Sept. 14, 1965 B. R. McFADDEN ETAL 3,206,718

PLUG CONNECTOR

Filed Oct. 8, 1963 2 Sheets-Sheet 1

Fig. 1

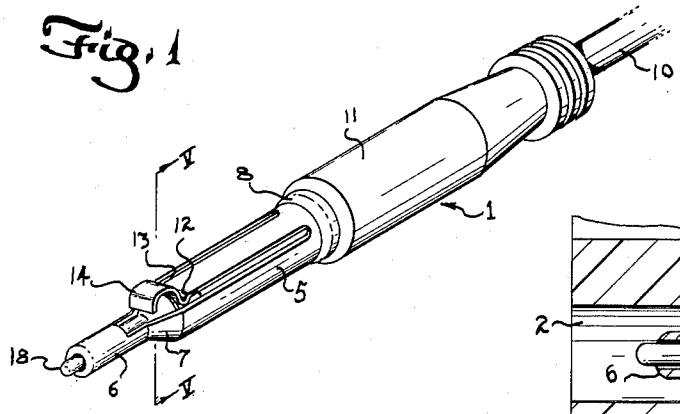


Fig. 2

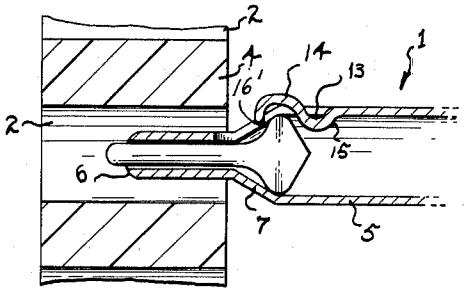
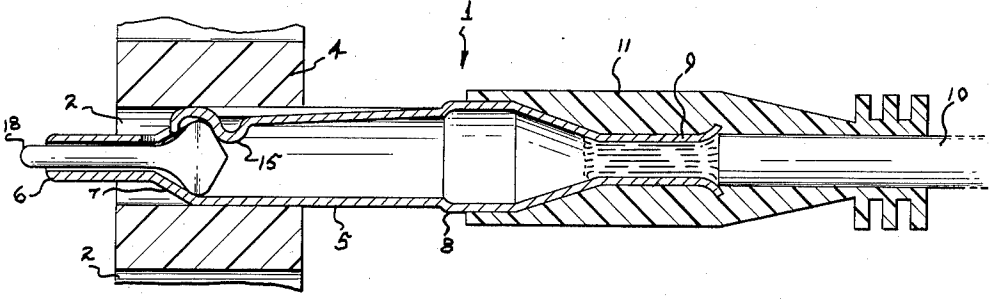


Fig. 3



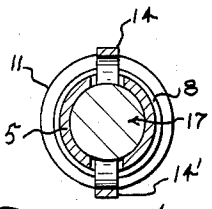


Fig. 5a

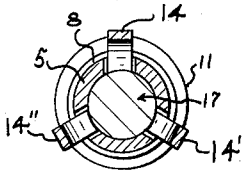


Fig. 5b

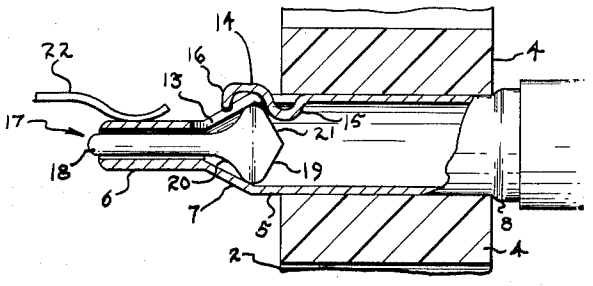


Fig. 4

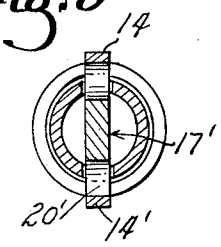
INVENTORS
Bruce R. Mc Fadden
Roy C. Jarrett
Bernard Edward Shlesinger, Jr.
By
Lauritzen, Morris & Safford

Sept. 14, 1965 B. R. McFADDEN ETAL 3,206,718

PLUG CONNECTOR

Filed Oct. 8, 1963 2 Sheets-Sheet 2

Fig. 8



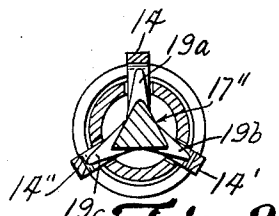


Fig. 9

Fig. 7

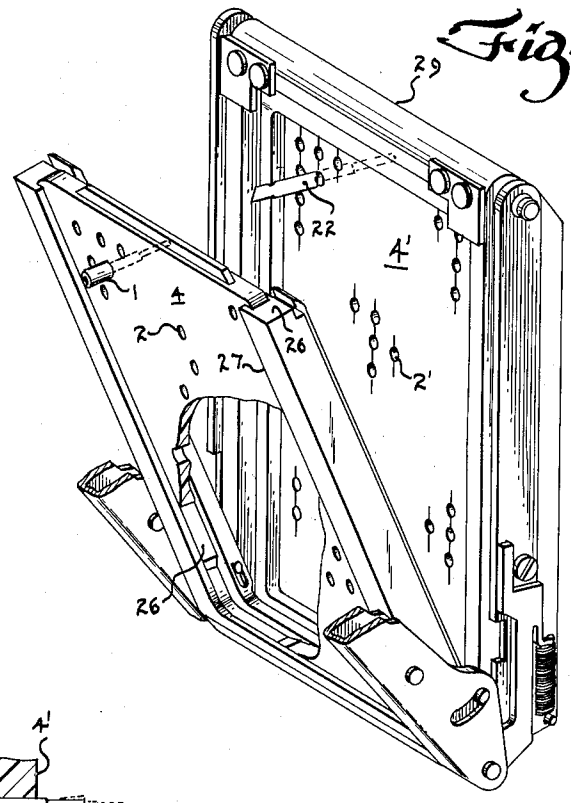


Fig. 7a

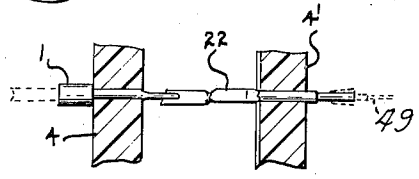
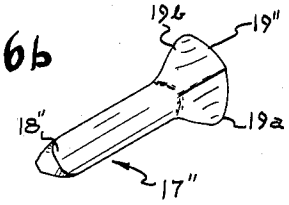


Fig. 6b



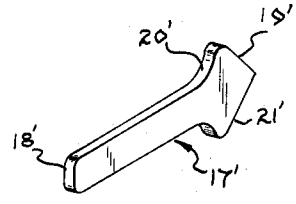
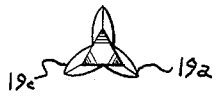


Fig. 6a

19b

Fig. 6c



INVENTORS
Bruce R. McFadden
Roy C. Jarrett
Bernard Edward Shlesinger, Jr.
By
Curtis, Morris & Safford

United States Patent Office 3,206,718 Patented Sept. 14, 1965

3,206,718

PLUG CONNECTOR

Bruce R. McFadden and Roy C. Jarrett, Harrisburg, Pa., and Bernard Edward Shlesinger, Jr., Annandale, Va., assignors to AMP Incorporated, Harrisburg, Pa.

Filed Oct. 8, 1963, Ser. No. 314,803
8 Claims. (Cl. 339—217)

This invention relates to electrical connector plugs and more particularly to spring latch hand plugs that hold against pressure on the front portion but are readily withdrawn by a pull on the rear portion.

In present day electrical equipment, it is common practice to employ connector panels or boards wherein connector plugs are inserted selectively in receptacles to connect and disconnect various control circuits. It is desirable that the plug be easily removable from the connector panel by a pull on the rear portion thereof, but not removable by a push on the front or tip portion of the contact member.

Heretofore snap latch plugs have been provided with a detent system that includes a spring detent member and detent locking means that are complex and generally include multiple parts which are expensive to manufacture and to incorporate in assembly in the plug body. If the number of parts has been reduced there still has been the problem of providing a detent system which is capable of allowing the plug to be readily inserted and removed from a panel board, to maintain the plug securely in position and to hold the plug in position upon a force being applied to the front or tip portion thereof.

One of the problems in connection with the detent system consisting of added spring parts is that the spring parts are made of material different from that of the shell portion of the plug, thereby requiring that the spring parts be manufactured separately from the shell portion. Another problem is the insertion of the spring parts into the shell portion during manufacture of the plug. A further problem is the probability that the spring parts may extend too far above the shell portion until they form a permanent engagement which is undesirable.

A variety of forms of detent systems defining detent locking means for spring detent members have been heretofore proposed, some involving separate spring elements assembled in a plug shell and others including spring elements of a form difficult to manufacture and maintain to the uniform shape and close tolerances desired for uniform detention characteristics as well as incidental elements thereof or connected thereto.

It is therefore an object of the present invention to provide a snap latch plug which is simpler and more economical in construction than previous plugs of this type.

It is another object of the present invention to avoid the use or added spring parts which are relatively costly in assembly and material and generally require more force to be removed from a plug board.

It is also an object of the present invention to provide a snap latch plug with a detent system which is rugged and will retain substantially its original characteristics over a long life.

An additional object of the present invention is to provide an effective arrangement to prevent the removal of the plug from a control panel upon force being applied to the front or tip portion thereof.

A still further object of the present invention is the provision of a detent system wherein the spring detent member thereof is integral with the plug shell and of a character susceptible to precise control of shape.

Other objects and attainments of the present invention will become apparent to those skilled in the art upon a

reading of the following detailed description when taken in conjunction with the drawings in which there is shown and described illustrative embodiments of the invention; it is to be understood, however, that this embodiment is not to be exhaustive nor limiting of the invention, but is given for purposes of illustration in the invention and principles thereof and the manner of applying it in practical use so that they may modify it in various forms, each as may be best suited to the conditions of a particular use.

In the drawings:

FIGURE 1 is a perspective view of an embodiment of a snap latch plug incorporating features of the present invention;

FIGURE 2 is a fragmentary longitudinal sectional view of the plug of FIGURE 1 illustrating the action of the detent system during insertion of the plug in a plugboard aperture;

FIGURES 3 and 4 are views similar to that of FIGURE 2 in a further stage of insertion and final position respectively of the plug in the plugboard aperture;

FIGURES 5*a* and 5*b* are sectional views taken along the lines V—V of FIGURE 1, but showing modifications thereof;

FIGURES 6*a* and 6*b* are perspective views and FIGURE 6*c* is a front view of FIGURE 6*b* of different embodiments of the detent locking means;

FIGURES 7 and 7*a* are respectively a perspective view of a plugboard assembly in which the present invention can be used and a side view of the contact assembly when engaged; and

FIGURES 8 and 9 are views similar to those of FIGURES 5*a* and 5*b* but with the embodiments of FIGURES 6*a* and 6*b* disposed within the plug.

Referring now to the drawings and in particular FIGURES 1–4, there is shown a plurality of apertures **2** disposed in a plugboard **4** adapted to receive therein snap latch plug contactors **1**. Plug **1** comprises a hollow cylindrical sleeve or shell portion **5** of a resilient conductive material such as nickel-plated full hard brass preferably rolled up from flat sheet stock into tubular form. Extending forwardly of portion **5** is a hollow tubular portion **6** which is interconnected thereto by a frusto-conical portion **7**.

At the rear portion there is provided a circumferential ridge **8** which acts as a stop means to limit movement of the plug into plugboard **4** when the plug is inserted thereinto. Extending rearwardly of ridge **8** is a securing means **9** by which conductor means **10** is mechanically and electrically connected to the plug. Securing means **9** preferably comprises a ferrule member which is crimped around the wire means of conductor means **10** by cold-forging techniques conventional in the art such as disclosed by U.S. Patent No. 2,600,012. Of course, any other means for securing the conductor means to the plug can be utilized.

An insulating sheath or sleeve **11** of a suitable plastic material is disposed around the rear portion of the plug and adjacent insulation of conductor means **10** as by molding or in any other suitable manner. Sheath **11** insulates the ferrule member or securing means **9**, supports the conductor means contiguous the securing means and provides a handle for manipulating the plug.

To form a spring detent member of the detent system, a pair of parallel slots **12** and **13** are provided in shell portion **5** and frusto-conical portion **7**, leaving therebetween the spring detent member **14** anchored in the shell portion and free from the frusto-conical portion **7**. As can be seen spring detent member **14** is in the form of a goose neck, i.e., a rear section **15** extending inwardly toward the longitudinal axis of the plug and an arcuate section **16** having a portion curved away from the longitu-

dinal axis and integral with rear section 15 and another portion curved toward the longitudinal axis. Thus, the spring detent member so formed has excellent resilient properties which provide proper retention capability after extensive repeated use. It should be pointed out that while the spring detent member is shown as extending from the rear section toward the frusto-conical section, it can be formed so as to extend in the reverse direction, i.e. from the frusto-conical section to the rear section.

While there has been illustrated a single detent spring member integrally formed in shell portion 5 and frusto-conical portion 7, another spring detent member 14' can be integrally formed in a similar manner as spring detent member 14, but diametrically therefrom as shown in FIGURE 5*a*. If desired, there can be integrally formed in the plug spring detent members 14, 14' and 14'' disposed at 120° with respect to each other as illustrated in FIGURE 5*b*. Of course, more than three spring detent members can be integrally formed in the plug.

The detent system further comprises a detent locking means 17 having a cylindrical nose section 18 disposed in tubular portion 6 and is freely movable relative thereto. Generally nose section 18 has a configuration corresponding to that of the interior surface of tubular portion 6 so that nose section 18 can effectively be guided therein. Detent locking means 17 further comprises an engaging section 19 integral with nose member 17 and having an upwardly tapering rounded portion 20 and a downwardly tapering rounded portion 21 which is similar in configuration to arcuate section 16 of spring detent member 14. The section between portions 20 and 21 has a diameter slightly smaller than the inner diameter of shell portion 5 so as to be guided thereby as well as engaging the inner surface of frusto-conical portion 7 to thereby limit the forward movement of the engaging section. The free end 16' of arcuate section 16 is rounded to decrease the frictional engagement thereof on portion 20.

As can be seen, engaging section 19 is disposed within arcuate section 16 such that downwardly tapering portion 21 engages the portion curved away from the longitudinal axis upon inward movement of the detent locking means 17 to thereby maintain the same within the plug. Thus, nose section 18 extends beyond tubular portion 6 to allow movement relative thereto upon a force being applied thereupon. The end of nose section 18 which extends beyond tubular portion 6 is rounded.

FIGURES 6*a* 6*b*, and 6*c* show different embodiments of the detent locking means. In FIGURE 6*a* there is shown a flat detent locking means 17' which comprises a rectangularly shaped nose section 18' having an outer end which is rounded. Integral with nose section 18' is an engaging section 19' having an upwardly tapering portion 20' and a downwardly tapering portion 21' similar in configuration to engaging section 19.

In FIGURES 6*b*, 6*c* there is shown a detent locking means 17'' which comprises a nose section 18'' having a cross-sectional configuration that is triangular and an integral engaging section 19'' comprising engaging portions 19*a*, 19*b* and 19*c* disposed at 120° with respect to each other and similar in configuration as engaging section 19. The outer end of nose section 18'' is preferably rounded.

FIGURE 8 shows flat detent locking means 17' disposed within the plug illustrated in FIGURE 5*a* with upwardly tapering portions 20' and downwardly tapering portions 21' being in alignment with spring detent members 14, 14'. FIGURE 9 shows detent locking means 17'' disposed within the plug illustrated in FIGURE 5*b* with engaging portions 19*a*, 19*b* and 19*c* being in respective alignment with spring detent members 14, 14' and 14''. The spring detent members in the embodiments of FIGURES 8 and 9 maintain the engaging sections of the detent locking means therewithin.

Of course, it is desirable to provide the inner surface of tubular portion 6 with the same configuration as nose sections 18, 18' and 18'' in order to effectively guide the detent locking means therein. The edges of nose sections 18' and 18'' are preferably rounded to decrease the frictional engagement thereof with the inner surface of tubular portion 6.

While there has been shown detent locking means having different configurations, it is to be understood that other configurations can be utilized.

FIGURE 7 shows a plugboard assembly in which the present invention can be used. In FIGURES 7 there is shown a fixed plugboard panel of any suitable electrical insulating material and generally designated at 4' is provided with rows and columns of apertures 2' which are adapted to receive therein a set of spring contact members 22. As best shown in FIGURE 7*a*, contact members 22 are the terminals for the leads 49 which electrically couple the fixed panel to the sensing elements and the operative instrumentalities of the computing machine or the like, not shown. Contact members 22 may take any suitable form, but it is preferred that these contacts have the characteristics as disclosed in the copending application to William S. Watts, Serial No. 409,603, filed February 11, 1954, now Patent No. 2,882,508. Cooperating with contact members 22 to effect the desired circuit interconnections within the accounting machine is a set of plug contact members 1 that are adapted to be received by a plurality of apertures 2, corresponding to apertures 2' in control plugboard panel 4, which also is of suitable insulating material.

To permit the control panel to be detached from the plugboard assembly, panel 4 is slidably mounted in channels 26 of a rotatable carrier frame 27 pivotally mounted at the base of a fixed frame 29 in which plugboard 4' is mounted and by which the plugboard assembly is supported on the computing machine. Pivotal movement of carrier frame 27 carries control panel 4 to a position parallel to fixed panel 4', subsequent rectilinear motion thereof along the fixed plugboard being effective to cause engagement of the sets of contacts.

The above plugboard assembly is disclosed in U.S. Patent No. 2,927,295 to G. C. Sitz, and further description of this plugboard assembly is deemed non-essential to the understanding of the present invention, therefore, reference is made thereto for any desirable details thereof. Of course, the present invention can be used in any other suitable plugboard.

Operation

When the plug is inserted into an aperture 2 of a plugboard 4, the arcuate section 16 of spring detent member 14 is cammed inwardly toward the longitudinal axis of the plug by the engagement of the outer front inclined surface thereof with the outer opening of the aperture (see FIGURE 2). If the detent locking means 17 is positioned forwardly within the plug, the inner front inclined surface of the arcuate section 16 will engage upwardly tapering portion 20 to thereby move the detent locking means 17 rearwardly.

After the plug has entered the outer opening of the aperture, the arcuate section 16 is maintained inwardly thereby during inward movement of the plug within the aperture as shown in FIGURE 3.

Upon complete insertion of the plug within the aperture with ridge 8 in engagement with the outer surface of the plugboard, spring detent member 14 moves beyond the inner opening of the aperture as shown in FIGURE 4. In this position spring detent member 14 provides a retentive force sufficient to maintain the plug within its aperture in spite of vibration effects and any other similar effects that would tend to normally cause the plug to work free of the plugboard.

If a force is applied to nose portion 18, as when movable panel 4 is carried to a position parallel to stationary panel 4' in conjunction with the panel assembly of FIGURE

7, detent locking means **17** is moved relative to the plug proper such that engaging section **19** engages the portion of arcuate section **16** curved away from the longitudinal axis and integral with rear section **15** thereby exerting an outward force on spring detent member **14** through camming action wherein spring detent member **14** is pressed further beyond the inner opening of the aperture than the normal position thereof, thereby establishing a locking arrangement. Thus, the plug is locked in position so that it will not be pushed out of its aperture, and as a result a good connection is established between the plug and contact member **22**.

Of course, forces can be applied to the nose portion other than that mentioned above which will provide the same locking arrangement and the plug can be used in plugboards other than the one used to explain the operation of the plug.

To remove the plug from the plugboard, a pull is exerted on sleeve **11** which causes the inner opening of the aperture to move the spring detent member inwardly through camming action until the detent spring member is within the aperture as shown in FIGURE 3, and the detent locking means **17** is moved outwardly relative to the plug proper until it abuts the inner surface of frusto-conical portion **7**. Upon complete removal of the plug, the spring detent member will assume its normal position. To facilitate insertion of the plug into an aperture, the aperture can be slightly tapering from a smaller inner diameter to a slightly larger outer diameter.

It can be discerned that there has been disclosed an electrical connector plug having a novel detent system which contains an effective locking arrangement with a minimum of parts and wherein the spring detent member is an integral part of the shell body portion of the plug.

It will, therefore, be appreciated that the aforementioned and other desirable objects have been achieved; however, it should be emphasized that the particular embodiments of the invention, which are shown and described herein, are intended as merely illustrative and not as restrictive of the invention.

We claim:

1. A plug connector for insertion in an aperture in a plugboard comprising a hollow cylindrical sheet metal sleeve, a pair of longitudinally extending slots circumferentially spaced in said sleeve, said slots releasing therebetween a spring detent member integrally anchored at one end to said sleeve and having a curved portion extending above the surface of said sleeve, and detent locking means having a nose portion extending beyond one end of said sleeve and an engaging portion for engaging said curved portion of said spring detent member, said engaging portion of said detent locking means being disposed within the curved portion of said spring detent member, said detent locking means being movable relative to said sleeve upon a pressure being applied to said nose portion to move said spring detent member beyond its normal position to thereby lock the plug connector in the plugboard.

2. A plug connector according to claim **1**, wherein said nose portion of said detent locking means is round and said engaging portion is round having an upwardly curved section extending from said nose portion and an inwardly curved section extending from said upwardly curved section.

3. A plug connector for insertion in an aperture in a plugboard comprising a hollow sheet metal sleeve, longitudinally extending slots circumferentially spaced in said sleeve, pairs of said slots releasing therebetween spring detent members, each of said spring detent members being integrally anchored at one end to said sleeve and having a curved portion extending outwardly from the surface of said sleeve, and detent locking means having a nose portion extending beyond one end of said sleeve and an engaging portion for engaging the curved portions of said spring detent members, said engaging portion of said detent locking means being disposed within the curved portions of said spring detent members to maintain same therewithin, said detent locking means being movable relative to said sleeve upon a pressure being applied to said nose portion to move said engaging section into engagement with said spring detent members to thereby lock the plug connector in the plugboard.

4. A plug connector according to claim **3**, wherein said detent locking means is flat.

5. A plug connector according to claim **3**, wherein said nose portion of said detent locking means is substantially triangular in cross-section and said engaging portion has three sections disposed about 120° with respect to each other.

6. A plug contactor of the type utilized to complete selected electrical circuits by engagement with contact means comprising a contactor sleeve having an outside surface of a configuration to slidably fit within an aperture of a panel means and a nose section extending beyond said panel means for engagement with said contact means, said nose section having an opening extending therethrough; a wire-receiving section on said contactor sleeve located remotely from said nose section; a spring detent means released from a U-shaped slot in said contactor sleeve and having one end anchored to said contactor sleeve, an elongated section extending from the anchored end and a free end of arcuate configuration which extends outwardly from the surface of said contactor sleeve in a normal position of rest; and detent locking means having a first section disposed in said opening of said nose section and extending slightly outwardly therefrom and a second section disposed within the arcuate configuration of said free end of said spring detent means; said detent locking means adapted to move relatively to said contactor sleeve upon a force being applied to said first section thereof which causes said second section to engage said arcuate configuration to prevent same from moving inwardly from said normal position of rest.

7. In a plug contactor adapted to be locked against being pushed from an aperture of a plugboard, a conductive sleeve member including a first portion having a diameter to fit within said aperture and a second portion which extends beyond said plugboard for engagement with a contact member, said second portion having an opening therein; spring detent means on said sleeve member, said spring detent means being a stamped-out part of said sleeve member and defining an elongated member extending substantially parallel to the longitudinal axis of said sleeve member, said elongated member having one end anchored to said sleeve member while the other end and sides are free therefrom, said elongated member at the free end thereof defining an arcuate-shaped portion having a section that extends outwardly from the surface of said sleeve member, said spring detent means moving toward the longitudinal axis upon insertion and withdrawal of the plug contactor into and from said aperture and moving away from the longitudinal axis to a position of rest upon complete insertion and withdrawal of the plug connector into and from said aperture, said section of said arcuate-shaped portion extending beyond said aperture when said plug contactor is completely inserted therein; and detent locking means having a first section disposed in said opening of said section portion of said sleeve member and extending therebeyond and a second section disposed within said arcuate-shaped portion, said detent locking means being movable relative to said sleeve member and adapted to lock said plug contactor when in said aperture upon a force being applied to the first section of said detent locking means which causes said second section thereof to engage said arcuate-shaped portion thereby preventing said section of said arcuate-shaped portion from moving inwardly from said position of rest adjacent said aperture.

8. In a plug contactor, a sleeve having a support portion and a nose portion; a nose member disposed in said nose portion for sliding movement axially therealong, said nose member including an engaging section and a nose section protruding from said nose portion; a pair of spaced slots in said sleeve, said slots releasing therebetween a spring detent member integrally anchored at one end to said sleeve and having a curved portion extending outwardly from the surface of said sleeve; said engaging section of said nose member being disposed within said curved portion and held captive within said sleeve by the rear surface thereof; said engaging section adapted to engage the rear surface of said curved portion upon a force being applied to said nose section to prevent said curved portion from moving inwardly.

References Cited by the Examiner

UNITED STATES PATENTS

2,624,774	1/53	Cunningham	339—217
2,691,146	10/54	Pollock	339—217
2,779,929	1/57	Sesny et al.	339—217
2,903,670	9/59	Sitz	339—217 X
2,980,883	4/61	Scheller	339—217 X
2,983,978	5/61	Wilgus.	
3,008,118	11/61	Mavity	339—217
3,085,222	4/63	Watts	339—217

OTHER REFERENCES

Twin Detent Patchcords by AMP, AMP Incorporated, Harrisburg, Pa., copyright, 1962.

JOSEPH D. SEERS, *Primary Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,206,718 September 14, 1965

Bruce R. McFadden et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 56, for "or" read -- of --; column 6, line 35, for "relatively" read -- relative --; line 60, for "connector" read -- contactor --.

Signed and sealed this 5th day of April 1966.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents