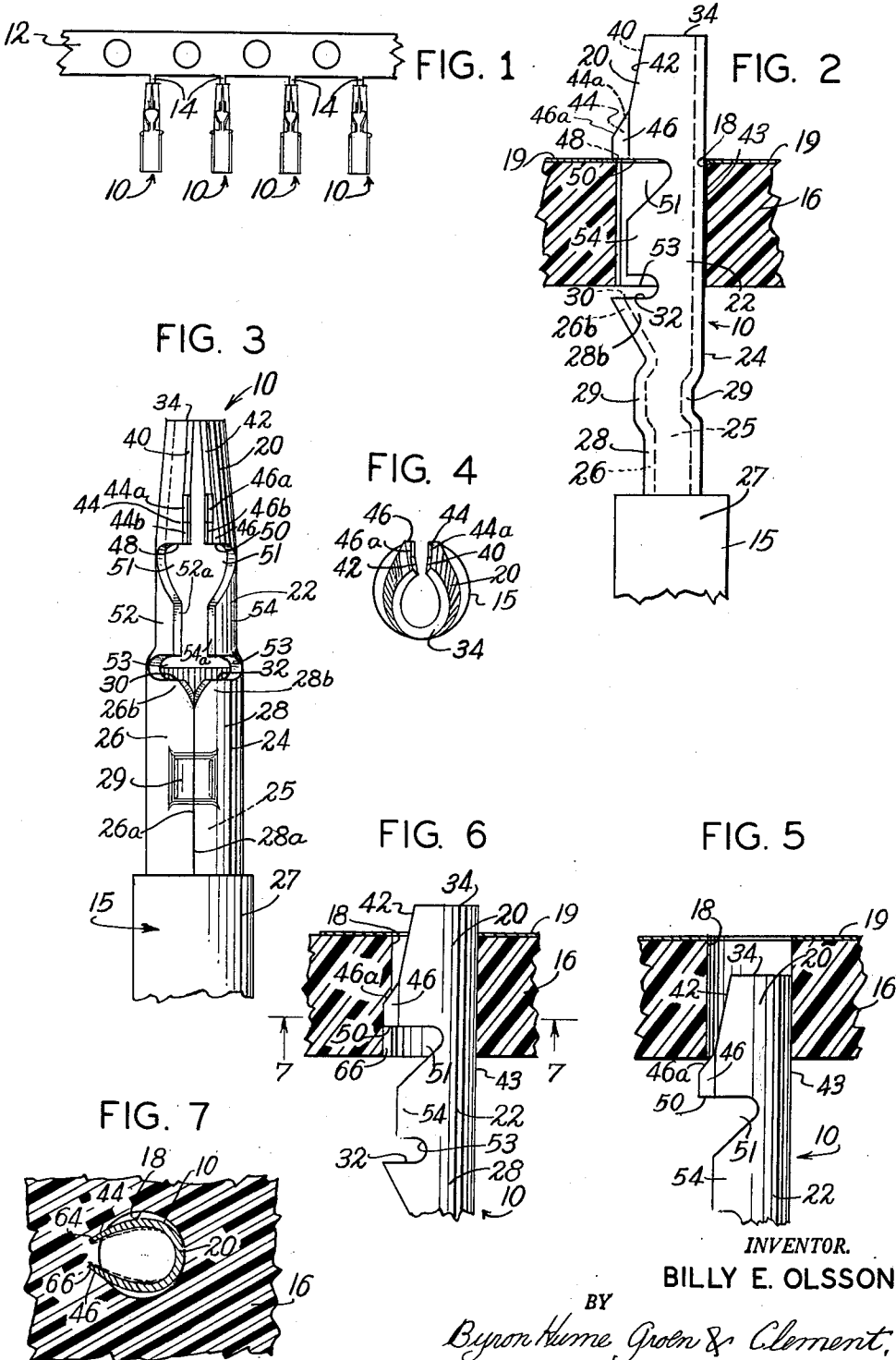


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B. E. OLSSON
SNAP-IN TERMINAL FOR PANEL

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1

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SNAP-IN TERMINAL FOR PANEL

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The present invention relates to electrical terminals, and in particular to electrical terminals that are adapted to be snap-mounted to a support or the like.

It is an object of the present invention to provide a new and improved terminal of the snap-in type.

It is another object of the present invention to provide a snap-tip terminal that is snap-mounted to a support or the like by inserting the tip of the terminal through an opening defined in the support.

It is a further object in accordance with the previous object to provide in a terminal a tip structure that is adapted to be inserted through a range of different sized support openings.

It is yet a further object of the present invention to provide a new and improved terminal which is provided with a plurality of barbs to penetrate a baseboard or the like during insertion through an opening defined in the baseboard.

It is still a further object of the present invention to provide in a new and improved terminal a tip embodying a plurality of barbs for penetrating a support during mounting of the terminal and for restraining the terminal against axial movement thereafter.

It is another object of the present invention to provide a new and improved snap-tip terminal that is adapted to be manufactured by automatic machinery and can be easily handled, shipped and stored.

The above and other objects are achieved in accordance with the present invention by providing a new and improved terminal of the snap-in type. The terminal is readily attached to a support or the like, for example a printed circuit baseboard, incident to its insertion through an opening defined in the baseboard. To this end, the tip of the terminal includes a plurality of barb means that readily penetrate the baseboard during mounting of the terminal yet restrain the tip against axial withdrawal movement after its mounting. The terminal is so constructed that it can be used with a range of different-sized openings within commercially acceptable tolerances. In addition, once the terminal is mounted to the baseboard, it is locked in situ by the coaction of the barb means and suitably spaced stop means, and can be removed from the baseboard only upon the application of a large force that causes the barbs to rupture the support during its withdrawal from the baseboard opening.

The invention, both as to its organization and method of operation, taken with further objects and advantages thereof, will best be understood by reference to the following description taken in connection with the accompanying drawing, in which:

FIG. 1 is an elevational view of a plurality of terminals embodying the features of the present invention, illustrated in "chain form" after fabrication by automatic machinery;

FIG. 2 is a greatly enlarged side elevational view of the terminal of FIG. 1, shown electrically connected to a conductor and mounted on a support, baseboard, or the like;

FIG. 3 is a front elevational view of the terminal of FIG. 2;

FIG. 4 is a top plan view of the terminal of FIG. 2;

FIG. 5 is a fragmentary side elevational view, shown partially in section, of the terminal of FIG. 2, illustrating the terminal immediately prior to mounting on the baseboard;

2

FIG. 6 is a fragmentary side elevational view, shown partially in section, of the terminal of FIG. 2 during mounting on a baseboard or the like; and

FIG. 7 is a sectional view taken along line 7-7 of FIG. 6.

Referring now to the drawing and in particular to FIG. 1, a plurality of terminals embodying the features of the present invention are illustrated and are individually identified by reference numeral 10. The terminals 10 are manufactured in "chain form" by suitable automatic machinery, i.e., are stamped from a strip of stock metallic material by a suitable punch and then are deformed by successive deforming steps into generally tubular terminals. As shown, the tips of the terminals 10 are respectively connected by tabs 14 to the longitudinal edge of a thin strip 12 of metallic material so as to extend perpendicularly to and coplanar with the strip 12. By this "chain" construction, the strip 12 and attached terminals 10 can be readily rolled in spiral fashion to facilitate handling, shipment, and storage. The terminals in "chain form" are fed into suitable dispensing equipment which severs the tip of the terminals 10 from the tabs 14 of the strip 12 and subsequently crimps the terminals 10 to suitable electrical leads, for example conductors, ends of electrical components, and the like.

After each terminal is severed from the strip 12 and crimped to a lead, for example conductor 15, it is snap mounted to a support, for example a printed circuit baseboard 16 or the like. Since the tip of the terminal 10 is adapted to be inserted through a suitable opening 18 provided in a printed circuit baseboard 16, the terminal 10 is hereinafter identified, for convenience, as a snap-tip terminal. By virtue of the unique tip construction of the terminal 10, the tip easily passes through the opening 18— and when the tip is in its mounting position it prevents the snap-tip terminal 10 from being withdrawn through the opening 18. Hence, in the absence of a large withdrawal force, downward movement of the terminal 10, as seen in FIG. 2, and disassembly of the terminal 10 and the baseboard 16, is prevented. Furthermore, as best shown in FIG. 2, after the terminal 10 is snap mounted to the baseboard 16, the tip structure loosely seats on electrically conductive material 19 embedded in the upper surface of the printed circuit baseboard 16. The electrically conductive material 19, as is well known, is used in lieu of a conductor or the like and serves to electrically interconnect spaced apart points in the baseboard 16. For example, the material 19 may extend between two openings 18 so that two terminals 10 disposed in the openings 18 may be electrically interconnected.

Considering now briefly the general construction of the terminal 10, as best shown in FIGS. 1 and 2, the terminal 10 comprises a generally tubular construction having a "barrel-like" tip 20 for passing through the baseboard opening 18 and for penetrating the baseboard structure adjacent the opening 18 during mounting of the terminal 10. At the end of the terminal 10 remote from the tip 20, there is provided a crimping portion 24 for accommodating the stripped end 23 of the conductor 15, the crimping portion 24 being trough-shaped as shown in FIG. 1 prior to connection with the conductor 15 and being generally cylindrical in construction as shown in FIGS. 2 and 3 after crimping of the conductor 15 and terminal 10. The tip 20 and the crimping portion 24 are spaced apart by an intermediate portion 22 that is located within the baseboard opening 18 when the terminal 10 is mounted on the baseboard 16.

Considering now FIGS. 2 and 3 in greater detail, the crimping section 24 comprises the lower portion of the terminal 10 and includes a pair of longitudinally extending flanges 26 and 28 that are crimped about the stripped end 23 of the conductor 15, the flanges 26 and 28 being

so constructed that their edges 26a and 28a face and contact with one another throughout substantially their entire lengths to form a substantially continuous cylindrical wall. In order to lock the stripped end 25 of the conductor 15 to the crimping portion 24, the left (forward) and right (rearward) central portions of the crimping section 24, as viewed in FIG. 2, are offset to the left, as indicated at 29. It will be appreciated that, in addition to the crimping action afforded by the flanges 26 and 28, the offset construction prevents movement of the stripped end 25 relative to the flanges 26 and 28 so that a good mechanical and electrical connection is obtained between the terminal 10 and the conductor 15. With such a rigid connection, the crimping section 24 of the terminal 10 remains immediately adjacent to the insulation 27 of the conductor 15. Although the offset, crimping section 24 provides both a mechanical and electrical connection between the terminal 10 and the conductor 15, the crimping section 24 and the stripped end 25 of the conductor 15 are soldered together as described hereinafter at the same time as the terminal 10 is soldered to the electrically conductive material 19 embedded in the baseboard 16.

As shown clearly in FIGS. 2 and 3, the upper ends 26b and 28b of the flanges 26 and 28 terminate in generally forwardly extending stops that define a pair of spaced apart stop means or horizontal ledges 30 and 32 for coacting with the under surface of the printed circuit board 16. The flange ends 26b and 28b diverge upwardly and are somewhat curled, as best seen in FIG. 3, so that the edges 26a and 28a at their extreme upper ends define a forwardly extending V. By this construction, as described in detail below, the terminal 10 is unable to be moved upwardly out of assembly with the printed circuit board 16. Thus, the ledges 30 and 32 of the crimping section 24 coact with the baseboard 16 to maintain the terminal 10 and the baseboard 16 in assembled relation.

Considering now the tip 20 of the terminal 10, the generally "barrel-shaped" tip 20 specifically comprises a hollow, generally conical configuration having a continuous wall terminating in a pair of slightly spaced apart edges 40 and 42, the upper end 34 of the wall being generally flat and comprising the extreme upper end of the terminal 10. Actually, the rear part of the tip 20 is substantially cylindrical thereby forming a portion of a somewhat straight "back" identified as 43 and extending throughout the length of the terminal 10, while the forward part of the tip 20 is substantially conical to facilitate disposition of the terminal 10 into the baseboard opening 18. As best shown in FIG. 2, the edges 40 and 42 are inclined relative to the axis of the terminal 10 and, as best shown in FIG. 3, the edges diverge slightly relative to one another as viewed from the top toward the bottom of the terminal 10. The diverging edges 40 and 42 do not perform any particular function other than incidentally guiding the tip 20 into the baseboard opening 18 as a part of the generally conical forward section of the tip 20. As described below in greater detail, if the back 43 of the tip 20 engages the wall of the opening 18 during mounting of the terminal 10, the edges 40 and 42 do not engage or coact in any way with the lowermost part of the baseboard opening 18.

In accordance with an aspect of the present invention, at the lower ends of the edges 40 and 42 there is provided generally converging and forwardly extending locking barbs 44 and 46, respectively. Although barbs 44 and 46 generally converge, their forward edges, in contrast to the diverging edges 40 and 42, are generally parallel as viewed in FIG. 3 and parts of the forward edges penetrate the baseboard 16 during snap-mounting of the terminal 10. The lower ends of the barbs 44 and 46 also define generally horizontal, converging ledges 48 and 50 (see FIG. 3) which coact with the conductive material 19 embedded in the upper surface of the printed circuit baseboard 16 and prevent the downward movement of

the terminal relative to the base 16 once the terminal 10 is snap-mounted on the baseboard 16. More specifically, the barbs 44 and 46 as best shown in FIG. 2 each comprise an axially extending, trapezoidal structure integrally related to the wall of the tip 20. The barbs 44 and 46, as viewed from the top of the terminal 10 (see FIG. 4), converge in the same general way as the wall of the tip 20, while the forward edges of the barbs 44 and 46, as viewed from the front of the terminal 10 (see FIG. 3) are at all points equally spaced apart. As clearly shown in FIG. 2, the forward edges include downwardly and forwardly inclined cutting edges 44a and 46a which respectively interconnect the diverging edges 40 and 42 with vertically extending portions 44b and 46b of the forward edges. The cutting edges 44a and 46a actually comprise the upper parts of the barbs 44 and 46 and are substantially razor sharp so as to cut paths for the bodies of the barbs through the baseboard structure 16 during snap-mounting of the terminal 10. With the terminal 10 in mounting position on the baseboard 16, the ledges 48 and 50 overlie spaced areas of the electrically conductive material 19 as suggested by FIG. 7. As clearly shown in FIG. 2, the ledges 48 and 50 extend rearwardly of the barbs 44 and 46 a substantial distance, but only those portions of the ledges 48 and 50 adjacent to the forward edges of the barbs 44 and 46 coact with the electrically conductive material 19. The intermediate portion 22 of the terminal 10 specifically comprises that portion of the terminal 10 between the lower ledges 30 and 32 and the upper ledges 48 and 50. As best shown in FIG. 2, the ledges 30, 32 and 48, 50 extend rearwardly in a generally horizontal manner, and then curve forwardly to respectively define upper and lower cutaway portions 51 and 53 which extend back approximately half the width of the terminal 10. The cutaway portions 51 and 53 specifically define a pair of flanges 52 and 54 which extend forwardly in a generally converging manner. Particularly, the flanges 52 and 54 comprise a part of the forwardly extending cylindrical wall of the terminal 10 and are generally trapezoidal in construction. They terminate in axially extending edges 52a and 54a which are more spaced apart from one another than the edges 40 and 42 of the tip 20. It will be appreciated that the cutaway portion 51 lends resiliency to the barbs 44 and 46 and to the forward portion of the wall of the tip 20, whereby slight rearward movement of the barbs 44 and 46 is permitted during snap mounting of the terminal 10 as described below. In any event, the flanges 52 and 54 perform no useful function other than to restrict the amount of sideward movement of the terminal 10 when it is located in the opening 18 prior to a soldering operation. Consequently, it will be understood that the diameter of the intermediate section 22 is somewhat less than the diameter of the baseboard opening 18 and that for various installations the diameter of the intermediate section 22 can be varied by varying the configuration of the flanges 52 and 54 to obtain the desired amount of "ply" between the terminal 10 and the base board 16.

In accordance with the present invention, the terminal 10 is quickly and easily snapped into mounting position on the base board 16. As indicated above, the baseboard 16 includes a plurality of openings 18 that are interconnected by electrically conductive material 19 embedded on the upper surface of the base board 16. Specifically, the terminal 10 is mounted on the printed circuit baseboard 16 by first aligning the terminal 10 with a selected one of the openings 18. Once proper alignment is obtained, the terminal 10 and base board 16 are moved relative to one another, whereby the terminal 10 is mounted to the baseboard 16 in one continuous operation. In conventional practice, the terminal 10 is moved toward the printed circuit baseboard 16 and the generally conical tip 20 guides the terminal 10 into the opening 18. If it be assumed that the back of the terminal is disposed immediately adjacent to one side

5

of the opening 18, then, as the tip 20 passes through the opening 18, the edges 40 and 42 move closer to the opposite side of the opening 18, as clearly seen by reference to FIG. 5, but do not engage the undersurface of the baseboard. Although the terminal 10 may be used with a range of different-sized openings, the terminal 10 is preferably used with an opening having a diameter somewhat less than the effective diameter at the upper ends of the cutting edges 44a and 46a but somewhat greater than the effective diameter at the lower ends of the cutting edges 44a and 46a. In any event, assuming that the opening has a diameter as shown in FIG. 5, the tip 20 of the terminal 10 is inserted easily through the opening 18 until the cutting edges 44a and 46a coact with the under surface of the baseboard 16 immediately adjacent to the opening 18, as shown in FIG. 5. Continued upward movement of the terminal 10 causes the cutting edges 44a and 46a to penetrate or cut into the base board 16. Specifically, as the tip 20, including the barbs 44 and 46 move upwardly, the edges 44a and 46a define a pair of vertically extending grooves 64 and 66, seen in FIGS. 6 and 7. FIG. 6 illustrates the barb 46 cutting the groove 66 during its upward movement through the baseboard 16, while FIG. 7 illustrates the relative position and size of the grooves 64 and 66 in a somewhat exaggerated form.

Inasmuch as the inclined cutting edges 44a and 46a of the locking barbs 44 and 46 cut or penetrate the baseboard 16 during snap mounting of the terminal 10, a rearwardly directed force component is applied to the barbs 44 and 46, with the result that the barbs 44 and 46 move rearward slightly to cause the wall of the tip to bulge or bow outwardly slightly, as seen in solid lines in FIG. 7, the original configuration being indicated in dotted lines. Consequently, as the tip 20 passes upwardly through the baseboard 16, the tip 20 remains somewhat bowed so that when the tip 20 leaves the opening 18 and the barbs 44 and 46 move above the conductive material 19, the tip 20 unbows and assumes its original position shown in dotted lines in FIG. 7, with the result that the barbs 44 and 46 move forward slightly. By this construction, the barbs 44 and 46 and, thus, the ledges 48 and 50 overlies more of the conductive material than is cut by the grooves 64 and 66. Accordingly, the barbs 44 and 46 are unable to register and reenter the grooves 64 and 66. In any event, once the barbs 44 and 46 move upwardly above the conductive material 19, the mounting force applied to the terminal 10 is removed, whereby the terminal 10 moves downwardly under gravity until the forward parts of the ledges 48 and 50 seat against the conductive material 19 immediately surrounding the opening 18.

With the terminal 10 in mounting position, the ledges 30, 32 and 48, 50 coact respectively with the lower and upper surfaces of the baseboard 16 to limit axial movement of the terminal 10 relative to the printed circuit baseboard 16 and, hence, prevent disassembly of the terminal 10 and baseboard 16 irrespective of the position of the baseboard 10. Particularly, the forward parts of the ledges 30 and 32 abut against the under surface of the baseboard 16, when the terminal 10 is elevated, to limit the upward axial movement of the terminal 10 to a fraction of an inch, while the forward parts of the ledges 48 and 50 seat against the conductive material 19 and prevent any downward axial movement of the terminal 10 when the baseboard 16 and terminal 10 are in their normally assembled position shown in FIGS. 2 and 3. It will be appreciated that the terminal 10 is not fixedly secured to the baseboard 16 but is maintained in loose assembled relation with the baseboard 16 by the ledges 30, 32 and 48, 50. As best seen in FIG. 2, the terminal 10 is permitted to move axially a distance equal to the difference of the distance between the ledges 30, 32 and 48, 50 and the thickness of the baseboard 16, and, further, is permitted to move laterally a distance equal to the difference of the diameter of the intermediate section 22 and the

6

diameter of the opening 18. Thus, there is both axial and lateral "play" between the terminal 10 and the baseboard 16—but, irrespective of this "play," the terminal 10 is unable to fall out of the baseboard 16 during subsequent handling operations.

It should be understood, however, that the terminal 10 may be forcibly disassembled from the baseboard 16 by applying a large downward axial force to either the tip 20 or the crimping portion 24 of the terminal 10. With the application of a relatively large force, the ledges 48 and 50 are forced through both the conductive material 19 and the baseboard 16. However, in contrast to the cutting action of the edges 44a and 46a, the ledges 48 and 50 rupture or puncture the conductive material 19 and the baseboard material. Since the ledges 48 and 50 are relatively flat in contrast to the sharp, cutting edges 44a and 46a, a substantially larger force is required to cause the ledges 48 and 50 to penetrate the baseboard 16 than is required to cause the edges 44a and 46a to penetrate the baseboard 16. In addition, it is highly probable that the ledges 48 and 50 will not pass downwardly through the previously cut grooves 64 and 66, but will pass downwardly through new grooves (not shown).

After the required number of terminals 10 are mounted on the printed circuit baseboard 16, all of the mounted terminals 10 are soldered to the baseboard 16 in a single dip-soldering operation. Particularly, the baseboard 16 and terminals 10 are inverted with the result that the terminals 10 move downwardly until the ledges 30 and 32 engage the under surface of the baseboard 16. As a result of the inversion of the baseboard 16, the tips 20 are spaced from and extend downwardly from the baseboard 16. Thereafter, the baseboard 16 is lowered in a generally horizontal fashion until the tips 20 are immersed in a solder bath. The solder readily enters the open end 34 of the "barrel-like" tips 20, as well as the cutaway portions 51 of the tip 20, and flows upwardly by capillary action through the tip 20 and the intermediate section 22 into the crimping section 24. Hence, as a result of the single solder operation, the stripped end 25 of the conductor 15 is soldered to the crimping section 24 and the tip 20 is soldered to the electrically conductive material 19 on the upper surface of the baseboard 16. By this operation, a good electrical connection is obtained between the conductive material 19 and the terminal 10 and, further, between the terminal 10 and the conductor 15.

While the embodiment described herein is at present considered to be preferred, it is understood that various modifications and improvements may be made therein, and it is intended to cover in the appended claims all such modifications and improvements as fall within the true spirit and scope of the invention.

What is desired to be claimed and secured by Letters Patent of the United States is:

1. A terminal of the snap-in type adapted to be inserted through an opening of a support, said terminal comprising a substantially rigid generally frusto-conical, hollow tip embodying adjacent spaced apart and generally parallel barb means located at one side of the terminal and extending in the same general direction, each of said means including cutting means extending outwardly and rearwardly to penetrate said support during mounting of the terminal and, further, stop means integral with but spaced axially of said cutting means to restrain said tip against axial movement after mounting of the terminal, and means axially spaced from said spaced apart means for restraining said tip against axial movement in a direction opposite to the above referred to axial movement, said stop and axially spaced means coacting to lock said tip to said support.

2. A terminal of the snap-in type adapted to be inserted through an opening of a support, said terminal comprising a wall having generally converging, spaced apart edges for engaging the support adjacent said opening, said edges including at their lower ends adjacent

spaced apart barb means that extend outwardly and rearwardly to cut through said support during passage of said tip through said opening, generally flat ledge means integral with an spaced axially of said barb means, said ledge means being adapted to pass through said support after said barb means and to coact with a first surface of said support to restrain said tip from movement in a first direction, stop means spaced from said ledge means for coacting with a second surface of said support to restrain said tip from movement in a second direction, said ledge and stop means being spaced apart to accommodate one of a plurality of supports having a variety of different widths.

5

10

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,072,880

January 8, 1963

Billy E. Olsson

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 1, for "base" read -- baseboard --; line 27, "The intermediate" will start a new paragraph; column 4, line 58, for "ply" read -- play --; column 7, line 4, for "an" read -- and --.

Signed and sealed this 10th day of September 1963.

(SEAL)

Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents