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3,289,148	11/1969	Antes	339/176 MP
3,434,091	3/1969	Walter.....	339/14 R
3,530,422	9/1970	Goodman.....	339/17

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[54] GROUND CONNECTOR
8 Claims, 14 Drawing Figs.

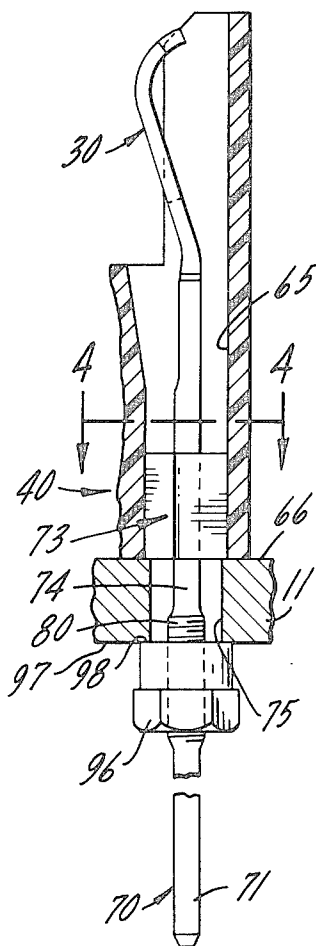
[52]	U.S. Cl.....	339/14 R, 339/17 R, 339/95 R, 339/130 R, 339/176 MP, 339/217 S
[51]	Int. Cl.....	H01v 3/06
[50]	Field of Search.....	339/14, 17, 130, 220, 221, 276, 217, 176, 95

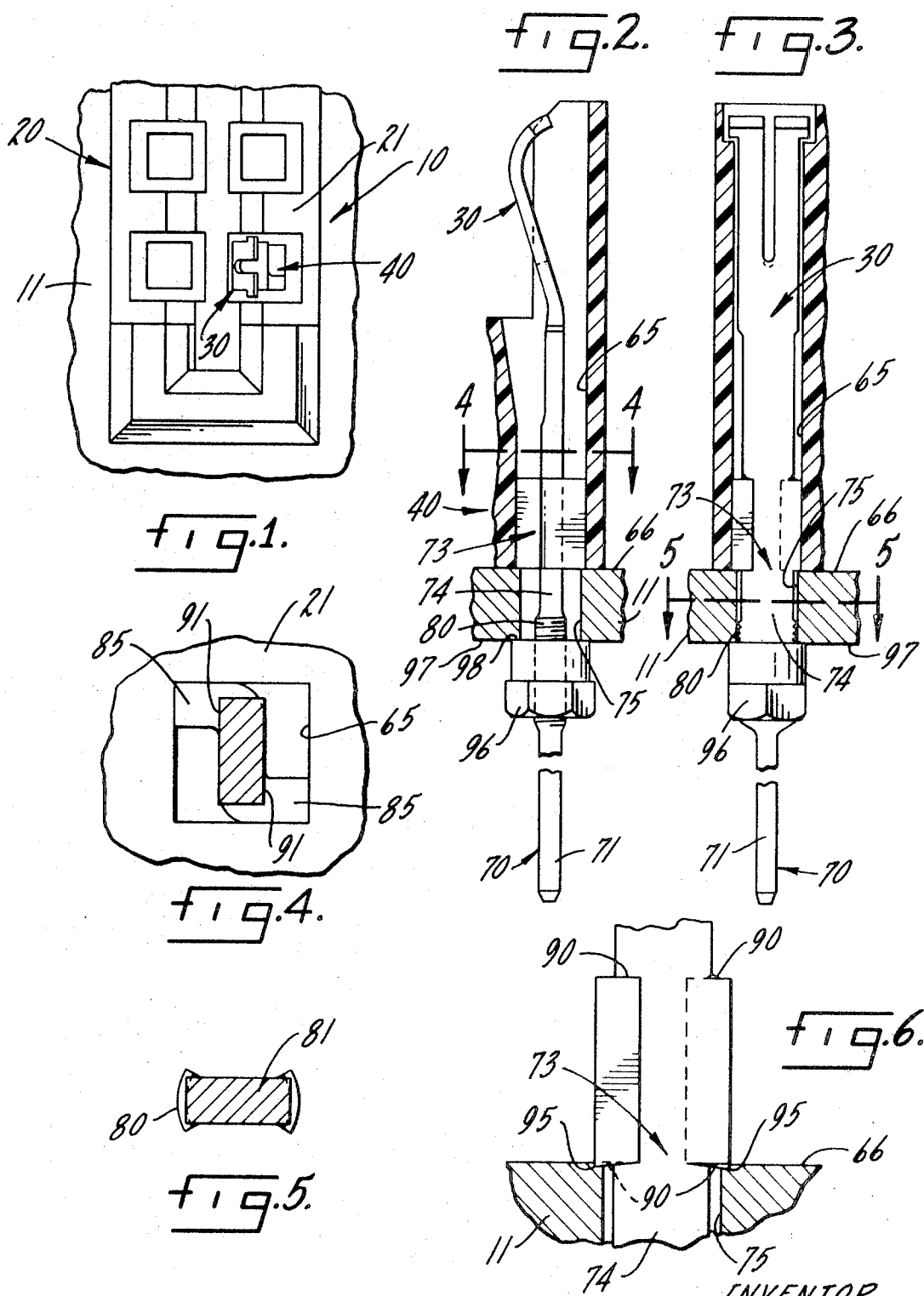
[56] **References Cited**

UNITED STATES PATENTS

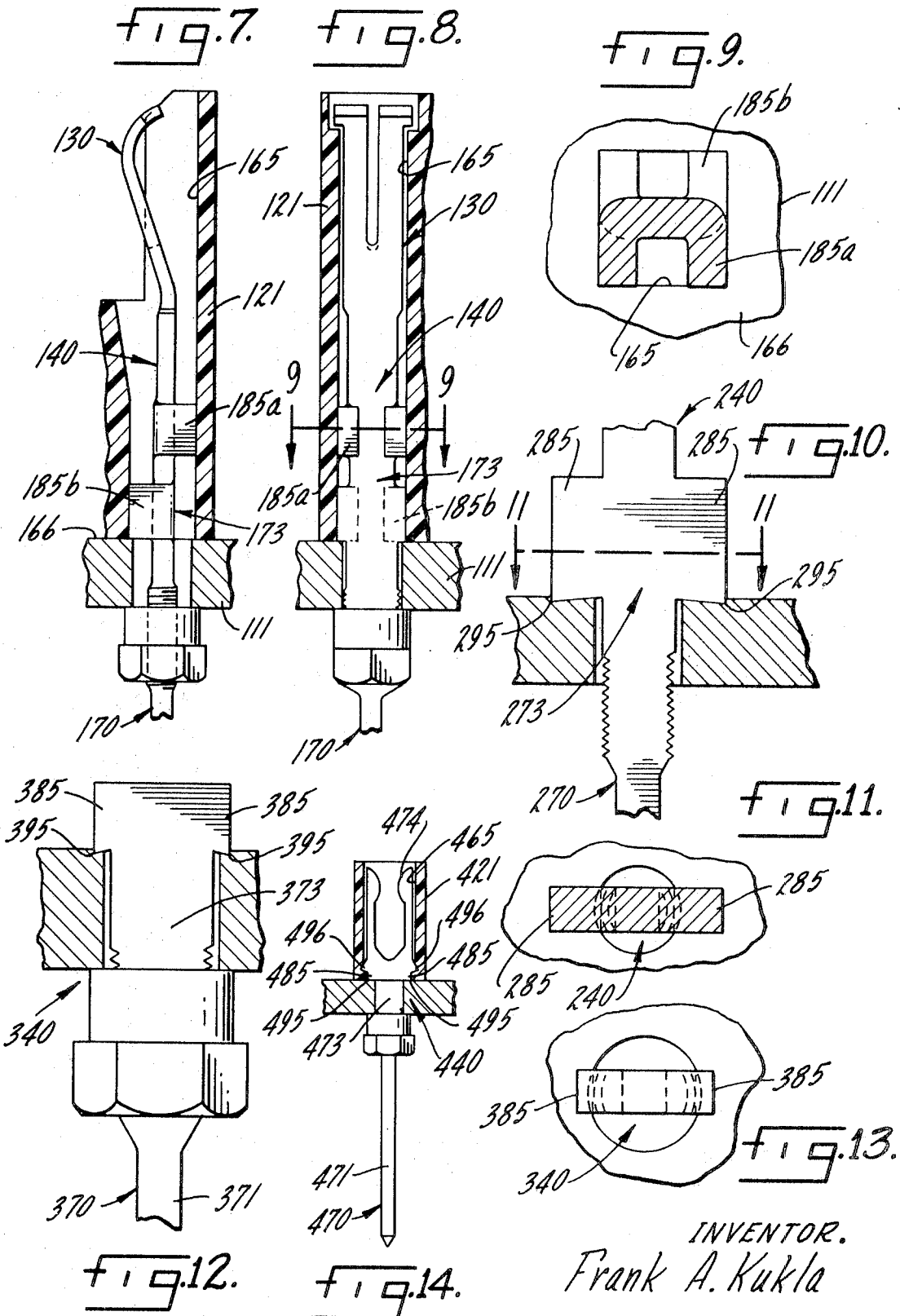
2,909,755	10/1959	Jackson et al.	339/176 MP
3,200,366	8/1965	Stuart.....	339/130 C

ABSTRACT: A ground connector assembly for connecting a terminal pin, with a wire-wrap post on one end, to a metal plate. The assembly includes a ground terminal of one piece construction made from flat sheet stock, having an integrally formed ground section including mounting means for seating on a metal plate and a shank which extends through a generally circular cylindrical aperture in a plate and is integrally threaded at its lower end to receive a locking nut which secures the terminal tightly to the plate. The configuration of the mounting means and the locking nut are such that the terminal is stabilized in perpendicular relationship to the plate and bites into the surface of the plate to provide excellent electrical contact between the terminal and the plate.





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GROUND CONNECTOR

BACKGROUND OF THE INVENTION

The invention relates in general to an electrical connector assembly of the type including a plurality of wire-wrap-type terminals mounted on a terminal plate. More particularly, it is related to a ground connector assembly for connecting a terminal pin, having a wire-wrap post on one end, with a metal plate. The ground connector assembly of this invention is an improvement over that disclosed in the Walter U.S. Pat. No. 3,434,091, issued March 18, 1969, and assigned to the same assignee as the present invention.

SUMMARY OF THE INVENTION

A primary object of the invention is to provide a ground connector assembly which is simpler in construction, has fewer component parts, is more easily assembled, and is less expensive than those constructions presently in use and designed to accomplish the same or similar ends. In its simplicity, the present ground connector assembly achieves additional advantages. More particularly, it is another object of the invention to provide a ground connector assembly which consistently affords extremely low resistance to current flow between the terminal pin and a metal-mounting plate. A further object is to provide, in preferred embodiments, a simple, two-piece connector assembly which automatically orientates into proper radial relationship on the axis of the aperture in the plate in which it is seated.

The foregoing and other objects are realized in accord with the invention by providing a grounding terminal which is diepunched from flat sheet stock and includes a contact section or other connecting means on one end, a wire-wrap post on the opposite end, and a ground section in between. The ground section includes a rectangular cross section ground shank which extends through the plate aperture in snug fitting relationship. At one end of the ground shank, "below" the plate, screw threads are swaged or coined onto the edges of a portion of the shank so that they are an integral part of the terminal. Opposite the ground shank from the screw threads, ground contact support shoulders are formed from the flat sheet stock. Formed on the ground contact shoulders are teeth which bit into the plate and establish excellent electrical contact with it.

In preferred embodiments of the invention, the shoulders are so formed from the sheet stock as to cooperate with an aperture in the insulating block surrounding the contact and orientate the contact properly in the block. A locking nut threaded onto the threaded portion of the ground shank impinges tightly against the opposite side of the plate to fasten the terminal tightly to the plate.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention, together with its organization and method of operation, taken with further objects and advantages thereof, is illustrated more or less diagrammatically in the drawings, in which:

FIG. 1 is a diagrammatic plan view of a portion of a connector complex mounted on a terminal plate, wherein the connector complex includes a ground connector assembly embodying features of a first preferred form of the present invention;

FIG. 2 is an enlarged view, partially in section, of the connector assembly of FIG. 1;

FIG. 3 is an enlarged view similar to FIG. 2, taken 90° from that of FIG. 2;

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

FIG. 5 is a sectional view taken along line 5—5 of FIG. 3, with parts removed;

FIG. 6 is an enlarged view of a portion of the ground section in the ground connector assembly of FIG. 3;

FIG. 7 is a view similar to FIG. 2 illustrating a second preferred form of the invention;

FIG. 8 is an enlarged view similar to FIG. 7, taken 90° from that of FIG. 7;

FIG. 9 is a sectional view taken along line 9—9 of FIG. 8;

FIG. 10 is an enlarged elevational view of a third form of the ground connector assembly embodying features of the present invention, with parts removed;

FIG. 11 is a sectional view taken along line 11—11 of FIG. 10;

FIG. 12 is an enlarged elevational view illustrating a fourth form of the invention, with parts removed;

FIG. 13 is a top plan view of the ground connector assembly illustrated in FIG. 12; and

FIG. 14 is a side elevational view, partially in section of a ground connector assembly embodying features of a fifth form of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, and particularly to FIG. 1, a portion of a connector complex is illustrated generally at 10, mounted on a conventional aluminum plate 11. The connector complex 10 includes a matrix 20 of dielectric material, such as a thermoplastic or thermosetting material or the like. The matrix 20 actually comprises a series of elongated printed circuit board receiving blocks 21 arranged in immediately adjacent, side-by-side relationship on a terminal plate 11 in the manner illustrated and described in the aforementioned Walter U.S. Pat. No. 3,434,091.

An end block segment 21 houses a plurality of electrical contacts (not shown) adapted to engage circuitry on a printed circuit board (not shown) inserted into the matrix 20. The contacts are distinctive as components of a buss strip and contact arrangement embodying features of an invention disclosed in the Walter U.S. Pat. No. 3,434,094, issued March 18, 1969, entitled BUSS STRIP, and assigned to the same assignee as the present invention. On the other hand, the end contact 30 is part of an improved ground connector assembly 40 embodying features of a first form of the present invention.

The improved ground connector assembly 40 is adapted to make electrical connection between circuitry on a printed circuit board (not shown) through the contact 30, to the terminal plate 11. Turning to FIGS. 2-6 of the drawings, the assembly 40 is illustrated in substantial detail.

The connector assembly 40 is mounted on the plate 11 in a well 65 in the end block segment 21. The matrix block segment 21 is seated on the upper surface 66 of the terminal plate 11 and secured to the plate in the manner described in the aforementioned Walter U.S. Pat. No. 3,434,094.

The ground connector assembly 40 includes the contact 30 which is an arcuate, flexible spring-type contact formed unitarily with a wire-wrap connector pin 70. The connector pin 70 has the contact 30 formed unitarily on one end, and a wire-wrap post 71 on its opposite end.

Intermediate the contact 30 and the wire-wrap post 71 of the pin 70 is a ground section 73. The ground section 73 includes a rectangular cross section ground shank 74 which extends through the circular cylindrical aperture 75 in the terminal plate 11. The cross-sectional dimensions of the ground shank are such that it extends through the plate aperture 75 in relatively snug fitting relationship.

At one end of the ground shank 74, extending "below" the plate 11, screw threads 80 are swaged or coined into the edges of a portion 81 of the shank. The threads 80 are swaged onto the shank portion 81 so that they are arranged, in cross section as illustrated in FIG. 5, integral with the pin 70.

Opposite the ground shank 74 from the screw threads 80, ground contact shoulders 85 are formed from the flat sheet stock of the terminal. In the preferred form of the invention, the shoulders 85 are formed from the terminal sheet stock in the manner illustrated in FIGS. 2-4 and 6. The shoulders 85 are actually transversely extending sections of stock bent at right angles to the flat sheet stock, in opposite directions, as illustrated. According to the invention, the body of the flat sheet stock is sheared slightly inwardly at points 90 above and below the shoulders 85 before this forming takes place. A relatively short shear area 91 is defined and the strength of the shank portion is not impaired while the cross-sectional dimensions of the shoulders 85 are minimized.

The lower surfaces of the shoulders 85 are inclined downwardly to sharp tips or "teeth" 95 formed thereon for digging into the surface 66 of the plate 11. This intrusion into the plate surface 66 by the teeth 95, effected in a manner hereinafter described, results in excellent electrical contact being established between the terminal and the plate 11.

The well 65 in the block 21 has, in the preferred embodiment of the present illustration, a rectangular cross section, as illustrated in FIG. 4. The cross-sectional dimensions of the well 65 at its base adjacent the surface 66 of the plate 11 are substantially identical to, or only slightly larger than, the overall cross-sectional dimensions of the angularly formed shoulders 85. Because of the squared-off configuration of the shoulders 85, the terminal necessarily orientates to a precise radial relationship in the block 21, when it is dropped into a corresponding well 65. As a result, the contact 30 is automatically aligned in prescribed relationship for contact with a printed circuit board.

The swaged threads 80 on the threaded portion 81 of the shank 73 are adapted to cooperate with internal threads (not shown) formed in a locking nut 96 until the nut tightly engages the lower surface 97 of the plate 11 to draw the teeth 95 into biting engagement with the upper surface 66 of the plate. The nut 96 engages the lower surface 97 of the plate 11 with its annular sealing end 98. The sealing end 98 of the nut includes a frustoconical surface terminating in a relatively thin, semisharp peripheral edge in a manner described in the aforementioned Walter U.S. Pat. No. 3,434,091. As the nut 96 is turned onto the threads 80, drawing the teeth 95 into the plate surface 66, the peripheral edge also bites into the lower surface 97, effecting an extremely secure, gastight joint. At the same time, the terminal is forced into precisely upright relationship, perpendicular to the plate 11.

Turning to FIGS. 7-9, a second form of ground connector assembly embodying features of the present invention is illustrated generally at 140. The ground connector assembly 140 is similar to the assembly 40 hereinbefore discussed in achieving the same advantages ends. It has, however, one additional feature of significance.

This additional significant feature is embodied in the arrangement of the shoulders 185 formed on the ground section 173 of the terminal pin 170. It will be noted that the shoulders comprise an upper set of shoulders 185a and a lower set of shoulders 185b extending in opposite directions and bent at right angles from the flat sheet stock, as illustrated.

The well 165 has a rectangular or substantial square cross section, as illustrated in FIG. 9. The cross-sectional dimensions of the well 165 at its base, adjacent the surface 166 of the plate 111 are, again, substantially identical to, or only slightly larger than, the overall cross-sectional dimensions of the angularly formed shoulders 185. The terminal 170 thus necessarily orientates to a desired radial relationship in the block 121 of phenolic and the contact 130 is automatically aligned for contact with a printed circuit board.

When a printed circuit board is inserted, in a well-known manner, it urges the resilient, curved contact fingers of the contact to the right, as illustrated in FIG. 7. Because the upper shoulders 185a are braced against the corresponding side of the well 165 in the phenolic block 121, this deflection is taken up entirely in the region where it is intended to; i.e., in the contact 130 itself. As a result, a precisely prescribed amount of pressure is exerted on the printed circuitry by the contact 130.

Turning now to FIGS. 10 and 11, a third form of the ground connector assembly embodying features of the invention is illustrated generally at 240. The ground connector assembly 240 is substantially identical to the assemblies 40 and 140 hereinbefore discussed in operation and effect. It achieves substantially the same advantageous ends with a slightly modified construction.

More precisely, the well (not shown) in the matrix end block segment 221 of the assembly 240 is merely an elongated rectangle in cross-sectional configuration. This elongated rectangular configuration is provided to accommodate the "straight" shoulders 285 formed on the ground section 273 of the terminal pin 270. They are not bent at right angles to the sheet stock, and accordingly, are commensurately less expensive to manufacture. This configuration is specially suited for applications where space limitations prohibit the use of larger "square" wells in the matrix block.

In seating the pins 270 in the matrix block 221, the rectangular configuration of the well orientates the shoulders 285 so as to properly position the pin 270 in radial relationship. Teeth 295 on the lower edges of the shoulders 285 once again are adapted to bite into the upper surface of the plate and achieve excellent electrical contact when the pin is drawn tightly against the plate by a locking nut (not shown) in the manner hereinbefore discussed.

FIGS. 12 and 13 illustrate at 340 a fourth form of ground connector assembly embodying features of the invention. The ground connector assembly 340 includes a terminal pin 370 having a wire-wrap post 371 on one end and a ground section 373 on the opposite end. No contact is provided on the pin 370, opposite the ground section 373 from the wire-wrap post 371, because this type of pin is used solely as a wire connection ground in a plate-type terminal complex.

Similar to the third form of the ground connector assembly 240 illustrated in FIGS. 10 and 11, the ground section 373 of the assembly 340 has "straight" shoulders 385 extending outwardly. In other words, they are not bent at right angles to the sheet stock. Teeth 395 on the lower edges of the shoulders 385 bite into the upper surface of the plate and achieve the excellent electrical contact hereinbefore discussed.

Yet another form of ground connector embodying features of the invention, the fifth such form, is illustrated generally at 440 in FIG. 14. In this form of ground connector assembly, the terminal pin 470 includes a wire-wrap post 471 separated by the ground section 473 from a female "tuning fork" contact 474 at the opposite end. The base of the tuning fork defines shoulders 485 which, in turn, have teeth 495 on their lower edges. The teeth 495 are adapted to bite into the upper surfaces of the plate to achieve the aforementioned excellent electrical contact.

Immediately above the downwardly pointing teeth 495, and extending outwardly of the shoulders 485, are barbs 496. In this form of the invention, the barbs 496 are designed to snap into corresponding recesses in the inner wall of the rectangular cavity 465 in the thermoplastic or thermoset material 421 and retain the insulator block on the plate.

It should be reiterated here that in each form of the invention, threads are formed integrally with the terminal pin opposite shoulders which bite into the mounting plate. These threads, formed by coining or swaging, achieve excellent electrical connection, and thus grounding, through the nuts to the plate.

While several embodiments described herein are at present considered to be preferred, it is understood that various modifications and improvements may be made therein.

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

1. A ground connector assembly for making a ground connection between a conductor and a metallic terminal plate, comprising:

- a. a terminal connector pin having a wire-wrap post at one end and a ground section adjacent said post,
- b. said ground section including a ground shank having a generally rectangular cross section and a largest transverse dimension corresponding substantially to the inside diameter of a generally cylindrical aperture through the terminal plate,
- c. said ground shank extending through said aperture and being threaded on its edges on a portion of the ground shank extending out of said aperture,
- d. said ground section including ground contact support shoulders formed outwardly of said ground shank opposite the plate from said threaded section,

- e. teeth means formed on the lower surface of said shoulders for biting into said plate and establishing excellent electrical contact with said plate, and
- f. an internally threaded locking nut threaded onto said threaded section into engagement with the plate opposite said shoulders to draw said shoulders tightly against the plate, said nut and the pin.
2. The ground connector assembly of claim 1 further characterized in that:
- a. said teeth means are formed by the lower surfaces of said shoulders inclined downwardly to sharp tips at their outer ends.
3. The ground connector assembly of claim 1 further characterized by and including:
- a. insulating block means mounted on said plate and having well means therein receiving said ground contact support shoulders portion of said ground section,
- b. the cross-sectional configuration and dimensions of said well means corresponding to those of said shoulder means so as to radially orientate said terminal connector pin relative to said insulating block means.
4. The ground connector assembly of claim 3 further characterized in that:
- a. outwardly extending barb means are formed on the radial periphery of said ground contact shoulders,
- b. said barb means serving to retain said insulating block means against the metallic terminal plate when said insulating block means is snapped over said shoulder and said barb means.

5. The ground connector assembly of claim 1 further characterized in that:
- a. said ground contact support shoulders comprise portions of the flat sheet stock from which said ground section is formed bent at right angles to the flat sheet stock in opposite directions.
6. The ground connector assembly of claim 5 further characterized in that:
- a. said portions bent at right angles to said flat sheet stock are defined at their upper and lower extremities by being sheared a short distance inwardly of said ground shank edges whereby said portions are more readily and compactly bent at said right angles.
7. The ground connector assembly of claim 5 further characterized in that:
- a. said shoulders comprises an upper set of shoulders extending in one direction from said flat sheet stock and a lower set of shoulders extending in the opposite direction from said flat sheet stock.
8. The ground connector assembly of claim 7 further characterized in that:
- a. said upper set of shoulders extends in the opposite direction from the contact surface of a contact formed on the end of a terminal pin formed opposite said wire-wrap post,
- b. said upper set of shoulders terminating immediately adjacent a corresponding wall of said well and providing lateral support for said contact.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,614,706 Dated October 19, 1971

Inventor(s) Frank A. Kukla

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 52, "185 the" should be --185. The--.

Column 4, line 68, before "cylindrical" insert --circular--.

Signed and sealed this 16th day of May 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents