

July 18, 1961

R. H. BISBING ET AL
MODULE BOARD FASTENER

2,993,187

Filed June 29, 1960

2 Sheets-Sheet 1

FIG. 1

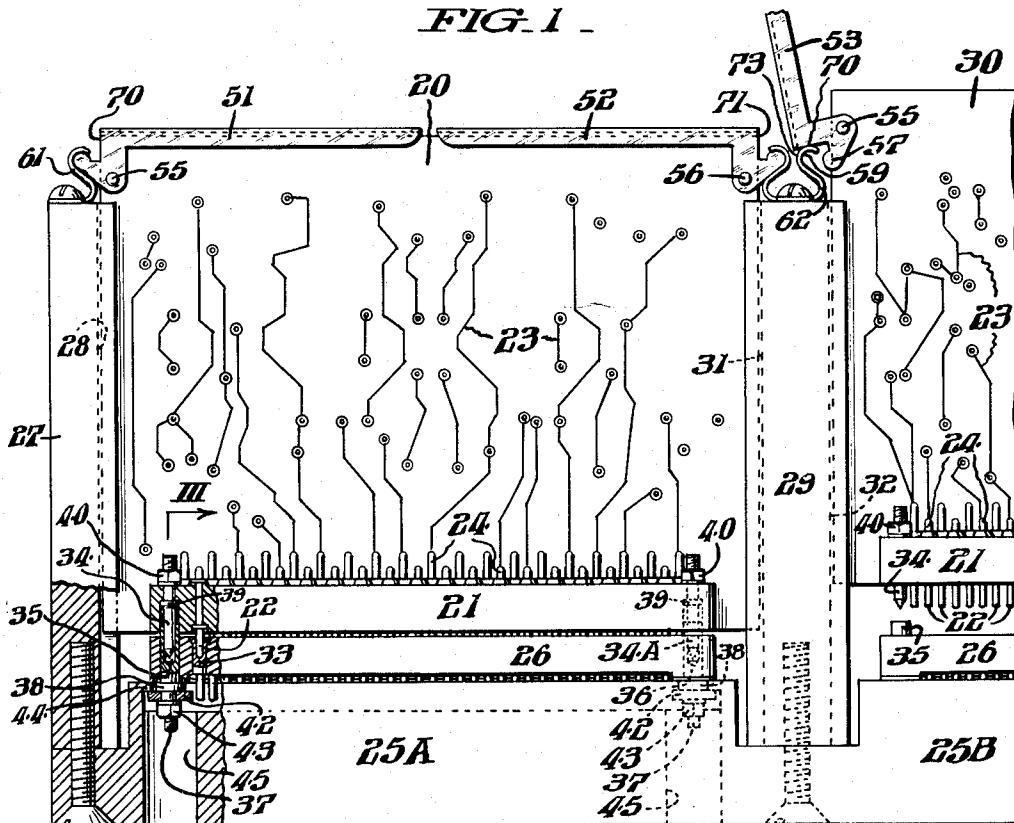
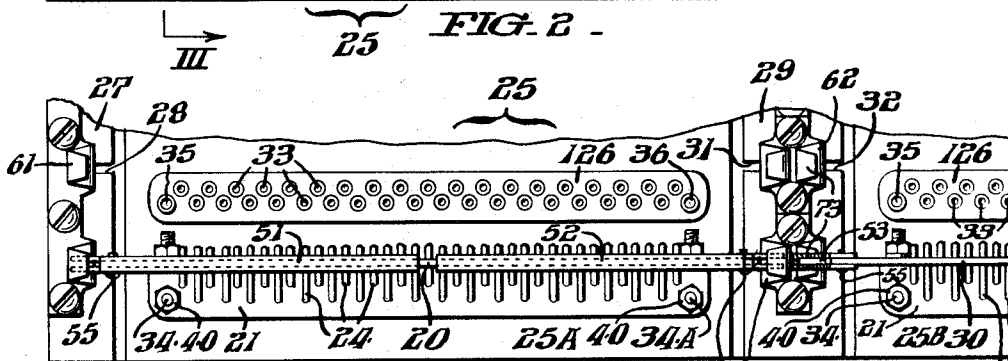


FIG. 2 -



20 24 FIG. 3

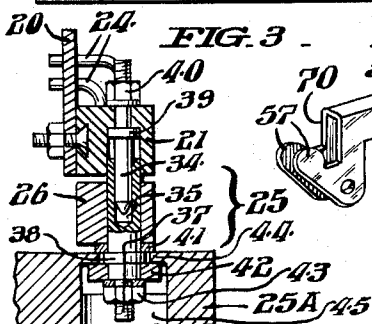
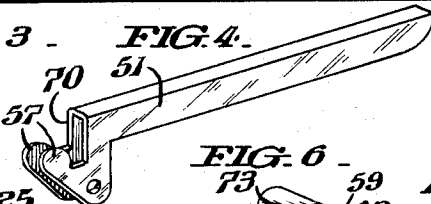


FIG 4.



56/FIG. 5
62

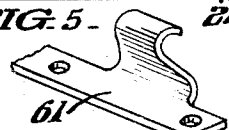
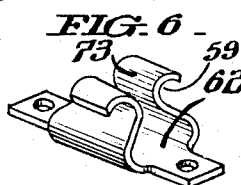


FIG. 6.



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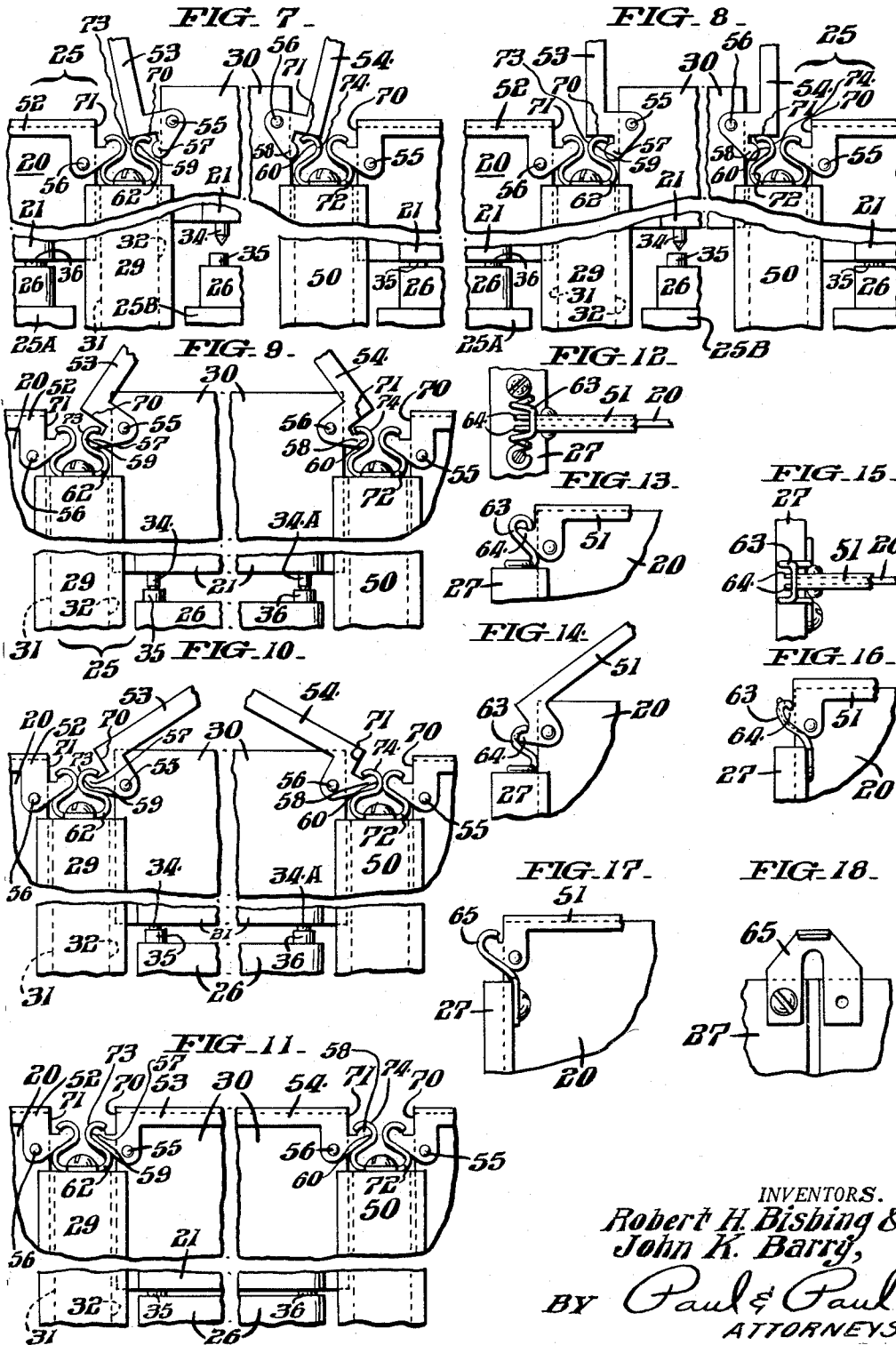
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MODULE BOARD FASTENER

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2 Sheets-Sheet 2



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MODULE BOARD FASTENER

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12 Claims. (Cl. 339-17)

This invention relates to fastening means for inserting and locking in a supporting rack, a modular panel board, for example, a printed circuit board or other panel board used in electronic equipment.

The fastening means provided by our present invention is adapted to assist in inserting the panel board into its locked position in the rack, to assist in holding the panel board locked therein, and to assist in ejecting or removing the panel board from its position in the rack, all without handling the panel board itself.

Our invention will be clear from a consideration of the following detailed description of several preferred embodiments selected for illustration in the drawing in which:

FIG. 1 is a side elevational view showing one modular panel board locked in position in its rack and another adjacent modular panel board about to be inserted into locked position (or about to be removed from the rack);

FIG. 2 is a top view of the structure of FIG. 1;

FIG. 3 is a detailed view in section along the line III-III of FIG. 1;

FIG. 4 is a perspective view of the handle lever;

FIG. 5 is a perspective view of a single-finger spring lock;

FIG. 6 is a perspective view of a double-finger spring lock;

FIGS. 7, 8, 9, 10 and 11 are a series of views illustrating in sequence the action of the handle lever and the spring lock when the panel board is being inserted into locked position in the rack;

FIGS. 12, 13, and 14 are views of an alternative form of top mounted single-finger spring lock and handle lever in which the lock is a spring steel wire instead of a leaf spring;

FIGS. 15 and 16 are views of another form of spring steel wire single-finger spring lock which is side mounted instead of top mounted; and

FIGS. 17 and 18 are views of a side-mounted form of leaf spring single-finger lock.

In describing the preferred embodiments of our invention illustrated in the drawing, specific terminology has been resorted to for the sake of clarity. However, it is not our intention to be limited to the specific terms so selected, and it is to be understood that each specific term includes all technical equivalents which operate in a similar manner to accomplish a similar purpose.

Referring now to FIG. 1, there is shown a first modular panel board 20, and a portion of a second modular panel board 30, shown in the illustration as printed circuit boards, each having secured to its lowermost edge a base bar 21 having projecting downwardly therefrom a plurality of connector plugs or pins 22, selected ones of which have printed circuits 23 connected to them by way of terminals 24.

Panel board 20 is shown inserted in the end position 25A of a rack 25 comprising a plurality of similar in-line positions, a portion of the next-to-end position 25B also appearing in FIG. 1. Each rack position includes a socket bar 26 and a pair of spaced-apart upright support or guide rails having edge grooves for receiving the opposing edges of the panel board. Position 25A, being an end position, guide rail 27 is an end rail having (see FIG. 2) grooves 28 along the inner edge only, where-

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as guide rail 29 is an intermediate guide rail between two adjacent rack positions and as such is equipped with edge grooves along both edges, left grooves 31 for receiving the right edge of the end-position panel boards 20 and right grooves 32 for receiving the left edge of second-position panel boards 30. A portion of a panel board 30 appears in FIG. 1.

Panel boards 20 and 30 illustrate but two of a larger number of panel boards which may be inserted adjacent to each other edge-to-edge in line in rack 25. Also, the rack 25 will, ordinarily at least, be equipped to receive other panel boards in front-to-back positional relationship with panel boards 20 and 30, as shown in FIG. 2 by the socket bars 126.

As shown in FIGS. 1 and 2, the socket bars 26, 126, are equipped with mating receptacles or sockets 33 for receiving the connector plugs or pins 22 which protrude from the base bars 21 of the panel boards.

The base bar 21 of each panel board is also equipped with a pair of positioning pins 34 and 34A, one at each end of the bar, and the socket bar 26 (or 126) at each rack position is provided with a pair of positioning sockets 35, 36 in corresponding locations for receiving the positioning pins 34, 34A, respectively. In order to reduce the requirements as to accuracy of the positioning sockets 35, 36 relative to that of pins 34, 34A, the socket bars 26, 126, are so mounted on the rack as to be movable to a limited extent in any direction in a plane perpendicular to that of the panel board.

FIG. 3 shows one way in which the socket bar 26 (or 126) may be mounted on rack 25 so as to be movable to a limited extent in any direction perpendicular to the panel board. Referring first, however, to the positioning pin in the panel board, the position pin 34 is shown as having a collar 39 and is shown to be firmly fixed in base bar 21 of the panel board by being clamped thereto by its collar 39 and a nut 40. The positioning socket 35 in the socket bar 26 is the axial bore of a stud 37 fixed in the socket bar. The stud 37 has a collar 38 having a first washer 41 on one side thereof and a second washer 42 on the other side, washer 42 being held in place against the collar 38 by a nut 43. The collar 38 is slightly thicker than the thickness of the inwardly extending flange or rim 44 of the hole 45 provided in rack 25A for receiving the stud 37. Thus, by means of the washers 41, 42 and nut 43, the collar 38 is held in the plane of the rimmed portion of the hole 45 but movable in the plane of the rim, the rimmed opening being larger in diameter than the collar. Thus, positioning socket 35 is movable in all directions in a plane perpendicular to that of the panel board.

Referring again to FIG. 1, this figure shows a first panel board 20 in the position occupied after it has been inserted into the grooves 28, 31 of rails 27, 29 and clamped into place. FIG. 1 also shows a portion of a second panel board 30 which is about to be clamped down between a pair of rails, one of which is rail 29 and the other of which (rail 50) does not appear in FIG. 1 but appears in FIGS. 7-11, discussed hereinafter.

In accordance with our present invention, insertion and removal of the panel boards, such as 20, 30, into and from the rack 25 is accomplished by means of a pair of handle levers, such as 51, 52 for panel board 20, and 53, 54 for panel board 30. These handle levers serve both as handles for handling the panel board without touching the panel board per se, and also as levers for pressing the panel boards into final in-place position in the rack (in which the positioning and connector pins are within their respective sockets) and for removing the panel boards from their in-place positions in the rack.

The lever action of the handle levers as the panel board is moved downwardly between the upright supporting

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rails into its fully inserted position is illustrated in FIGS. 7, 8, 9, 10, and 11 which illustrate a series of sequential movements.

Referring now to FIGS. 7-11, FIG. 7 shows panel board 30 in the same position that it occupies in FIG. 1. This position is taken by the panel board after it has been held by the handle levers above the slotted or grooved rails 29, 50 and pushed down in the opposing grooves of the rails 29, 50 until the shoulders 70, 71 of the lever arms 53, 54 engage the top surfaces of the spring locks 62, 72. In pushing the panel board 30 down, the handle levers 53, 54 are used in the positions shown in FIG. 7 in which the handles are in a generally vertical position. In FIG. 7, positioning pin 34 has not yet entered positioning socket 35 and is illustrated as being slightly off the center axis of the socket, as may actually occur in practice.

In FIG. 8, the handles of the handle levers 53, 54 have been started toward each other, the levers pivoting about their pivot points 55, 56, which may be rivets, studs, or screws inserted into the panel board near the upper corners. In FIG. 8, the round camming lugs 57, 58 of the levers have each begun to enter the mating recess 59, 60 of the respective locking fingers 73, 74 of spring locks 62, 72. The positioning pin 34 has not yet entered the socket 35.

In FIG. 9, the handles of levers 53, 54 have been brought closer together, and the round camming lugs 57, 58 of the levers have engaged the locking fingers 73, 74 of spring locks 62, 72. The panel board 30 has started to move downwardly, and the positioning pins 34 and 34A are now entering sockets 35 and 36. It will be noted that in response to the wedging action of the tapered ends of pins 34 and 34A, the sockets 35 and 36 have moved sufficiently laterally so that the center axis of the sockets is now in line with the center axis of the pins.

In FIG. 10, as the handles of the levers 53, 54 are brought still closer together, the panel board 30 is moved still further downwardly by the action of the camming lugs 57, 58 against the locking fingers 73, 74 of spring locks 62, 72. In FIG. 10, the centers of the pivot points 55, 56 have reached a position just below the centers of the camming lugs 57, 58, nested in the locking fingers 73, 74 of the spring locks. At this position, an over-center action comes into play in that, as the reaction force line of the spring-lock locking fingers 73, 74 passes above the horizontal center line of the handle-lever pivot points 55, 56, the spring reaction of the fingers exerts a transverse force which causes the handle levers to pivot about their respective pivot points and to snap firmly into closed position. The reaction force of the spring-lock locking fingers also keeps the panel board locked down under tension.

Panel board 30 in final locked-in position is illustrated in FIG. 11, while final locked-in position with respect to panel board 20 is illustrated in FIG. 1. In the final position, the upper edge of the panel board is partly within the recessed portion of the handles of the handle levers, as is indicated by the dash line in FIGS. 1 and 11.

The panel boards are ejected by reversing the procedure just described. The ejection procedure is illustrated in the drawing by FIGS. 11, 10, 9, 8, and 7, considered in that order. As the handle levers 53, 54 are raised, as seen in FIG. 10, the camming lugs 57, 58 bear down on the locking fingers 73, 74 of the spring locks 62, 72 forcing the panel board 30 upwardly. As soon as the center of the pivot points 55, 56 passes above the center axis of the camming lugs as engaged by the locking finger 73, 74, as in FIG. 9, the over-center action again takes place, the reaction force of the locking fingers 73, 74 forcing the camming lugs 57, 58 of the handle levers inwardly toward the panel board and thus forcing the panel board 30 upwardly.

In FIGS. 1, 2 and 7-11 discussed above, the spring locks are shown to comprise leaf springs, either single finger, such as 61 illustrated in FIG. 5, or double finger,

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such as 62 illustrated in FIG. 6. However, other forms of spring locks may be used. For example, the spring lock may be a wire spring, such as 63 illustrated in FIGS. 12-16.

Also, instead of mounting the spring locks on top of the rail, the spring lock may, if desired, be mounted on the side of the rail. FIGS. 1, 2, and 7-11 illustrate top-mounted leaf-spring locks. FIGS. 17-18 illustrate a side-mounted leaf-spring lock 65. FIGS. 12-14 illustrate a top-mounted wire-spring lock. FIGS. 15-16 illustrate a side-mounted wire-spring lock.

If a wire-spring lock is used, the camming lug of the handle lever may preferably be in the form of a slightly elongated finger, such as 64 illustrated in FIGS. 12-16, instead of being round as in FIGS. 1-4, 7-11 and 17-18.

The spring locks, whether single or double, and whether leaf spring such as illustrated in FIGS. 5 and 6, or wire spring, such as illustrated in FIG. 12, may if desired be formed in one continuous strip, as shown by the strip of single-finger locks 61 in FIG. 2, with mounting holes and spring fingers occupying alternate positions along the length of the strip.

It should also be mentioned that where the panel board is of sufficiently narrow width, it is feasible to install and employ but one handle lever and one spring finger lock to effect insertion, lock in, and removal of the panel board from the rack, using of course a pair of spaced grooved guide rails, one on each edge of the panel board.

While the preferred embodiments of our invention have been described in some detail, it will be obvious to one skilled in the art that various modifications may be made without departing from the invention as hereinafter claimed.

Having thus described our invention, we claim:

1. In combination; a panel board having connecting pins projecting from one end thereof; a rack having sockets for receiving the pins of said panel board, said rack having spaced-apart guide rails extending orthogonally therefrom for receiving said panel board therebetween and for guiding said panel board into final in-place position in which said pins are within said sockets; a handle lever pivotally secured to each of the two corner portions of said panel boards more remote from said rack, each of said handle levers having a camming lug at the load end extending beyond the side of said panel board; a resilient locking finger secured to the outer end portion of each of said guide rails for receiving and engaging the camming lug of one of said handle levers and for exerting a reaction force urging said panel board between said rails toward said rack and into final in-place position in response to the rotational pivotal movement of said handle levers toward each other to closed position in which the handles of said levers are substantially parallel with the outer edge of said panel board, said locking fingers when said panel board is in final in-place position also exerting a lateral force against said camming lugs tending to lock said levers in said closed position.

2. The combination claimed in claim 1 characterized in that the handles of said handle levers are recessed for receiving the outer edge of said panel board when said handle levers are in closed position.

3. The combination claimed in claim 1 characterized in that said locking fingers are leaf springs.

4. The combination claimed in claim 1 characterized in that said locking fingers are wire springs.

5. In combination; a panel board having connecting pins projecting from one edge thereof; a rack having sockets for receiving the pins of said panel board; a pair of spaced-apart grooved rails extending orthogonally from said rack for receiving said panel board therebetween and for guiding said panel board to final in-place position in which said pins are within said sockets; a pair of handle levers, one pivotally secured to each outer corner portion of said panel board, each of said handle

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levers having a camming lug at the load end extending beyond the side limit of said panel board; a resilient locking finger, one secured to the outer end portion of each of said guide rails for receiving and engaging the camming lugs of said handle levers, said resilient locking fingers exerting a transverse reaction force relative to said panel board whereby when the pivot point of said handle lever falls inside the center line of said locking fingers said reaction force urges said panel board inwardly toward final in-place position and tends to lock said panel board in said final in-place position.

6. The combination claimed in claim 5 characterized in that said handle levers have recessed handles for receiving the outer edge of said panel board.

7. The combination claimed in claim 5 characterized in that said locking fingers are leaf springs.

8. The combination claimed in claim 5 characterized in that said locking fingers are wire springs.

9. In combination; a panel board having connecting pins projecting from one edge thereof; a rack having sockets for receiving the pins of said panel board; a pair of spaced-apart grooved rails extending orthogonally from said rack for receiving said panel board therebetween and for guiding said panel board to final in-place position in which said pins are within said sockets; at least one handle lever pivotally secured to an outer cor-

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ner portion of said panel board, said handle lever having a camming lug at the load end extending beyond the side limit of said panel board; a resilient locking finger secured to the outer end portion of at least one of said guide rails for receiving and engaging the camming lug of said handle lever, said resilient locking finger exerting a transverse reaction force relative to said panel board whereby when the pivot point of said handle lever falls inside the center line of said locking finger said reaction force urges said panel board inwardly toward final in-place position and tends to lock said panel board in said final in-place position.

10. The combination claimed in claim 9 characterized in that said handle lever has a recessed handle for receiving the outer edge of said panel boards.

11. The combination claimed in claim 9 characterized in that said locking finger is a leaf spring.

12. The combination claimed in claim 9 characterized in that said locking finger is a wire spring.

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