of the jack, it is necessary only to depress the bent end of the spring detent enough to allow the latch 29 to ride thereover, and swing the latch away from the catch 31 back over the block 11. Both latches are thus released, although it may be pointed out that it is not necessary that the latch 29 on the lower end of block 11 be swung out of overlying relation with block 10. With the latches thus disengaged, the block 11 may easily be moved to the position of FIGURE 3 with the terminals in overlapping but offset relation. In the arrangement illustrated in FIGURES 1 to 3, in fact, gravity will effect the downward movement of block 11 relative to block 10 to result in the block position of FIGURE 3. Unlocking of the latches may be accomplished by a suitable tool, if desired, pivoting on the latch pivot 30 and depressing the spring detent and also providing a handle for turning the latch.

The movement of the block **11** from the terminal-inserted but offset position of FIGURE 3 to the closed-contact position of FIGURE 2 brings the free or projecting end portions of the terminals **21** into contact with the curved end portions **26** of the terminals **20** before the movement is completed, as will be clear from a comparison of FIGURES 2 and 3, so that the latter part of the movement causes flexing of the terminals **20** and **21**, the respective limits of which are defined by the walls **14** and **15** of the passages **13**. The terminals **20** and **21** thus have movement relative to each, due both to the flexing and to the realtive movement of the terminals with the respective blocks after the terminals have come into engagement. There is therefore a wiping action between the free end of terminal **21** and the curved portion **26** of terminal **20** of each pair which provides a bright, clean area of contact therebetween to assure good electrical conduction and prevent corrosional accumulation.

In FIGURE 4, there is illustrated a jack according to the invention which is substantially identical to the jack as shown in FIGURES 1 to 3, differing only in employing different means for bringing the parts or blocks into the closed-contact position from the inserted but non-contacting terminal position and maintaining the blocks in the contact-closing position. The block **10** is mounted on a panel P or the like in any suitable manner, as in FIGURES 1 to 3, and the male block or part **11** is disposable in the terminal-inserted offset position in the same manner as explained hereinabove in connection with FIGURES 1 to 3. The camming and locking structures **28** are replaced by a simpler but nevertheless effective camming and locking construction. This construction comprises a plurality of bores or apertures **40** extending through the block **10** substantially parallel to the passages **13**, and a corresponding plurality of apertures **41** extending through the block **11** parallel to the passages therethrough, only one of each of the apertures being shown. The respective apertures **40** and **41** are located so as to be aligned or registered when the blocks are in the passage-registering of contact-closing position. When the blocks are in offset position with the terminals engaged but not stressed, as shown in dotted lines, the apertures **40** and **41** are offset to the same extent as the passages **13** of the two blocks, but have their adjacent ends in radially overlapped relation so as to open one into the other. A pin **42**, of a length substantially greater than the length of either of the apertures **40** and **41** and having a diameter corresponding to that of the apertures or otherwise formed so as to fit snugly therein, is provided for engagement in each pair of apertures **40** and **41**. Each pin **42** has a tapered or wedging leading or pilot end **43**, and may have a head **44** at its other end.

In operation, the blocks **10** and **11** are manually moved relatively from the full-line to the dotted-line position, bringing the terminals **20** and **21** into engagement, as in the case of the construction of FIGURES 1 to 3, and the pins **42** are pushed through the apertures **41** of the block **11**, their leading ends **43** entering the corresponding apertures **40** of the block **10** through the openings between the apertures when they reach the contacting faces of the blocks. Continued pushing or driving of the pins **42** then causes camming movement of the blocks relative to each other to bring them to the passage-aligning position as the pins move along the apertures **40**. When the pins **42** are fully driven into the apertures of the two blocks, they further serve to hold the blocks against relative movement normal to the passages **13** thereof. Of course, the pins **42** may be inserted first in the apertures **40** to enter the apertures **41** and effect the wedging or camming of the blocks. It will be apparent that the apertures **40** and **41** may extend transversely relative to the passages **13**, instead of parallel as shown. While the apertures **40** and **41** are shown as not overlapping in cross section relative to each other in the full-line position of the blocks, it will be understood that they may be enlarged to obtain such overlap, the pins **42** of course being similarly enlarged.

It will be obvious that other means may be provided for moving the blocks from the offset to the passage-aligned or closed-contact position, if desired, and that such means need not be camming means, and also that the means for locking the blocks in the closed-contact position may be separate from the means for moving the blocks.

While the blocks **12** of the parts or blocks **10** and **11** are shown as provided with the passages **13** so located as to be brought into alignment or registration upon movement of the blocks from the offset terminal-inserted but non-engaging position to the contact-closing position, this is not necessary to the invention. The important point is that the terminals be so arranged in the blocks that inserting and retracting movement thereof may be accomplished without need to overcome any appreciable frictional or resilient force, and can be moved from the loosely inserted position to stressed contacting engagement by relative movement of the blocks transversely relative to the terminals. Thus, the blocks in the terminal-inserting position may be in substantial registry or alignment, and be moved to an offset position while bringing the terminals into the engaged contacting condition.

For convenience in illustration, the blocks **12** are shown as of solid one-piece construction, but it will be understood that as a matter of practical convenience they may be formed of several sections in order to allow for formation of the passages **13**, and the sections then secured together in any suitable manner. Similarly, for convenience in description, terms such as "upper," "vertical," "upwardly," and the like have been used, corresponding to the positions of the parts as illustrated in the drawings, but it will be understood that these expressions are not used in an absolute sense, since the parts would retain their same relative locations or movements if the jack position were changed from that shown. In such case, of course, the particular terms could be changed in an obvious manner to correspond to the new jack position.

It will be understood that the disclosed embodiments of the invention are illustrative, and that many changes and modifications may be made without departing from the inventive concept disclosed, and accordingly it is not intended to limit the invention otherwise than as required by the appended claims.

We claim:

1. A position-and-lock jack construction comprising a pair of substantially identical blocks of insulating material each having formed therethrough a plurality of passages each located for registration with one of the passages in the other block and having a projection therein providing abutment surfaces facing opposite ends thereof, a spring terminal removably secured in each of said passages having an offset portion adjacent one end engaged with one of said abutment surfaces and a resilient tongue struck from the terminal having its free end engaged with the other abutment surface, said one end of each of said terminals having a crimped connection to a conductor, the terminals in registrable passages constituting pairs with one terminal of each pair having the end thereof other than said one end substantially flat and projecting out of the passage and with the other terminal of the pair having said other end thereof formed in a curve and disposed within the passage, said blocks being movable toward and from each other respectively to and from a first position locating the terminals of said pairs with the respective flat and curved ends thereof in overlapping but offset relation, camming means operable to shift the blocks from said first position in the direction of said terminal offset to a second position with the terminals of each pair disposed in stressed contacting relation, and means to lock the blocks in said second position, said camming and locking means comprising a plurality of substantially identical through apertures in each block each located to oppose

in offset but communicating relation a corresponding aperture in the opposed block upon disposition of the blocks in position locating the terminal pairs in engaging but unstressed condition and to extend in substantial registry therewith upon disposition of the blocks in said second position thereof, and a plurality of pins each engageable in a pair of registering apertures in the second block position to hold the blocks in the second position, each of said pins being longitudinally movable in the apertures and having a tapered leading end for wedging engagement in the communicating opening between the pair of apertures in said offset relation to effect movement of the blocks to the second position.

2. A position-and-lock jack construction comprising a pair of blocks each having formed therethrough a plurality of passages each opposable in communicating relation with a passage in the other block, a spring terminal in each of said passages, means removably securing the terminal in the passage, means for connecting one end of each terminal to a conductor, the terminals in opposable passages constituting pairs with one terminal of each pair having the end thereof other than said one end substantially flat and projecting out of the passage and with the other terminal of the pair having said other end thereof terminating within the passage and having a protrusion thereon, said blocks being movable toward and from each other respectively to and from a position with the terminals of said pairs in overlapping but offset relation, means for shifting the blocks from said position to a second position with the terminals of each pair disposed in stressed contacting relation, and means to lock

the blocks in said second position, said block shifting and locking means comprising a plurality of corresponding apertures in the blocks located to extend in pairs partially offset but communicating relation upon positioning of the blocks to bring the terminal pairs into unstressed engagement and to extend in substantially registering pairs upon disposition of the blocks in said second position thereof, and a plurality of wedge members each engageable in a registering pair of apertures to hold the blocks in the second position, each of said wedge members being longitudinally movable in the aperture pairs into the communicating opening between the apertures in said partially offset relation to effect relative movement of the blocks to the second position.

References Cited in the file of this patent

UNITED STATES PATENTS

1,126,133	Urbanides	Jan. 26, 1915
1,917,009	Betts et al.	July 4, 1933
2,111,118	Lake	Mar. 15, 1938
2,742,534	Martin et al.	Apr. 17, 1956
2,769,964	Lartz	Nov. 6, 1956
2,895,120	Lach et al.	July 14, 1959
2,938,190	Krehbiel	May 24, 1960
2,945,201	Waninger	July 12, 1960
3,011,143	Dean	Nov. 28, 1961
3,058,091	Henschen	Oct. 9, 1962
3,085,220	Sitz	Apr. 9, 1963

FOREIGN PATENTS

625,388	Great Britain	June 27, 1949