ABSTRACT: A one piece plug connector comprising a front portion, an intermediate portion and a rear portion and said plug connector having an integral locking member comprising a detent and a release member, an opening in the front portion for the detent and an opening in the rear portion for a release member; and said plug connector being formed from a one piece blank of material having a detent cutout on the front portion and the locking member extending along one side and parallel to that side edge of the blank.
ONE-PIECE CONNECTOR INCLUDING RELEASE MEANS

This invention relates to electrical connector plugs, and more particularly to spring latch hand plugs which lock the plug in a receptacle such as a panel or board and which is provided with means on the rear of the plug for manually releasing the plug from the board. This application is related to one-piece plug connectors such as disclosed in my U.S. Pat. No. 3,275,973 issued Sept. 27, 1966, and my application, Ser. No. 558,043 June 16, 1966.

HISTORICAL BACKGROUND

In present day electrical equipment, it is common practice to employ connector panels or boards wherein connector plugs are inserted selectively into 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.

Hereinafter, snap latch plugs have been provided with a detent system that includes a spring dent member and a dentent 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 dentent system which is capable of allowing the plug to be readily inserted and removed from a plugboard, 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 dentent system consisting of added spring parts is that the spring parts were 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. With the one-piece plug connector as illustrated in the above-mentioned patent and application, no provision is made for providing a permanent lock against withdrawal from the rear. In some instances, it is necessary to provide a positive lock which not only prevents the plug from being pushed out from the front or tip portion, but also prevents the plug from being pulled out from the rear of the board or the like.

OBJECTS AND SUMMARY

It is, therefore, an object of the present invention to provide a one-piece snap latch plug which is simple and economical to manufacture and which can be blanked from a sheet of material by simple stamping operation and which positively locks the plug in the panel or board or the like from being accidentally pushed out or pulled out.

It is another object of this invention to provide a plug which eliminates the necessity of having additional parts which require a costly assembly and material.

A further object of this invention is to provide a snap latch plug with a dentent system which is rugged and will retain substantially its original characteristics over a long life.

An additional object of this invention is to provide a latch means for a one-piece plug which can be manually operated either by a tool or by hand.

Still a further object of this invention is to provide a plug which can be precisely controlled under manufacturing conditions.

Another object of this invention is to provide a release mechanism for one-piece plug which requires little force to operate due to the utilization of a fulcrum principle.

Still another object of this invention is to provide a spring release latching mechanism for a one-piece plug.

To summarize this invention, it relates to a one-piece plug having a manually releasable latching member which in normal position maintains the plug in a block against pull out or pushout.

These and other objects of this invention will be apparent from the following description and claims.

In the accompanying drawings which illustrate by way of example various embodiments of this invention:

FIG. 1 is a plan view of the configuration of a piece of material for a plug connector prior to formation thereof;

FIG. 2 is a perspective view of the plug connector after formation thereof from the material of FIG. 1;

FIG. 3 is a sectional view in elevation of the plug connector of FIG. 2 in fully inserted position in an aperture of a plugboard showing the locking number in latched position;

FIG. 4 is a sectional view in elevation similar to that of FIG. 3 and showing the locking member in unlatched position for removal of the plug from the plugboard;

FIG. 5 is a top plan view of the plug illustrated in FIG. 2.

FIGS. 6 through 9 are fragmentary cross-sectional views showing other embodiments of the present invention with FIG. 7 showing the front portion of a releasing tool for the locking mechanism;

FIG. 10 is a plan view of a blank used for the plug connector illustrated in FIGS. 7 and 9;

FIG. 11 is a plan view of a blank for an additional embodiment of the present invention;

FIG. 12 is a sectional view of a plug connector of FIG. 11 illustrated with the conductor lead cramped and sealed;

FIG. 13 is an enlarged cross-sectional view taken along the lines 13–13 in FIG. 12 and viewed in the direction of the arrows;

FIGS. 14 and 15 are a cross-sectional view and a planned view respectively of a formed plug and a blank illustrating yet another embodiment of this invention;

FIGS. 16 and 17 are a cross-sectional view and a planned view respectively of a formed plug connector and the blank illustrating yet another embodiment of this invention;

FIGS. 18 and 19 are cross-sectional views illustrating yet additional embodiments of this invention.

FIGURES 1 THROUGH 5

The plug 10 as best shown in FIGS. 2 and 5 are formed from a blank 12. The blank consists of a forward portion 14, an intermediate portion 16, and a rear portion 18. In general, the blank 12 has a rectangular appearance. The forward portion 14 is provided with cutouts 20 and 22 which form the nose 24 of the plug 10. A locking or latching member 26 is formed in the blank 12 and extends parallel to the left edge 28 of the blank 12 as viewed in the drawings. The latching member 26 is spaced from the edge 28 a distance equal to the forward edge 30 of the slot 32. A shoulder 34 substantially equal in length to the forward edge 30 is formed on the other side of the latching member 26. The right-hand edge 36 of the blank 12 is cutout as at 38 so as to form a shoulder 40.

The rear portion 18 includes a struckout stop 42 and a cutout notch 44 formed in the right edge 36.

When the blank 12 is formed into the plug 10, the locking member 26 forms a detent 46 and a release finger 48 which is formed in the release arm 50. The detent 46 is integrally hinged at 52 to the forward portion 14. In assembly, the hinge 52, the forward edge 30, the shoulder 34, and the shoulder 40 form a slot 54 for receiving the detent 46 which is inclined rearwardly and is provided with an abutment member 56 which projects into the slot 54 in an area adjacent the shoulder 40. The release arm 50 extends from the forward portion 14 past the intermediate portion 16 to the rear portion 18. The lead 58 is cramped or otherwise secured to the rear portion 18. The cramped area 60 may be insulated by an insulating cap 62. The release finger extends upwardly from the release arm into the cutout notch 44 as best illustrated in FIG. 5.

In FIGS. 3 and 4, the plug is shown inserted into a panel, base, receptacle or the like 64. The nose 66 of the plug formed by the nose cutouts 20 and 22 engages the contact member 68 which may project from another board, etc.

FIG. 3 shows the latching member 26 with the detent 46 and release finger 48 in locking engagement so as to prevent push out or pull out of the plug 10. In FIG. 4, the latching member
26 is shown in a release position with the detent 46 and the release finger 48 depressed to allow for withdrawal of the plug 10. The blank 12 from which the plug 10 is formed is of conductive metal and may be plated as desired.

FIGURES 6 THROUGH 10
In FIG. 6, the plug 70 is provided with a locking member 72 having a detent 74 and a release finger 76. The detent 74 projects from the slot 78 and the release finger 76 projects from the slot 80. The slot 78 is on the forward member 82 and the slot 80 is on the rear member 84. A fulcrum 86 is provided in the intermediate member 88 to permit a locking action by the locking member 72. The solid line position of locking member 72 as illustrated in FIG. 6 shows the locking position and the phantom line position illustrates the release position of the locking member 72. A stop 90 similar to stop 42 is provided. The fulcrum 86 is formed by dimpling or indenting the plug 70 in the intermediate member 88.

In FIG. 7, the plug 92 is provided with a stopper cutout 94 in the rear portion 96. The front portion 98 includes the detent 100 and the release arm 102. The release arm 102 extends rearwardly and the cutout 104 which permits the insertion of a release tool 106 which engages the release arm 102 to depress it thereby to hinge downwardly the detent 100 in the slot 108 allowing or permitting withdrawal of the plug 92. In FIG. 8, the plug 110 shows the locking member 112 as having a detent 114 and the release arm 116 with a release finger 118 having a release flange or shoulder 120. The release finger 118 extends through a slot 122 opposite to the slot or cutout 124 for the detent 114. The slots or cutouts 122 and 124 are axially aligned. A strengthening member 126 is provided in the release arm 116 in order to reduce bowing of the release arm and permit greater leverage of action so as to depress the detent 114 when the release flange on the release finger is lifted. The strengthening or reinforcing means 126 is best illustrated in FIG. 10. It may be bent downwardly as illustrated in FIG. 8.

In FIG. 9, the plug 128 with a locking member 130 provided with a detent 132 and the release arm 134. The release arm 134 is provided with a release finger 136 extending from the cutout 138. A stop 140 is provided in the plug 128. In this instance, the release arm as shown in FIG. 9 extends rearwardly from the bottom of the plug towards the top of the plug 128. Thus, when the release finger 136 is pushed in a forward direction, the detent 132 in the cutout 142 moves downwardly and forwardly as illustrated in the phantom lines for releasing the plug 128.

FIG. 10 illustrates the blank 144 used to form the plug illustrated in FIG. 9. The shoulders 146 and 148 and the edge 150 form the front and rear walls of the slot 142.

FIGURES 11 THROUGH 15
In FIG. 11, the blank 152 is provided with a locking member 154 extending rearwardly from the connecting piece 156. Struckout 158 is the stop member and cutout 160 receives the connecting piece 156 which is turned inwardly as illustrated in FIGS. 12 and 13. Cutout 162 receives detent 164. Cutout 166 receives release finger 168. It is to be noted that the cutouts 162 and 166 are on the opposite side of the plug 170 from the cutout 160.

In FIG. 14, the plug 172 formed from the blank 174 illustrated in FIG. 15 shows the connecting piece 176 in the rear portion of the plug rather than in the forward portion as illustrated in FIGS. 11 through 13. The plug 172 is provided with a stop or struckout 178. The cutout 180 receives a tool operating similar to that described with reference to that of FIG. 7. The slot or cutout 182 receives the detent 184 formed in the locking member 186. It is to be noted that the locking member 186 extends forwardly in FIGS. 14 and 15 rather than rearwardly as in the previous figures described. The cutout 188 is provided for receiving the connecting piece 176 of the locking member 186.

In FIGS. 16 through 19, the locking members generally indicated by 190 extend forwardly from the rear portion 192. There is not connecting piece as in FIGS. 11 through 15. The plug 194 of FIG. 16 if formed from the blank 196 of FIG. 17. The detent 198 extends into the slot or cutout 200. The release cutout 202 is made to receive a tool for depression of the locking member 190 to release the detent 198 for withdrawal or insertion of the plug. A stop 204 is provided for limiting the insertion of the plug in a plugboard as heretofore described with reference to other modifications.

In FIG. 18, the plug 206 is provided with a fulcrum 108 for the locking member 210. The cutout 212 permits insertion of a tool for depressing the locking member 210 to withdraw the detent 214 from the slot 126. The fulcrum 208 is formed in the intermediate section of the plug which is the portion of the plug axially encompassed between the front and rear surfaces of the board on which the plug is inserted.

FIG. 19 shows the plug 218 with the locking member 220 having a release finger or member 222 which is formed by doubling the locking member back on itself. The release finger 222 extends into the slot 224. When the release member 222 is depressed, the locking detent 226 is withdrawn into the slot 228 to permit withdrawal of the plug 218. A stop member 230 is also provided for purposes aforementioned.

While the invention has been described in connection with different embodiments thereof, it will be understood that it is capable of further modification, and this application is intended to cover any variations, uses, or adaptations of the invention following, in general, the principles of the invention and including such departures from the present disclosure as come within known or customary practice in the art to which the invention pertains, and as may be applied to the essential features hereinbefore set forth and fall within the scope of the invention or the limits of the appended claims.

What I claim is:

1. A one-piece electrical plug connector adapted to be inserted within a receptacle comprising:
   a. a one-piece sleeve having front, intermediate and rear portions
   b. said front portion having a detent opening in the wall of said sleeve
   c. said rear portion having a release opening in the wall of said sleeve,
   d. a spring locking member connected to and integral with said sleeve and extending inside said sleeve and including a detent extending through said detent opening and a release arm,
   e. said release arm extending from said detent toward said rear portion and beneath said release opening,
   f. said sleeve having a longitudinal seam extending from front to rear along one side of said sleeve and
g. said spring locking member extending in a direction generally parallel to said seam.

2. A one-piece connector as in claim 1 and wherein:
   a. a locking member connection to said sleeve is on said front portion.

3. A one-piece plug connector as in claim 2 and wherein:
   a. said locking member connection and said sleeve is on the side of said sleeve opposite said detent opening.

4. A one-piece plug connector as in claim 2 and wherein:
   a. said locking member connection to said sleeve is on the same side of said sleeve as said detent opening.

5. A one-piece plug connector as in claim 2 and wherein:
   a. said locking member connection to said sleeve is on the side of said sleeve opposite said release opening.

6. A one-piece plug connector as in claim 2 and wherein:
   a. said locking member connection to said sleeve is on the same side of said sleeve as said release opening.

7. A one-piece plug connector as in claim 2 and wherein:
   a. said locking member connection to said sleeve is on the side of said sleeve opposite said release and detent openings.

8. A one-piece plug connector as in claim 2 and wherein:
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8 a. said locking member connection to said sleeve is on the same side as said release and detent openings.

9. A one piece plug connector as in claim 2 and wherein:
   a. said release and detent openings are axially aligned.
   b. A one piece plug connector as in claim 2 and wherein:
   a. said locking member connection is axially offset from said detent opening.

11. A one piece plug connector as in claim 2 and wherein:
   a. substantially the entire locking member lies within said sleeve.
   b. A one piece plug connector as in claim 2 and wherein:
   a. said locking member connection includes reinforcing means.
   c. A one piece plug connector, as in claim 2 and wherein:
   a. said sleeve includes a fulcrum for said locking member.

14. A one piece plug connector as in claim 13 and wherein:
   a. said fulcrum is in said intermediate portion.

15. A one piece plug connector as in claim 2 and wherein:
   a. said release arm includes a projecting member positioned adjacent said release opening for release actuation of said release arm.
   b. A one piece plug connector as in claim 15 and wherein:
   a. said release arm projecting member includes a lift flange.

17. A one piece plug connector as in claim 2 and wherein:
   a. said release arm is substantially flat.

18. A one piece plug connector as in claim 1 and wherein:
   a. said locking member connection to said sleeve is on said rear portion.

19. A one piece plug connection as in claim 18 and wherein:
   a. said locking member connection and said sleeve is on the side of said sleeve opposite said detent opening.

20. A one piece plug connection as in claim 18 and wherein:
   a. said locking member connection to said sleeve is on the same side as said sleeve as said detent opening.

21. A one piece plug connection as in claim 19 and wherein:
   a. said locking member connection to said sleeve is on the side of said sleeve opposite said release opening.

22. A one piece plug connection as in claim 18 and wherein:
   a. said locking member connection to said sleeve is on the same side as said sleeve as said release opening.

23. A one piece plug connection as in claim 18 and wherein:
   a. said locking member connection to said sleeve is on the side of said sleeve opposite said release and detent openings.

24. A one piece plug connection as in claim 18 and wherein:
   a. said locking member connection to said sleeve is on the same side as said release and detent openings.

25. A one piece plug connection as in claim 18 and wherein:
   a. said release and detent openings are axially aligned.

26. A one piece plug connection as in claim 18 and wherein:
   a. said locking member connection is axially offset from said detent opening.

27. A one piece plug connection as in claim 18 and wherein:
   a. substantially the entire locking member lies within said sleeve.

28. A one piece plug connection as in claim 18 and wherein:
   a. said rear portion includes a stop member shaped for positioning abutment against a surface of the receptacle.

29. One piece plug connection as in claim 18 and wherein:
   a. said locking member includes reinforcing means.

30. A one piece plug connection as in claim 18 and wherein:
   a. said sleeve includes a fulcrum for said locking member.

31. A one piece plug connection as in claim 30 and wherein:
   a. said fulcrum is in said intermediate portion.

32. A one piece plug connection as in claim 18 and wherein:
   a. said release arm includes a projecting member positioned adjacent said release opening for release actuation of said release arm.

33. A one piece plug connection as in claim 32 and wherein:
   a. said release arm projecting member positioned adjacent said release opening for release actuation of said release arm includes a lift flange.

34. A one piece plug connector comprising:
   a. a sleeve having front, intermediate and rear portions.
   b. said front portion having a detent opening.
   c. said front opening having front and rear edges.
   d. a spring locking member including a hinge connected to and integral with said sleeve.
   e. said spring locking member including a detent having an upwardly and rearwardly extending portion projecting above the surface of said sleeve and a downwardly extending portion connected to said upwardly extending portion substantially perpendicular with the axis of said sleeve.
   f. said downwardly extending portion entering said detent opening adjacent said rear edge, and
   g. said front edge of said detent opening being said hinge, and
   h. said sleeve having means integral therewith for moving said detent to a release position.

35. A one piece plug connector as in claim 2 and wherein:
   a. said rear portion includes a stop member projecting outwardly from said sleeve for positively positioning said plug connector in a receptacle.

36. An electrical terminal of the type adapted to be inserted into a socket of a terminal block and having a hollow elongate body formed of resilient sheet material and having a forward end and a rear end, said forward end being adapted for telescopic connection with another terminal and said rear end having means thereon for connection with an electrical conductor, said body having a longitudinal seam along one side thereof defined by opposed edge portions of the sheet material from which the terminal is formed, one of said edge portions having a tab struck inwardly therefrom, said tab extending lengthwise of the terminal and having its forward end portion connected to the body and its rear end portion free, said tab being bent radially outwardly of the body at said rear end portion so that the free end of the tab projects radially outwardly beyond the outer surface of the body adjacent said seam, the opposite edge portion of the body having a lug thereon which extends circumferentially over the inwardly struck portion of the tab, said lug having a rear edge which is disposed forwardly and closely adjacent the radially projecting free end portion of the tab.

37. A terminal as called for in claim 36 wherein the portion of the tab adjacent its connection with the body is substantially flat to permit the tab to flex readily in a radial direction.

38. A terminal as called for in claim 36 wherein the portion of the tab between its connection with the body and said radially outwardly bent free end is disposed radially inwardly of the inner surface of said body.

39. A terminal as called for in claim 36 wherein the circumferentially extending lug has an axial extent substantially less than the axial extent of the inwardly struck portion of the tab.

40. A terminal as called for in claim 36 wherein said body is of generally cylindrical shape nd cross section and said lug lies in the cylindrical surface of the body.

41. A terminal as called for in claim 36 wherein said tab is defined in part by a lanced edge on the body which extends longitudinally of the body, the free end of the lug abutting said lanced edge on the body.

42. A terminal as called for in claim 36 wherein said tab is defined in part by a lanced edge on the body which extends longitudinally of the body, the portion of said lanced edge and said opposite edge of the body adjacent the radially outwardly bent free end of the tab being shaped to provide clearance for the adjacent side edges of the tab to thereby permit the tab to flex readily.

43. A terminal as called for in claim 36 wherein the portion of said body diametrically opposite said tab is defined by a substantially continuous circumferentially extending surface.

44. A terminal as called for in claim 36 wherein said tab is connected to the body along a line extending transversely of the tab.
45. A terminal as called for in claim 36 wherein the tab is connected to the body along a line extending longitudinally of the tab adjacent the end thereof opposite said free end.

46. A terminal as called for in claim 36 wherein the tab is connected with the body of the terminal by a connecting portion defined by a pair of spaced-apart bend lines.

47. A terminal as called for in claim 36 wherein said body has a portion spaced rearwardly of said projecting portion of the tab which is circumferentially continuous.

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