United States Patent [19]

Hollingsead et al.

[11] **3,710,476**

[45] **Jan. 16, 1973**

[54] AVIONIC TRAY

[75] Inventors: **Robert A. Hollingsead,** Yorba Linda; **Clyde Robert Pryor,** Anaheim, both of Calif.

[73] Assignee: **Hollingsead-Pryor Enterprises, Inc.,** Santa Fe Springs, Los Angeles County, Calif.

[22] Filed: **March 18, 1971**

[21] Appl. No.: **125,536**

[52] **U.S. Cl.**.....**29/200 J,** 29/200 P, 113/116 FF, 317/100

[51] **Int. Cl.**.....**B23p 19/00,** B01d 51/00

[58] **Field of Search**.....29/200 P, 200 J, 200 R, 432; 113/116 FF; 317/100

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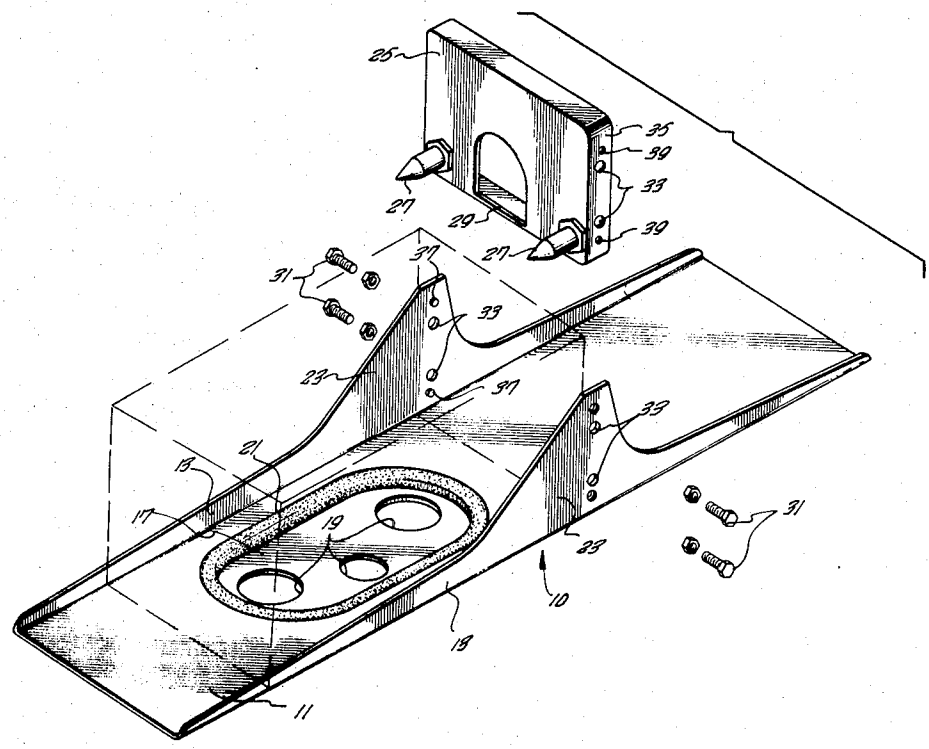
Primary Examiner—Thomas H. Eager

Attorney—Jackson & Jones

[57] **ABSTRACT**

An avionic tray is disclosed having a backplate secured between a pair of vertical uprights of the tray with the aid of self-jigging structure located thereon. The vertical uprights include a plurality of jig pins formed on the interior sides thereof which are adapted to snap into a plurality of registering holes formed in the backplate. The jig pins are formed by a half-shear punch process, while the holes are also formed by a punching process. A pair of precision dies are used to accurately locate the jig pins and holes to ensure precise linear and angular positioning of the backplate relative to the tray prior to securing the backplate to the uprights with rivets, bolts or other attachment means.

10 Claims, 5 Drawing Figures



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SHEET 1 OF 2

FIG. 1

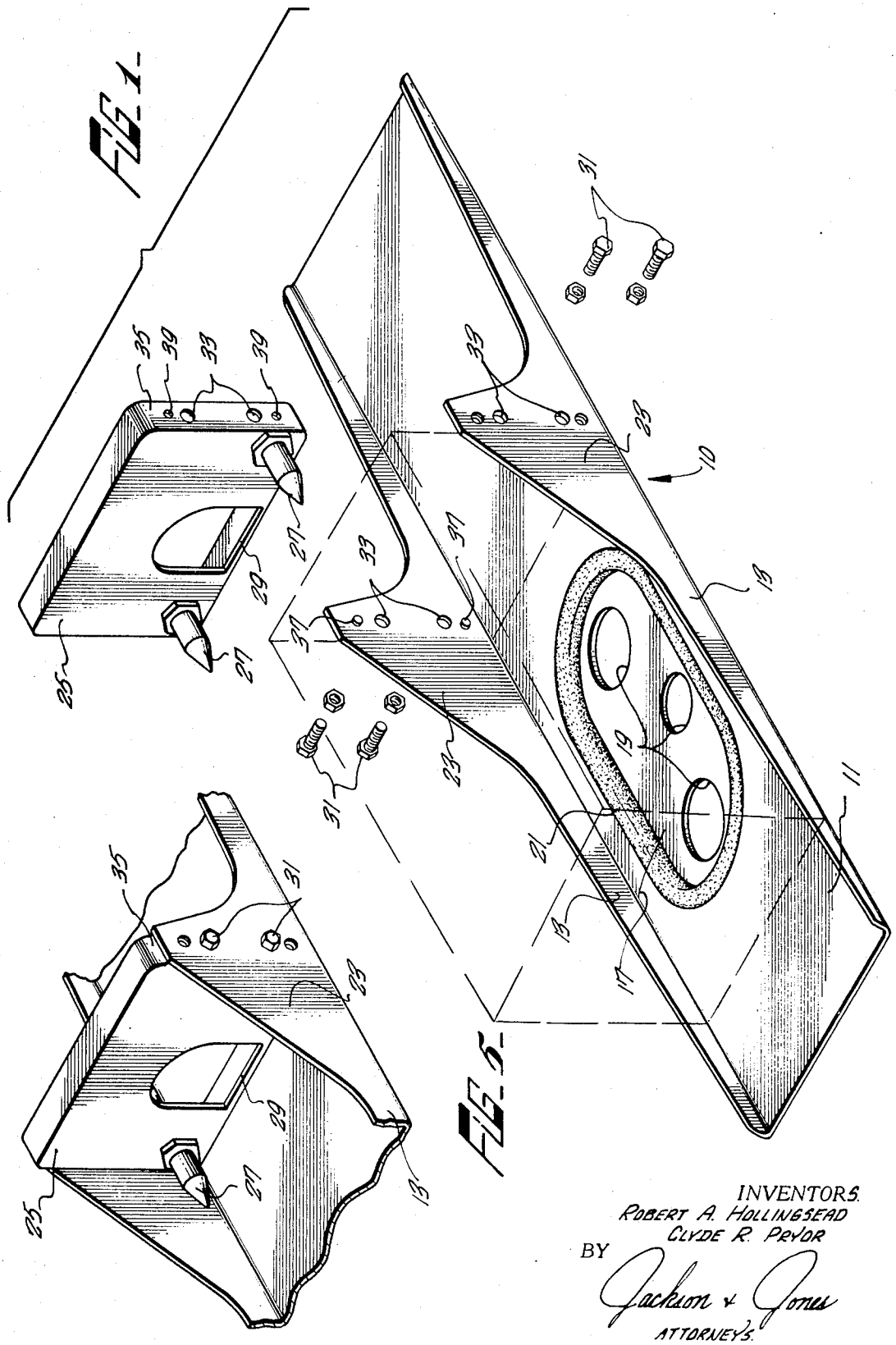


FIG. 2

INVENTORS.
ROBERT A. HOLLINGSEAD
CLYDE R. PRYOR

BY

Jackson & Jones

ATTORNEYS.

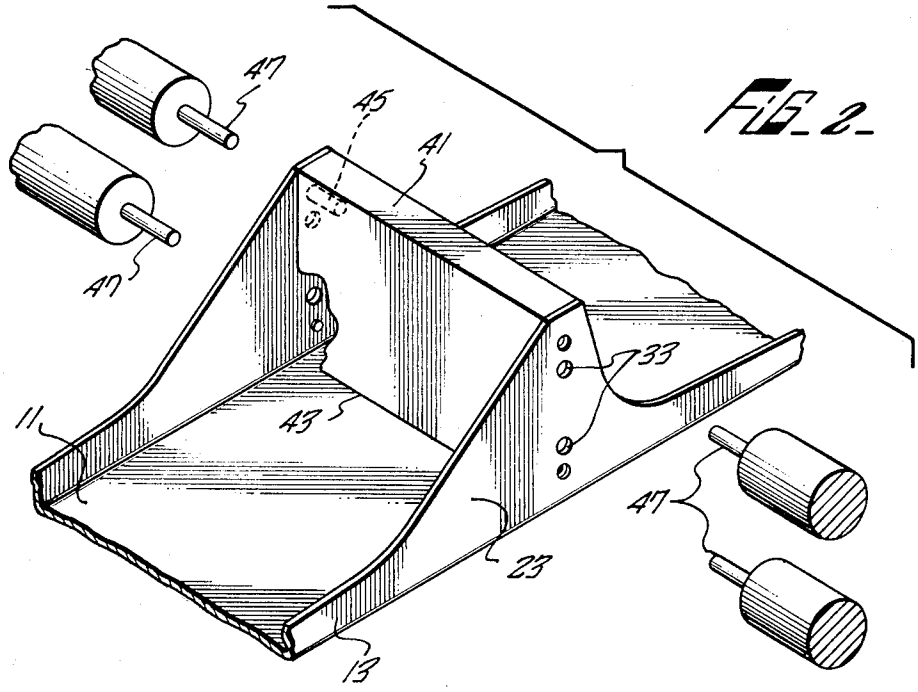


FIG. 2

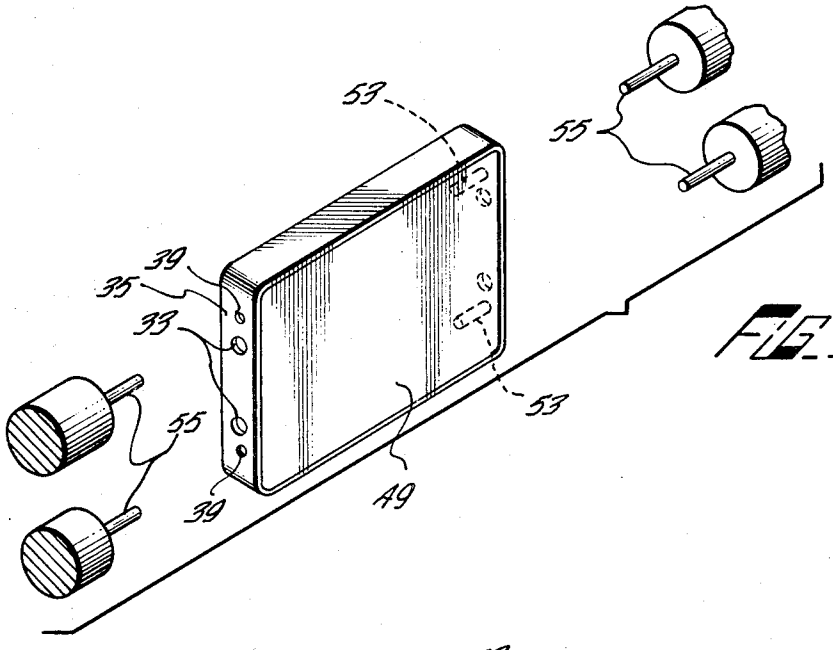


FIG. 3

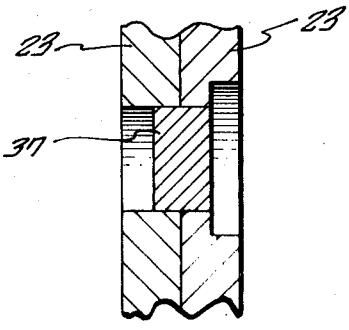


FIG. 4

INVENTORS.
ROBERT A. HOLLINGSEAD
CLYDE R. PRYOR
BY
Jackson & Jones
ATTORNEYS.

AVIONIC TRAY

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to means for attaching one member to another and more particularly to means for accurately positioning the two members prior to securing the two members together.

2. Description of the Prior Art

In an aircraft, each piece of electronic equipment is supported on an individual tray. Each tray usually comprises a bottom section having a pair of side rails extending upwardly therefrom. The side rails function as guides for the supported instrument during installation and also serve as a lateral support after installation. The side rails further include a pair of upright sections which are adapted to be connected to and support a backplate therebetween.

The backplate usually includes a pair of dagger pins accurately positioned on its front face for mating with the rear of the instrument to function as a rear hold down. An electrical receptacle is mounted on the backplate and functions to receive the connectors extending out of the rear end of the instrument. The backplate is also provided with a cut-out portion for receiving a portion of the receptacle along with the receptacle wires. After the backplate is connected to the tray, the backplate functions to absorb a hold-down load that is applied to the instrument from the front of the shelf. This hold-down load, usually of the magnitude of one hundred pounds, is necessary to secure the instrument during flight.

A serious shortcoming involved with prior assemblies is that because of the tolerance buildup involved in connecting the backplate to the tray, a great amount of misalignment occurs. This not only results in the improper support of the instrument but also results in faulty electrical connections between the instrument and the receptacles. This tolerance buildup occurs in the bolting or riveting process used in interconnecting the backplate to the upright sections of the tray. More specifically, in drilling the bolt or rivet holes in the two elements, care must be taken to ensure that the center lines of the holes in each side of the connections are perpendicular to the bottom section of the tray. If such drilling is done by hand, inaccuracies occur that are quite large. If the drilling is done by machine, the accuracy is improved.

However, even if the center lines are perfect, there is a tolerance problem in forming the holes to accept the rivets or bolts. This is because in the manufacturing of rivets or bolts, there is an acceptable tolerance in which the bolt or rivet diameter can be manufactured. As a result, the holes must be drilled to such a size that even the largest bolt made within those tolerances can go through. Moreover, the holes are made within tolerances also. As a result, the holes must be dimensioned such that the low side of the tolerance level of the holes be sufficient to accommodate the bolts made on the high side of its tolerance level.

It follows, then, that through random selection, a small bolt can be mounted in relatively large holes in the backplate and uprights.

Upon installing the backplate, the bolts are inserted in upper and lower registering holes of the side sections of the backplate and the uprights. Because of the loose

fit of the bolts, the backplate can be easily tilted as the bolts are applied. In fact, the bottom of the backplate can move in one direction the total amount of tolerances found in the two holes and the bolt, while the upper portion of the backplate can move the same distance in the opposite direction. This tolerance buildup can actually result in a total angular displacement of up to 15° from the perpendicular. Not only is this angular displacement of the backplate sufficient to cause misalignment of the instrument, but it is sufficient enough to prevent the instrument from being properly connected to the electrical receptacle mounted on the backplate.

SUMMARY OF THE INVENTION

The present invention obviates the above-mentioned shortcoming by providing self-jigging means for perpendicularly mounting the backplate on the tray with a high degree of accuracy.

In accordance with the present invention, the uprights of the tray are provided with jig pins formed thereon which are adapted to mate with registering apertures on the backplate to permit the backplate to be snapped onto the uprights in a perpendicular relationship before the bolts or rivets are secured within the holes.

In forming these jig pins on the uprights, a die having a perpendicular edge is positioned adjacent the bottom surface of the tray. A pair of female holes is located on each side of the die with the center lines of these holes being perpendicular to the base plate. A pair of male punches of a diameter larger than the diameter of the female holes is then applied to the opposite side of the uprights to press metal from the uprights inwardly into the female holes of the die. The punches extend half way into the uprights to half-shear the pressed metal to form a plurality of jig pins. Registering holes are likewise formed in the backplate with the exception that punches equal to the size of the female holes are utilized to extend entirely through the material of the backplate and completely shear off the metal and form the holes.

The main advantage of the present invention is that the interconnecting members have self jigging means formed thereon which function to align the backplate in a perpendicular position with respect to the tray with a high degree of accuracy prior to applying the bolts or rivets. In this manner, the interconnection of the members is not influenced in any way by the tolerance buildup or the rivet or bolt means.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The present invention, both as to its organization and manner of operation, together with further objects and advantages thereof, may best be understood by reference to the following description, taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded view of an avionic die apparatus having a backplate positioned between two uprights by means of self-jigging means in accordance with the present invention;

FIG. 2 is a fragmentary perspective view showing a die positioned on the tray to form the jig pins;

FIG. 3 is a fragmentary perspective view of the rear of the backplate, showing a die positioned therein to form the jig holes;

FIG. 4 is an enlarged fragmentary sectional view of the jig pin connection; and

FIG. 5 is a fragmentary perspective view of the apparatus in its assembled form.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, FIG. 1 shows an avionic tray, generally indicated by arrow **10**, for supporting an electronic instrument (shown in broken lines). The tray **10** comprises a bottom section **11** and a pair of side rails **13** extending upwardly along the lateral edges thereof. The bottom section **11** is adapted to be mounted at its ends to a pair of cross channels **15**. The bottom section **11** also includes a metering section **17** extending below the surface of the tray with the metering section **17** having a plurality of metering ports **19** for controlling the amount of air drawn through the instrument.

An annular gasket **21** extends around the periphery of the metering section **17** and above the surface of the tray to sealingly engage the bottom of the supported instrument.

The side rails **13** further include a pair of uprights **23** which are adapted to be connected to and laterally support a backplate **25**. The backplate **25** is perpendicularly positioned with respect to the bottom surface of the tray and includes a pair of dagger pins **27** for mating with a pair of registering apertures on the supported instrument. The backplate further includes a cut-out portion **29** for receiving a portion of an electrical receptacle (not shown) along with the receptacle wires. The backplate **25** functions to support the rear of the instrument as a holding force is applied at the front of the instrument. Moreover, the perpendicular orientation of the backplate **25** permits the instrument to lie flush against the backplate **25** to ensure a proper electrical connection between the instrument and the receptacle.

The backplate **25** is secured to the uprights **23** by means of bolts **31** extending through registering holes **33** formed on the uprights **23** and the lateral sides **35** of the backplate **25**.

Prior to such connections, however, the backplate is mounted on the uprights by means of jig pins **37** formed on the interior sides of the uprights **23** which extend into a plurality of registering apertures **39** formed in the lateral sides **35** of the backplate **25**.

As shown in FIG. **2**, in fabricating the jig pins **37**, a die **41** is utilized having a face portion **43** on the bottom edge thereof which is adapted to contact the bottom surface of the tray **10**. A plurality of female apertures **45** is formed within the lateral sides of the die **41** with each pair of apertures being accurately formed to cause their center lines to be perpendicular to the face portion **43**.

In operation, the die **41** is mounted on the tray **10** in such a manner that the face portion **43** rests against the bottom section **11** of the tray **10** and the female apertures **45** are aligned adjacent the uprights **23**. A plurality of punches **47** are then provided to contact that portion of the uprights **23** that registers with the female apertures **45**. The punches **47** are dimensioned to be larger than the diameter of the female apertures. In pressing the material with the punches **47**, a portion of the upright material is forced into the female apertures **45**. Since the punches are over-sized, a complete filling of the female apertures **45** with the upright material is ensured. The punches travel about half way through the uprights to create the half-sheared pins **37**.

As shown in FIG. **3**, a second die **49** is provided to extend within the cavity formed in the backplate **25**. The die **49** includes a face portion **51** adapted to lie flush against the rear surface of the backplate **25** and a pair of lateral sides having pairs of female apertures **53** whose center lines are parallel to the face portion **51**.

A second plurality of punches **55** are provided to contact the backplate material adjacent the female apertures **53** with the punches being of the same cross sectional area as the female apertures. This permits the punches **55** to extend entirely through the backplate material to completely shear off the punched out portion to form the apertures **53**.

In connecting the backplate **25** to the tray **10**, the backplate **25** is first snapped onto the jig pins **37** of the uprights **23**. A typical connection is shown in FIG. **4**. Because of the exceptionally low tolerances of the manufacturing process, the backplate is precisionally positioned to be perpendicular with respect to bottom section **11** of the tray **10**. In such a secured position the bolts **31** are then inserted through the aligned holes **33** with each connection being secured by a nut. The backplate **25** is shown connected to the uprights **23** in FIG. **5**.

As can be seen, the backplate **25** is secured in position before the bolts **31** are used. As a result, the positioning of the backplate **25** is completely independent of the tolerance buildup found in the use of the bolts and the holes.

Moreover, the forming of the jig pins **37** and apertures **39** is accomplished with a very high degree of accuracy. The dies **41** and **49** are both precisionally made and are easy to operate.

It should be noted that various modifications can be made to the apparatus while still remaining within the purview of the following claims.

It should also be noted that such self-jigging means can be used to secure any two elements together whenever precision alignment is required.

What is claimed is:

1. Apparatus for securing a backplate member on a tray comprising:

a pair of vertical upright members connected to said tray, said backplate member positioned between said upright members;

a plurality of jig pins aligning said upright members and said backplate member and formed on at least one of said members; and

a plurality of jig holes formed on the other of said members for registering with said jig pins.

2. The apparatus of claim **1** further comprising means for securing said vertical upright members to said backplate member after said jig pins are engaged in said jig holes.

3. The apparatus of claim **1** wherein said jig pins are integrally formed from the material of one of said members.

4. The apparatus of claim 1 wherein said jig pins are formed such that the front face of the backplate is perpendicular to the surface of said tray.

5. The apparatus of claim 1 wherein said tray is an avionic tray adapted to support electronic equipment and said backplate is adapted to mate with said electronic equipment for fastening said electronic equipment in position and said vertical uprights are integral with said avionic tray.

6. The apparatus of claim 1 wherein said tray is an avionic tray adapted to support electronic equipment and said backplate is adapted to mate with said electronic equipment for fastening said electronic equipment in position; a metering plate for controlling air flow to said electronic equipment and a gasket for sealingly engaging said electronic equipment, said evionic tray having an opening on its surface for receiving said gasket and metering plate.

7. The apparatus of claim 2 wherein said means for securing includes said members having holes extending therethrough and fasteners for interconnecting said members.

8. The apparatus of claim 5 wherein a pair of jig pins are provided on each side of said tray.

9. The apparatus of claim 8 wherein means for locking said vertical members are provided between said jig pins.

10. The apparatus of claim 8 wherein said jig pins are integrally formed of the material of one of said members.

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