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Brorein et al.

[11] **3,789,344**

[45] **Jan. 29, 1974**

[54] **ELECTRICAL CONNECTOR FOR TELEPHONE CORDS**

[75] Inventors: **William J. Brorein,** Whippany; **Nicholas Humen,** Bayonne, both of N.J.

[73] Assignee: **General Cable Corporation,** New York, N.Y.

[22] Filed: **Nov. 12, 1971**

[21] Appl. No.: **198,323**

[52] **U.S. Cl.** ..... **339/59 M,** 339/91 R, 339/106, 339/176 M

[51] **Int. Cl.** .. **H01r 13/54,** H01r 13/58, H01r 13/40

[58] **Field of Search** .. 339/210 M, 97 P, 97 R, 91 R, 339/176 M, 105, 106, 59 M, 176 S, 175 C, 44, 98, 176 MP; 220/60 R

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Primary Examiner—Marvin A. Champion
Assistant Examiner—William F. Pate, III

[57] **ABSTRACT**

This electrical connector has a housing and a cover hinged together. Conductors and terminals on the conductors are assembled in the housing, and the cover is then swung into closed position where it has a snap lock for holding it closed. The housing has different cavities for receiving each terminal and the upper ends of the cavities are constructed so as to distort as the terminals are inserted and then spring back to hold the terminals and their connected conductors in place. This connector cannot only be assembled in much less time than prior connectors, but in the event of an error in the relation of the terminals, the error can be easily corrected; and repairs are also facilitated since the connector can be reopened without removal of any rivets or other fastenings.

20 Claims, 14 Drawing Figures

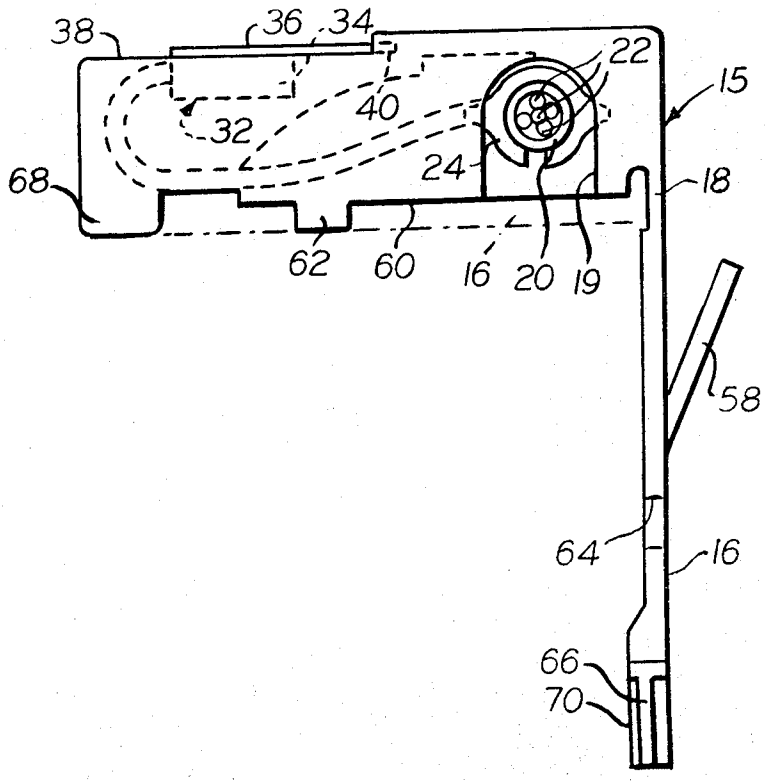


FIG. 1.

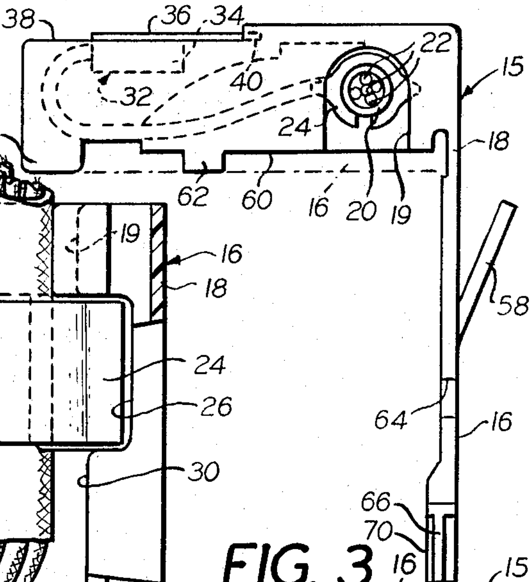


FIG. 2.

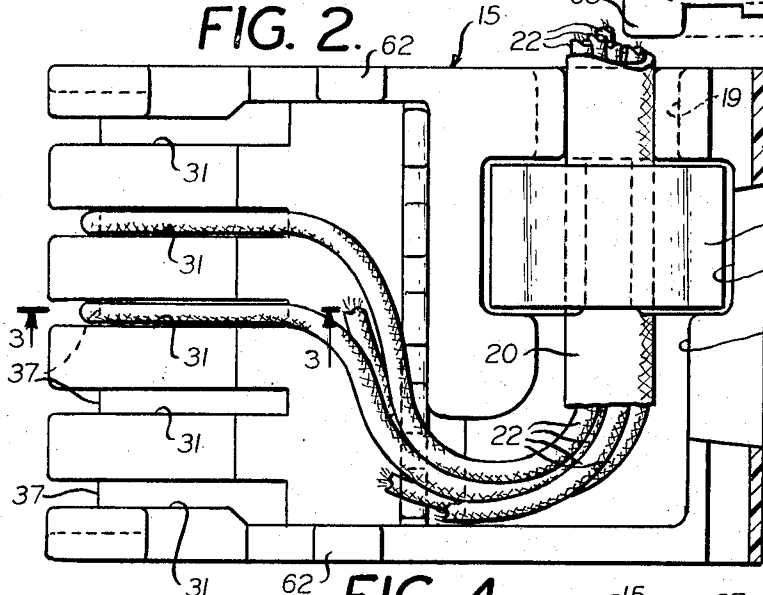


FIG. 3.

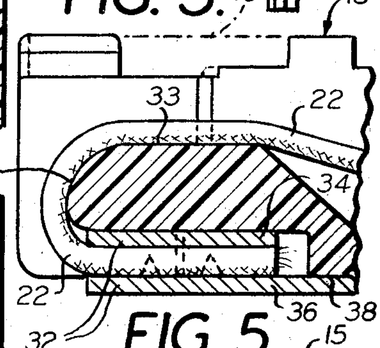


FIG. 4.

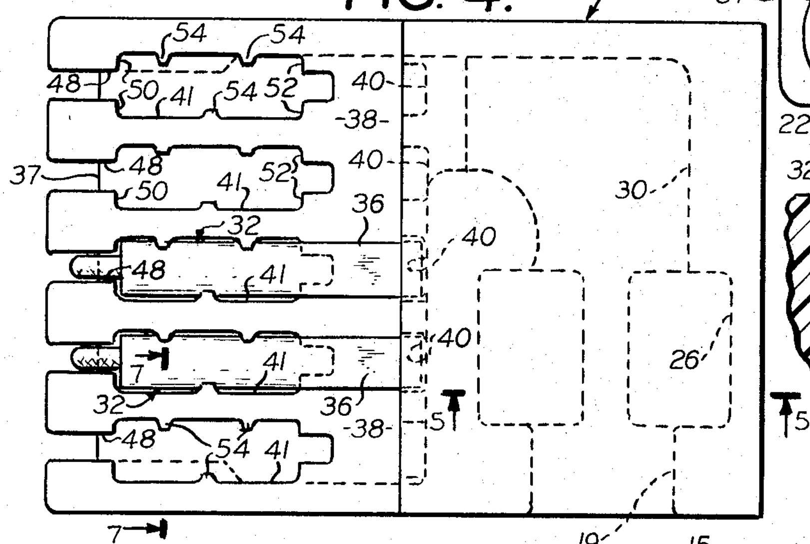


FIG. 5.

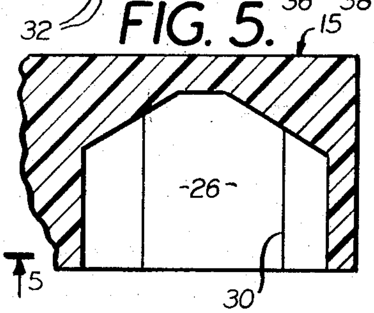
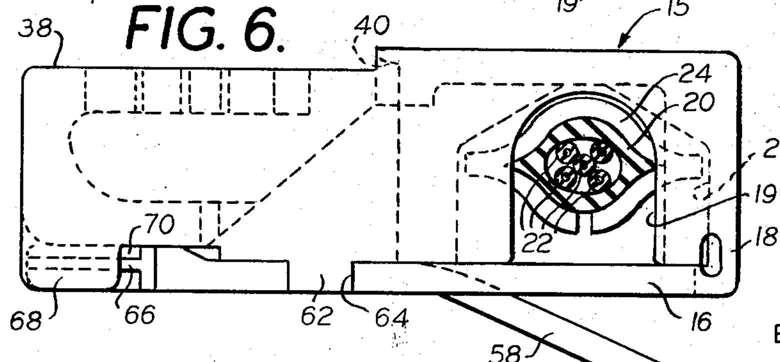


FIG. 6.



INVENTORS
William J. Brown
Nicholas Hennen

BY Sandoe, Hopgood & Calimafde

ATTORNEYS.

FIG. 7.

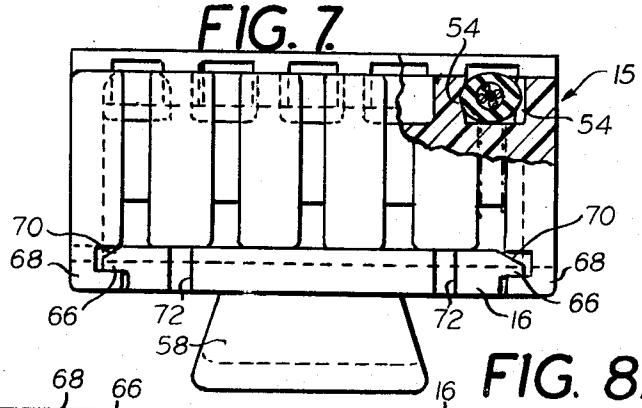


FIG. 9.

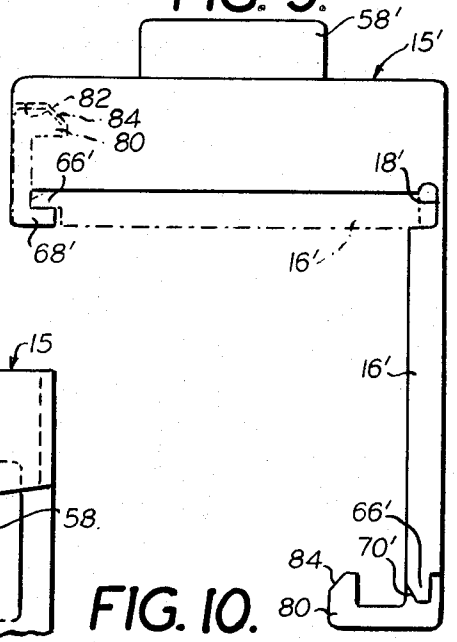


FIG. 8.

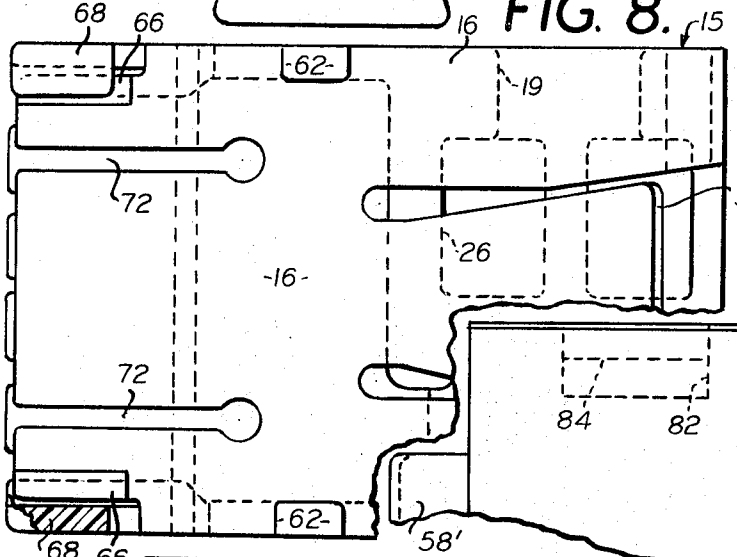


FIG. 10.

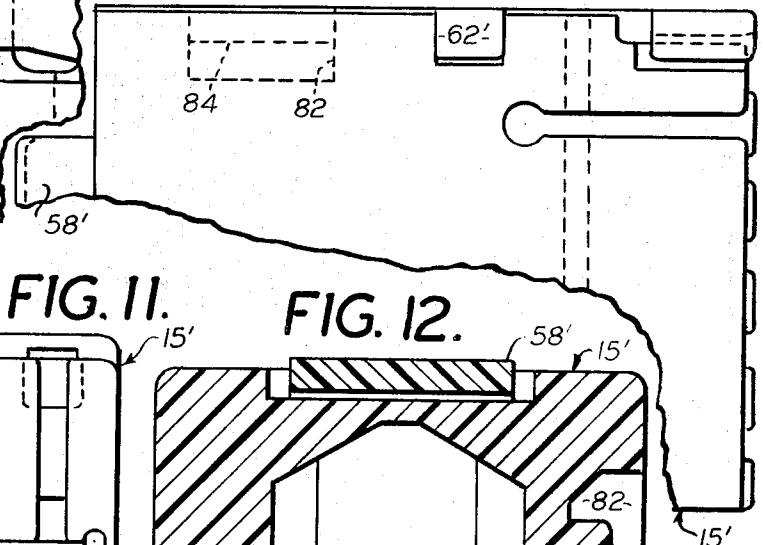


FIG. 11.

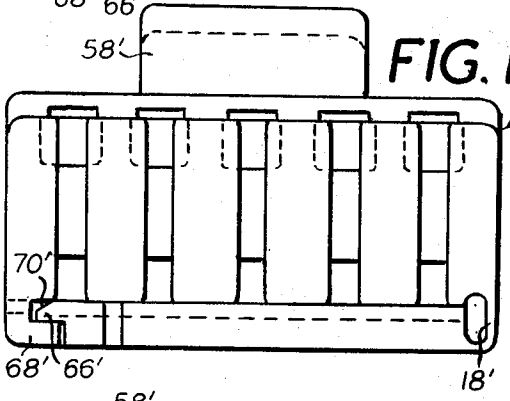


FIG. 12.

FIG. 13.

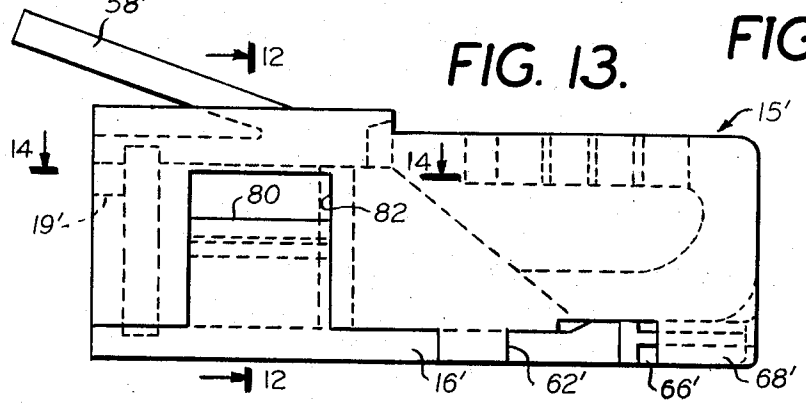
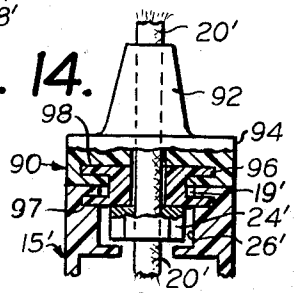


FIG. 14.



INVENTORS
William J. Brown
Nicholas Hunen

BY Sandoe, Hargrave & Talmadge
ATTORNEYS.

ELECTRICAL CONNECTOR FOR TELEPHONE CORDS

BACKGROUND AND SUMMARY OF THE INVENTION

This invention provides a low cost electrical connector for telephone cordsets and similar applications.

This connection is unique in that the top and bottom halves of the connector housing or shell are joined together by an integrally molded hinge, thus allowing the connector housing to be molded in one piece of semi-flexible thermoplastic material. When closed, the top and bottom halves are locked together by means of interlocking protrusions, or "dove tails" along the sides that are opposite to the hinged side. An integrally molded plastic leaf spring is provided to lock the assembled connector into its mating receptacle in the telephone or similar apparatus to which it is connected.

No metal spring retainers, rivets, screws or the like are required for this invention as were required in prior connectors to hold the various parts together and to lock the connector into its receptacle.

This new invention also has an improved means to retain the electrical contacts in the housing thus allowing contacts that are about 30% smaller than previous contacts to be used. This provides considerable savings since these contacts are usually coated with precious metal such as gold or silver.

The contacts are held in place by the elastic deformation of precisely molded protrusions comprising triangular ridges that are located on opposite walls of the cavities into which the contacts are inserted. The triangular ridges are deformed by the round barrel of the terminal and securely lock the terminal barrel in place. The flat terminal tab that extends from the barrel is locked into a molded cavity in the housing to provide additional means for securing the terminal in place.

The connector housing can be reopened and repairs or rearrangement of the positions of the electrical contacts can be easily made if required. Prior connectors required several rivets to be removed before repairs could be made, and upon completion of the repairs expensive reassembly and reriveting was needed.

The top, bottom and retainer spring of this new connector, being molded as a single piece with all parts of this piece correctly oriented, eliminates the need for an assembly operator to select, pick up and to correctly position separate pieces as was required in the past. It completely elminates the possibility of error of assembling incorrect or improperly positioned parts.

The electrical cord is locked into the connector housing of this invention by means of a metal band that is crimped over the cord jacket and which abuts against a heavy molded retaining wall in the housing. In previous designs, the cord was retained by clamping the cord between ridges that were molded into the halves of the housing which necessitated that the cord jacket be carefully positioned between these ridges and the housing halves be riveted together under considerable pressure.

The hinged halves of the connector housing of this invention are not required to clamp the cord under pressure and thereby can be molded from a less rigid, less expensive material than has been used heretofore.

By eliminating the clamping action of the housing halves, the expensive clamping and riveting process is dispensed with, and the halves are locked together by means of simple interlocking "dove tails."

The metal cord retainer band is applied to the cord at the same time that the terminals are applied to the electrical conductors of the cord thus providing an economy in labor.

Other objects, features and advantages of the invention will appear or be pointed out as the description proceeds.

BRIEF DESCRIPTION OF DRAWING

In the drawing, forming a part hereof, in which like reference characters indicate corresponding parts in all the views;

FIG. **1** is a diagrammatic side view of a connector made in accordance with this invention and showing the cover of the housing in open position;

FIG. **2** is a bottom view, on an enlarged scale, of the housing shown in FIG. **1** with the cover removed as indicated by the section lining at the right hand end of FIG. **2**;

FIG. **3** is a fragmentary sectional view taken on the line **3—3** of FIG. **2**;

FIG. **4** is a top plan view of the housing shown in FIG. **1**, the drawing being on the same scale as FIG. **2**;

FIG. **5** is a sectional view taken on the line **5—5** of FIG. **4**;

FIG. **6** is an enlarged side view of the connector from the same side as FIG. **1** but with the cover in closed position;

FIG. **7** is an end view of the connector shown in the other views, the end shown in FIG. **7** being the left hand end of the connector as viewed in FIG. **6** and being the end which is inserted into the receptacle with which the connector is intended to be used; and partly in section on line **7—7** of FIG. **4**.

FIG. **8** is a bottom view of the connector with the cover in closed position as shown in FIG. **6**;

FIG. **9** is a diagrammatic end view of a modified form of connector made in accordance with this invention;

FIG. **10** is an enlarged bottom view of the connector shown in FIG. **9** with the cover in closed position;

FIG. **11** is an end view of the connector shown in FIG. **9** on the same scale as FIG. **10** and with the cover in closed position;

FIG. **12** is a sectional view taken on the plane **12—12** of FIG. **13**;

FIG. **13** is a side view of the connector shown in FIGS. **9 - 12**, the view being taken from the right side of FIG. **11**; and

FIG. **14** is a reduced sectional view on line **14—14** of FIG. **13**.

DESCRIPTION OF PREFERRED EMBODIMENT

FIG. **1** shows a connector comprising a housing **15** to which is connected a cover **16** by a hinge **18**. In the preferred construction the housing **15** and the cover **16** are a one piece plastic molding and the molding is thinner at the connection of the cover **16** to the housing, the thin and therefore more flexible portion of the plastic serving as the hinge **18**. In FIG. **1** the cover **16** is shown in open position in full lines and is shown in closed position in dot and dash lines.

There is an opening **19** through one side of the housing **15**. A telephone cable or cord **20** extends through the opening **19** and this cord **20** contains a plurality of

conductors 22, each of which is insulated in the conventional manner.

There is a collar 24 which permanently and tightly grips the outside of the cord 20; and this collar 24 fits into an enlarged chamber 26 in the housing 15. This collar 24 being wider than the opening 19, as shown in FIG. 2, cannot pull out of the connector through the opening 19.

The chamber 26 walls of the chamber 26 which is formed in the housing 15 prevent displacement of the collar 24 in all directions except downward in the chamber 26. The housing 15 is constructed so that the chambe26 is open at its lower end as long as the cover 16 is in open position but when the cover 16 moves into the closed position shown in dot and dash lines in FIG. 1 and in full lines in FIG. 6, then the chamber 26 is closed at its lower end and there is no way in which the collar 24 can be removed from the chamber 26 except by opening the cover 16.

It is a feature of the construction illustrated that the longitudinal pull on the cord 20, which would tend to pull it out of the connector housing 15 is resisted by walls of the chamber 26 which are fixed parts of the housing and this is the direction from which the principal strain comes on a connector cord. Thus the cover 16 does not have to withstand any of this strain and the only force that the collar 24 and cable 20 can exert against the closed cover 16 is a radial force in a downward direction in FIGS. 1 and 6. Since the hinge 18 is at the same end of the connector as the cord 20, the latch which holds the cover closed has a substantial mechanical advantage for resisting any force from the cable tending to open the cover 16.

There is a narrower chamber 30, best shown in FIG. 2, in which the conductors 22 leave the end of the cord 20 and pass to individual channels 31 formed in the bottom of the housing 15. The drawing shows two conductors 22 extending through channels in FIG. 2 and FIG. 3 but the other conductors are broken off in the chamber 30, it being understood that they extend in the same manner but the construction is not shown since the omission of these conductors permits better illustration of the construction of the connector.

FIG. 3 shows one of the conductors 22 extending through a channel 31 and then passing around a curved end face 37 which constitutes a continuation of the channel and which permits the conductor to reach the top of the connector (the connector 15 being shown upside down in FIG. 3).

There is a terminal 32 connected to the end of the conductor 22 in FIG. 3 and it will be understood that all of the conductors have similar terminals connected to them. These terminals are of conventional construction and include insulation piercing tangs in the terminal barrel 34 which is clamped to the insulated conductor 22 and there is a contact portion 36 at the top of the barrel (bottom as viewed in FIG. 3) which extends across tbe top surface 38 of the connector and then into a recess 40, as shown in FIGS. 1 and 4. This recess 40 is in the form of a pocket which prevents displacement of the end of the contact portion 36 in all transverse directions.

It will be apparent from FIG. 1 that the contact portion 36 and the outer surface of the barrel 34 of the terminal of each conductor is above the adjacent top surface 38 of the connector and in a position to contact with complementary contacts in a receptacle into which the connector is inserted when in use.

The construction for holding the terminals 32 in the connector are shown in FIGS. 4 and 7. There is a cavity for receiving each terminal. These cavities are designated by the reference characters 41 and correspond to the channels 31. The rounded end face 37 of each of the channels 31 merges into the bottom of the respective cavities 41 through a channel entrance 48 which is substantially narrower than the rest of the cavity 41 so that there are end walls 50 in each cavity 41 for preventing the terminals 32 from being displaced toward the left in FIG. 4.

There are corresponding end wall 52 at the other end of each cavity 41 for preventing displacement of the terminals 32 in the opposite direction. The longitudinal distance between the end walls 50 and 52; that is, the actual length of each full width cavity 41 is substantially equal to the length of the barrel of the terminal 32.

The terminals 32 are pushed into the respective cavities 41 from the top and the width of each cavity 41 is substantially equal to the diameter of the terminal barrel except at the upper ends of the cavities 41. In orderto hold the terminals 32 down in the cavities 41 after they have once been inserted, there are triangular ridges 54 in the form of protuberances extending from the side walls of the cavities 41, as best shown in the portion of FIG. 7 which is in section.

These protuberances 54 are preferably made of the same plastic material as the housing of the connector and are soft enough to be displaced temporarily as a terminal is pushed down into any one of the cavities 41. When the maximum diameter of the width of the terminal passes the protuberances 54, these protuberances spring back into their original positions and overlie the barrel of the terminal so as to hold the terminal firmly down in the cavity.

Although the protuberances 54 hold the terminals 32 permanently assembled in the connector, terminals can be removed for repair or for changing the relative positions of terminals with respect to the cavities across the width of the housing by applying sufficient force to distort the protuberances 54 so as to let the terminals move upward out of the cavities. No such force is ever applied to the terminals by insertion and removal of the connector into a receptacle and terminals cannot come out of the connector unless purposely removed with the use of sufficient force to distort the protuberances 54 which hold the terminals down in the cavity.

Connectors used for telephone cords ordinarily have a leaf spring which acts as a latch to prevent the connector from being removed from the receptacle after it has been inserted. When removal is necessary, an implement is used to depress the leaf spring so that the connector can be withdrawn from the receptacle. With this invention a leaf spring 58 is formed from plastic material displaced from the cover 16 and when the cover is molded, and the leaf spring 58 is molded extending in the direction shown in FIGS. 1 and 5 so that it will operate as a latch to prevent the connector from being pulled out of a receptacle with which the connector is intended to be used in connection with a telephone. The leaf spring 58 is, therefore, of one piece construction with the cover 16 and preferably of one piece construction with the housing 15 also.

The material used for the housing of the connector of this invention is preferably a semi-flexible thermoplastic material; sometimes described as "stiffly flexible." Materials suitable for the purpose include

1. Polypropylene
2. Polyvinyl chloride - (semi-rigid)
3. Polypropylene modified Polyvinyl chloride
4. Acrylic modified Polyvinyl chloride
5. Nylon

Referring again to FIG. **1**, the bottom surface of the housing **15** is indicated by tbe reference character **60.** Along both edges of the bottom of the housing there are posts **62,** also shown in FIG. **2** and FIG. **6.** These posts **62** extend into cutout sockets **64** (FIG. **1**) in the cover **16** for centering the cover transversely as it swings into closed position and for preventing the cover from moving transversely when closed in a direction which might release the locking means which will be explained.

The locking means for holding the cover closed includes a latch **66** (FIGS. **1** and **7**) located on each side of the cover **16** near the end of the cover most remote from the hinge **18.** There is a downwardly extending projection **68** on each side of the housing **15** with an undercut portion behind which the latch **66** engages with a snap action when the cover **16** is pushed into closed position as shown in FIG. **7.** A sloping surface **70** on top of each of the latches **66** acts as a cam surface to move these latches inward so that it can pass the innermost edge of the downward extending projection **68** and engage behind the projection **68** as the cover reaches fully closed position. In order to provide flexibility so that the latches **66** can move inward, there is a slot **72** through the cover **16** at a slight distance inward from each of the latches **66** and extending for a substantial distance beyond the latches. There is some flexibility in the downwardly extending projections **68** so that as the cam surfaces **70** thrust the latches **66** inward, the force of the cam action also moves the projections **68** outward to a limited extent to facilitate passage of the latch **66** into locking position as shown in FIG. **7.**

FIG. **9** shows a modified form of the invention in which a housing **15'** has a cover **16'** joined to it by a hinge **18'** which extends along a side edge of the housing instead of across the back of the housing as in the case of FIG. **1.** The parts of this modified construction which correspond with those of the construction already described in connection with FIGS. **1 – 8** are indicated by the same reference character with a prime appended.

The leaf spring **58'** for locking the connector in the receptacle is molded as part of the back of the housing **15'** instead of being part of the cover in the modified construction shown in FIG. **9.**

The opening **19'** for the electric cord to come through the end of the connector is in the end wall remote from the end of the connector which first enters the receptacle with which the connector is intended to be used. The cord is held by a collar **24'** as already described and this collar **24'** is held in the housing by the cover **16'** when the cover is in closed position.

The means for holding the cover **16'** closed are somewhat different from the modification shown in FIG. **9** than for the modification shown in FIG. **1.** There is still a latch **66'** with a cam face **70'** which latches behind a downwardly extending projection **68'** when the cover **16'** is in closed position as shown in dot and dash lines in FIG. **9.**

There is, however, an additional locking means for holding the cover **16'** in closed position in the construction of FIG. **9.** This additional locking means includes a hook **80** which is an integral part of the cover **16'** and which extends upward from the cover **16'.** There is a recess **82** (FIGS. **9** and **10**) in the side of the housing **15',** opposite the side that has the hinge **19',** for receiving the hook **80.** This recess **82** is near the rearward end of the housing **15** and the latch **66'** is adjacent to the forward end, as shown in FIG. **10.**

The portion of the hook **80** which connects with the cover **16'** is made of stiffly flexible plastic material and is long enough so that the hook **80** can bend outward (toward the left in FIG. **9**) to pass the side of the housing **15'** as the cover **16'** swings into closed position. The resilience of the distorted plastic causes the hook **80** to snap into the recess **82** when the cover reaches its closed position shown in FIG. **9.** A sloping cam face **84,** on the top surface of the hook **80,** causes the hook to be pressed outward by contact with the lower right hand corner of the housing **15'** as the cover **16'** swings toward closed position.

FIG. **14** shows a cable or cord **20'** extending through opening **19'** in the end of the housing **15'.** A collar **24'** tightly and permanently grips the cable **20';** and this collar engages behind a coupling **96** through which the cord **20'** extends. The collar **24'** is in a chamber **26'** in the housing **15',** being inserted therein through an open side of the chamber **26'** when the cover **16'** is open.

A supporting guide for the cable **20'** includes a fitting **90** that surrounds the cable **20'** closely with a sleeve **92** having a tapered outside surface and having an end portion **94** that is preferably of one-piece construction with the sleeve **92.** This end portion **94** abuts against the end of the housing **15'** and is locked to the housing **15'** by a coupling **96** that extends through the part of the opening **19'** which is in the end wall of the housing **15'.** The coupling has flanges **97** and **98** at its opposite ends. The inner flange **97** engages the inside surface of the end wall of the housing **15';** and the outer flange **98** of the coupling **96** is held in the fitting **90** by molding the fitting **90** over the upper end of the coupling **96.**

The coupling **96** and the fitting **90** comprise, therefore, a unitary assembly. This assembly is placed on the cable **20'** before the collar **24'** is crimped on the cable; and it is inserted into the opening **19'** on the side of this opening which is exposed when the cover **16'** is in open position.

The preferred embodiments of the invention have been illustrated and described but changes and modifications can be made and some features can be used in different combinations without departing from the invention as defined in the claims.

We claim:

1. An electrical connector for a multi-conductor cord including a housing into which an end portion of an electrical cord extends, cavities at a front end of the connector and in one side of the housing for receiving different conductors of the cord, a terminal at the end of each conductor and in the same cavity that receives that conductor, a cover on the other side of the housing movable between open and closed positions, the conductors extending from said cavities around an end face of the housing to the side of the housing opposite the terminal cavities, the cover holding the conductors

snubbed around the end face of the housing and in assembled relation with the housing when the cover is in closed position, means holding the cover against the lateral displacement on the housing, and a snap lock that is an integral part of the connector and that holds the cover in closed position.

2. The electrical connector described in claim **1** characterized by the means for holding the cover against lateral displacement on the housing, being a hinge connecting the cover to the housing, said hinge being made of plastic material that flexes to provide the hinge action.

3. The electrical connector described in claim **1** characterized by the snap lock comprising a latch connected to part of the connector and made of resilient flexible elastic material that deforms to permit the latch to move into a locking location, said snap lock also comprising a part of the connector behind which the latch hooks in said locking location to hold the cover in closed position, the latch being held in said locking location by the force required to deform said flexible, elastic material, one part of the snap lock being carried by the housing and the other part by the cover.

4. The electrical connector described in claim **2** characterized by the snap lock being partly on the housing and partly on the cover at locations spaced from the hinge, and at least part of the lock including a latch made of resilient, flexible elastic material that is deformed as the cover moves into closed position to provide force for holding the latch in locking position.

5. The electrical connector described in claim **4** characterized by the cover being substantially thinner than the housing and having a slot through it extending from an edge of the cover remote from the hinge and toward the hinge along that part of the cover that carries part of the snap lock for providing semi-flexibility in the plane of extent of the cover for distortion of the part of the snap lock that is carried by the cover, there being a snap lock on both sides of the cover and a similar slot for each lock.

6. The electrical connector described in claim **2** characterized by the cover and housing including the snap lock being of one piece plastic construction with the material at the hinge substantially thinner than other parts of the housing and cover for obtaining a high degree of flexibility for effective hinge action.

7. The electrical connector described in claim **6** characterized by the connector being a connector of a telephone cord, a retainer comprising a leaf spring projecting from one side of the connector at an incline to the said side and with the lower end of the incline toward the front end of the connector the retainer being distorted by a side of a receptacle as the connector is inserted into the receptacle for subsequent snap back into a depression in the receptacle to lock the connector therein, said retainer being of one piece construction with the cover, housing and hinge of the connector.

8. The electrical connector described in claim **7** characterized by the retainer being carried by the cover.

9. The electrical connector described in claim **2** characterized by the cover being hinged to the housing at an end of the housing remote from the front end of the connector.

10. The electrical connector described in claim **2** characterized by the cover being hinged to the housing along a side edge of the housing, which edge extends from the front end of the connector and toward the opposite end of the connector, and the locking means being carried partly by the cover and partly by the housing at the side of the housing opposite to that at which the hinge is located.

11. The electrical connector described in claim **2** characterized by channels in the side of the housing opposite the side on which the cavities are located, the connector having a recessed end face and the cavities being open at one end into the recess in the end face, each conductor from the cavities having a terminal and being led around a wall in the recessed end face and back through a different one of the channels along a course under the cavities, and a chamber in the housing beyond the ends of the channels and in which all of the conductors from said channels are brought together in the electrical cord, and in which the end of the electrical cord is held and secured to said connector.

12. The electrical connector described in claim **11** characterized by projecting portions of the housing that hold each of the terminals in their cavities, the cover of the connector, when in closed position, covering the conductors in the channels and also covering said chamber for holding the conductors and cord in the housing.

13. The electrical connector described in claim **12** characterized by a collar on the cord near the end thereof within the housing, said collar surrounding the cord and gripping the cord for holding it in the connector, a recess in the housing and into which the collar fits and by which the collar is held against displacement in all directions except toward an open end of the recess, said open end of the recess being closed by the cover to retain the collar in the housing recess when the cover is closed.

14. An electrical connector for a multi-conductor cord including a housing into which an end portion of an electric cord extends, cavities opening through one side of the housing for receiving different conductors of the cord, a terminal at the end of each conductor and in the same cavity that receives that conductor, a cover for the connector on the other side of the housing from said cavities and that can be moved into a closed position in which it holds the conductor cord in assembled relation with the housing, each of the cavities being made of soft elastic material and having a width into which a terminal can be inserted but having an upper portion of said width, adjacent to the side of the housing through which the cavity opens, that is distorted by insertion of the terminal so that the terminal is held in the cavity by the pressure of the distorted material.

15. The electrical connector described in claim **14** characterized by the terminal being of greater width at a location substantially below the top of the cavity into which the terminal is inserted, and the cavity having elastic protuberances from its side wall above the part of the terminal that is of greatest width, the protuberances being yieldable to permit insertion of the terminal into the cavity but expanding above the said greater width of the terminal to retain the terminal in the cavity.

16. The electrical connector described in claim **14** characterized by each of the terminals being of generally cylindrical cross-section over a portion of its extent, and the cavity having a width as great as the diameter of said cylindrical cross-section, the housing being

made of semi-flexible plastic material with protuberances at the upper part of the opposite side walls of each cavity above the maximum width of the terminal in that cavity and temporarily deformable for insertion of the terminal downward into the cavity and for holding the terminal down in the cavity after insertion.

17. The electrical connector described in claim **14** characterized by a contact top surface of each terminal for touching complementary contacts of the receptacle, each contact surface having an end that extends into a recess in the housing at the end of the contact surface for holding the tab against displacement, channels on the other side of the housing opposite each of the cavities, other channels near the end of the housing joining the cavities and the channels, the conductors from the terminals extending through said other channels and then along said channels on the side of the housing opposite the cavities and generally parallel to the terminals, and a chamber in the housing beyond said channels that are parallel to the terminals and into which the conductors extend and come together in the electric cord, and a hinged cover over the chamber and the channels leading to the chamber.

18. The electrical connector described in claim **17** characterized by a cord from which the conductors extend, said cord being enclosed in the chamber, a collar surrounding and gripping the cord, a section of the chamber having surfaces for holding the collar against displacement, the chamber opening through the side of the housing on which the cover is located when in closed position, and the chamber being closed by said cover to retain the collar in the chamber.

19. An electrical connector for a multi-conductor cord including a housing into which an end portion of an electrical cord extends, cavities in the housing for receiving different conductors of the cord, a terminal at the end of each conductor and in the same cavity that receives that conductor, a cover for the housing that can be moved into a closed position in which it holds the conductors in assembled relation with the housing, means holding the cover against lateral displacement on the housing, and a snap lock that is an integral part of the connector and that holds the cover in closed position and characterized by the chamber that contains the collar being near the end of the housing at which the cover is hinged to the housing so that any loading on the cover by the collar is carried more by the hinge than by the snap lock.

20. The connector described in claim **1** characterized by a supporting fitting that surrounds tbe conductor cord adjacent to the housing, a wall of the housing having an opening therein through which the conductor cord enters the housing, said opening extending to the end of the wall on the side of the wall that is adjacent to the cover when the cover is in closed position, the supporting fitting having a portion that extends through the opening, and also having shoulders in position to engage both the inside and the outside of the wall through which the opening extends to lock said supporting frame to the housing when the cover is in closed position.

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