Aug. 8, 1961 W. H. McKEE 2,995,724

SNAP-IN SOCKET CONTACT

Filed June 26, 1959

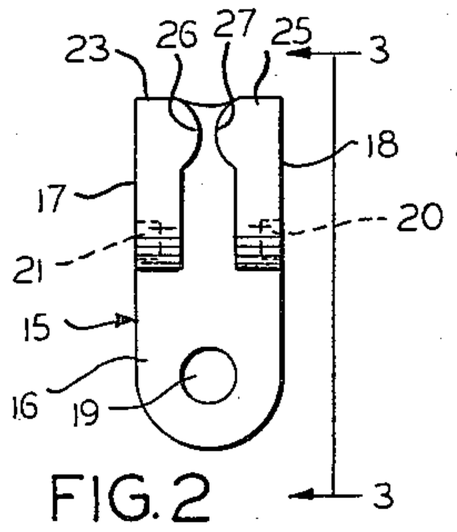

FIG.2

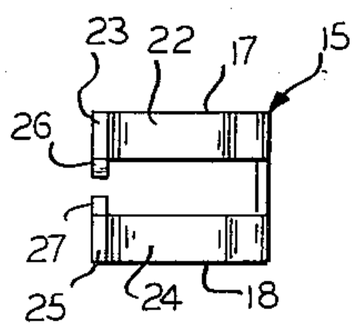

FIG.4

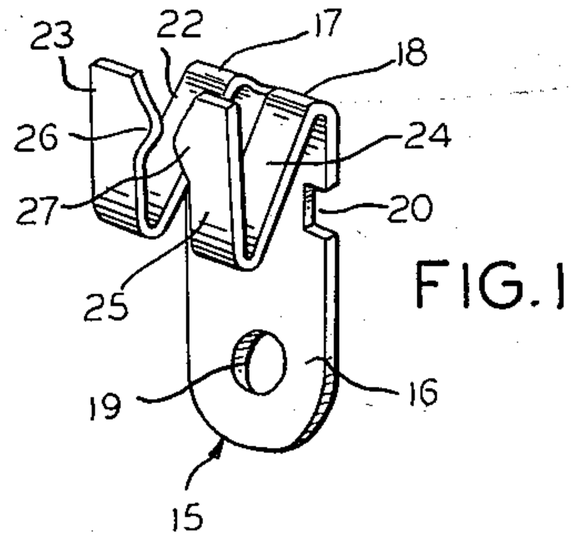

FIG.1

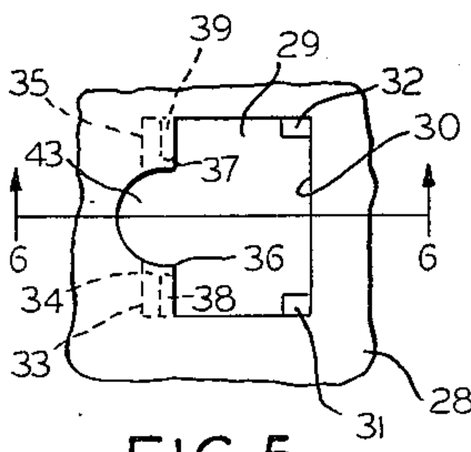

FIG.5

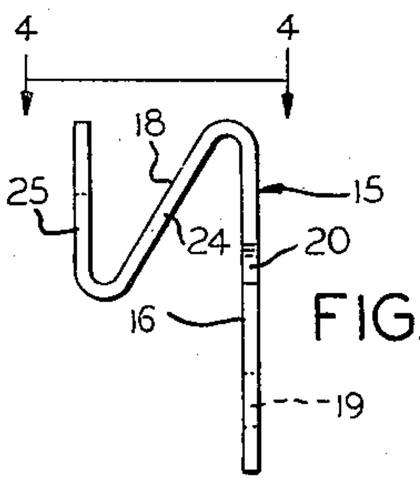

FIG.3

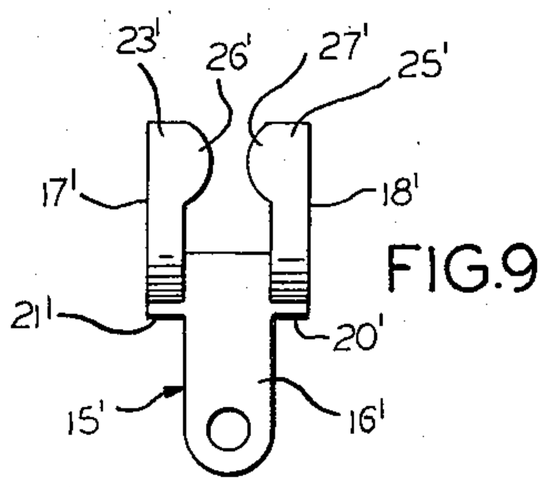

FIG.9

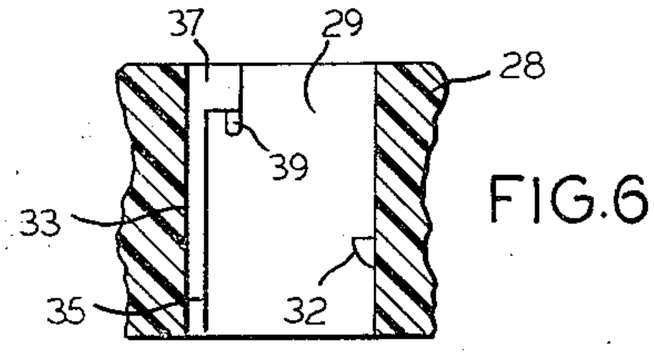

FIG.6

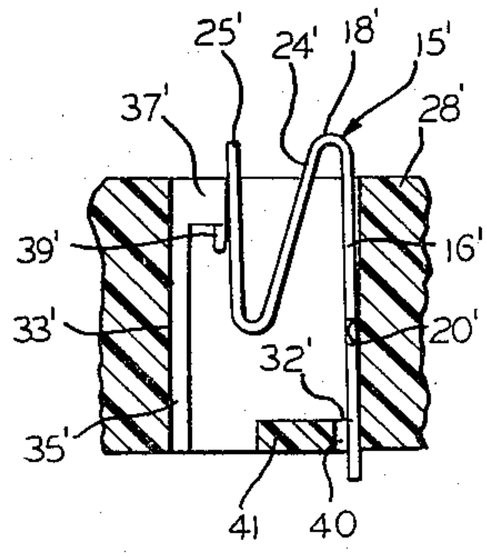

FIG.10

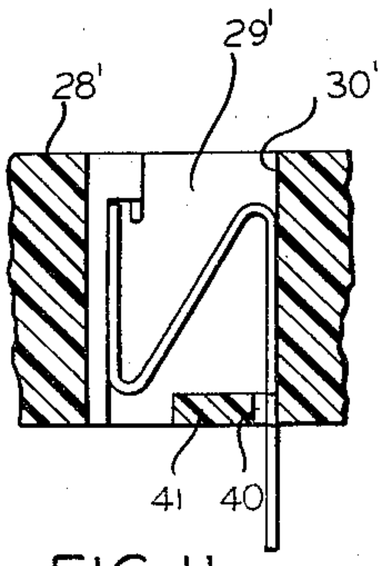

FIG.11

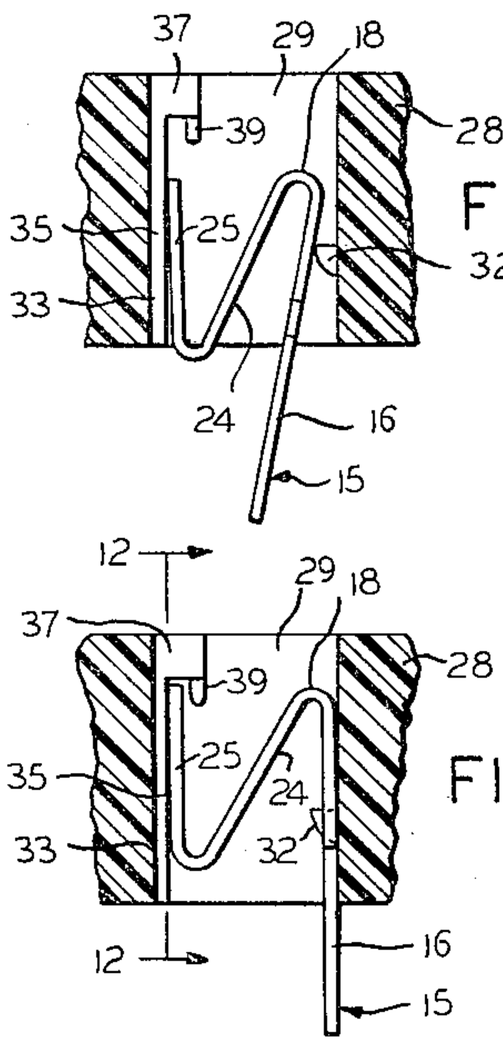

FIG.7

FIG.8

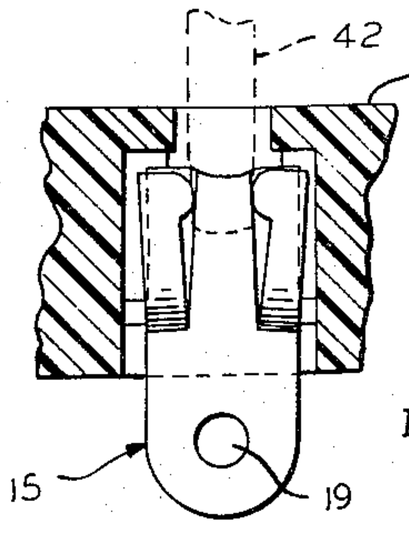

FIG.12

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SNAP-IN SOCKET CONTACT

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This invention relates to a contact element adapted to frictionally engage and thereby establish an electric connection with a complementary contact member, and more particularly it relates to a snap-in socket contact defining a female element adapted to engage a prong or other male member inserted thereinto.

Socket structures of the general class considered herein ordinarily comprise a relatively rigid casting having one or more cavities provided therein, and positioned in each such cavity is a contact element adapted to have a prong inserted thereinto so as to establish an electric connection therewith. Examples of such connectors or socket structures are tube sockets, Jones-type plugs, etc. It will be apparent from these examples that the male member must be removed from the socket at least occasionally to permit general repair and maintenance of the circuit with which the connector is associated. Further, it will be appreciated that a good frictional engagement must be established between the contact element and prong member because an electric connection is made between these two components through such frictional engagement.

Therefore, if the contact element is to perform its function satisfactorily, it must have good flexibility so as to readily accommodate insertion and removal of the male prong member, it must define a good frictional grip and electric connection with such prong member, and the life cycle must be good—that is to say, the contact element must accommodate repeated insertion and removal of the prong member without losing its other properties. All of these necessary conditions are usually satisfied by providing a relatively long contact element so as to maximize the distance through which the contact element must flex during insertion and extraction of the prong member, for by elongating the contact element a livelier component will be provided, with the result that flexibility is improved, the frictional grip defined thereby with a prong member is increased, and the life cycle is maximized because flexural fatigue is minimized.

However, the length of a contact element is limited by the thickness of the casting in which the element is mounted for, with the exception of the contact tail, no portions thereof can protrude from the casting. As a consequence, a serious problem results where the casting is necessarily thin—that is, has a relatively small dimension from face to face thereof. In the past then, in environments requiring thin castings, it has been necessary to reduce the length of the contact element, and as a result such contact element has neither the flexibility nor life cycle that is desired. Further, while the frictional grip established through the contact element with a prong member may be good initially, it rapidly decreases in quality with repeated insertions and removals of the prong member.

In view of these premises, an object of the present invention is to provide an improved contact element particularly suited for use with relatively thin castings and which affords good flexibility, frictional grip, and has an excellent life cycle. Another object of the invention is that of providing a snap-in contact having the foregoing desirable characteristics.

Still another object of the invention is in the provision of a contact element adapted for use with relatively thin castings, and which has an elongated contact leg defining

a long flexural component adapted to frictionally grip at one end thereof a male prong inserted into a socket defined thereby, and in which such frictional grip is good because of the length of the contact leg, as is the flexibility and life cycle thereof.

Yet another object is to provide a contact element of the type described, and which is adapted to snap into a cavity provided therefor in a socket casting, and after being snapped into position is thereafter constrained automatically against displacement except for the flexure that occurs during insertion and removal of a prong member from the socket. A further object of the invention is that of providing a contact element having an elongated contact leg defining a plurality of leg segments angularly disposed with respect to each other so as to minimize the additive physical lengths thereof in one direction, but in which the effective flexural length of the contact leg is substantially equal to the additive lengths of the segments.

Still a further object is in the provision of a contact element of the character described, adapted to be snapped into position in a cavity provided therefor in a socket casting, and in which the angularly disposed contact leg segments define a compressible spring that resiliently anchors the contact element in position within the socket casting and permits the contact element to be snapped into such position. Yet a further object of the invention is to provide a socket structure comprising a cavity-equipped casting and a snap-in contact element therefor, the contact element having a generally Z-shaped configuration comprising a tail, a contact leg segment extending in generally parallel relation with the tail, and a second contact leg segment angularly oriented with respect to both the tail and leg segment parallel therewith and being formed integral with each, the leg segments being effective to resiliently anchor the contact element in position within the cavity therefor and at the same time afford a flexing action throughout the composite length thereof so as to resiliently and frictionally grip a prong member inserted into the socket.

Additional objects and advantages of the invention will become apparent as the specification develops.

Embodiments of the invention are illustrated in the accompanying drawing, in which—

FIGURE 1 is a perspective view of a contact element embodying the invention; FIGURE 2 is a front view in elevation of the contact element illustrated in FIGURE 1; FIGURE 3 is a side view in elevation of the contact element, and the view is taken generally along the line 3—3 of FIGURE 2; FIGURE 4 is a top plan view of the contact element, and the view is taken generally along the line 4—4 of FIGURE 3; FIGURE 5 is a broken top plan view of a socket casting, and shows the cavity therein before the contact element is inserted thereinto; FIGURE 6 is a vertical sectional view taken along the line 6—6 of FIGURE 5; FIGURE 7 is a vertical sectional view similar to that of FIGURE 6, but showing one stage in the insertion of the contact element into the cavity therefor in the casting; FIGURE 8 is a vertical sectional view, again similar to that of FIGURE 6, but showing the contact element in position within the casting cavity; FIGURE 9 is a front view in elevation of a modified contact element; FIGURE 10 is a vertical sectional view of a modified casting that can be used in conjunction with the contact element shown in FIGURE 9, and in which the contact element is shown at one stage during the insertion thereof into the casting cavity; FIGURE 11 is a vertical sectional view similar to that of FIGURE 10, but showing the modified contact element in position within the casting; and FIGURE 12 is a transverse sectional view taken generally along the line 12—12 of FIGURE 8, but showing in broken lines a prong member inserted

into the socket and being engaged by the contact element.

Referring now to the drawings in greater particularity, the contact element is designated in its entirety with the numeral **15** and comprises a tail **16** having a pair of contact legs **17** and **18** formed integrally therewith. The tail **16** is preferably provided with an aperture **19** therethrough to facilitate connection of a circuit conductor thereto. Further, the tail **16** has a pair of recesses **20** and **21** along the respective longitudinal edges thereof, and such recesses are transversely aligned and define shoulders or stops adapted to receive and abut lands provided by the casting to constrain longitudinal movement of the contact element in one direction relative to the casting, as will be described in greater detail hereinafter.

The contact legs **17** and **18** extend in parallel relation and are identical, except that they are oriented in reverse facing relation. The contact legs are respectively defined by first and second contact leg segments, respectively denoted with the numerals **22—23** and **24—25**. The segments **23** and **25** are respectively provided adjacent the outer ends thereof with aligned, inwardly extending protuberances **26** and **27** adapted to frictionally grip and establish an electric connection with the prong or pin of a male element, as will be described subsequently. The segments **22** and **23** are angularly disposed with respect to each other, as are the segments **24** and **25**; and further, the segments **22** and **24** are each angularly disposed relative to the plane defined by the tail **16**. If reference is made to FIGURE 3, it will be noted that the contact element **15** has a generally **Z**-shaped configuration with the segments **23** and **25** substantially paralleling the tail **16**. The segments **22** and **24** form the cross member of the **Z** and interconnect the tail **16** with the respective segments **23** and **25**. The contact legs **17** and **18** are equally spaced apart throughout the lengths thereof, except for the inwardly extending protuberances **26** and **27** which are aligned with each other and narrow the spacing between the legs for the frictional gripping purpose heretofore mentioned.

The contact element **15** is adapted for use in conjunction with a socket casting **28** having a prong-receiving cavity **29** therein. The casting **28** may be formed from any of the conventional dielectric materials used for this purpose, such as plastic as illustrated which may be, for example, Bakelite. It will be apparent that while the casting **28** may have but one cavity and contact element in association therewith, the usual condition is that the casting is equipped with a plurality of contact elements, each of which is adapted to make electric connection with the respective prongs or pins of a male element. In the specific structure shown, the cavity **29** is generally rectangular and is equipped along a vertical or longitudinal wall **30** thereof with horizontally aligned lands **31** and **32** adapted to seat, respectively, in the recesses **20** and **21** provided by the tail **16** of the contact element. As seen best in FIGURES 6 through 8, the lands **31** and **32** are disposed in the lower portion of the casting **28** a spaced distance from the bottom surface thereof.

Along the respective edges of the opposite longitudinal wall **33** of the cavity **29** are elongated, vertically extending spacers or ribs **34** and **35** that are transversely spaced and terminate at the upper ends thereof in the respective shelves or ledges **36** and **37** that overhang the cavity **29** at the upper end thereof. Depending from the respective shelves **36** and **37** are a pair of abutments or lips **38** and **39** that extend downwardly into the cavity in spaced apart, generally parallel relation with the spacers, but are substantially shorter than the spacers and terminate in the upper end portion of the cavity. The openings defined between the spacer **34** and lip **38**, and between the spacer **35** and lip **39**, respectively receive therein the upper ends of the contact leg segments **23** and **25** so as to prevent displacement thereof in the directions of the walls **30** and **33**, as shown in FIGURE 8.

In assembling the contact element **15** and socket casting **28**, the successive steps illustrated in FIGURES 7 and 8 are followed. Namely, the contact element is aligned with the cavity **29** at the bottom thereof so that the tail **16** of the contact element extends downwardly or away from the casting. The contact element is then moved upwardly into the cavity **29** (as shown in FIGURE 7), and during such movement the contact element is compressed as the tail **16** thereof rides over the lands **31** and **32**. Ultimately, the recesses **20** and **21** are brought into respective alignment with the lands **31** and **32**, whereupon the resilience of the contact element causes a decompression thereof and snaps the lands into the recesses. At such time, the contact element and socket casting are positionally related as shown in FIGURE 8, and the contact element can shift neither upwardly nor downwardly within the cavity because movement in either direction is constrained by abutment of the lands with the edges of the recesses. Further, upward movement of the contact element is also restrained because of the substantial abutment of the upper ends of the contact leg segments **23** and **25** with the overhanging shelves **36** and **37**. If necessary, the contact element **15** can be removed from the cavity **29** by compressing the contact element to remove the lands **31** and **32** from the recesses **20** and **21**.

A modified form of snap-in contact element and socket casting therefor are illustrated in FIGURES 9 through 11, and are respectively designated with the numerals **15′** and **28′**. The primary difference between this modification and the structure heretofore described is that the contact element is designed to be inserted into the cavity in the socket casting through the upper end thereof rather than through the bottom end. The contact element **15′** has on apertured tail **16′** that is relatively narrow throughout substantially the entire length thereof, but is widened adjacent its upper end portion to provide shoulders or stops **20′** and **21′**. In another sense, and comparing the contact element **15′** with the contact element **15**, the structures are the same except that the recesses **20** and **21** have been elongated along the length of the tail **16** to the point that they have no lower edges. The contact element **15′** has contact legs **17′** and **18′** that are structurally identical with the contact legs of the element **15**, and thus have contact leg segments **23′** and **25′** which are respectively equipped with enlargements or protuberances **26′** and **27′**.

The socket casting **28′** is provided with a cavity **29′** having exactly the same structural configuration as the cavity **29** except that the lands are disposed along the bottom of the cavity **29′**. In FIGURES 10 and 11, only one of the lands is seen (namely, the land **32′**), and in this specific construction the lands are defined by a slot **40** formed in a bottom wall portion **41** extending across the bottom of the cavity. The slot **40** is arranged so that the tail **16′** of the contact element **15′** can pass therethrough in moving downwardly along the vertical wall **30′** of the cavity **29′**. Since the spacers, shelves and lips provided in the cavity **29′** are the same as those heretofore described, they will be identified by the same numerals and each will be primed for purposes of differentiation.

In assembling the contact assembly **15′** with the socket casting **28′**, the contact element is aligned with the cavity **29′** at the upper end thereof with the tail **16′** of the contact element extending downwardly toward the casting. The contact element is then moved downwardly into the casting and the lower end portion of the tail **16′** passes through the slot **40**, and downward movement is continued until the stops or shoulders **20′** and **21′** abut the lands defined by the bottom wall **41**. Thereafter, further downward movement of the contact element is prevented. During such movement, the contact element is compressed because of the engagement of the contact legs thereof with the overhanging shelves along the verti-

cal wall 33'. The contact element will snap into place when the upper ends of the contact leg segments 23' and 25' clear the depending lips; and if necessary in order to effect such clearance, the contact legs can be further compressed and pivoted downwardly by flexing the tail 16' in a counterclockwise direction, as viewed in FIGURES 10 and 11, along the line of the shoulders 20' and 21'. The contact element is then constrained within the cavity since it cannot move downwardly because of the abutment of the shoulders 20' and 21' with the lands, and cannot move upwardly because of the abutment of the ends of the contact leg segments 23' and 25' with the overhanging shelves.

FIGURE 12 illustrates the function of either form of the contact element when a prong or male component is inserted into the cavity so as to establish an electric connection with the contact element. In this FIGURE, such prong or male component is denoted with the numeral 42, and it will be evident that such male component is dimensioned so as to freely pass through the opening 43 defined by the shelves 36 and 37 along the vertical wall 33 of the socket cavity. Ordinarily, the prong 42 will be cylindrical, and consequently the opening 43 is of semicylindrical configuration so as to correspond thereto.

It is clear from FIGURE 12 that the prong 42 has a greater diameter than the normal distance between the facing protuberances 26 and 27; and as a result, the normal distance between the protuberances must increase to permit insertion of the prog therebetween. This result is achieved because of the flexibility of the contact legs 17 and 18, and therefore such legs flex laterally as the prong is inserted therebetween. It should be noted that the contact legs flex along the entire length thereof, which is the additive lengths of the segments 22 and 23 in the case of the contact leg 17 and segments 24 and 25 in the case of the contact leg 18. During such lateral flexing of the contact legs, they cannot be displaced along a line normal to the path of lateral flexing because the end portions of the segments 23 and 25 are confined, respectively, between the spacer 35 and lip 39 and spacer 34 and lip 38.

Thus, the construction disclosed provides a contact element of diminished over-all length in one direction—namely, along the vertical axis of the cavity 29—so that the contact element is especially suitable for use with castings that are relatively narrow from top to bottom or face to face thereof. On the other hand, the contact element has all of the advantages of a contact element which would be elongated along such axis because the effective flexural length of the contact legs is equal to the actual physical length thereof. Therefore, a good frictional engagement is defined between the protuberances 26 and 27 and prong 42 because the flexural length of the contact legs is extensive, the contact legs are flexible and thereby afford easy insertion and removal of the prong because of this same extensive length, and the life cycle of the contact element is excellent as a result of this extensive length which affords incremental flexing along the entire length thereof.

While in the foregoing specification embodiments of the invention have been set forth in considerable detail for purposes of making a complete disclosure thereof, it will be apparent to those skilled in the art that numerous changes may be made in those details without departing from the spirit and principles of the invention.

I claim:

1. A socket structure, comprising a body provided with a longitudinally extending cavity having a contact element therein, said body providing within said cavity along one side thereof a transversely extending land for abutment by said contact element to prevent movement thereof through said cavity in one longitudinal direction, said body providing also within said cavity along the opposite side thereof a transversely extending shelf for abutment by said contact element to prevent movement thereof through said cavity in the opposite longitudinal direction, a longitudinally extending spacer provided by said body along said opposite side of the cavity to space said contact element therefrom, an abutment provided by said body within said cavity in spaced relation with said spacer so as to confine an end portion of said contact element therebetween, said contact element having a tail provided with a stop in abutment with said land to effect the aforesaid prevention of movement in said one longitudinal direction and having also both a contact leg segment providing an end portion thereof in substantial abutment with said shelf to effect the aforesaid prevention of movement in the other longitudinal direction, said leg segment having yieldable spaced apart elements for receiving a male terminal therebetween, said contact element having further a segment connected with said tail and contact leg segment and extending therebetween to resiliently urge the same toward the respective sides of said cavity.

2. The socket structure of claim 1 in which said spacer extends longitudinally from said shelf, and in which said abutment extends longitudinally from said shelf in substantially parallel relation with said spacer.

3. The socket structure of claim 1 in which said contact leg segment and tail are compressible toward each other to permit longitudinal insertion of said contact element into said cavity, the resilience of said contact element between the tail and contact leg segment thereof being effective to snap the contact element into position within said cavity when longitudinal insertion of the contact element thereinto has progressed to a predetermined extent.

4. A socket structure, comprising a body provided with a longitudinally extending cavity having a contact element therein, said body providing within said cavity along one side thereof a transversely extending land for abutment by a portion of said contact element to prevent movement thereof through said cavity in one longitudinal direction, said body providing also within said cavity along the opposite side thereof a transversely extending shelf for abutment by a portion of said contact element to prevent movement thereof through said cavity in the opposite longitudinal direction, a pair of spaced apart, longitudinally extending ribs provided by said body along said opposite side of the cavity to space said contact element from said opposite side and defining a socket therebetween adapted to receive a male member therein, a pair of spaced apart, longitudinally extending abutments extending from said shelf in spaced relation with said ribs and respectively aligned therewith so as to confine an end portion of said contact element therebetween, said contact element having a tail defining a stop in abutment with said land to effect the aforesaid prevention of movement in one longitudinal direction and having also a pair of spaced apart contact leg segments respectively positioned between the corresponding ribs and abutments and being in substantial engagement with said shelf to effect the aforesaid prevention of movement in the other longitudinal direction, said spaced apart leg segments being resilient for receiving a male terminal therebetween, said contact element having also an additional pair of segments respectively connecting said contact leg segments and tail and extending therebetween to resiliently urge the same toward the respective sides of said cavity, said contact leg segments being adapted to frictionally engage such male member inserted into said cavity.

5. The socket structure of claim 4 in which the respectively corresponding contact leg segments and tail are compressible toward each other to permit longitudinal insertion of said contact element into said cavity, the resilience of said contact element between the tail and contact leg segments thereof being effective to snap the contact element into position within said cavity when longitudinal insertion of the contact element thereinto has progressed to a predetermined extent.

(References on following page)

References Cited in the file of this patent

UNITED STATES PATENTS

2,193,940	Schmitt	Mar. 19, 1940
2,424,405	Lytgens	July 22, 1947
2,682,038	Johnson	June 22, 1954

2,734,177	Gilbert	Feb. 7, 1956
2,869,093	Benander	Jan. 13, 1959
2,882,512	Morone	Apr. 14, 1959

FOREIGN PATENTS

588,604	Germany	Nov. 21, 1933