April 15, 1969 W. R. EVANS 3,439,316

MINIATURE ELECTRICAL CONNECTOR

Filed Dec. 22, 1966 Sheet 1 of 6

Fig. 1

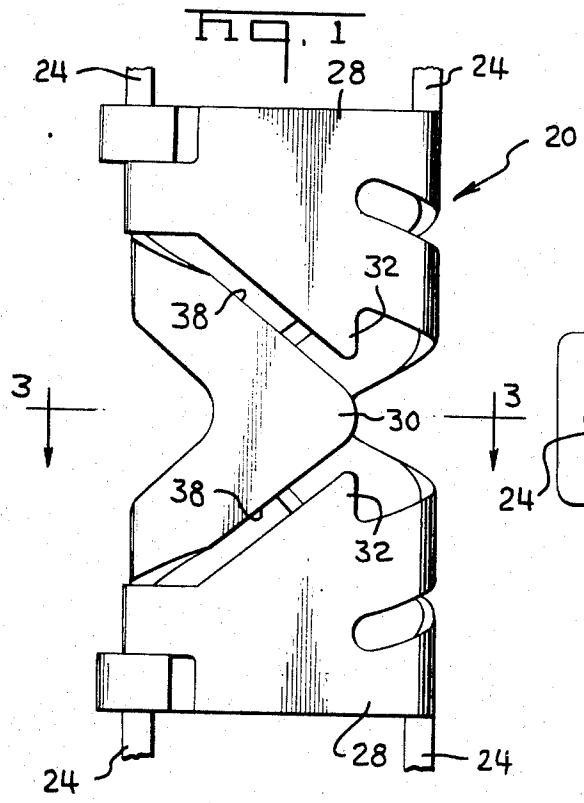


Fig. 2

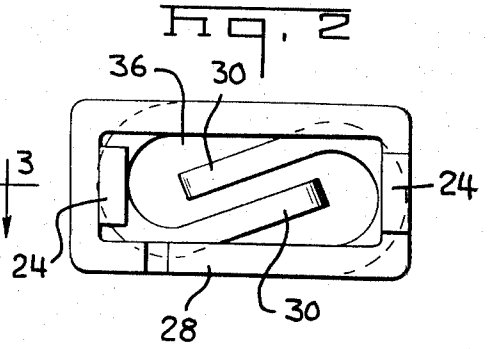


Fig. 3

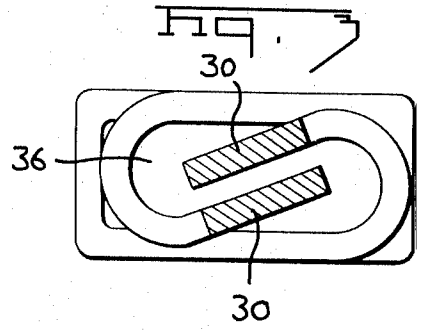
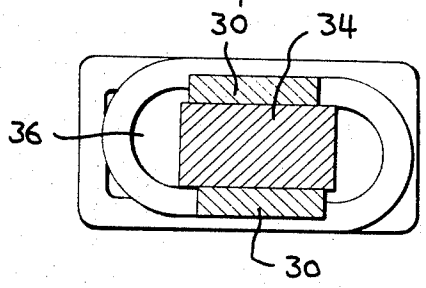


Fig. 4



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April 15, 1969 W. R. EVANS 3,439,316

MINIATURE ELECTRICAL CONNECTOR

Filed Dec. 22, 1966 Sheet 2 of 6

Fig. 6

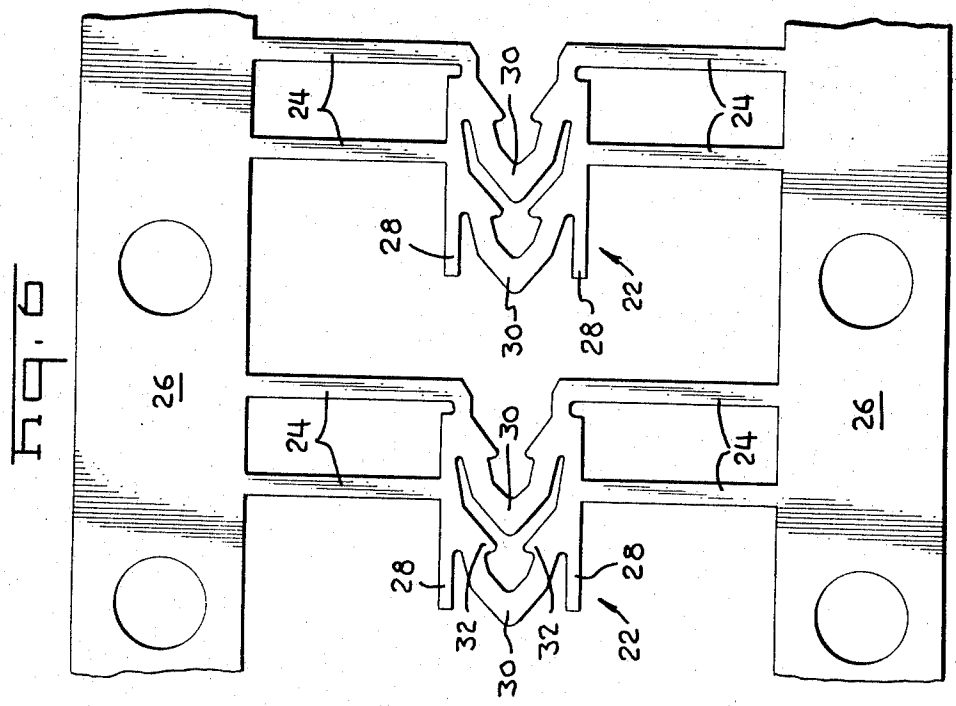
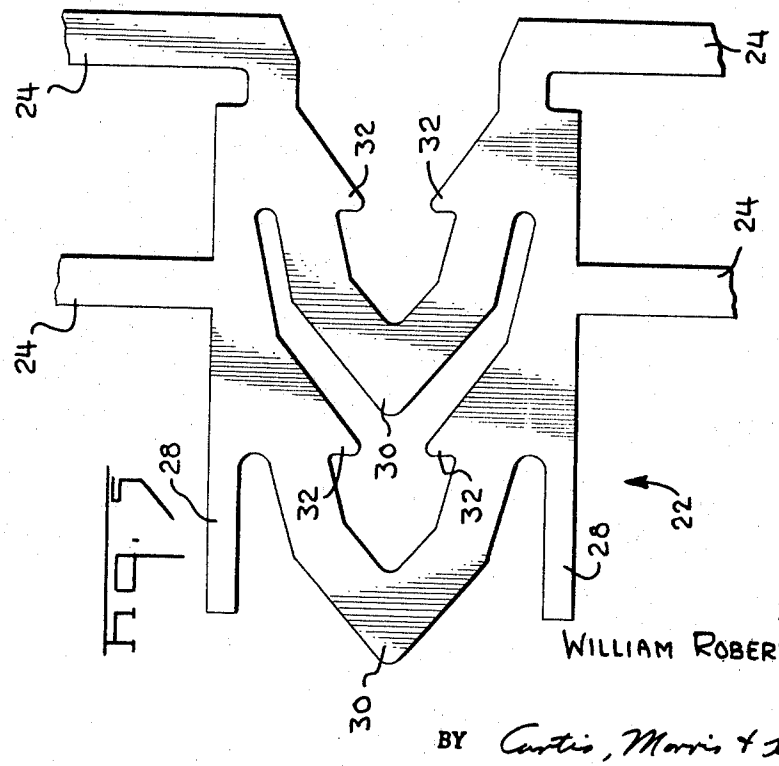


Fig. 5



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April 15, 1969 W. R. EVANS 3,439,316

MINIATURE ELECTRICAL CONNECTOR

Filed Dec. 22, 1966 Sheet 3 of 6

Fig. 7

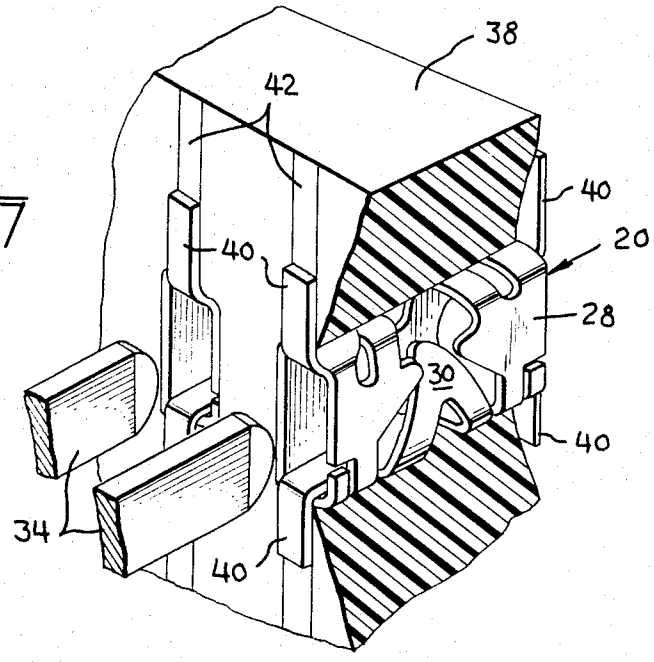
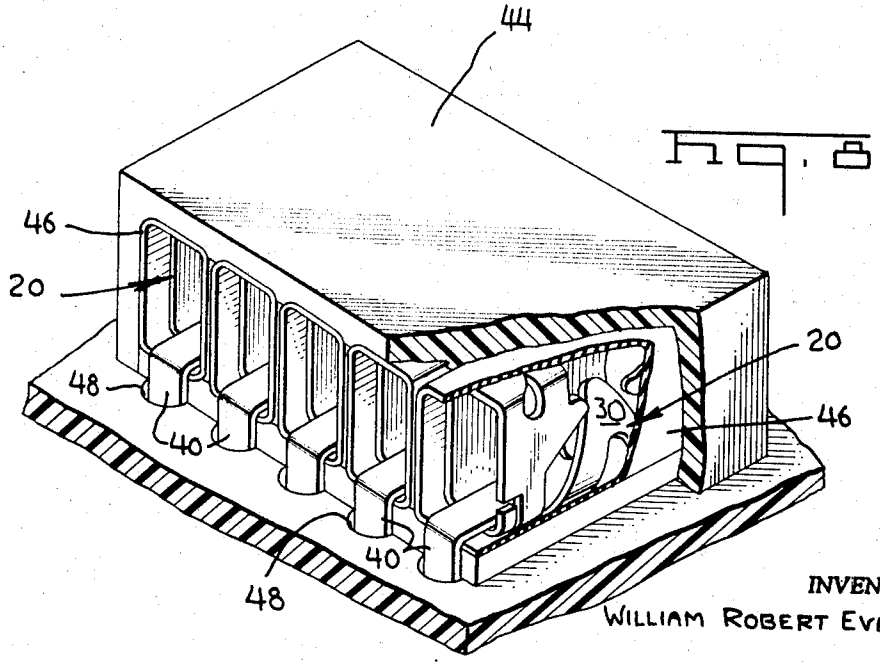


Fig. 8



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April 15, 1969 W. R. EVANS 3,439,316

MINIATURE ELECTRICAL CONNECTOR

Filed Dec. 22, 1966 Sheet 4 of 6

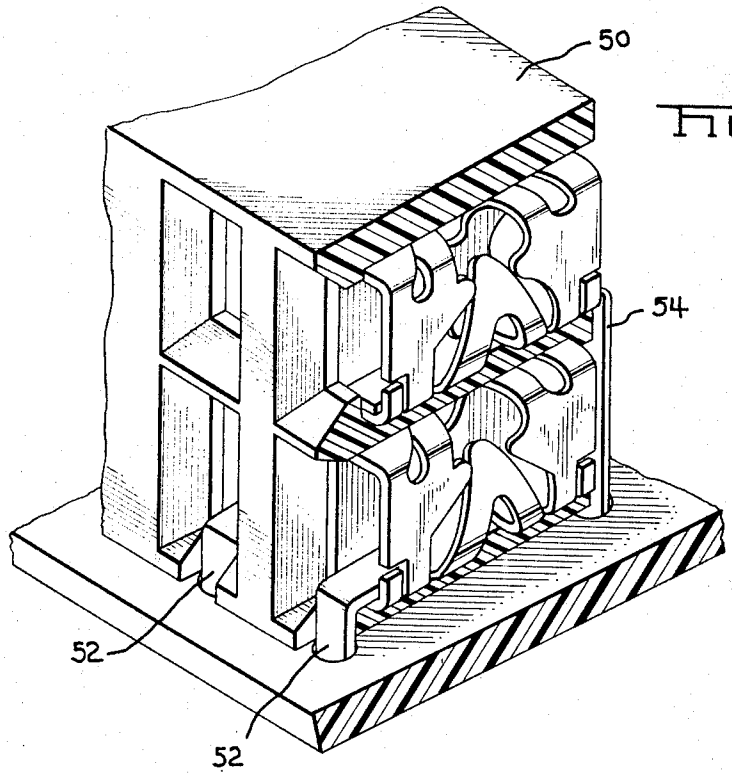


Fig. 9

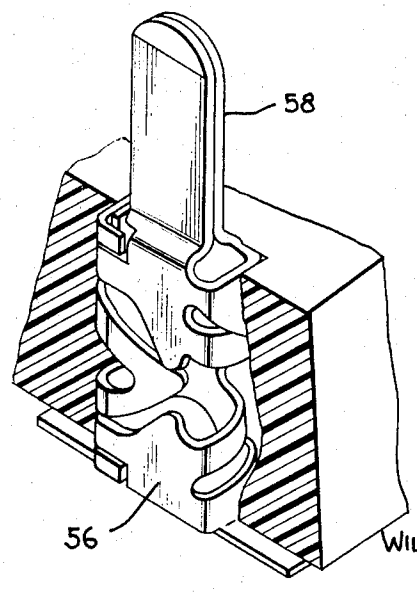


Fig. 10

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April 15, 1969 W. R. EVANS 3,439,316

MINIATURE ELECTRICAL CONNECTOR

Filed Dec. 22, 1966 Sheet 5 of 6

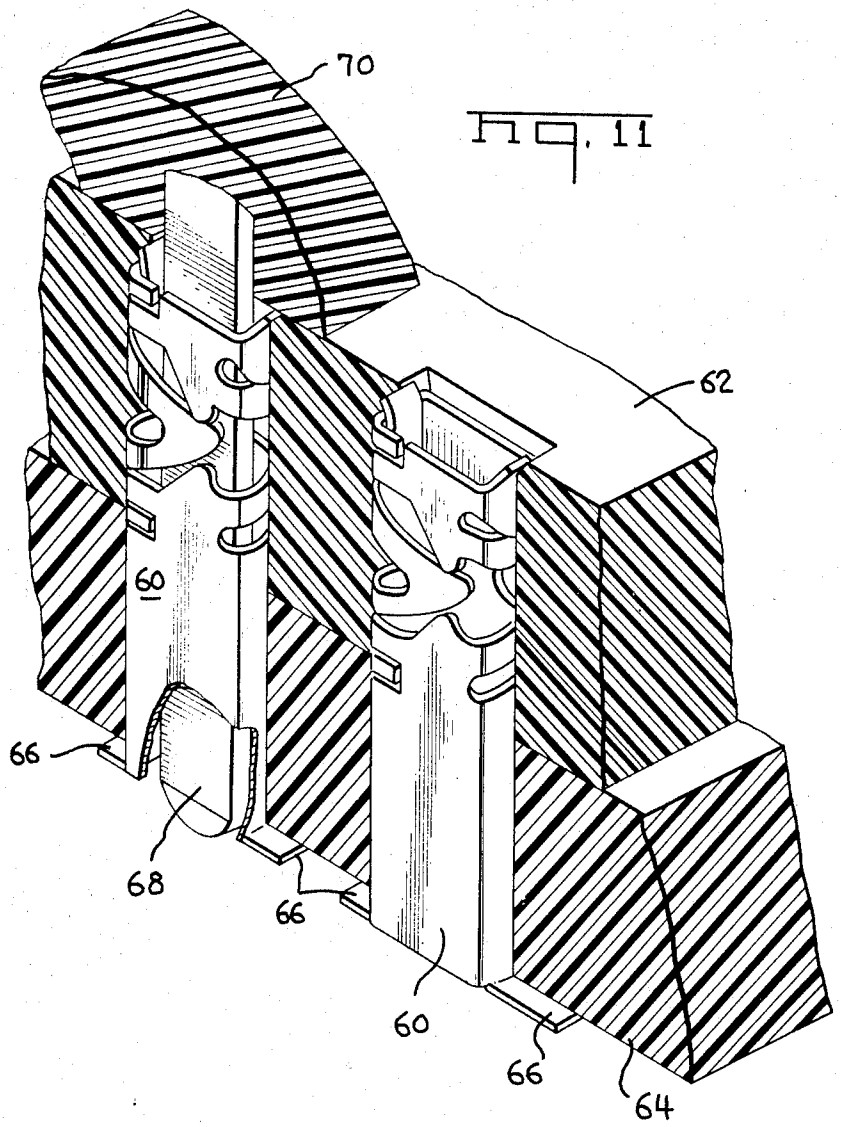


Fig. 11

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April 15, 1969 W. R. EVANS 3,439,316

MINIATURE ELECTRICAL CONNECTOR

Filed Dec. 22, 1966

Sheet 6 of 6

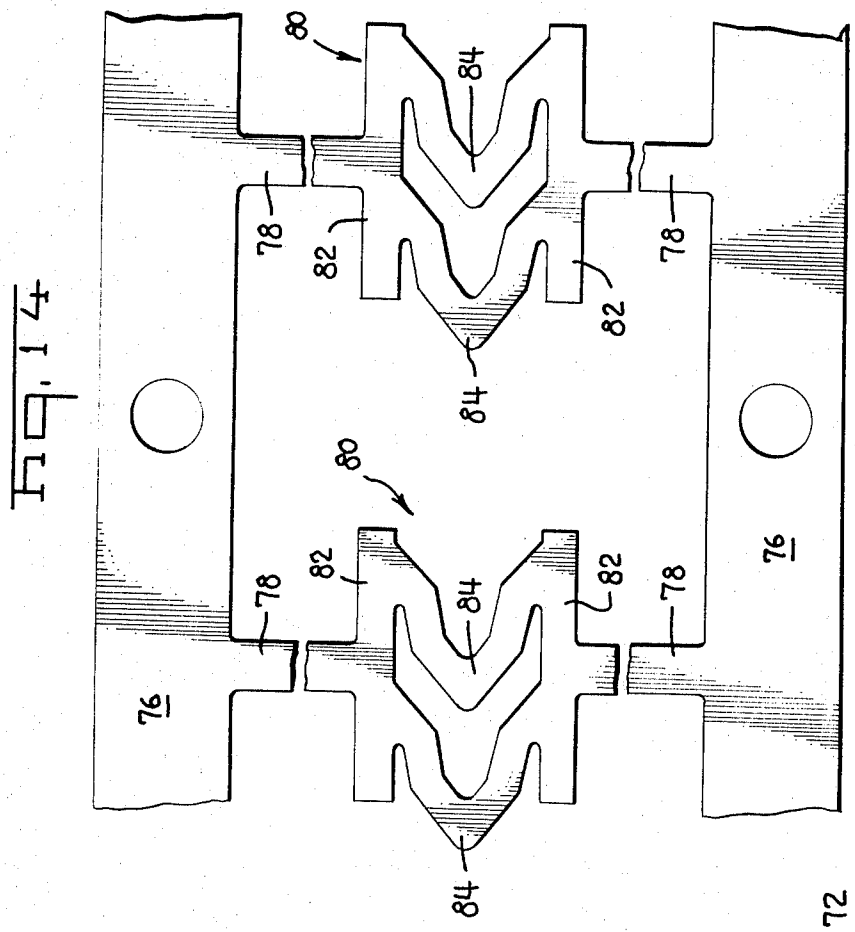


Fig. 14

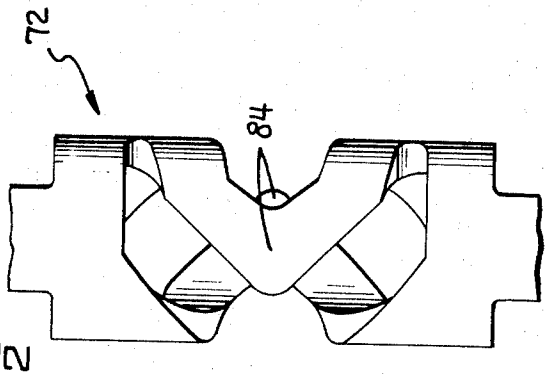


Fig. 12

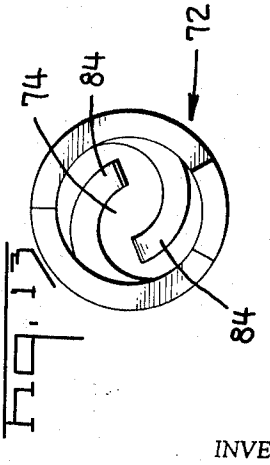


Fig. 13

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United States Patent Office 3,439,316 Patented Apr. 15, 1969

3,439,316

MINIATURE ELECTRICAL CONNECTOR

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Filed Dec. 22, 1966, Ser. No. 603,854
Int. Cl. H01r 13/24, 11/20
U.S. Cl. 339—258 13 Claims

ABSTRACT OF THE DISCLOSURE

A female electrical contact having a socket passage therethrough and adapted to receive a male contact, said female contact having a strap portion at either end of the socket passage and having a pair of V-shaped spring tongues extending between the strap portions and disposed in opposed relation along the sides of the socket passage. In addition, there is disclosed a blanked strip from which the female electrical contacts described above are to be formed.

BACKGROUND OF THE INVENTION

Field of the invention

Electrical connectors having resilient engaging parts; and metallic blank (incomplete article of manufacture).

Description of the prior art

Prior art connectors have several drawbacks which are overcome by the present connector. Some of the prior art drawbacks are non-versatility, low contact spring deflection per length, no axial resiliency, poor lead-in for cooperating male tab, and difficulty in miniaturization.

Summary of the invention

This invention relates to, and has for an object the provision of, an electrical connector of extreme versatility and yet of simple, rugged design. The unique contact spring configuration yields relatively high spring deflection while requiring only a relatively low linear engagement length. The contact has axial resiliency to thereby avoid cracking during flexure of the contact housing. The spring design yields natural lead-in for the male tab, and the simplicity of the design allows for drastic miniaturization of the contact.

Brief description of the drawings

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

FIGURE 1 is a side elevational view of an electrical connector made in accordance with the teachings of the present invention;

FIGURE 2 is a top plan view of the connector of FIGURE 1;

FIGURE 3 is a cross-sectional view taken along the line 3—3 of FIGURE 1 showing details of the contact spring;

FIGURE 4 is a cross-sectional view similar to FIGURE 3 but showing a male contact tab inserted within the contact of FIGURE 1;

FIGURE 5 is a top plan view of a blanked strip from which the contact of FIGURE 1 is formed;

FIGURE 6 is a view similar to FIGURE 5 but on a reduced scale showing the contact unit blanks supported in carrier strip form;

FIGURES 7 through 11 are views partly in section showing various applications of the connector of FIGURE 1;

FIGURE 12 is a side elevational view similar to FIGURE 1 but showing an alternative embodiment of the invention;

FIGURE 13 is a top plan view of the contact shown in FIGURE 12; and

FIGURE 14 is a top plan view of a blanked strip from which the contact of FIGURE 12 is formed.

Description of the preferred embodiments

The 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.

With reference to FIGURE 1 there is shown a contact **20** according to the present invention. The contact forms the female portion of a tab and socket connection most useful in the interconnection of modular systems. The contact is believed to be best described by considering first the shape of the contact blank when disposed in strip form, such as seen in FIGURES 5 and 6. The strip comprises the contact unit blanks **22** joined by web portions **24** to a pair of resilient metal strips **26**. The blank strip shown in FIGURE 6 is commonly referred to as a ladder strip and is a convenient form for feeding the unit blanks to a forming die for shaping the blanks into their final configuration.

Each unit blank **22** comprises a pair of strap forming portions **28** disposed in parallel relationship and preferably disposed parallel to the strips **26**. Between the portions **28** there is provided a pair of spring forming portions **30** which are of generally V-shaped configuration. The apex of each V-shaped portion is freely disposed between the portions **28** whereas the end portions of the V's are integral with the strap forming portions **28**. A pair of protuberances **32** extend inwardly from each V-shaped portion **30** for a purpose to be described.

Referring again to FIGURES 1 through 4 it is seen that the strap forming portions **28** have been formed into generally rectangular straps at opposite ends of the formed contact. The spring sections **30** each extend approximately halfway around the periphery of the contact with the free ends of the springs extending in opposite directions as seen in FIGURE 2. The ends of the springs are disposed generally parallel to each other for a portion of their length and are adapted to receive a male tab **34** as seen in FIGURES 4 and 7.

The contact **20** has a longitudinal socket passage **36** which is open from end to end thereby enabling the contact to receive the tab **34** from either end. The inclined surfaces **38** of the spring sections **30** provide for a gradual lead-in for the tab to thereby permit entrance of the tab with minimum insertion force. The protuberance **32** serves the purpose of providing additional closure along the sides of the passage to thereby prevent the tab **34** from accidentally extending out of the side of the contact rather than remaining in the socket passage.

The shape of the spring sections **30** provide for high deflection and a relatively low linear engagement length between the spring and the tab. This high deflection results in optimum contact force which produces excellent electrical characteristics. The small engagement length of the contact springs allows the overall contact size to be kept at a minimum and permits extreme miniaturization of the contact. Further a high spring deflection permits rather loose alignment tolerances between the contact and the male tab thus resulting in lower applied cost for

the overall system. As is apparent from FIGURE 4 the spring action of the portions **30** is a combined bending and torsion action which provides maximum contact force and maximum spring life.

In FIGURES 7 through 11 various applications are shown for the contact previously described. While each of the applications illustrates the contact confined by a housing, printed circuit board, or the like, ti is to be understood that large versions of the contact could be individually mounted externally of a board in a manner similar to that shown in my prior U.S. Patent No. 3,270,-251. In FIGURE 7 the contact **20** is shown mounted within a printed circuit board **38**. Tine means **40** extend from a strap portion of the contact and make engagement with circuitry strips **42** disposed on the board **38**. The tines **40** are formed from the web portions **24** and are cut to proper length. Subsequently the tines are permanently secured to the strips **42** by dip soldering or similar techniques. It is important to note that the contact **20** has no solid support members running the entire length of the passage and therefore the contact has a limited capability for longitudinal flexing. The board **38** in use may be flexed slightly and therefore the contacts must be able to flex similarly or else solder cracks would result. Also, as is readily apparent, a number of boards **38** can be sandwich stacked and all interconnected by the single male tab **34**.

FIGURE 8 shows another application of the contacts **20** and includes a housing **44** within which are mounted several of the contacts in close proximity. A thin strip of adhesive or similar material **46** is wrapped around the contacts **20** to insure electrical isolation between adjacent contacts. The contact tines extend through apertures **48** in the board and make contact with circuitry on the lower side of the board.

In FIGURE 9 there is shown a further application wherein the contacts are stacked in a housing **50**, the housing being designed to accommodate two rows of contacts. The contacts on the lower row have a tine **52** extending through the board and making contact with the circuitry thereon while the upper row contacts utilize a rather long tine **54** which passes adjacent an end of the lower row contacts and enters the board for engagement with the circuitry on the reverse board side.

In FIGURE 10 there is shown a contact **56** which is similar to the contacts **20** previously described with the exception that tab means **58** extends from one strap portion of the contact and is aligned with the longitudinal passage of the contact to thereby provide a male contact extension on the female contact. This contact allows for the stacking of several boards while requiring only one contact per board.

As stated previously the contacts of the present invention are extremely miniaturized and therefore their handling is often quite difficult. FIGURE 11 shows one method whereby the contacts are easily handled and aligned for assembly to a printed circuit board. The contacts **60** are identical with the contacts **20** previously described with the exception that one strap portion of the contact has been greatly elongated, the extent of the elongation being approximately equal to the thickness of the printed circuit board to which the contact will be mounted. The contacts **60** are carried by a header **62**, the header serving to accurately space and locate the contacts. The contact extension is then passed through the board **64** and the tines **66** at the end of the contact are secured to the circuitry strips on the board as described above. FIGURE 11 further shows a typical male tab **68** extending from a header or board **70** and making electrical contact with the female **60**. This configuration allows the header **62** and contacts **60** to be a pluggable unit which may be inserted and re-inserted, together with the capability of permanent connection (tines **66**) when and if required.

In FIGURE 12 there is shown a contact **72** which is similar to the contact **20** previously described with the exception that the contact **72** has a circular longitudinal passage **74** designed to mate with a round male pin as opposed to the rectangular configuration of the contact **20**. The strip from which the contact **72** is formed is shown in FIGURE 14 and is similar to the strip of FIGURE 6 in that there is provided a pair of parallel carrier strips **76** from which extends web portions **78** leading to the contact unit blanks **80**. The blanks comprise a pair of parallel strap forming portions **82** between which extend the V-shaped spring forming portions **84**. The operation and application of the contact **72** is the same as that of contact **20** and therefore is not additionally described.

While the various contacts have been shown with securing tines it is to be understood that these tines could be replaced by wire barrels or other devices by which the contact could be secured to various types of current carrying members without departing from the spirit or scope of the present invention.

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.

What is claimed is:

1. A female contact having a longitudinal passage extending therethrough for the reception of a male contact, said female contact comprising a strap portion disposed at each of opposite ends of said passage, and a pair of spring tongues positioned between said strap portions and spaced along said strap portions for engaging a said male contact, said spring tongues being of generally V-shaped configuration having fixed portions integral with each said strap portion and having a free end intermediate said fixed portions and located within said passage, said free end being located at the apex of each said tongue, said spring tongues being diametrically opposed and separated from each other by open areas thereby permitting substantially free movement of said tongues.

2. A female contact as set forth in claim **1** wherein said tongues have relatively steep sides adjacent the apices of said tongues to provide lead-in for a male contact, and relatively shallow sides adjacent said fixed portions to provide for increased tongue length.

3. A female contact as set forth in claim **1** wherein said spring tongues are spaced apart a distance equal to approximately one-half the peripheral dimension of said strap portions.

4. A female contact as set forth in claim **1** wherein said strap portions are of generally rectangular configuration.

5. A female contact as set forth in claim **1** wherein said strap portions are of generally circular configuration.

6. A female contact as set forth in claim **1** wherein said spring tongues have their free ends extending in opposite directions.

7. A female contact as set forth in claim **1** further comprising an elongated extension integral with one said strap portion to effectively increase the length of said longitudinal passage.

8. A female contact as set forth in claim **1** further comprising tine means extending from said strap portions for engagement with external circuitry.

9. A female contact as set forth in claim **1** further comprising tab means extending from one said strap portion and aligned with said longitudinal passage, said tab means forming a male contact extension on said female contact.

10. A blanked strip from which female contacts are to be formed having a longitudinal socket passage therethrough, said blanked strip comprising a plurality of contact unit blanks joined together by a strip of resilient metal, each said contact unit blank comprising a pair of parallel strips which constitute strap-forming portions, and a pair of generally V-shaped spring-forming portions disposed between said parallel strips, said spring-forming

portions being spaced apart along said strip a distance equal to approximately one-half the length of said parallel strips, each said spring-forming portion having its ends integral with said parallel strips and having its apex disposed intermediate said strips, and a blanked-out area between said spring-forming portions for permitting free movement of said spring-forming portions when said contact unit blanks are formed into female contacts.

11. A blanked strip as set forth in claim **10** wherein said spring-forming portions are of generally constant cross-sectional area.

12. A blanked strip as set forth in claim **10** wherein there are two said strips of resilient metal and wherein said strap-forming portions are generally parallel to said strips of resilient metal.

13. A blanked strip as set forth in claim **12** further comprising web portions disposed between said strap-forming portions and said resilent metal strips.

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U.S. Cl. X.R.

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