April 2, 1968 D. R. COLDREN ETAL 3,375,749

FASTENER

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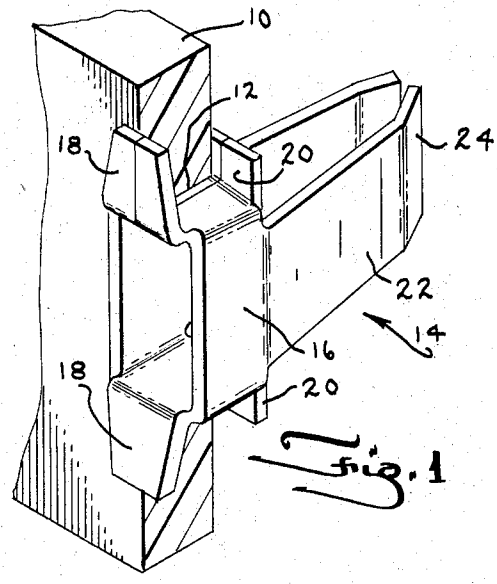


Fig. 1

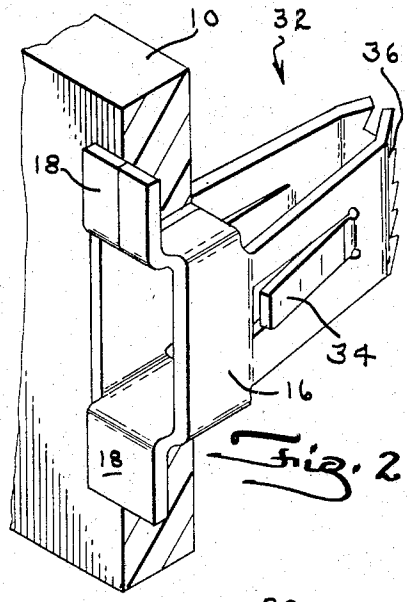


Fig. 2

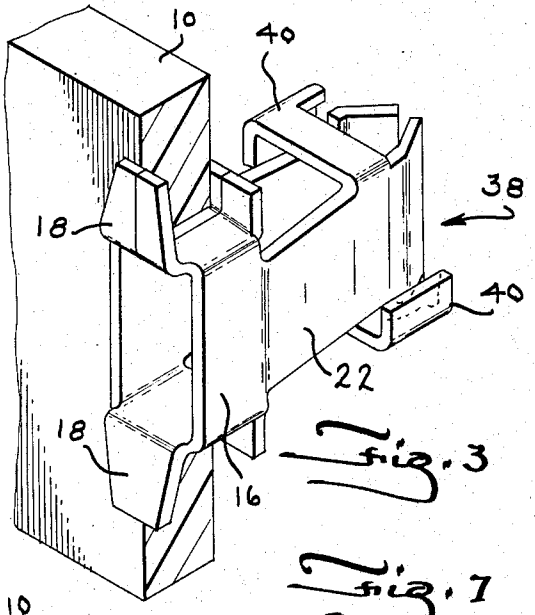


Fig. 3

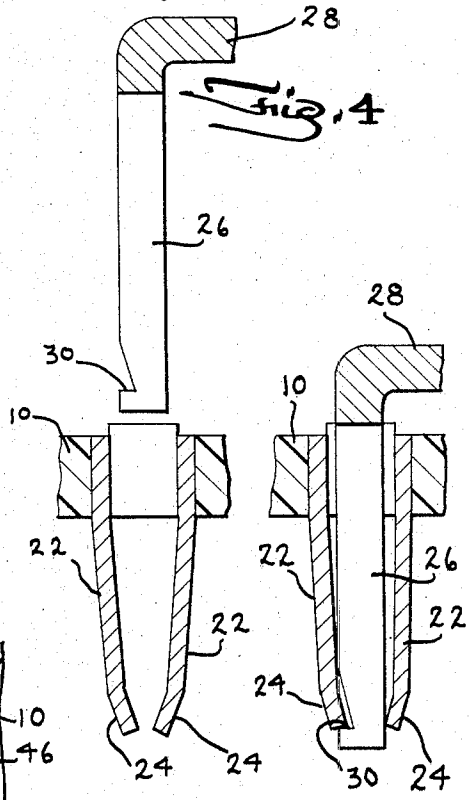


Fig. 4

Fig. 5

Fig. 7

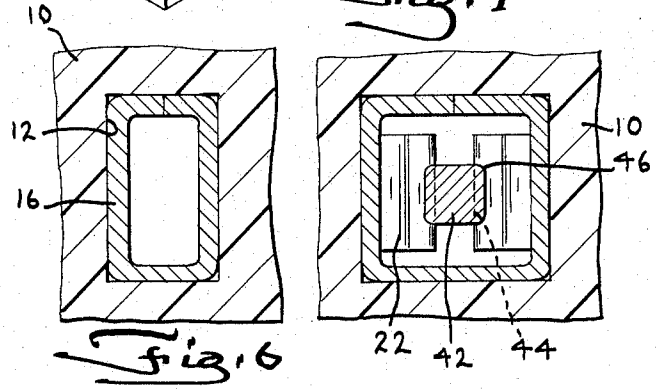


Fig. 6

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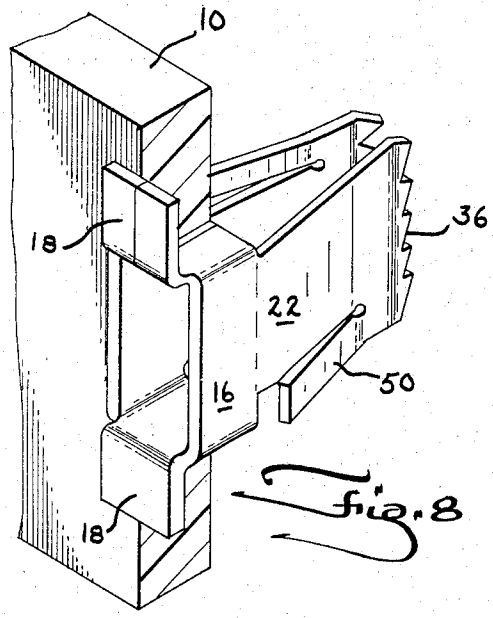


Fig. 8

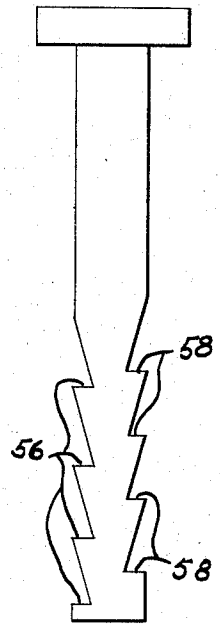


Fig. 9

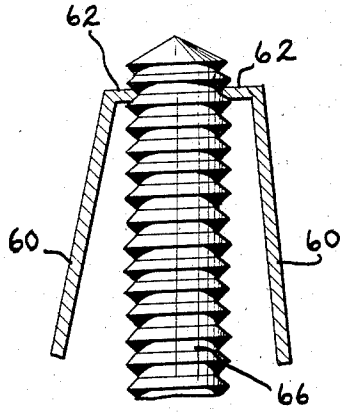


Fig. 10

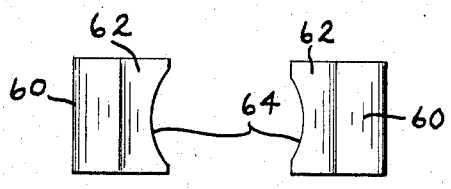


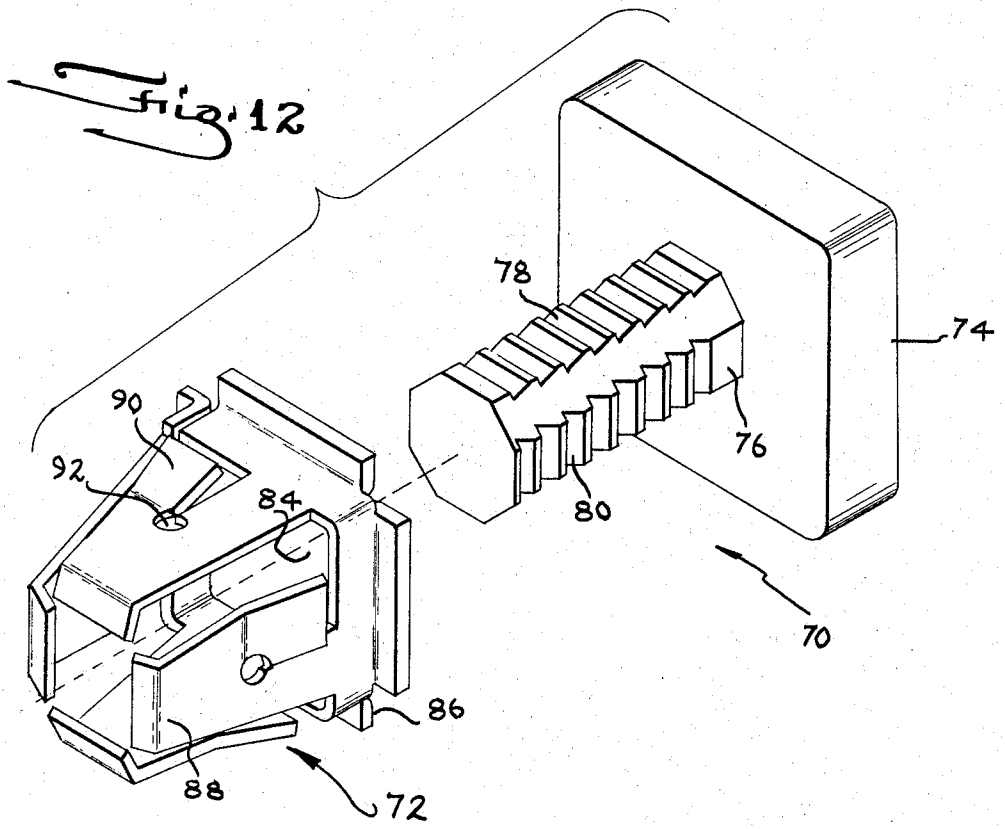
Fig. 11

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Fig. 12



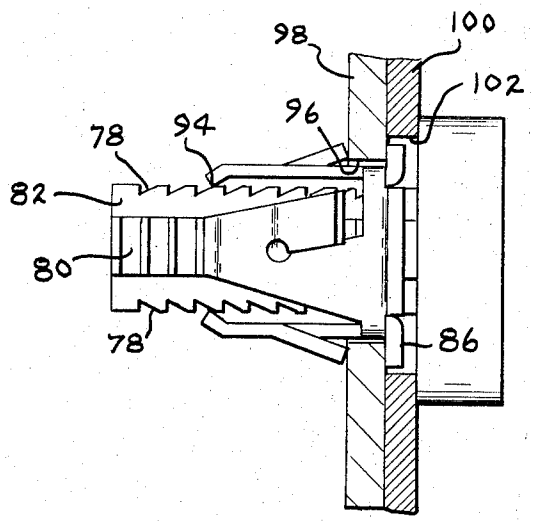


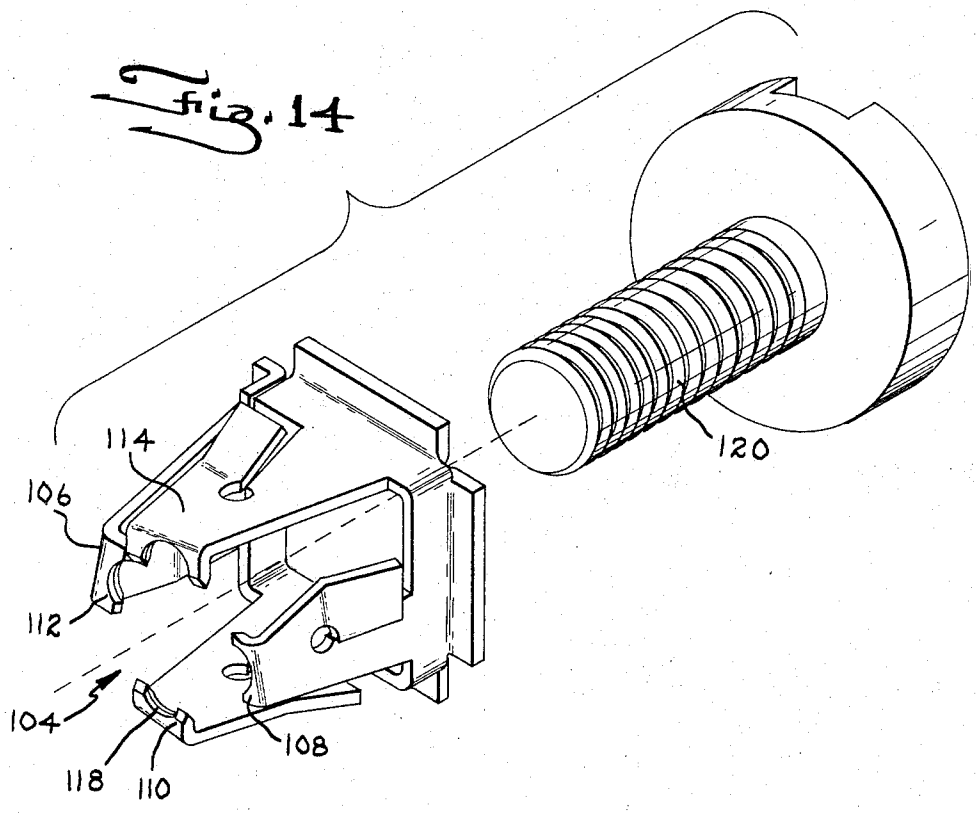
Fig. 13

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Fig. 14



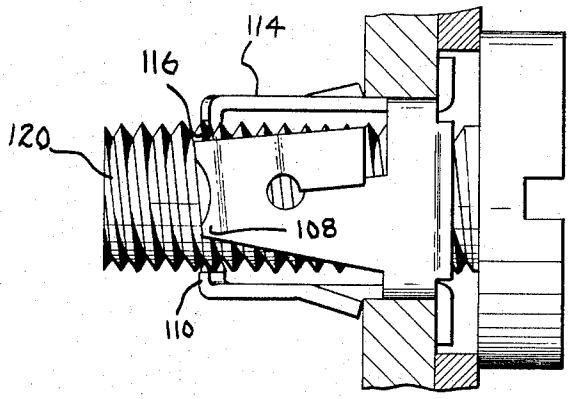


Fig. 15

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3,375,749

FASTENER

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Continuation-in-part of application Ser. No. 513,012, Dec. 10, 1965. This application Mar. 2, 1966, Ser. No. 531,097

4 Claims. (Cl. 85—80)

ABSTRACT OF THE DISCLOSURE

A fastener is provided for mechanically and electrically joining two members. The fastener comprises a receptacle having resilient arms for cooperating with an insert. The insert permits a wide range of adjustability and is quickly connectable and disconnectable.

This application is a continuation-in-part of our copending application Ser. No. 513,012 filed Dec. 10, 1965.

This invention relates to the art of fasteners and more particularly to a new and novel means for electrically grounding and mechanically fastening a printed circuit board to a chassis or the like, and to a new and novel means for mechanically fastening any two members together.

It is an object of the present invention to provide a means for rapidly connecting a printed circuit board to a chassis.

A further object is to provide a means which will ground the printed circuit board to the chassis.

A further object is to provide a fastening means which is of rigid construction and yet is relatively inexpensive to produce.

Another object is to provide a quick disconnect type fastening means which securely holds two members together yet is releasable by a slight rotational movement of the fastener.

Other objects and attainments of the present invention will become apparent to those skilled in the art upon a reading of the following detailed description when taken in conjunction with the drawings in which there are shown and described illustrative embodiments of the invention; it is to be understood, however, that these embodiments are not intended to be exhaustive nor limiting of the invention but are given for purpose of illustration in order that others skilled in the art may fully understand the invention and the principles thereof and the manner of applying it in practical use so that they may modify it in various forms, each as may be best suited to the conditions of a particular use.

In the drawings, in which like reference numerals refer to like parts:

FIGURE 1 is a perspective view of one embodiment of the present invention;

FIGURE 2 is a perspective view of an alternative form of the present invention;

FIGURE 3 is a perspective view of still another form of the invention;

FIGURE 4 is a cross-sectional view of a tab and fastener prior to engagement;

FIGURE 5 is a cross-sectional view of a tab and fastener in their engaged position;

FIGURE 6 is a cross-sectional view showing a fastener mounted within a printed circuit board;

FIGURE 7 is a cross-sectional view similar to FIGURE 6 showing an alternative configuration of the fastener;

FIGURE 8 is a perspective view of an alternative form of the invention;

FIGURE 9 is a view showing a modified form of tab;

FIGURE 10 is a view partly in section of still another form of the invention;

FIGURE 11 is a view looking in the direction of the arrows 11—11 in FIGURE 10;

FIGURE 12 is an exploded perspective view of a fastening insert and receptacle constituting a further modification of the present invention;

FIGURE 13 is a side elevational view partly in section showing the insert and receptacle of FIGURE 12 in their assembled form;

FIGURE 14 is a perspective view of a further modification of the fastener of FIGURE 12 for cooperation with a threaded member; and

FIGURE 15 is a side elevational view partly in section showing the receptacle of FIGURE 14 in its mounted position ready to receive a threaded member.

With reference to FIGURE 1 there is shown a printed circuit board **10** having a generally rectangular aperture **12** for receiving a fastener indicated generally at **14**. The fastener **14** has a strap portion **16** which fits snugly within aperture **12** and is retained therein by means of two pair of flanges **18** and **20**, the said flanges grasping opposite side walls of the board **10**. The flanges **18** are electrically connected to suitable conductors on board **10** by means of dip soldering. Extending from strap portions **16** are a pair of arms **22** having inwardly turned ends **24**. The fastener **14** is preferably made out of steel but may be made of any material which has sufficient resiliency to give spring characteristics to the arms **22**.

Fastener **14** is shown in FIGURE 4 about to receive a tab member **26** which may be struck from a suitable metallic chassis **28**. The tab **26** is provided with an indented portion **30** adjacent the end thereof. In use when a chassis is to be secured to a printed circuit board the tab **26** is passed through the strap portion **16** of fastener **14** and between the arms **22** thereof. When the tab is fully seated the indented portion **30** will cooperate with the ends **24** of arms **22** to form a locking means to thereby prevent the subsequent separation of the board member from the chassis. The tab can be seen in its seated position in FIGURE 5. It will be noted that during insertion of tab **26** the end thereof will spring the arms **22** outwardly prior to the seating of one of the arms into the indented portion **30**.

It can be seen at this point that fastener **14** and tab **26** provide a means for mechanically connecting a printed circuit board to a chassis. It is also obvious that an electrical ground for the printed circuit board has been provided, the electrical path being through the fastener **14** and tab **26** into the metal chassis **28**. Although fastener **14** has been illustrated in conjunction with a printed circuit board and chassis it is to be understood that this is a preferred use but not the only use of the fastener of the present invention. It is contemplated that the fastener and tab arrangement of the present invention may be used for installing door panels in automobiles, assembling office furniture, installing ceiling and wall panels, and assembling many other everyday products.

In FIGURE 2 there is shown a fastener **32** which is similar to fastener **14** but varies therefrom in certain details to be described. The flanges **20** of fastener **14** have been deleted in fastener **32** to thereby permit the fastener to be inserted through the aperture **12** in printed circuit board **10** without the necessity of a subsequent forming operation. To retain the fastener **32** in position there is provided a pair of lances **34** struck from the pair of arms **22**, the said lances cooperating with the back side of board **10**, as seen in FIGURE 2, to thereby serve the same function as the previously described flanges **20**. As also seen in FIGURE 2 the ends **24** of arms **22** have

been provided with a serrated surface indicated at **36**. It has been found that the serrated surface at the ends of the arms **22** provides better electrical characteristics than does the flat surface as shown in FIGURE 1. It is obvious however that the fastener **14** may also be provided with a serrated surface at the ends of the arms **22** and likewise the fastener **32** may be provided with a flat surface in place of the serrations in those instances of use where electrical characteristics are of little or no importance. In FIGURE 3 there is shown a fastener **38** which is identical to fastener **14** with the exception that a pair of legs **40** extend from the arms **22** and overlie the opposite arm to which the leg is attached. These legs **40** limit the outward movement of the arms **22** and thereby prevent the overstressing of the arms.

In those applications where only a single fastener and tab are employed it may be often desirable to provide for the quick disconnect of the assembled parts. This may be achieved, with reference to FIGURE 7, by replacing the rectangular strap portion **16** and aperture **12** with corresponding parts having a generally square configuration. The tab **42** is provided with indented portions **44** on opposite edges thereof for cooperation with the arms **22** of the fastener. When it is desired to disconnect the tab from the fastener all that is required is to rotate the tab 90 degrees whereby the arms **22** would be in engagement with the smooth side edges of the tab to thereby permit the easy withdrawal of the tab from the fastener. If desired the corners of the tab **42** may be rounded as indicated at **46** to facilitate the rotation of the tab.

In FIGURE 8 there is shown a fastener **48** which is similar to the fastener **32** of FIGURE 2 with the exception that lance **50** is struck from the sides of the arms of the fastener rather than the center of the arms. The lance design of FIGURE 8 is advantageous in those situations where a very small fastener is used and a lance in the center of the arms would severely reduce the strength of the arms. Also by placing the lance at the sides of the arms the lances are more free to move relative to the arms with no problem of binding. The purpose of the lances **50** is the same as that of the lances **34** previously described.

The tab **26** described in connection with FIGURES 4 and 5 is integral with one of the parts to be connected i.e. the chassis **28**. However the fastening concept of the present invention may be employed for joining two members wherein the tab is a separate element. In FIGURE 9 there is shown a tab **52** which may be employed with any of the previously described fasteners. The tab **52** has an enlarged head **54** for limiting the insertion of the tab into the member to be connected. A plurality of indents **56** and **58** are formed in opposite sides of the tab, the indents **58** being offset from the indents **56**. With this configuration the tab may be inserted into a fastener such as **48** and the plural indents permit the tab to connect members of various thicknesses.

In FIGURES 10 and 11 there is shown a modified fastening arrangement. The arms **60**, similar to the arms **22** previously described, are provided with portions **62**, adjacent their free ends, which extend at generally right angles to the longitudinal extent of the fastener. The portions **62** have semi-circular recesses **64** formed therein for receiving a threaded member **66**, the member **66** replacing the indented tabs of the previous embodiments.

Turning now to FIGURE 12 there is shown a fastening insert indicated generally at **70** and a fastening receptacle indicated generally at **72** which receptacle is adapted to receive the insert **70**. The insert has an enlarged head **74** and an elongated section **76**. The elongated section **76** is of polygonal configuration and in the preferred embodiment shown is octagonal. A series of equally spaced notches **78** are disposed in opposite sides of the insert and as can be seen in FIGURE 13 the notches **78** are in transverse alignment. A second series of equally spaced notches **80** are disposed in opposite sides of the insert with the notches **80** being disposed in those sides which are 90 degrees removed from the sides containing the notches **78**. The notches **80** are laterally offset from the notches **78** to provide a fine increment of adjustment as will become apparent as the description proceeds. Disposed between the notched sides of the insert are planar faces **82** which provide a disconnect feature as will become apparent.

The receptacle **72** is formed from a flat sheet metal stamping into a boxlike configuration and comprises a rectangular strap portion **84** having securing tines **86** extending from each side of said strap portion, the tines serving to secure the receptacle in position on a member to be connected. A resilient spring finger **88** extends from each side of said strap portion on the opposite side from the securing tines **86**, the fingers **88** having lances **90** formed therein, the lances terminating in apertures **92** serving as a strain relief to prevent cracking of the receptacle. The outer free ends **94** of the fingers **88** are bent inwardly for cooperation with the notches on the insert **70**.

As seen in FIGURE 13 the insert **70** and receptacle **72** are in their assembled position. The receptacle is mounted within an aperture **96** in a panel **98** with the strap portion **84** being disposed within the aperture and the securing means **86** and lances **90** contacting opposite sides of the panel **98** to thus retain the receptacle in position. The receptacle is inserted into the panel **98** from left to right as seen in FIGURE 13 with the lances **90** being deflected inwardly during insertion and then springing outwardly into their securing position. A second panel **100** is shown with an aperture **102** through which extends the insert **70**. The head **74** of the insert limits the rightward movement of the insert into the panel. The ends **94** of the fingers **88** will be cammed outwardly by the insert and will eventually seat in either a pair of notches **78** or a pair of notches **80** depending on the thickness of the panels **98** and **100** which are fastened together. As is evident two of the arms **88** will be in engagement with a pair of notches while the other two arms will merely serve a steadying function. As shown in FIGURE 13 the forward finger **88**, and the hidden rearward finger, are positioned in a pair of the notches **80** while the upper and lower fingers have assumed an intermediate position on the notches **78**. The provision of offset notches allows for an increment of adjustment which is twice as fine as would be if the notches **78** and **80** were in transverse alignment. The number of notches on any particular side of the insert is limited by the requirement of a fairly gradual sloping surface on the notch to insure proper seating of the fingers **88**.

The receptacle **104** shown in FIGURE 14 is similar to the receptacle **72** previously described with the exception that the receptacle **104** has been modified to cooperate with a circular threaded member. The ends **106**, **108**, **110** and **112** of the spring fingers **114** are turned inwardly at approximately 90 degrees to the longitudinal extent of the fingers **114** so that the ends will engage deeply with the threads of a mating member. The extreme ends of the fingers are provided with bevelled surfaces such as **116** which surfaces approximate the configuration of a standard thread. Further the spring fingers are provided with arcuate recesses **118** in ends thereof which recesses approximate the circumference of a threaded member.

As best seen in FIGURE 15 the ends **106** through **112** of the spring fingers **114** are disposed at a slight angle relative to a transverse plane passing through the receptacle, this angle being approximately 5 degrees, the angle chosen being dependent on the lead of the particular thread design on a mating part such as **120**. The spring arms having ends **106** and **110** are slightly longer than the spring arms having ends **108** and **112**. Because of this configuration the ends **106** and **108** will engage one thread on the member **120** while the ends **110** and **112** will engage the adjacent thread. The provision of two long and two short spring arms allows all of the arms to be of approximately the same length. If the arms were

designed to be of gradually increasing or gradually decreasing length whereby all four arms would engage the same thread there would be a wide variation in length between the longest and the shortest arm, which arrangement would adversely affect the stability of the receptacle and would require that the receptacle be longer than is actually necessary.

It can thus be seen that a fastener has been provided which achieves the objectives of the invention. The fastener is extremely versatile in that it has possible use in many applications requiring the joining together of two members.

Changes in construction will occur to those skilled in the art and various apparently different modifications and embodiments may be made without departing from the scope of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only. The actual scope of the invention is intended to be defined in the following claims when viewed in their proper perspective against the prior art.

What is claimed is:

1. A fastening device for connecting a first member to a second member comprising in combination a receptacle having a generally rectangular strap portion, said strap portion being adapted to seat within an aperture in said first member, means extending from said strap portion for securing said receptacle to said first member, a resilient arm extending from each side of said strap portion and having one end fixed thereto, said arms having their free ends converging towards each other, an insert adapted to extend through an aperture in said second member and having an enlarged end to prevent passage of said insert completely through said second member, said insert comprising an elongated element of generally polygonal configuration, a first and second plurality of notches disposed in a first and second side respectively of said member, said first and second sides being oppositely disposed, said first and second plurality of notches being in transverse alignment, and a third and fourth plurality of notches disposed in a third and fourth side respectively of said member, said third and fourth sides being oppositely disposed and approximately 90 degrees from said first and second sides, said third and fourth plurality of notches being in transverse alignment and being longitudinally offset from said first and second plurality of notches, whereby the free ends of a pair of opposite ones of said arms will engage a pair of opposite ones of said notches upon insertion of said insert into said receptacle to thereby secure said first member to said second member.

2. A fastening insert comprising an elongated member of generally polygonal configuration, a first and second plurality of notches disposed in a first and second side respectively of said member, said first and second sides being oppositely disposed, said first and second plurality of notches being in transverse alignment and a third and fourth plurality of notches disposed in a third and fourth side respectively of said member, said third and fourth sides being oppositely disposed and approximately 90 degrees from said first and second sides, said third and fourth plurality of notches being in transverse alignment and being longitudinally offset from said first and second plurality of notches.

3. A fastening insert as set forth in claim 2 further comprising two pairs of oppositely disposed longitudinally extending planar faces, each said face lying between adjacent sides of said member whereby said member has a generally octagonal cross-sectional configuration.

4. A fastening receptacle comprising a generally rectangular strap portion, a resilient arm extending from each side of said strap portion and having one end fixed thereto, said arms having their free ends converging towards each other and disposed at approximately 90 degrees to the longitudinal extent of said receptacle, each said free end having an arcuate recess formed therein and being obliquely disposed relative to said receptacle, flange means extending from said strap portion, and lance means formed in each of said arms, said lance means cooperating with said flange means for retaining said receptacle on a mounting member.

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