

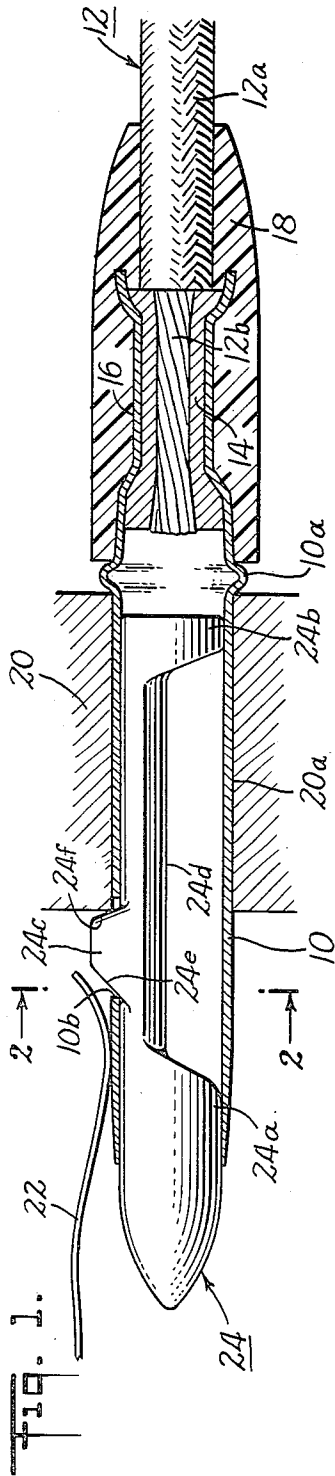
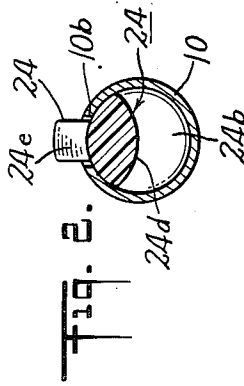
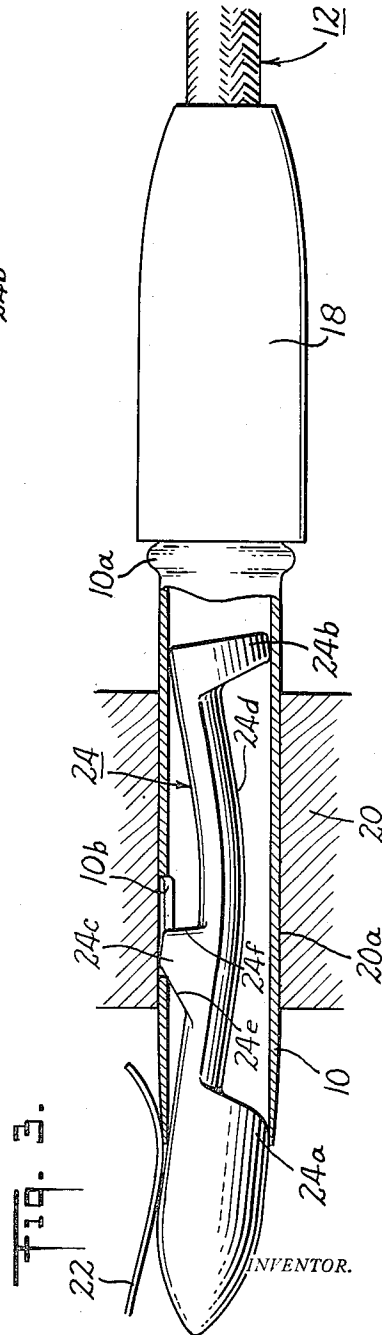
Aug. 7, 1956

W. S. WATTS
PLUG CONNECTOR

2,758,290

Filed May 19, 1953

2 Sheets-Sheet 1



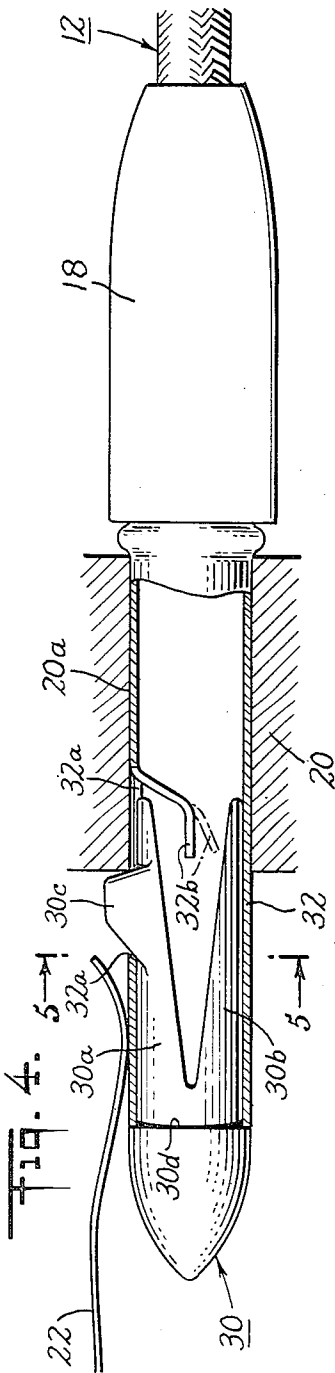
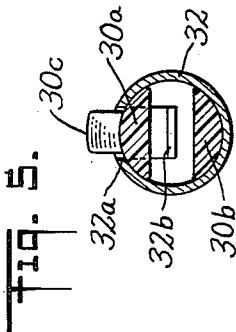
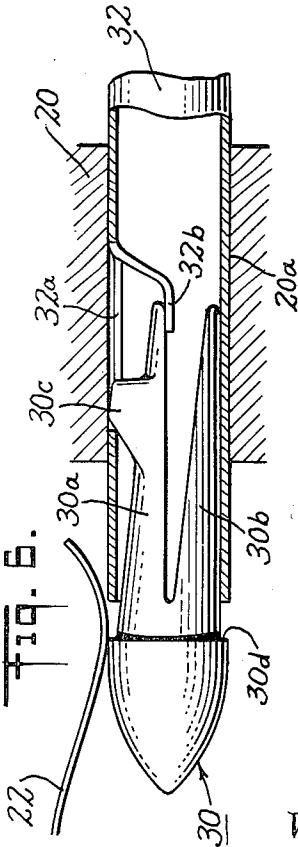
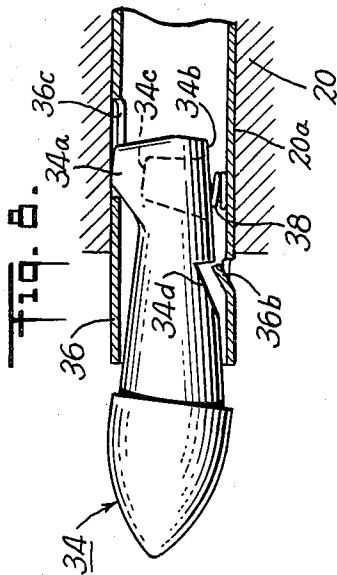
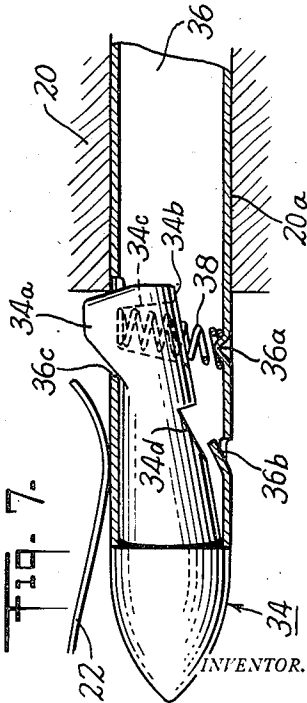
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W. S. WATTS
PLUG CONNECTOR

2,758,290

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2 Sheets-Sheet 2



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2,758,290

PLUG CONNECTOR

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5 Claims. (Cl. 339—91)

This invention relates to plug contactors of the type used, for example, in plugboards for automatic computers, tabulators, accounting machines and the like, which may be withdrawn from the plugboard by pulling the electrical conductor to which the plug is attached, but which may not normally be pushed from the plugboard by pressure on the nose of the plug.

It is among the objects of the present invention to provide a plug of the type described which is simpler and more economical in construction than previous plugs of this type. It is also an object of the invention to provide a plug which can be pushed from the plugboard by pressure on the nose of the plug, but which requires a substantially greater force to accomplish this than is required for pulling the plug from the plugboard. Another object is that of providing a plug which may be assembled easily but which is not subject to accidental disassembly during use or handling. Other objects of the invention will be in part apparent and in part pointed out hereinafter.

In the drawings:

Figure 1 is a longitudinal sectional view of a plug embodying features of the present invention, with the plug being shown in fully inserted position in a plugboard;

Figure 2 is a transverse sectional view of the plug taken generally along the line 2—2 of Figure 1;

Figure 3 is a view similar to that of Figure 1 but showing the plug in partially withdrawn position with respect to the plugboard;

Figure 4 is a side view, partially in section, of an alternative form of plug embodying features of the invention;

Figure 5 is a transverse section taken generally along the line 5—5 of Figure 4;

Figure 6 is a fragmentary longitudinal sectional view of the plug shown in Figures 4 and 5, with the plug shown in partially withdrawn position with respect to the plugboard;

Figure 7 is a fragmentary longitudinal sectional view of still another form of plug embodying features of the invention; and,

Figure 8 is a view similar to Figure 7, showing the plug in partially withdrawn position with respect to the plugboard.

The plug shown in Figures 1-3 comprises a hollow cylindrical sleeve 10 of a conductive metal, suitably brass which is formed by drawing and then nickel-plated, the sleeve being attached at the rearward end of the plug (the right-hand end as viewed in Figures 1 and 3) to an insulated wire 12. The insulation 12a is stripped from the end portions of the wire 12 to expose the stranded inner conductor 12b for a short distance. The bare wire end 12b is then inserted into a bushing or ferrule 14 in the rear end portion of the sleeve 10 and the assembly is secured together as by crimping at 16. The bushing 14 is formed of a relatively soft, conductive metal such as pure, annealed copper and the crimping results in cold forging the bushing and the conductor 12b into a solid mass. This not only results in an excellent

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electrical connection between the conductor 12b and the sleeve 10 but also produces a connection of sufficient mechanical strength to withstand the tensile stresses to which the conductor 12 and sleeve 10 will be subjected in normal use.

After the connection has been crimped, an insulating sheath 18 of a suitable resin, for example polyvinyl chloride, is molded onto the rearward end of the sleeve 10 and the adjacent portion of the insulated wire 12. This sheath 18 not only electrically insulates the end portion of the sleeve 10 but supports the insulated wire 12 adjacent the sleeve and increases its resistance to bending fatigue, while affording a convenient grip by which the rear end of the plug may be grasped for inserting the plug into or withdrawing it from the plugboard.

In Figure 1, the plug is shown in fully inserted position in a plugboard 20 which is provided with a number of cylindrical openings such as 20a which are adapted slidably to receive the sleeve 10 of the plug. The sleeve 10 is provided with an outwardly projecting crimp 10a just ahead of the forward end of the insulation sheath 18 to act as a stop when inserting the plug in the plugboard.

When the plug is in the fully inserted position, as shown in Figure 1, the forward end of the sleeve 10 is conductively engaged by a spring contact 22 within the electrical device with which the plugboard is used, in order to complete an electrical circuit.

The forward end of the sleeve 10 is open and in it is slidably received a nose member 24, which is suitably a relatively hard, tough and stiffly flexible plastic, for example, nylon, and advantageously may be formed by injection molding. It is provided near its opposite ends with cylindrical supporting portions 24a and 24b which fit snugly within the hollow interior of the sleeve 10 and support the nose member in properly aligned relationship with respect to the longitudinal axis of the sleeve.

Between these supporting portions 24a and 24b the nose member 24 is provided at one side with an integral latch 24c which projects laterally from the nose member 24 through an opening 10b in the sleeve 10 to a normal outer position, shown in Figure 1, at which it is beyond the outer surface of the sleeve 10 and in position for engagement with the rear face of the plugboard 20. On the opposite side of the nose member 24 from the latch 24c and intermediate the supporting portions 24a and 24b, the nose member 24 is provided with an elongated recess 24d. This recess reduces the cross-sectional area of the intermediate portion of the nose member 24 and renders it resiliently flexible so that it may be bowed or sprung to permit the latch 24c to be depressed at least to an inner position, illustrated in Figure 3, where it is substantially flush with the outer surface of the sleeve 10 and thereby allow the plug to be inserted into or withdrawn from the plugboard 20. It is, of course, necessary that the depth of the recess 24d be at least equal to the height of the latch 24c above the outer surface of the sleeve 10, so that there will be sufficient clearance between the bottom of the recess and the adjacent inner surface of the sleeve 10 to permit flexing of the nose member to the extent required for depressing the latch 24c to its inner, flush position.

The leading and trailing edges of the latch, 24e and 24f, respectively, are inclined or bevelled so as to form acute angles with the sleeve 10, the angle of the leading edge 24e being somewhat shallower than that of the trailing edge 24f.

When the plug is inserted into the plugboard 20, the leading edge 24e of the latch engages the front face of the plugboard and the latch is cammed to its inner position. When the plug has been inserted fully into the

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plugboard, as shown in Figure 1, the latch springs back outwardly and is engaged behind the rear face of the plugboard.

With the plug thus positioned in the plugboard, a rearward pull on the wire 12 or insulation sheath 13 will move the sleeve 10 rearwardly and squeeze the latch 24c between the forward edge of the opening 10b in the sleeve and the rear face of the plugboard. Because of the slope of the leading and trailing edges of the latch, this pressure will result in camming the latch to its inner position to allow the plug to move out of the plugboard. As soon as the latch 24c clears the front of the plugboard, it will spring back to its outer position, and, by camming action with the leading edge of the opening 10b in the sleeve, draw the nose member 24 back into proper longitudinal position within the sleeve 10. It will therefore be understood that the angle of the leading edge 24e of the latch should be shallow enough so that the latch may be readily cammed inwardly for insertion or removal of the plug from the plugboard, but steep enough so that the latch may spring back outwardly and draw the nose member 24 back into the sleeve 10. An angle of 45° for the leading edge 24e has been found satisfactory.

When the plug is in its fully inserted position, any pushing force applied on the forward end of the plug, i. e., upon the nose member 24, will press the trailing edge 24f of the latch against the rear face of the plugboard. Because of the inclination of the trailing edge 24f of the latch, there is a tendency for the latch to be cammed in as a result of such pressure. But, since a pushing force on the nose member 24 brings into camming action only the relatively steep trailing edge 24f of the latch, as contrasted to a pulling force on the wire 12 or insulation sheath 13, which brings into camming action both the leading and trailing edges of the latch, a substantially greater force must be applied to push the plug out of the plugboard than is required to pull the plug from the plugboard.

This capability of the plug to be pushed from the plugboard upon the application of a moderately high pressure tends to prevent the plug from being pushed accidentally from the plugboard, as, for example, when the plugboard is placed front-side-up on a table and supported by the projecting noses of the plugs, while at the same time preventing damage to the plug by the application of an inordinately high pressure on its nose, as when the plugboard is accidentally dropped. It has been found that an angle of the order of 60° for the trailing edge 24f is satisfactory.

In assembling the plug of Figures 1-3, the nose member may be inserted into the sleeve 10 by merely flexing the nose member 24 in the manner illustrated in Figure 3 so as to permit the latch 24c to fit into the sleeve 10. When the nose member has been inserted into proper position within the sleeve, the latch 24c pops up through the opening 10b in the sleeve, as shown in Figure 1, thereby securing the nose member and the sleeve together.

The alternative form of plug which is shown in Figures 4-6 is generally similar to that just described except for the construction of the nose member 30 and the shape of the opening in the sleeve 32. The nose member 30 of the plug of Figures 4-6 is provided with a pair of rearwardly extending leg portions 30a and 30b, the outer surfaces of which normally conform generally to the inner contours of the sleeve 32. One of the legs 30a of the nose member 30 is provided with an integral latch 30c which projects laterally from the leg 30a through an opening 32a in the sleeve 32 to an outer position, shown in Figures 4 and 5, at which it is beyond the outer surface of the sleeve 32, in position to be engaged behind the plugboard 20 and act as a detent.

The nose member 30 is formed of a suitable material, such as nylon, and its construction gives the nose mem-

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ber sufficient resilience and sufficient clearance to permit the leg 30a to move toward the leg 30b to such extent as to allow the latch to be depressed at least to the extent wherein it is substantially flush with the outer surface of the sleeve 32, as shown in Figure 6, so that the plug may be inserted into or withdrawn from the plugboard.

The latch 30c of the plug of Figures 4-6 is shaped similarly to the latch 24c of the plug of Figures 1-3 and functions in a similar manner for insertion and withdrawal of the plug.

In stamping the opening 32a in the sleeve 32, an inwardly extending flange 32b is formed. This is positioned so as to engage the rearward end of the leg 30a, as shown in Figure 6, and prevent the latch 30c from being depressed to a point wherein it is flush with the inner surface of the sleeve 32. The flange 32b therefore effectively prevents accidental withdrawal of the nose member 30 from the sleeve 32. In order to facilitate initial insertion of the nose member 30 into the sleeve member 32 when assembling the plug, the flange 32b may be originally bent so that its forward end is at a slightly lower position than its ultimate position, as indicated in broken lines in Figure 4. The nose member 30 may then be inserted into the forward end of the sleeve 32 by merely squeezing the legs 30a and 30b together to such extent as to place the latch 30c below the inner surface of the sleeve 32. When the nose member has been inserted to the proper position, the latch 30c will spring to its outer position. The lip 32b may then be bent to its final position, as shown in full lines, for example by inserting a tool into the sleeve 32 from its rearward end before the wire 12 is inserted into the sleeve.

A shoulder 30d formed around the end portion of the nose member 30 engages the forward end of the sleeve 32 to prevent excessive rearward movement of the nose member in the sleeve, for example, during insertion of the plug into the plugboard.

The plug shown in Figures 7 and 8, while generally similar in function to those previously described, differs from them in that the nose member 34 is not necessarily flexible, but is arranged so that it may be tipped to allow the latch 34a to be depressed sufficiently for the plug to be inserted into or removed from the plugboard.

The surface of the rearwardly extending portion of the nose member 34 on the side opposite the latch 34a is inclined away from the inner surface of the sleeve 36, as indicated at 34b, in order to permit the nose member 34 to be tipped to its inner position as shown in Figure 8, at which the latch 34a is flush with the outer surface of the sleeve 36. A coil spring 38 is compressed between the inner surface of the sleeve 36 and the bottom of a recess 34c in the nose member 34 in order to urge the nose member 34 normally to its outer position, as shown in Figure 7. A dimple or internal boss 36a is formed in the sleeve 36 for engaging the free end of the coil spring 38 to keep the spring properly positioned. An inwardly projecting finger 36d is stamped from the sleeve 36, and is positioned to be engaged in a recess 34d in the adjacent surface of the nose member 34 when the nose member is in its inner position, in order to prevent accidental withdrawal of the nose member from the sleeve.

In order to facilitate initial assembly of the plug, the finger 36b is not stamped until the nose member 34 has been inserted into proper position in the sleeve 36. The nose member 34 may conveniently be assembled with the sleeve 36 by placing the coil spring 38 within the recess 34c in the nose member 34 and compressing it so that its free end is substantially flush with the adjacent surface 34b of the nose member and inserting the nose member into the sleeve to the point where the free end of the spring will snap over the boss 36a, and the latch 34a will spring through the opening 36c in the sleeve 36 to its outer position.

From the foregoing description, it will be understood

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that each of the several embodiments of the invention shown is comprised of only a limited number of parts which may be easily and quickly assembled. Each of the plugs is provided with a resiliently mounted latch which is easily cammed inwardly when the plug is inserted into an opening in a conventional plugboard or when the rear end of the plug or the electrical wire to which the plug is attached is pulled rearwardly, while an outward pressure on the nose of the plug will cause the plug to be pushed out of the plugboard only if a relatively large force is applied. It will therefore be appreciated that the aforementioned and other desirable objects have been achieved. It should be emphasized, however, 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.

I claim:

1. A plug contactor comprising an elongated hollow metal sleeve adapted to be conductively attached at its rearward end to a wire conductor, a nose member slidably received within said sleeve and projecting from the forward end thereof, a latch integrally formed on a portion of said nose member and projecting laterally therefrom through an opening in said sleeve to an outer position beyond the outer surface of said sleeve, the forward edge of said latch forming an acute angle with said sleeve whereby rearward movement of said sleeve relative to said nose member will cause said latch to be cammed inwardly, said portion of said nose member being transversely movable to permit said latch to be depressed to an inner position at which it is substantially flush with the outer surface of said sleeve, and spring means urging said latch to said outer position.

2. A plug contactor comprising an elongated, hollow metal sleeve adapted to be conductively attached at its rearward end to a wire conductor, a nose member of a plastic material slidably received within said sleeve and projecting from the forward end thereof, a latch integrally formed on said nose member and projecting laterally therefrom through an opening in said sleeve to an outer position beyond the outer surface of said sleeve, the forward edge of said latch forming an acute angle with said sleeve whereby rearward movement of said sleeve relative to said nose member will cause said latch to be cammed inwardly, said nose member being resiliently flexible to permit said latch to be depressed from said outer position to an inner position at which it is substantially flush with the outer surface of said sleeve.

3. A plug contactor comprising an elongated, hollow sleeve adapted to be conductively attached at its rearward end to a wire conductor, a nose member of a plastic material slidably received within said sleeve and projecting from the forward end thereof and having within said sleeve longitudinally spaced supporting portions generally fitting the internal dimensions of said sleeve member

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for supporting said nose member therein and an intermediate portion having at one side an integral latch projecting laterally therefrom through an opening in said sleeve to an outer position beyond the outer surface of said sleeve, the forward edge of said latch forming an acute angle with said sleeve whereby rearward movement of said sleeve relative to said nose member will cause said latch to be cammed inwardly, the opposite side of said intermediate portion being recessed to permit resilient flexure of said nose member to sufficient extent to allow said latch to move to an inner position at which it is substantially flush with the outer surface of said sleeve.

4. A plug contactor comprising an elongated, hollow sleeve adapted to be conductively attached at its rearward end to a wire conductor, a nose member of a plastic material slidably received within said sleeve and projecting from the forward end thereof and having within said sleeve two integral legs projecting rearwardly and adapted normally to conform generally to the internal dimensions of said sleeve member, one of said legs having an integral latch projecting laterally therefrom through an opening in said sleeve to an outer position beyond the outer surface of said sleeve, the forward edge of said latch forming an acute angle with said sleeve whereby rearward movement of said sleeve relative to said nose member will cause said latch to be cammed inwardly, said nose member being resiliently flexible and said legs being spaced sufficiently to permit said latch to be depressed to an inner position at which it is substantially flush with the outer surface of said sleeve.

5. A plug contactor comprising an elongated, hollow sleeve adapted to be conductively attached at its rearward end to a wire conductor, a nose member slidably received within said sleeve and projecting from the forward end thereof, a latch formed on said nose member and projecting laterally therefrom through an opening in said sleeve to an outer position beyond the outer surface of said sleeve, the forward edge of said latch forming an acute angle with said sleeve whereby rearward movement of said sleeve relative to said nose member will cause said latch to be cammed inwardly, the surface of said nose member on the side opposite said latch being spaced from the adjacent inner surface of said sleeve a sufficient distance to permit tipping of said nose member to allow said latch to be depressed to an inner position at which it is substantially flush with the outer surface of said sleeve, and spring means engaging said nose member and urging said latch toward said outer position.

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