United States Patent

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[45] Patented Aug. 3, 1971

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[54] **CONNECTOR**
5 Claims, 11 Drawing Figs.

[52] U.S. Cl. 339/19, 24/73, 24/216, 339/17, 339/18
[51] Int. Cl. A44b 21/00, H01r 9/02
[50] Field of Search ..... 339/18, 19, 17, 258 P; 24/73 B, 73.7, 223, 224, 222, 222 BS, 216, 211 K, 130, 81 TH

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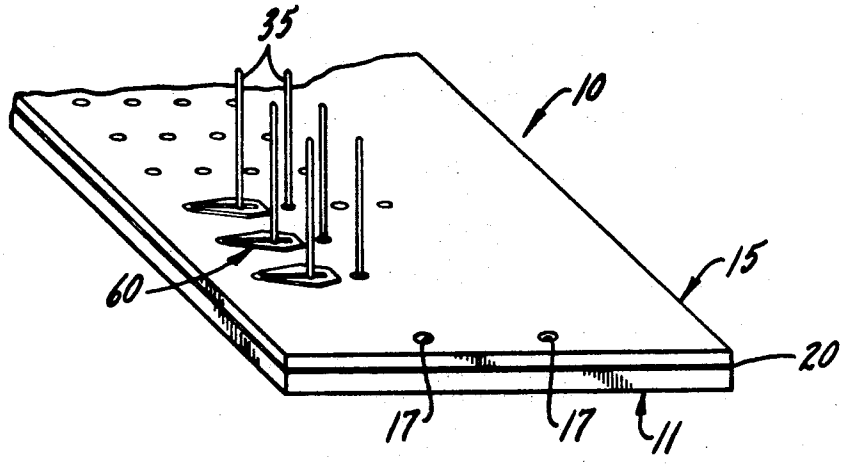
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Primary Examiner—James A. Leppink
Assistant Examiner—Terrell P. Lewis
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ABSTRACT: A connector clip for making an electrical connection between a terminal post and an apertured plate or the like. The clip has resilient parallel legs and bows outwardly to grip the post between them while anchoring itself in the aperture. The plate provides a uniform power source at all terminals to which it is connected and is insulated from a ground plate, which it overlies, and in which the terminals are mounted.



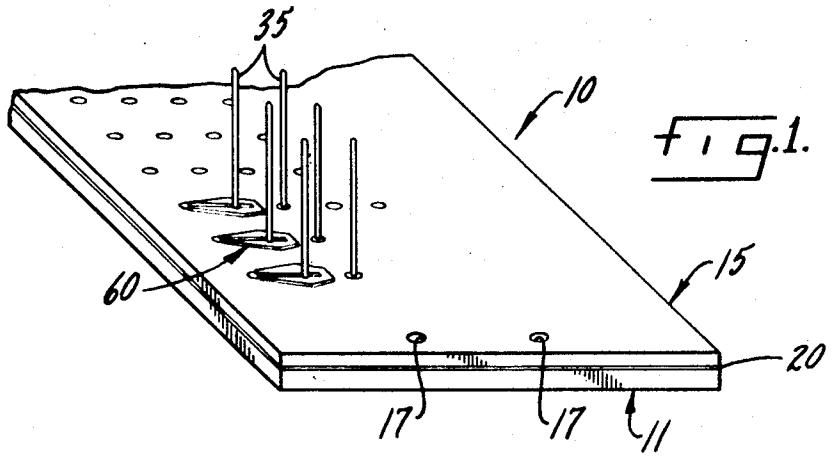


Fig. 1.

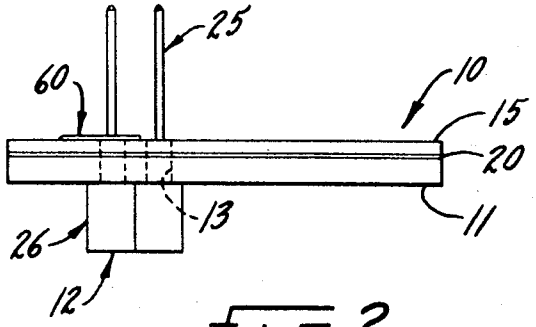


Fig. 2.

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fig.10.

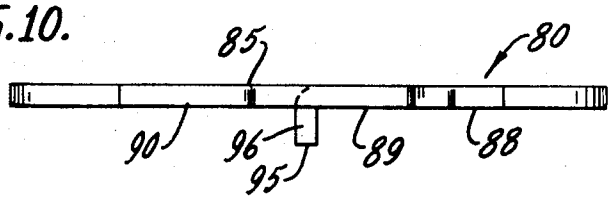
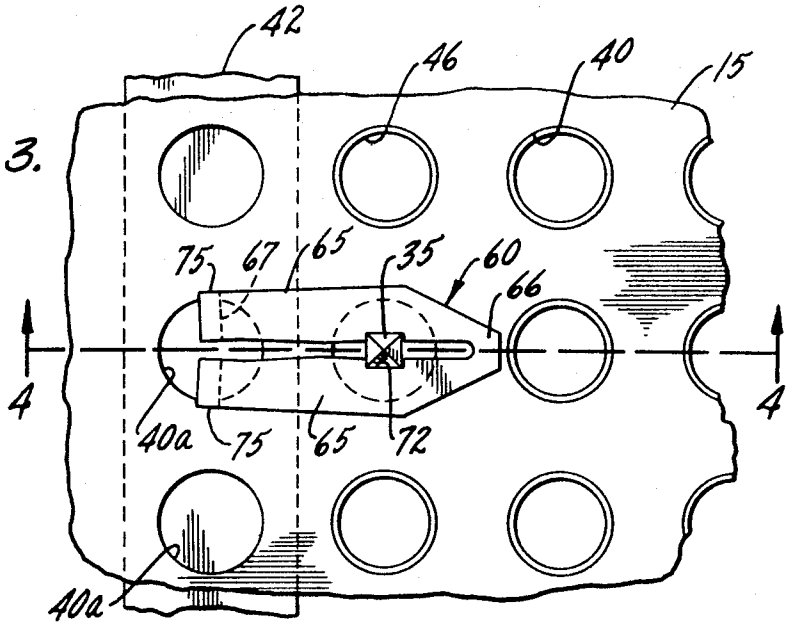


fig.3.



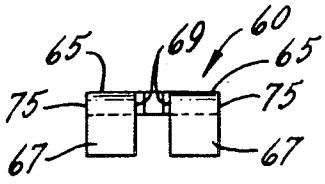


fig.8.

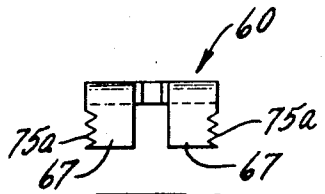
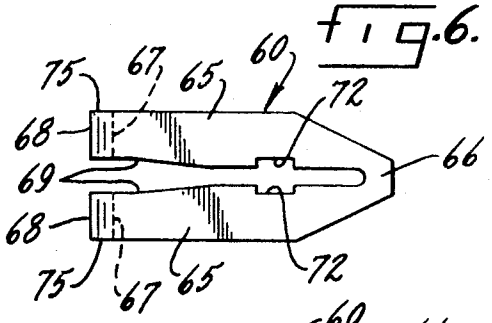


fig.8a.

fig.6.



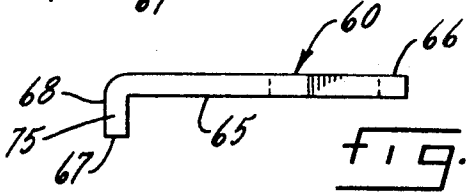


fig.7.

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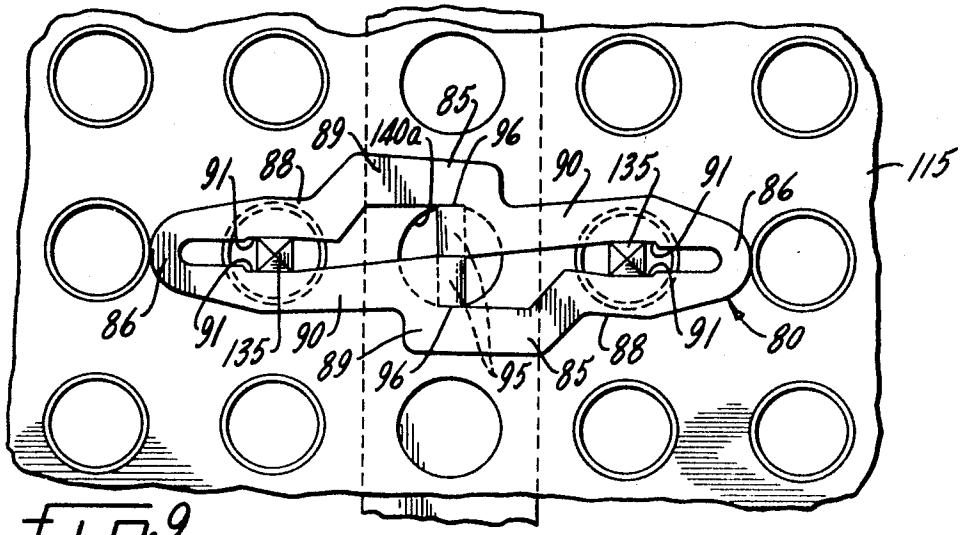


fig.9.

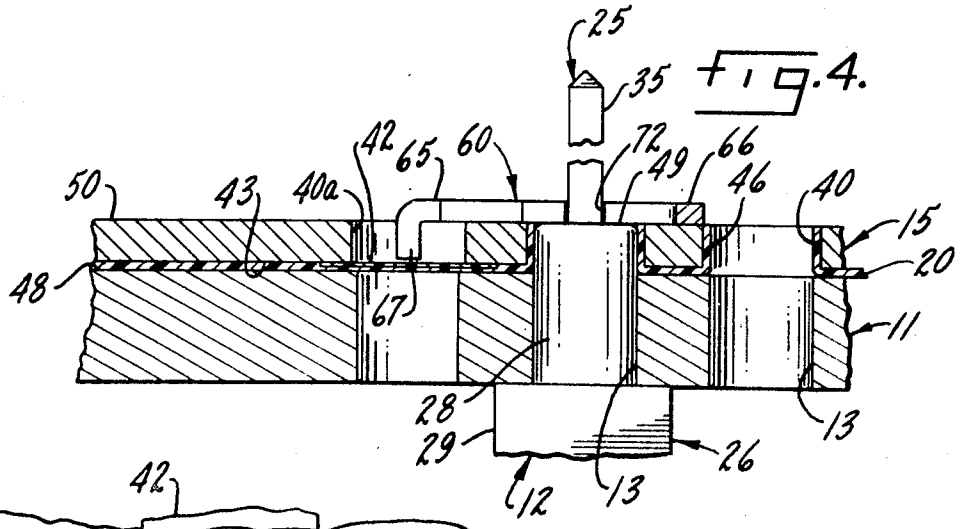


fig.4.

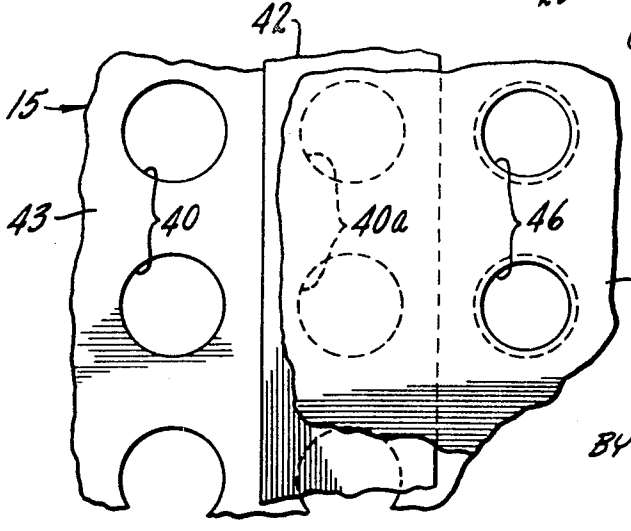


fig.5.

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CONNECTOR

This application is a division of the copending application of George Walter, Ser. No. 667,245, filed Sept. 12, 1967, entitled CONNECTOR, now U.S. Pat. No. 3,496,517, issued Feb. 17, 1970.

This invention is in the field of electrical hardware. It deals particularly with electrical hardware especially suited for high density computer circuitry and the like.

It is now common for computer circuitry to include terminal plates seating thousands of electrical terminals. A preferred arrangement comprising multiple, parallel rows of wire wrap terminals seated in self-locking relationship (as described in the Just et al. U.S. Pat. No. 2,995,617, assigned to the same assignee as the present invention) in insulators extending through corresponding apertures in the terminal plates. The terminals conventionally have wire wrap posts on one end and contacts on their opposite ends suitably disposed in the insulators for receipt of mating terminals or printed circuit boards or the like. The wire wrap posts are connected to computer circuitry leads or a power source by wire wrap techniques.

Power for the circuitry in which these self-locking terminals are components has conventionally been distributed by conductor wires connecting certain terminals to a power source. This arrangement has serious drawbacks in computer circuitry, however. Current distribution is necessarily affected by conductor length and size, for example. Variations in voltage drop from one terminal to another occur through the conductors. In a computer, where very slight voltage variations actually affect the basic functions of the computer, including relay and semiconductor triggering and the like, uniform power distribution is of primary importance.

To solve this problem of uniform power distribution, the applicant has developed a power plate arrangement wherein power is supplied through a separate plate overlying and generally insulated from the conventional ground plate upon which the terminals are mounted. As such, it is an object of the invention to provide a power plate arrangement for a multiple terminal complex wherein uniform voltage is provided to any selected terminal throughout a multitude of terminals mounted in a ground plate.

Another object is to provide a power plate arrangement wherein a voltage plate and ground plate sandwich acts as a capacitor in affording a "current storage" unit so that even if current fluctuations occur, the capacitor continues to provide a constant current flow to terminals connected to the voltage plate.

Still another object is to provide a power plate arrangement wherein a magnetic field is developed around the connections made so as to shield them from interference by adjacent circuitry.

Yet another object is to provide a plate arrangement wherein the voltage distribution means acts as an excellent heat dissipation medium.

Another object of the present invention is to provide a new and improved connector for connecting terminal wire wrap posts to electrical components such as a voltage plate or printed circuit board or the like.

It is another object to provide a connector which comprises a rugged and reliable, yet simple and inexpensive, connector clip.

It is still another object to provide a connector clip which is quickly and simply seated in temporary or permanent connection of a terminal post and a voltage plate, for example, to provide a superior electrical connection between these components.

It is yet another object to provide a connector clip which effectively clamps the terminal post and bites into a voltage plate so as to assure a superior connection regardless of the presence of foreign material, films or oxides or the like, on the surface of these components.

It is a further object to provide a connector clip which, when properly seated, readily adapts itself to relative movement of a terminal post and voltage plate, for example, such as when the post inadvertently is bent, without breaking the clip connection between the post and the voltage plate.

It is yet a further object to provide a connector clip which is removable and replacable without damage to either the clip or the voltage plate.

The foregoing and other objects are realized in accord with the present invention by providing a power plate arrangement including a ground plate in which are mounted a plurality of electrical terminals in insulated relationship. A voltage plate overlies the ground plate in sandwiched relationship. A layer of insulating material such as an epoxy resin or the like is disposed between the plates, whereby a capacitor is formed, affording a "current storage" capacity. The terminals are mounted in insulated relationship in the ground plate and extend through suitably formed apertures in the voltage plate. The voltage plate (or plates) is connected to each selected terminal by providing a connector clip which comprises two generally parallel legs fabricated of resilient, conductive material, resiliently joined to each other at at least one corresponding end. The legs resiliently clamp a terminal post. The legs are retained in this clamped relationship on the post by locking feet which extend generally perpendicular from corresponding legs into prescribed apertures in a power plate, for example.

In one form of the voltage clip, it is adapted to connect a single terminal post to a component such as a voltage plate. In this form, the clip legs are resiliently joined at only one corresponding end. The locking feet are formed integrally with and extend perpendicular from the opposite free ends of the legs. In another form of the clip, it connects two terminal posts to the voltage plate. In this form, the legs are resiliently joined at both corresponding ends. The locking feet are formed integrally with the legs generally intermediate the resiliently joined opposite ends of the legs.

The invention, both as to its organization and method of operation, is illustrated more or less diagrammatically in the attached drawings, in which:

FIG. 1 is a perspective view of a portion of a ground terminal plate and power plate assembly;

FIG. 2 is a side elevational view of the assembly illustrated in FIG. 1;

FIG. 3 is an enlarged view of a portion of the ground terminal plate and power plate assembly illustrated in FIGS. 1 and 2, showing a connector clip embodying features of the present invention;

FIG. 4 is a sectional view taken along line 4–4 of FIG. 3;

FIG. 5 is a plan view of a portion of the voltage plate, illustrating a segment of its dielectric film;

FIG. 6 is a plan view of a first form of clip-type connector embodying features of the invention;

FIG. 7 is a side elevational view of the connector illustrated in FIG. 6;

FIG. 8 is an end elevational view of the connector illustrated in FIGS. 6 and 7;

FIG. 8*a* is an end elevational view of a modified form of the connector illustrated in FIGS. 6 and 7;

FIG. 9 is a plan view, similar to FIG. 3, illustrating a second form of the clip-type connector; and

FIG. 10 is a side view of the clip-type connector illustrated in FIG. 9.

Referring now to the drawings, and particularly to FIGS. 1 and 2, an electrical connector assembly is seen generally at 10. The assembly 10 comprises a ground terminal plate 11, usually fabricated of an aluminum alloy, mounting a plurality of terminals 12 in suitably formed apertures 13 (see FIG. 2) in the plate 11. Overlying the ground terminal plate, and insulated therefrom, is a power plate 15, which is also fabricated of an aluminum alloy or other conductive material. The power plate 15 is connected to a source (not shown) of current, as at 17, and provides a uniform current dwell at any and every point throughout its extent.

Because the current dwell is uniform throughout the power plate **15**, any selected terminal or terminals **12** can be tapped into the power plate immediately adjacent the terminal and receive precisely the same current flow. Thus, the voltage at any and all such "power" terminals **12** is exactly the same. It then becomes possible, according to the present invention, to develop computer circuitry which completely obviates malfunction due to voltage irregularities in power transmission.

It has been pointed out that the ground terminal plate **11** and the power plate **15** are insulated from each other. More precisely, a film **20** of dielectric material such as an epoxy resin or the like extends between the ground terminal plate **11** and the power plate **15**. The epoxy resin film is actually applied to the power plate **15** by conventional silk screen techniques, spraying or vapor deposition, for example.

The aforedescribed arrangement of metal plates **11** and **15** and a dielectric film **20** between them forms a capacitor, the plates **11** and **15** being at different potentials since power is supplied to the power plate **15**, while the ground terminal plate is normally grounded. Acting as a capacitor, the assembly **10** provides a "current storage" unit so that even if current fluctuations occur at the power source, the capacitor continues to provide a constant current flow at any terminals **12** which are tapped into the voltage plate **15**.

The power plate **15** also has a magnetic field formed around it when supplied with power. This field serves to shield the terminals **12** from outside electrical interference. Furthermore, the plate **15** serves as a conductor to channel heat away from the terminals.

Turning to FIGS. **3—5**, the terminal connector assembly **10**, or part of it, is seen substantially enlarged. Note that the ground terminal plate **11** is substantially thicker than the power plate **15**. In practice, the ground terminal plate is preferably constructed of aluminum alloy plate which is approximately 0.80 inch in thickness, while the voltage plate **15** is constructed of aluminum alloy plate of approximately 0.30 inch in thickness. The thickness of the ground terminal plate **11** is sufficient to provide the assembly **10** with structural strength and rigidity required, while the thickness of the voltage plate **15** is sufficient to assure excellent conductivity and uniform current dwell throughout, while being thin enough to occupy minimal space.

The aluminum ground terminal plate **11** is anodized after the terminal apertures **13** are formed in it to protect the plate surface. Anodizing is preferably avoided in selected areas by masking, however, to afford good contact areas for grounding connection. Since the feature does not pertain to this invention, however, it is not illustrated or described in detail.

Each terminal **12** comprises a terminal pin **25** seated in self-locking relationship, as described in the aforementioned Just et al. patent, in a bushing **26** extending through a prescribed aperture **13** (see FIG. **4**). The bushing **26** is fabricated of a dielectric material, preferably nylon, for example, and includes a circular cylindrical locking section **28** and a square head section **29**. In the ground terminal plate **11** and terminal **12** arrangement illustrated, the terminals **12** are adapted to receive male blade connectors in the head sections **29** where they mate with the terminal pins **25**. Alternatively, however, printed circuit boards might be received by the head sections **29** to connect to the terminal pins. In the latter instance, of course, the construction and configuration of the head section **29** would differ considerably.

Each terminal pin **25** illustrated comprises a wire wrap post **35** which extends through the locking section **28** of the bushing **26**, and a suitably formed female tine arrangement (not shown) within the head section **29**. The pins are fabricated of brass or phosphor bronze or the like. The terminal posts **35** are conventionally either 0.25 or 0.45 inch square in cross section and are adapted to receive and retain wire leads applied by conventional wire-wrapping techniques.

The power plate **15** is also fabricated of an aluminum alloy, as has been pointed out. Circular cylindrical apertures **40** of slightly larger diameter than the apertures **13** in the ground terminal plate **11** are formed in the power plate **15**, in a pattern corresponding precisely to the pattern of apertures **13** in the terminal plate. The power plate **15** is then iridite finished for conductive purposes, similar to the terminal plate **11**.

After the power plate **15** has been finished in the aforedescribed manner, a thin strip **42** of plastic tape is preferably applied to one surface **43** over one or more rows of apertures **40** in the plate **15** which are not programmed to overlie terminals **12**. As illustrated in FIGS. **4** and **5** where one row of these apertures **40***a* are illustrated, the tape thus closes these apertures to communication with one surface **43** of the power plate **15**.

With a row, for example, of apertures **40***a* masked in the aforedescribed manner, the thin film **20** of a dielectric material, an epoxy resin in this case, is applied to the surface **43** of the power plate **15**. According to present practice, the film **20** is applied by silk-screening techniques. However, the film **20** might be applied in other ways, such as by spraying or vapor deposition, for example. At any rate, a dielectric film **20** is formed over the entire surface **43** of the power plate **15**.

As the film **20** is applied to the surface **43** of the power plate **15** by silk screening, for example, it also forms within the apertures **40** which are not covered by the masking plastic tape **42**. A thin section of film **46** thus also builds up within these unmasked apertures **40**.

With the ground terminal plate **11** mounting thousands of terminals in a prescribed arrangement, and the power plate **15** prepared in the aforementioned manner, the plates **11** and **15** are sandwiched together, as illustrated in FIG. **4**. The open apertures **40** of the power plate **15**, lined with the film **46** of plastic, are seated over the extending ends of corresponding locking sections **28** of the terminal bushings **26** until the film **20** lies flush against the surface **48** of the ground terminal plate **11**. With the power plate **15** seated snugly against the ground terminal plate **11**, the free ends **49** of the locking sections **28** in the terminal bushings **26** preferably lie flush with the outer surface **50** on the power plate **15**.

The power plate **15** is connected to a power source (not shown) by suitably leads connected to the plate. The thickness of the plate **15** is such that a constant current dwell is established throughout the plate. According to the present invention, a precisely identical voltage is thus available at each of an entire row of terminals **12**, for example, through identical connector clips **60** (only several of which are shown) embodying features of the invention.

Terminal clips **60** ordinarily connect one or more terminals **12** in one row of a block of terminals to a power plate **15**, for example. The block of terminals **12** might be connected to a multiple lead connector block forming terminations for a single or multiple circuitry module. Power is supplied to the module from the power plate **15**, through the clips **60** and the terminals **12**.

One of the terminal clips **60** is illustrated in mounted relationship in figS. **3** and **4**. The terminal clip **60** embodies features of the first form of the present invention. It tightly clamps onto the wire wrap post **35** of a terminal pin **25** and, at the same time, resiliently wedges into the apertures **40***a* in the power plate **15** which are not lined with the film section **46** of insulating plastic. The clip **60** is sufficiently flexible so that even if the post **35** is flexed or bent during handling of the assembly **10**, the clip remains seated and maintains an excellent electrical connection between the power plate **15** and the terminal pin **25**.

Referring now to FIGS. **6—8**, in addition to FIGS. **3** and **4**, the connector clip **60** if formed from a single strip of beryllium copper or phosphor bronze by die punching or the like and includes identical, parallel legs **65** joined by a common base section **66** at adjacent one ends of the legs. The legs **65** and base section **66** are generally flat, while perpendicularly extending feet **67** depend from the other ends **68** of each of the legs **65**.

Formed in opposing relationship on the inner edge **69** of each of the legs **65** intermediate the base section **66** of the clip **60** and the free ends **68** of the legs **65** are shallow, semirectan-

gular cutouts **72**. The cutouts **72** are adapted to receive and clamp onto the wire wrap post **35** and, accordingly, each cutout **72** is preferably 0.025 or 0.045 inch in width.

A clip **60** is slipped over the wire wrap post **35** of each selected terminal **12** and forced downwardly into the position shown in FIGS. **3** and **4**. The feet **67** are wedged into the apertures **40***a* in the power plate **15**. The feet **67** are relatively short, their length being slightly less than the thickness of the plate **15** so the insulation is not punctured. In contrast, the legs **65** are relatively long.

The width of each clip **60** between its outer edges **75**, in a relaxed condition, is greater than the diameter of the apertures **40***a* into which the feet **67** are received, and the distance between the bottoms of the cutouts **72** normally provides a slip fit over the wire wrap post **35**. Accordingly, when the feet **67** of the clip **60** are pinched together and placed into a corresponding aperture **40***a* in the power plate **15**, the legs **65** of the clip are bowed outwardly and clamp the terminal post **35** in the cutouts **72**. At the same time, the spring force in the bowed, resilient legs **65** causes the outer edges **75** of the feet **67** to bite into the side of the aperture **40***a*. The clip **60** is thus resiliently clamped into place and excellent electrical connections are established between the clip and the post **35**, as well as between the clip and the power plate **15**. Because of the resiliency of the clip **60**, it will not inadvertently work loose from its seated relationship on the post **35** and in the power plate **15**, even if the post **35** is bent extensively, for example. Referring to FIG. **8***a*, however, it is possible to provide additional retaining means for the clip **15** by serrating the outer edges of the feet **67**, as at **75***a*.

The clip **60**, while is adapted to be connected to a single terminal post **35**, is illustrated as a relatively straight member with its base section **66** directly opposite the cutouts **72** from the feet **67** of the clip. However, it should be understood that if terminal density is greater, and clip size presents interference problems, the base section **66** and those portions of the legs **65** between the cutouts **72** and the base section **66** might be canted at an angle or split into two separate or splayed base sections. It is only necessary that the extremities of the base section be sufficiently spaced from the cutouts **72** to assure that a resiliently tight clamping effect will be made on the post **35** without breaking the clip at the base section.

Attention is now directed to FIGS. **9** and **10** where a connector clip **80** embodying features of a second form of the present invention is illustrated. The clip **80** is substantially identical in concept to the clip **60**, but is adapted to connect two terminal posts **135** to a power plate **115** through a single power plate aperture **140***a*. The clip **80** is also formed of beryllium copper or phosphor bronze by die punching, for example.

The clip **80** comprises elongated, parallel legs **85** joined at their opposite ends by identical base sections **86**. The legs **85** are somewhat irregularly shaped. They are, however, substantially identical to each other in configuration, although oppositely arranged in the clip as will be recognized.

Each leg **85** includes a relatively short end section **88**, a central section **89** and a relatively longer opposite end section **90**. On the opposed end sections **88** and **90**, the inner edge is squared, as at **91**, to engage and clamp the sides of a corresponding terminal post **135**.

The oppositely disposed central sections **89** of the legs **85** have a foot **95** bent downwardly therefrom, as best illustrated in FIG. **10**. The outer edges **96** of the feet are, in the relaxed condition of the clip **80**, spaced apart a distance greater than the diameter of the corresponding aperture **140***a* through the power plate **115**. In addition, the opposed edges **91** in the leg sections **88**, **90** are normally spaced apart sufficiently to make a slip fit to the corresponding terminal posts **135**.

The clip **80** is slipped over a pair of terminal posts **135** in much the same manner that the clip **60** is mounted on a single post **35**. The clip **80** is forced downwardly on the post **135** until the feet **95** reach and are pinched together and placed into the corresponding apertures **140***a*. As the feet expand into the aperture, they bite into its surface as the opposed edges **91** clamp tightly onto the terminal **135**. Similar to the clip **60**, an excellent electrical connection, with the clip **80** actually clamping onto the posts **135** and biting into the aperture **140***a*, is effected. Even if the posts **135** are bent extensively, the resiliency of the clip **80** permits it to remain securely seated and maintain an excellent connection.

The connector clips **60** and **80** have been described in detail solely in the context of a power plate **15** connection to a square cross section wire wrap post. It is within the purview of the invention, however, to make connections with these clips to printed circuit boards and other electrical components from round pins or pins having other cross-sectional configurations.

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 I desire to claim and secure by Letters Patent of the United States is:

1. A connector clip for electrically connecting a terminal post in an electrical terminal with a plate having one aperture through which said post extends and another aperture adjacent said one aperture, comprising:

a. a pair of generally coextensive legs formed of resilient material and disposed substantially parallel to each other,
b. each end of one of said legs being disposed adjacent the corresponding end of the other of said legs,
c. a common base section joining one pair of adjacent ends of said legs together,
d. a foot extending from each of the other adjacent ends of said legs for seating in said other aperture, and
e. a cutout formed in the opposed surfaces of each of said legs between said base section and said feet for engaging and clamping the post when said feet are seated in the other aperture.

2. A connector clip for electrically connecting a terminal post in an electrical terminal with a plate having one aperture through which said post extends and another aperture adjacent said one aperture, comprising:

a. a pair of relatively long, generally coextensive legs formed of resilient material and disposed substantially parallel to each other,
b. each end of one of said legs being disposed adjacent the corresponding end of the other of said legs,
c. a common base section joining at least one pair of adjacent ends of said legs together,
d. a relatively short foot for seating in said other aperture depending from each of said legs at a distance substantially greater than the length of said feet from said base section, and
e. means formed on opposed inner surfaces of said legs disposed between said base section and said feet for resiliently engaging and clamping the post,
f. said legs being long enough so that they bow outwardly around the post when said feet are seated in said other aperture and said engaging and clamping means grip the post.

3. The clip of claim **2** further characterized in that:

a. said legs and said base section lie substantially in a single plane, and
b. said feet depend generally perpendicular from said plane.

4. The clip of claim **2** further characterized in that:

a. said feet depend from the other ends of each of said legs.

5. The connector clip of claim **2** further characterized in that:

a. said legs are joined together by common base sections at both ends of the legs,
b. said feet depend from each of said legs intermediate said base sections,
c. said engaging means include means formed on opposed inner surfaces of said legs disposed between said feet and each of said base sections.