

[54] **SPRING-TYPE PRESS-FIT**

[76] Inventor: **Gordon D. Shoholm**, Box 433,
Grantsburg, Wis. 54840

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[51] Int. Cl. **H01r 9/08**

[58] Field of Search 29/625, 630; 339/221 R,
339/221 L, 221 M, 220 R, 220 A, 220 C, 220
L, 220 T, 252 P, 17

[56]

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Primary Examiner—Bobby R. Gay

Assistant Examiner—Robert A. Mafer

[57]

ABSTRACT

A spring-type press-fit section for anchoring and electrically connecting wire-wrap and other terminal pins which is capable of providing greater retention of terminal pins with a lower ratio of damage to the mating hole material than existing designs for use in military and commercial electronic and electrical equipment assemblies.

3 Claims, 5 Drawing Figures

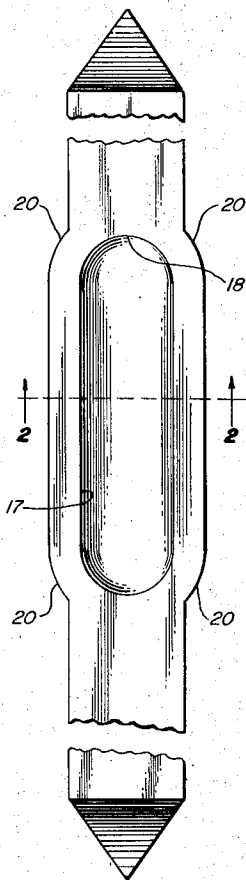


FIG. 1

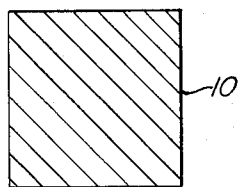


FIG. 2

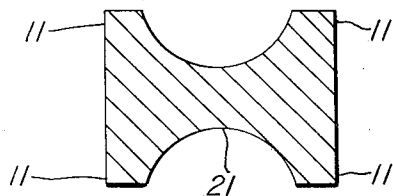


FIG. 3

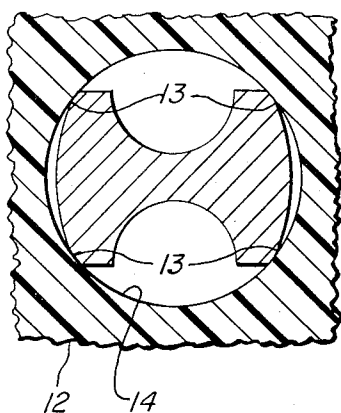


FIG. 5

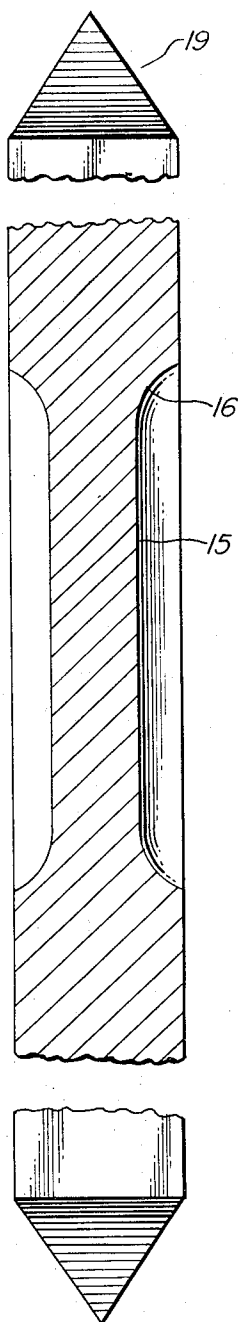
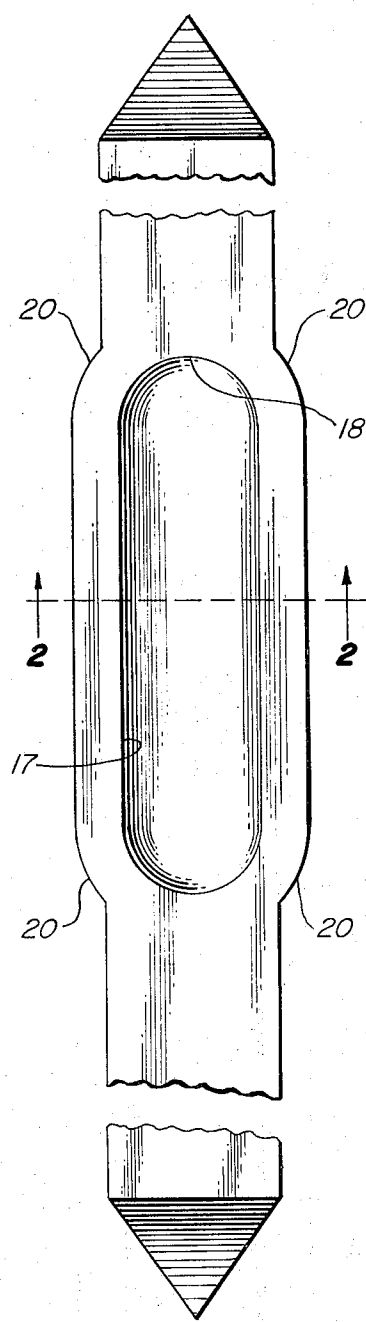


FIG. 4



SPRING-TYPE PRESS-FIT

Background of the invention: Engineering standards for construction of military and commercial electronic and electrical equipment indicate that wire-wrap pins in the size range of 25 thousandths inch square by 0.5 to 1.5 inches long are becoming one of the most lowcost and acceptable means of electrically connecting integrated circuits to printed circuit panels, printed circuit panels to printed circuit panels, printed circuit panels to printed circuit panels by wiring from pin to pin and terminating to the pin with the wire-wrap technique, other components to printed circuit panels and the using of interconnecting cables which are easily removeable from the terminal pins which anchor in the printed circuit panel and plug into the cable connectors.

With the above functional needs in mind, I have developed a spring-type press-fit section for anchoring terminal pins in printed circuit panels, connectors and other interconnection media, not limited to square wire-wrap pins, but for the sake of brevity I will discuss the following objectives of this invention in relation to small, square wire-wrap terminal pins:

1. Simplicity of forming the press-fit section from low-cost, square phosphor bronze wire by cold forming the wire with two opposing punches with rounded faces which contact and form the press-fit section into a somewhat rectangular portion which exerts spring tension against the sides of a hole or opening into which it is inserted under force.

2. Lowering the cost and reducing the size of such forming machine yet incorporating simplicity of machine set-up and adjustment so as to be able to produce press-fit sections which fit properly in a realistic range of hole sizes. This is important in that hole sizes after copper plating of thru-holes in printed circuit panels are difficult to control in both diameter and deviation from round, both in one panel and in panels of different production lots.

3. By reducing the size and cost of the pin and press-fit making machine it is possible to use this equipment in conjunction with a tape or manually controlled pin insertion machine. With this system and pre-gold plated square wire, terminals can be made from a continuous coil of wire and inserted in panels or connectors without any additional handling. This approach cannot be used when the fabrication specifications require plating on the cut-off ends.

4. The spring-type press-fit section is for the improvement in terminal retention in the hole it is to be anchored in. It also establishes better electrical contact with plated-thru holes and circuitry because of constant spring tension of the terminal body against the sides of the hole. This is especially important when solder contact bonding is required between the pin and the plated-thru hole for better electrical contact and greater terminal pin retention in the hole. There are many approaches to soldering pins to plated-thru holes, but the easiest and most reliable is to raise the temperature of the pin and panel or connector assembly to near the soldering temperature, slowly so as to eliminate thermal shock, and then immerse the assembly in an oil-type bath maintained at the correct soldering temperature. This will cause the solder in the plated hole to reflow to the pin forming an excellent solder bond between the pin and the plated-thru hole. The plated

hole may or may not be electrically attached to the etched or plated circuitry on the panel or assembly.

5. To form a gradual lead-in on each end of the press-fit section to enable the terminal to be inserted from either necessary end, or in the case of damaged, to be removed from either end and replaced with another pin.

6. To form a press-fit section which will have much greater retention when tested by means of pulling from either end of the terminal than existing designs so the wire-wrap and connector assemblies could become qualified for stringent military and commercial environmental applications and specifications, especially high reliability space and missile equipment usage.

7. To form a press-fit section that will not damage plated-thru holes and their electrical connection to printed circuitry when inserted into panels. To also cause only minimum deformation and in no way damage the much softer non-plated-thru holes in printed circuit panels and other connectors so that when a pin or terminal is removed and replaced with another the retention of the replacement item will be equal to the required retention range of the original pin and meet the engineering specifications of the assembly.

8. To form a press-fit section which can be inserted into a hole with a minimum of force in relation to the end retention required.

9. To form a press-fit section that will seat and align itself with minimum error in relation to the theoretical center line of the terminal hole. Most terminals such as wire-wrap pins require some straightening, either hand or automatic machine, to meet this need.

10. To produce simple and inexpensive insertion tooling to help accomplish meeting the straightness requirements set forth above.

11. To develop automatic pin insertion machines for pins made from continuous wire or bulk pins which have been barrel plated. Two approaches are used: feeding insertion machines from vibratory hopper feeders or using a plastic or metal carrier strip as a pin carrier to feed the insertion equipment.

12. To produce a spring-type press-fit section which will not lose too much strength of the original wire when cold formed. This is a direct function of the shape design of the contact faces of the male forming punches. Other types of press-fit sections have been known to break apart when subjected to pull testing for retention determination test analysis. This can be especially true when pulling terminals from plated-thru holes for test or replacement when the pin is soldered to the hole.

13. To produce a press-fit section which will become spring-hard because of the cold forming operation but yet not affecting the softer wire to either side of the press-fit section.

DESCRIPTION OF PRIOR ART

Searches have not uncovered any pertinent prior patents that utilize the same technology and principles for the same resultant advances in the development of press-fit sections for wire-wrap terminal pins or the previously mentioned similar electrical and mechanical connection terminals that we have accomplished with the design we are using for the fabrication of wire-wrap printed circuit panel assemblies and connector applications. We are producing both military and commercial terminals and assemblies. We have also been unable to

locate any samples or production products in this field which use this design other than the parts and assemblies which have been produced by me or a corporation bearing my name. We do sight the following inventors and the applicable patent numbers as worthy of consideration in this field of development, however, as being unable to duplicate my design and development for the above functions: U.S. Pat. Nos. to F. A. Kukla, 3,328,749; Lloyd Mancini, 3,601,750; J. D. Bratsch, 3,365,539; J. G. Hatfield, 3,288,915; Mitchell J. Zaleski, 3,546,368; A. Just, 3,166,372; P. F. Herb, 3,611,562; F. L. Donohue, 2,994,057; W. M. Kohring, 2,597,338; W. M. Kohring, 2,640,903; and R. S. Mautner, 2,894,240.

SUMMARY OF THE INVENTION

This invention relates to new development and implementation of spring-type press-fit sections for wire-wrap terminal pins and other connector applications which serve to anchor to the proper engineering standards the terminal in the printed circuit panel or other media or connector type for both mechanical and electrical connections.

In the drawings:

FIG. 1 is a sectional view representing a typical piece of square wire, although not necessarily square, from which a wire-wrap pin could be made and in which a spring-type press-fit section could be formed according to our specifications and military and industry standards;

FIG. 2 is a sectional view of FIG. 4 taken along line 2-2;

FIG. 3 is a sectional view of a press-fit section similar to FIG. 2 after being inserted under force into a round hole in a section of printed circuit panel;

FIG. 4 is a side view of a wire-wrap pin and press-fit section which shows the wide dimension of the rectangular portion produced by cold forming; and

FIG. 5 is a partial sectional view, the ends of which are not sectioned for clarity, of FIG. 4 turned ninety degrees and sectioned longitudinally at the center line.

Referring now to the drawings: The spring-type press-fit section of the wire-wrap pin illustrated in FIGS. 1 thru 5 can be most easily envisioned by considering the faces of the two opposing male punches which cold form the press-fit section by forcing the material per 21, 15, 16, 17 and 18, which punch faces are rounded and the longitudinal ends are also rounded.

After the press-fit section has been cold formed of the proper pin material of hard temper 10 the resultant material 21 becomes spring hard temper. If somewhat equal forces are applied at 11 the outer ends of the

press-fit section will bend inward toward the center of the press-fit section with spring-like qualities in that when the forces at 11 are removed the press-fit section will return to basically the same shape it had before the forces were applied. The one exception to this is the same as most metal spring materials, if forced past realistic limits 11 will not recover properly.

A typical hard printed circuit material or connector compound for molding 12 having a hole in it which diameter 14 is of the proper size for the desired realistic pounds of retention for the terminal which will be provided by the corners 13 maintaining spring tension against the hole 14. If the drawing of FIG. 3 is closely analyzed realizing that the drawing is representative of an actual terminal pin press-fit section conforming under spring tension to the hole 14 the spring force is generally in the vectors of direction represented by 13.

The contours 16 and 18 serve to eliminate the shear effect that would weaken the terminal in these areas if the punches were not properly formed for the size and type of material being used 10.

Some type lead-in 19 must result for wire-wrap terminal pins to facilitate insertion of the pin into the panel or connector hole 14 or into a female connector or wire-wrap tool or insertion device.

The rounded lead-in section 20 of the press-fit section serves to enable the pin to be inserted from either end without hole 14 damage.

What I claim as my invention is:

1. A pin having a spring type, press-fit section, said pin comprising an elongated piece of material, said pin having two end portions and at least one press-fit section intermediate its ends, said press-fit section having two opposed basically flat, planar sides which terminate in smooth curved ramps, said ramps forming a juncture portion with said end portions, the remaining two opposed sides of said press-fit section each containing one elongated, radiused central depression, each depression having a one-quarter spherical depression at each of its ends, said press-fit section having a basically I-beam cross-section, said press-fit section of said pin adapted to be inserted into an aperture and to be securely retained therein.

2. A pin having a press-fit section as in claim 1, said pin including two of said press-fit sections intermediate said end portions.

3. A pin having a press-fit section as in claim 1 with the ends of the narrow basically flat sides made of a resilient material capable of flexing inward toward the radiused depressions.

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