Feb. 23, 1971 K. F. SCHMITT ET AL 3,566,342

MINIATURE CONNECTOR

Filed Sept. 9, 1968 2 Sheets-Sheet 1

Fig. 1.

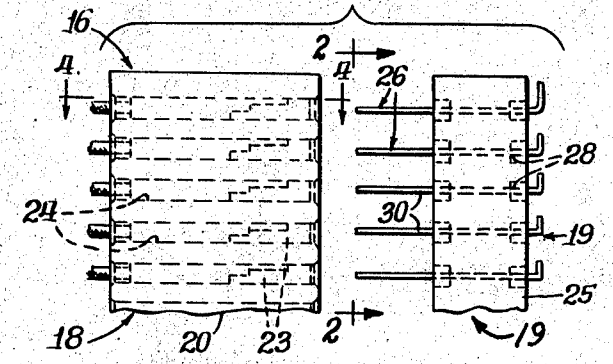


Fig. 2.

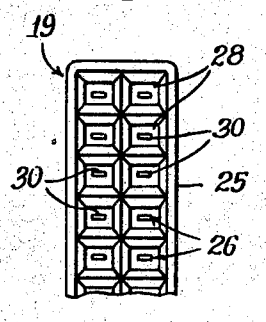


Fig. 3.

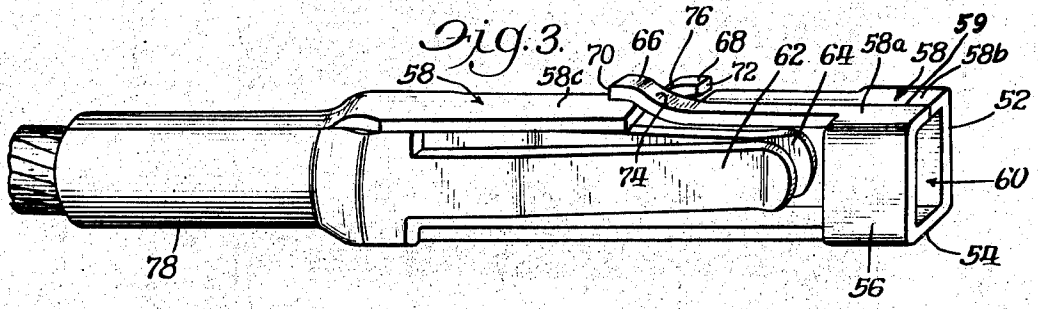
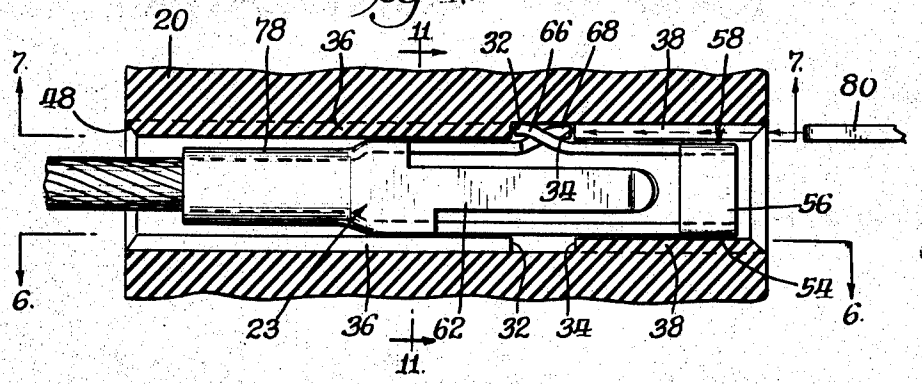


Fig. 4.



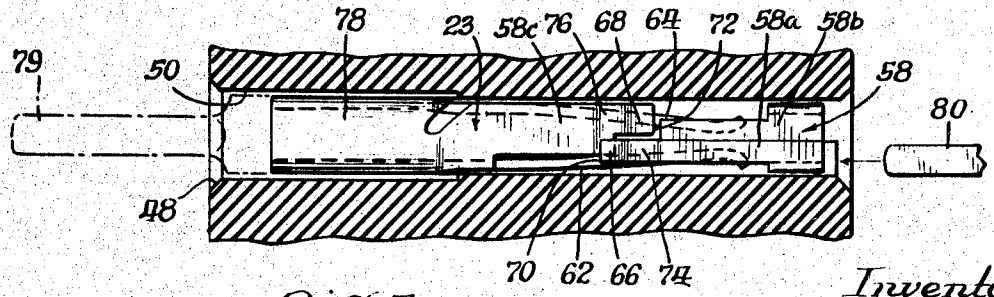


Fig. 5.

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MINIATURE CONNECTOR

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Fig. 6.

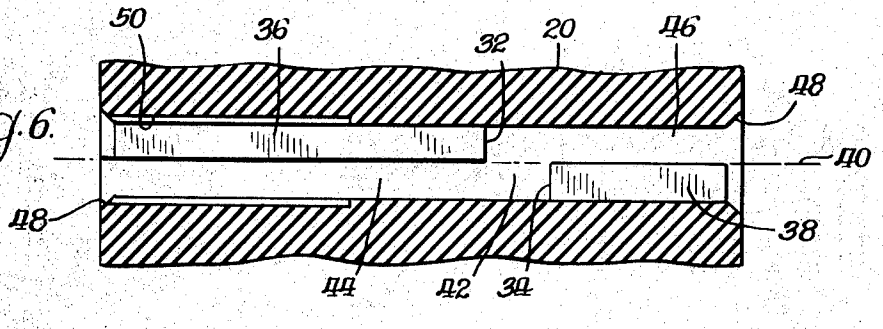


Fig. 7.

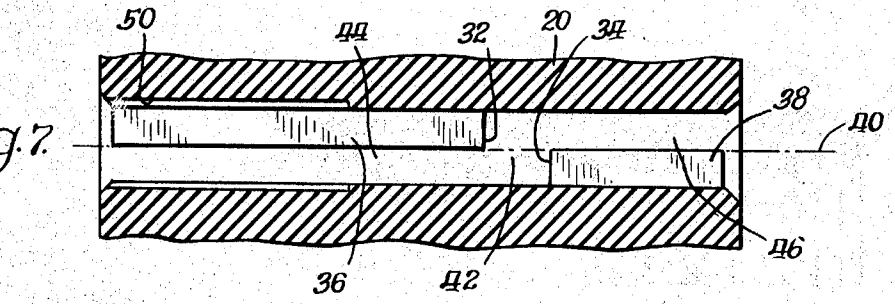


Fig. 8.

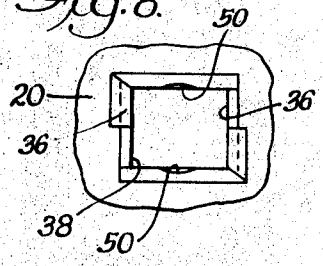
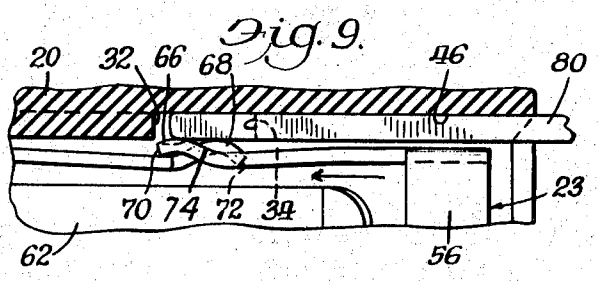


Fig. 9.



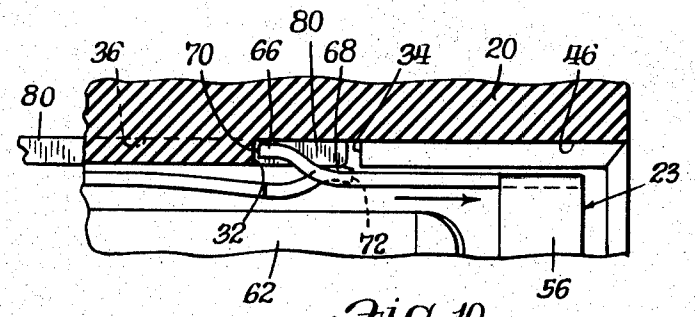


Fig. 10.

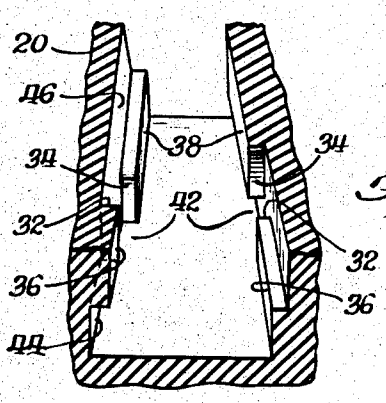


Fig. 11.

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3,566,342

MINIATURE CONNECTOR

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Int. Cl. H01r 9/12
U.S. Cl. 339—217 12 Claims

ABSTRACT OF THE DISCLOSURE

Connector member including a block having cavities for receiving contacts, each cavity having shoulders directed longitudinally oppositely and disposed on opposite sides of a longitudinal center line, the contact having spring detents corresponding to the shoulders and engageable therewith, the contact being positively but releasably held in place, and the contact being insertable and removable through either end of the cavity; the shoulders being arranged in association with grooves which facilitate molding of the block.

OBJECTS OF THE INVENTION

The present invention relates to a miniature connector of the closed entry type, each connector part including a block and contacts mounted in cavities in the block.

A broad object of the invention is to provide a connector of the foregoing character including a block having cavities and contacts insertable into the cavities, in either direction, and removable in either direction.

Another object is to provide a connector member of the foregoing character in which the contact is normally positively, but releasably, held in operative position, against movement in either direction.

Another object is to provide a connector member of the character stated in which the contact is easily inserted merely by moving it into the cavity and when it reaches its operative position, it is positively detained against further movement in that inserting direction and latched and postively held against movement in the opposite direction.

Still another object is to provide a device of the foregoing character in which the contact is a single one piece metal article, and the block is a single one piece molding of dielectric material.

Still another object is to provide a connector member of the character stated in which the block includes a special design having shoulders for normally positively locking the contact in position, and is of such design to facilitate molding thereof.

DESCRIPTION OF A PREFERRED EMBODIMENT

In the drawings:

FIG. 1 is an elevational view of a connector embodying the present invention;

FIG. 2 is a partial view taken at line 2—2 of FIG. 1;

FIG. 3 is a large scale perspective view of a contact embodying the present invention;

FIG. 4 is a large scale view taken at line 4—4 of FIG. 1 and showing the contact of FIG. 3 in one direction;

FIG. 5 is a view of the subject matter of FIG. 4 but at a 90° angle relative thereto;

FIG. 6 is a view taken at line 6—6 of FIG. 4;

FIG. 7 is a view taken at line 7—7 of FIG. 4;

FIG. 8 is an end view taken from the left end of FIG. 6;

FIG. 9 is a view oriented according to FIG. 4 representing a step in the removal of the contact;

FIG. 10 is a view similar to FIG. 9 but representing a step in the removal of the contact from the opposite end; and

FIG. 11 is a large scale perspective view, in exaggerated proportions, of a pin cavity, taken at line 11—11 of FIG. 4.

Referring now in detail to the accompanying drawings, FIG. 1 shows a connector **16** which includes two main parts or members **18** and **19** which in general, and as except for the detailed disclosure hereinbelow, are of known character. In the connector member **18** is a dielectric block **20** having a plurality of socket contacts or female members **23** mounted in cavities **24** therein while the member **19** includes a dielectric block **25** with a plurality of pin contacts or male members **26** mounted in a plurality of cavities **28** (FIG. 2). The socket contacts **23**, and the construction of the cavities **24** cooperating therewith, form the features of the present invention. The cavities **24, 28** are usually large in number.

The pin contacts **26** may be of any suitable character and mounted in the cavities in any manner which is not pertinent to the present invention, but the stems thereof indicated at **30** in the present instance are of rectangular cross section although this is not a critical limitation. A cavity **24** of the block **20** of the connector member **18** in which a socket contact **23** is mounted, is shown in FIGS. 6 and 7. The cavity is generally rectangular in cross section and is provided on each of opposite sides with shoulders **32, 34** formed at the ends of the ribs **36, 38**, the shoulders facing in longitudinally opposite directions and being disposed on opposite sides of a longitudinal center line indicated at **40**. While it is preferable to have the stops **32, 34** on each of opposite sides of the cavity, for convenience in inserting the pin contact in either of opposite directions, the invention is not limited to such an arrangement but encompasses provision of these stops on only one of those sides. Preferably the shoulders are spaced apart forming a gap **42** therebetween.

Beside the ribs are grooves **44, 46** which lead longitudinally from the respective shoulders, forming bottom surfaces or floors in a plane common with the floor of the gap **42**. The ribs **36, 38** on the opposite sides of the cavity are symmetrical relative to rotation about a longitudinal center axis through the cavity. The cavity preferably is chamfered at the ends as indicated at **48** facilitating entry of the contacts into the cavity. If desired, one end of the cavity may be provided with a counterbore **50** of cylindrical shape and leading inwardly from the corresponding end of the cavity but terminating short of the shoulders.

The socket contact **23** is shown as a whole and in perspective in FIG. 3, and is made up of a single piece of metal (e.g. copper) and shaped and fabricated to provide the various functional elements required. It is made as a stamping from a blank in the form of a flat piece of metal and is of generally tubular form, although having specific conformations, and shapes at different portions thereof, having for convenience in identification, four side elements **52, 54, 56, 58** the latter, at one end, being made up of elements **58*a*** and **58*b*** on opposite sides of the longitudinal parting line **59** formed by bounding edges of the original blank. At the other end, the side element may be a single element **58*c*** extending across the side of the device. This relation will be referred to again hereinbelow. The four side elements **52, 54, 56, 58** surround and form an open end or socket **60** for reception of the contact end of a pin contact. On two of the opposite sides, e.g., **52, 56** are tongues **62, 64** bent inwardly from the plane of the respective sides, and biased inwardly for electrical contact engagement with the entry end of the pin contact. On one of the other sides, e.g., the side **58**, are

formed oppositely directed tangs **66**, **68**, one of them, **66**, being part of and extending from the element **58***a* and the other, **68**, being part of and extending from the element **58***c*. The tang **66** overhangs the element **58***c* for a purpose referred to hereinbelow, this relation being made possible by the provision of the two separate elements **58***a* and **58***b*. The tangs **66** and **68** function as spring detents and are biased outwardly from the plane of the side **58** and have end stop surfaces **70**, **72**, facing in longitudinally opposite directions and positioned on opposite sides of the longitudinal parting line **59**, these detents corresponding with the shoulders **32**, **34** mentioned above and as referred to again hereinbelow.

The detents **66**, **68** are provided with inclined surfaces **74**, **76** to facilitate flexing of them in removal thereof, as referred to below, and to enable them to be cammed onto the ribs in the removal operation. The end of the contact opposite the entry end **60** is formed as a tubular element **78** which may be of any suitable peripheral shape, such as cylindrical, rectangular, etc., this element being utilized for connection with a conductor in a known manner. However, if desired, the contact **23** may be formed instead with an extension **79** (FIG. 5) to which a conductor may be connected externally.

The contact is inserted into the cavity as from the left end of FIG. 4, the detents **66**, **68** being presented to one or the other of the sides of the cavity having the shoulders **32**, **34**.

In inserting the contact in the manner stated, the detent **68** rides in the groove **44** (FIGS. 4 and 6) while the detent **66** engages the rib **36** and is flexed inwardly thereby and the movement is continued until the detent **68** engages the shoulder **34** which limits the movement of the contact, this defining the operative position of the contact. At this position the detent **66** falls off of the rib **36** and then engages the shoulder **32**, latching the contact against removal in the opposite direction, the longitudinal spacing between those shoulders being such as to accommodate the detents and the contact is thereby held positively in position against removal in either of opposite longitudinal directions.

The contact is insertable into the cavity from the opposite end as well, and in this instance, the detent **66** rides in the groove **46** while the detent **68** rides on the rib **38**, until the detent **66** engages the shoulder **32** and the detent **68** falls off of the rib and in opposed engagement with the shoulder **34**, the position of the contact in that case being the same as the limit position mentioned before, positively preventing removal of the contact in either direction.

When the contacts **23** are all in position in the connector member **18** (FIG. 1) and the corresponding pin contacts **26** are in the other connector member **19**, the two connector members are connected, with the pins entering into the socket contacts, in the usual manner.

Preferably the contact extension **30** of the pin contact is rectangular in cross section (see FIG. 2) as mentioned above and upon entering into the space between the contact tongues **62**, **64** they present flat surfaces against those tongues for more effective contact engagement, the tongues being straight in transverse direction. The entry end or socket **60** of the contact **23** is also rectangular, for accommodating the pin extension **30** and maintaining proper alignment therebetween.

The construction enables the removal of the contact, and such removal in either direction longitudinally. A pry **80** may be utilized for inserting into the cavity, and insofar as the construction of the contact is concerned, it can be inserted from either end; however, it often occurs that the contact is positioned or mounted so that because of space problems or otherwise, it can actually be inserted from only one end, and as a practical matter from what is known as a "front end," or the right end as viewed in FIGS. 4–6. Considered in the broad sense, and without any space limitations of the nature mentioned, the

pry can be, in one instance, inserted in the groove **46** (FIG. 9) until it engages the inclined surface **74** of the detent **66** whereupon it flexes it inwardly beyond the shoulder **32**, and then the contact is withdrawn to the left. Similarly the pry can be inserted from the opposite end, in the groove **44** (FIG. 10) until it engages the detent **68** which it flexes inwardly beyond the shoulder **34** and enables the contact to be withdrawn. When the contact is put in a position where it is not possible to insert the pry from each end, as referred to, it is most usually the case that it can be inserted only in the direction indicated, i.e., as represented in FIGS. 4 and 5. It is however desired that the contact can be removed in either direction, and the present invention is capable of enabling that maneuver—because of the overhang of the tang **66** over the element **58***c*, that tang upon depression thereof engages the element **58***c* and the latter is accordingly depressed, carrying with it the tang **68** and thus with both tangs depressed, the contact can be withdrawn from either end.

The specific shape of the cavity **24** in the connector member **18** facilitates the molding operation of that member. Molding pins are put in place to form the grooves **44**, **46** and after the article is molded, the pins can be withdrawn longitudinally, eliminating any necessity for movement in transverse directions and disturbing the mold. The pins are put in position in a common plane to form the floors of the grooves **44**, **46** and the gap **42**, this plane extending accurately longitudinally, enabling removal of the molding pins in the manner stated.

FIG. 11 pictorially represents the arrangement of the ribs **36**, **38**, the grooves **44**, **46** and gap **42**. The cavity may be provided with a counterbore **82** to accommodate possible oversize dimension of the element **78** of the contact.

We claim:

1. A connector comprising a block having a cavity therein, and a contact insertable into the cavity into an operative position, the cavity surface having fixed stop elements, and the contact having stop elements yieldable in response to insertion of the contact into the cavity and thereafter engaging the fixed stop elements in the cavity and positively restraining the withdrawal of the contact from the cavity, the dimensions of the cavity and contact being such as to enable insertion of a pry into the cavity and flexing of a first of the yieldable stop elements out of engagement with the associated fixed stop element, and the yieldable stop elements overlapping longitudinally at the ends thereof, and being thus interengageable in transverse directions whereby transverse flexing of said first of them flexes the other one out of engagement with its associated fixed stop element.

2. A connector comprising a block having a cavity therein, and a contact insertable into the cavity into an operative position, the cavity surface including ribs having end surfaces forming fixed stop elements, the contact having stop elements yieldable in response to insertion of the contact into the cavity and thereafter engaging the fixed stop element and thereby the contact is positively restrained from removal in direction reverse to the inserting direction, the yieldable stop elements being manually releasable for controllably removing the contact, and the ribs having inclined camming surfaces on their ends opposite the stop elements thereon producing yielding movement of the stop elements on the contact in response to inserting movement of the contact into the cavity, the cavity and the contact being of complementary polygonal form, the cavity having a set of ribs and stop elements of the kind stated on each of opposite sides, symmetrically arranged about a longitudinal center line through the cavity, whereby the contact can be inserted in either of opposite positions in each of which the stop elements on the contact cooperate with the correspondingly positioned ribs and stop elements in the cavity.

3. A connector comprising a block having a cavity therein, and a contact insertable into the cavity into an operative position, the cavity surface having on at least one side thereof a pair of ribs respectively on opposite sides of a central longitudinal plane and generally at opposite end portions of the cavity and forming grooves therebeside also respectively on opposite sides of that plane and longitudinally aligned with respect to the ribs, the ribs being provided with shoulders forming fixed stop elements facing longitudinally and aligned with respective grooves and the grooves extending out through the ends of the cavity away from the shoulders, and the contact having stop elements longitudinally aligned with respective ribs and grooves, and pursuant to insertion of the contact into the cavity, one of the stop elements on the contact rides in the aligned groove and engages the aligned stop element in the cavity and the other engages the aligned rib and it thereby yields transversely, and upon passing the stop element on that rib it moves outwardly and it engages that stop element.

4. A connector according to claim 3 wherein the ribs on their longitudinally outer ends are provided with inclined camming surfaces operative for camming the yieldable stop elements on the contact pursuant to insertion of the contact into the cavity.

5. A connector according to claim 3 wherein the fixed stop elements at the ends of the ribs in the cavity are spaced apart longitudinally, and of those on the contact, one overlaps the other, whereby a pry can be inserted into one of the grooves for flexing the corresponding yieldable stop element on the contact inwardly to release it from the corresponding fixed element, and that yieldable stop element releases the other one.

6. A connector according to claim 5 wherein each yieldable stop element on the contact includes an inclined camming surface displaced longitudinally from the end surface thereof engageable with a pry inserted into the corresponding groove whereby to facilitate flexing of the yieldable stop element by a camming action.

7. A connector comprising a block having a cavity therein, and a contact insertable into the cavity into an operative position, the cavity and contact being of complementary polygonal shape whereby to prevent rotation of the contact in the cavity, the cavity having ribs on at least one side surface thereof respectively on opposite sides of a central longitudinal plane and together extending nearly the entire length of the cavity, the ribs forming grooves beside the respective ribs and accordingly on respectively opposite sides of said central longitudinal plane, the grooves being aligned longitudinally with the respective ones of the ribs, the ribs having end surfaces forming fixed stop elements, the contact having a snug fit against the ribs, the contact having stop elements on one side of the contact yieldable transversely inwardly pursuant to engagement with said ribs whereby to pass beyond the ribs, and the resilient stop elements on the

contact spring outwardly beyond the respective ribs and positively engaging the fixed stop elements on the cavity surface, the ribs extending longitudinally to closely adjacent the corresponding ends of the cavity, wherein the contact is supported by said ribs throughout nearly the full length of the cavity.

8. A connector according to claim 7 wherein the stop elements on the cavity surface include a set of such stop elements on each of opposite sides of the cavity surface, whereby the contact can be operatively positioned in the cavity and each of opposite positions relative to rotation about a central longitudinal axis.

9. A socket contact fabricated of a single sheet and of generally rectangular tubular cross sectional shape for defining an inner socket, having a longitudinal seam formed by the side edges of the sheet, the socket having stop elements on opposite sides of said seam directed in longitudinally opposite directions, one of the stop elements extending longitudinally beyond the other, and both being yieldable laterally inwardly, and flexing of the first of the stop elements being operative for flexing the other.

10. A socket contact according to claim 9 wherein the stop surfaces on the yieldable stop elements are disposed generally transverse to the longitudinal direction thereof for providing positive stop action, and the stop elements have inclined surfaces displaced longitudinally from said stop surfaces for enabling camming of the stop elements laterally inwardly.

11. A socket contact according to claim 9 and including a pair of opposed tongues biased laterally inwardly into the interior of the socket for contact engagement with a pin contact inserted into the socket.

12. A socket contact according to claim 11 wherein the tongues are substantially straight in transverse directions for effective contact engagement with flat sides of a pin contact inserted into the socket, and the socket contact at the end opposite the socket being of tubular shape for connection with a conductor.

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U.S. Cl. X.R.

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