April 2, 1957 W. R. FRANCIS 2,787,771

JACK PLUG FOR ELECTRONIC CALCULATOR

Filed Dec. 1, 1953

Fig. 1.

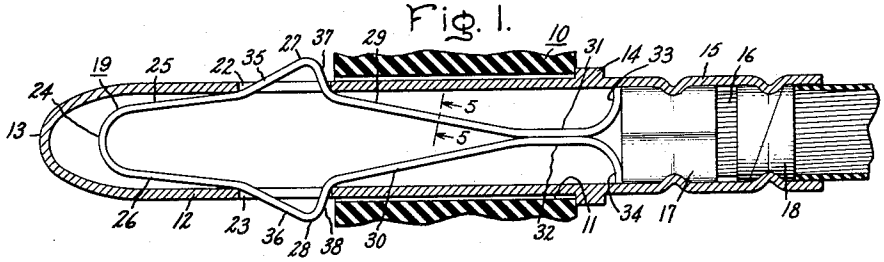


Fig. 2.

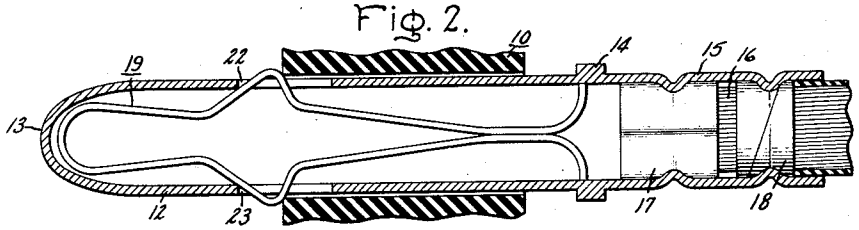


Fig. 3.

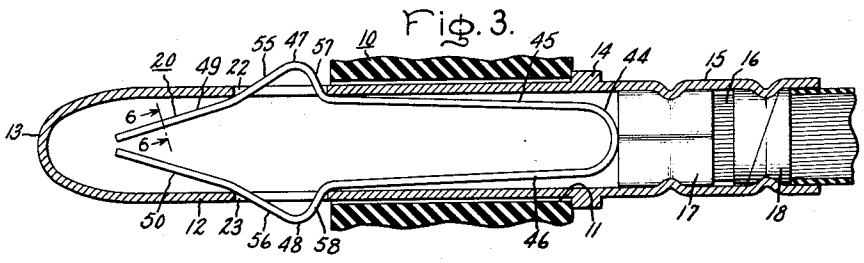


Fig. 4.

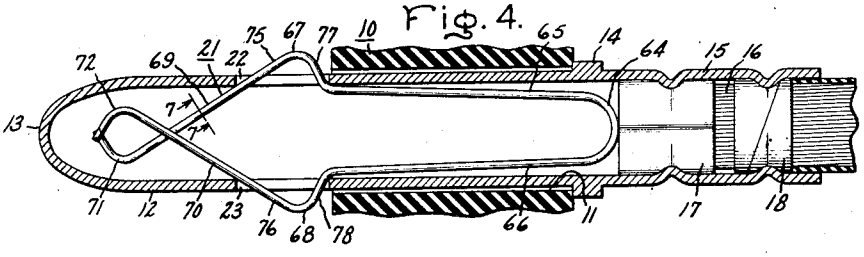


Fig. 5.

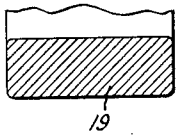


Fig. 6.

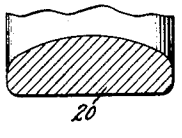
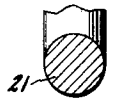


Fig. 7.



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JACK PLUG FOR ELECTRONIC CALCULATOR

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Application December 1, 1953, Serial No. 395,505

10 Claims. (Cl. 339—91)

This invention relates to jack plugs for use in the plug board or circuit connecting panel of an electronic calculating machine.

The principal object of this invention is to provide an improved construction of the detent spring for the jack plug.

A further object is to provide a jack plug with an improved detent spring which may be inserted from the open back portion of the plug.

A still further object is to provide a jack plug with an integral nose portion.

A well-known type of jack plug in present day use comprises a tubular member having a separate nose portion because the inner detent spring is of such a nature that it must be inserted from the front of the tube. A lancing is struck out of a tube towards the back thereof so as to form an inner stop member for the spring. Longitudinally spaced from the resulting hole made by the lancing is a second hole in the tube that is arranged towards the front end of the tube. The detent spring is generally of hairpin construction with a short and a long leg. The long leg is provided with a hook end that extends through the lanced-out hole in the back of the tube and cooperates with the stop member when the plug is inserted into the board. The short leg comprises an outwardly extending ear or loop that engages into the hole in the front of the tube. Consequently, the detent spring of this known construction is inserted into the front end of the tube until it is seated by the ear of the short leg and the hook end of the long leg of the spring engaging within their respective holes. The front opening of the tube is then sealed with a bullet-shaped end plug. The conductor is inserted into the back end of the tube and is crimped thereto.

The present invention involves a jack plug comprising a tubular member having an integral nose portion, an open back portion, and a pair of diametrically opposed openings in the tube of the plug for receiving a pair of opposite ears on the inner slidably movable detent spring. I have disclosed three modifications of the detent spring, but they all include a wire-like construction of generally hairpin shape. The legs of the springs are provided with outwardly extending ears which seat in the diametrically opposed openings in the tube of the plug. There is no inner lancing which acts as a stop member for the spring, for this function is carried out by the cut-off end of the conductor which is crimped in the back end of the plug. The distal end of the legs of the springs are all formed in a novel manner to insure a strong spring action for the full life of the springs.

My invention will be better understood from the following description taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

In the drawing:

Fig. 1 is a cross sectional view of a jack plug that has been inserted into a plug board.

Fig. 2 is a view similar to Fig. 1 which shows the action of the detent spring while the jack plug is being removed from the plug board.

Fig. 3 is a view similar to Fig. 1 but showing a second modification of the detent spring.

Fig. 4 is a view similar to Fig. 3 but showing a third modification of the detent spring.

Fig. 5 is a cross sectional view taken on the lines 5—5 of Fig. 1.

Fig. 6 is a cross sectional view taken on the lines 6—6 of Fig. 3.

Fig. 7 is a cross sectional view taken on the lines 7—7 of Fig. 4.

The particular type of electronic calculating machine to which the present invention applies is one in which there is provided a fixed plug board containing ranks and files of spring connectors and an insertable plug board in which there are corresponding ranks and files of companion jack plugs secured to this board. This latter board is arranged to be swung into engagement with the first board so that electric contact is effective between oppositely located connectors and plugs on the two boards.

Referring in detail to the drawing, **10** represents an insertable plug board of insulating material containing ranks and files of circular holes of which **11** is a single example. The jack plug embodying my invention comprises a hollow tube **12** having an integral nose portion **13**, a collar member **14** located toward the back of the tube to serve as a stop member against the face of the plug board **10**, and a ferrule portion **15** for receiving the end of the conductor **16** which is to be crimped to said plug.

Banding clips **17** and **18** are formed around the end of the conductors **16**. The clip **17** is formed around the bare end of the conductor **16** so that the back end of the tube is completely closed to form a stop means for the detent springs. The banding clip **18** is spaced along the conductor **16** and over the conductor insulation to add strength to the connection and also to prevent the fraying of the insulation.

The tube **12** has a pair of diametrically spaced longitudinal slots **22** and **23** formed near the front portion of the tube. These slots are spaced from the collar **14** by a distance slightly greater than the thickness of the plug board **10**.

Referring now to the first modification of Fig. 1 and Fig. 2, it should be noted that the same elements in the different views are all identified by the same reference numerals. The detent spring **19** is generally of hairpin construction with a U-shaped nose portion **24** joining a pair of diverging legs **25** and **26**. Opposed ears **27** and **28** of generally V-shape connect the diverging legs **25** and **26** with the converging legs **29** and **30**, respectively. Leg portions **29** and **30** converge until they engage each other along flat portions **31** and **32**, respectively. The distal ends of the legs of the detent spring **19** are formed outwardly as oppositely extending feet **33** and **34**, respectively.

The spring **19** is mounted in the tube **12** through the ferrule end **15** of the tube until the ears **27** and **28** protrude through the slots **22** and **23**, respectively. The overall length of the spring **19** is shorter than the length of the tube from the nose **13** back to the end of the conductor **16** which is crimped in the ferrule portion **15**. The ears **27** and **28** have been earlier described as V-shaped, but the legs of the V are of different lengths in order to make it possible to easily insert the plug into the board and to make it relatively more difficult to withdraw the plug from the board. This end is accomplished by making the front leg of the V with a more gradual slope than the rear leg of the V. It will be understood that the

more gradual the slope, the less effort is needed to force the ears into the interior of the tube 12 to insert and withdraw the plug from the board.

When the end of the plug is forced into the opening 11 in the plug board, the long sloping surfaces 35 and 36 of the ears of the spring engage the edge of the circular hole 11. The resulting force applied to the spring represents a small horizontal force and a large downward vertical force so that by continually applying a force against the back of the plug toward the plug board, the ears 27 and 28 will be depressed so that they lie within the outer circumference of the tube 12. Thus, the plug will easily slide into the opening 11 until the collar 14 strikes against the outer surface of the plug board. As soon as the slots 22 and 23 pass through and out of the hole 11, the ears 27 and 28 spring outwardly and extend in their normal locking position, which is shown in Fig. 1.

When this procedure is reversed by applying a pulling force to the back end of the plug, the short steep legs 37 and 38 strike the edge of the circular hole 11. The horizontal components of the forces acting against these legs 37 and 38 are relatively large compared with the downward vertical components; therefore, the tube moves backwardly so that the nose 24 is in engagement with the curved end 24 of the spring, while the ears 27 and 28 are being pinched into the slots by the edge of the hole 11 and the front wall portions of the slots. Fig. 2 shows the plug after the spring 19 has moved into engagement with the inner surface of the nose 13 and the ears 27 and 28 have been partially depressed inwardly of the tube.

Therefore, it can be appreciated that when the plug is forced into the board, the back end of the spring 19 bears against the end of the conductor 16; and since the portions of the ears 35 and 36 have a gradual slope, there are large downward vertical components and small horizontal components acting against the ears of the spring which result in the easy insertion of the plug into the board. In withdrawing the plug, the board reacts against the ears of the spring and assists in pinching them inwardly of the tube while the inner surface of the nose 13 moves into engagement with the spring at 24. Then with large horizontal components acting against the sloping legs 37 and 38 of the ears of the spring and small downward vertical components, the ears are finally depressed inwardly in the tube to enable the plug to be withdrawn from the board.

Turning now to the second modification of Fig. 3, it will be noted that the position of the spring 20 is reversed from the position of the beforementioned spring 19. The detent spring 20 is also generally of hairpin shape with a U-bend 44 joining diverging leg portions 45 and 46 which are provided with generally V-shaped ears 47 and 48, respectively, having steep sloping legs 57 and 58 at the back end of the tube 12 and gradually sloping legs 55 and 56, respectively. Extending from the said long legs 55 and 56 are converging leg portions 49 and 50 which, when the spring is seated within the tube 12 in its normal locking position, are spaced from each other by a slight amount substantially equal to the thickness of the spring material.

When the plug of Fig. 3 is inserted into the circular hole 11, the ears 47 and 48 engage with the edge of the hole so that a force is applied to the ears which tends to depress them within the tube 12 and also to force the U-bend 44 into engagement with the end of the conductor 16. When the ears 47 and 48 are inwardly depressed, the ends of the legs 49 and 50 are brought together so that they react against each other to gradually increase the resistance to the bending of the spring. It is also somewhat easier to withdraw the plug of Fig. 3 from the plug board because of the normal spacing of the ends of the diverging legs 49 and 50. There is little spring resistance to the withdrawal of the plug from the board until the leg portions 49 and 50 engage and react against each other. But by this time the short steeply inclined leg portions 57 and 58 have been depressed inwardly into the tube so that they have a much smaller effective slope. Therefore, less force is needed to withdraw the plug of Fig. 3 from a plug board than the plug of Fig. 1.

Turning lastly to the third modification of Fig. 4, the detent spring 21 is also generally of hairpin construction and it has many of the features of the second modification of Fig. 3. In Fig. 4, the spring 21 comprises a U-bend 64 joining the diverging leg portions 65 and 66. Generally V-shaped ears 67 and 68 are joined to the leg portions 65 and 66, respectively. Each ear is provided with a short, steeply sloped leg portion 77 and 78, respectively, and gradually inclined longer legs 75 and 76, respectively. The longer legs are formed into converging leg portions 69 and 70, respectively, which are staggered from each other so that they each pass beyond the other and are provided with a reversely curved end portion 71 and 72, respectively. It will be noted that when the plug is pulled outwardly from the board, the ears 67 and 68 of the detent spring 21 will be depressed inwardly of the tube 12 with very little resistance until the rounded ends 71 and 72 bear against the inner walls of the tube 12. From that time on, the resistance of the spring will increase in a manner similar to that of detent spring 20 wherein the legs 49 and 50 engage each other to react against the inner depression of the ears 47 and 48. In the third modification of Fig. 4, the distal ends of the spring 21 bear against the inner walls of the tube 12 rather than against each other. Otherwise, the actions of the two springs 20 and 21 are the same.

Fig. 5 is a cross sectional view of the spring material of Fig. 1 showing that detent spring 19 is made of spring stock of generally rectangular form. Fig. 6 is taken along the line 6—6 of Fig. 3 showing that the material of spring 20 is generally of oval shape with a flat inner surface of the spring. Fig. 7 is a view taken along the lines 7—7 of Fig. 4 showing that the spring 21 is of circular wire material. It should be understood that any of the springs 19, 20, and 21 could be made of spring material having any one of the cross sectional shapes of Figs. 5, 6, and 7 without departing from the present invention.

Consequently, having described my invention of an improved jack plug having novel detent springs, it will be readily apparent to those skilled in this art that I have provided a jack plug of tubular construction which is simple in design and easy to manufacture at low cost. I have also devised three modifications of detent springs to be used with said plugs each of which has a pair of opposite ears that provide a positive locking means for the jack plug in a plug board.

Modifications of this invention will occur to those skilled in the art, and it is to be understood, therefore, that this invention is not limited to the particular embodiments disclosed, but that it is intended to cover all modifications which are within the true spirit and scope of this invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An electrical connector comprising a hollow cylindrical tube of one piece construction having a rounded front portion and an open back portion for receiving the bare end of an electric conductor, and a pair of diametrically opposed longitudinally extending slots formed in the walls of said tube toward the front thereof, and a stop member on the outer surface of said tube and near the back thereof to limit the movement of the connector into a connector-receiving opening, and a longitudinally symmetrical detent spring of generally hairpin shape slidably mounted within said tube and having a pair of outer V-shaped ears which protrude through and engage the the end walls of said slots whereby when the connector is inserted into a board having a connector-receiving opening, the connector is held in the board by the opposite ears of the said detent spring engaging behind the back wall of the board.

2. A jack plug comprising a hollow cylindrical tube

of one piece construction having a rounded front portion and an open back portion for receiving the end of an electric conductor, and a pair of diametrically opposed slots formed in the walls of said tube toward the front thereof, and a collar member on the outer surface of said tube and near the back thereof to limit the movement of the jack plug into a plug board, and a longitudinally symmetrical detent spring of generally hairpin shape slidably mounted within said tube and having a pair of outer V-shaped ears which protrude through and engage the end walls of said slots whereby when the jack plug is inserted into the plug board, the plug is held in the board by the engagement of the back wall of the board by the ears of the jack plug.

3. An electrical connector comprising a hollow cylindrical tube having a rounded front portion and an open back portion for receiving the end of an electric conductor, and a pair of diametrically opposed slots formed in the walls of said tube toward the front thereof, and a stop member on the outer surface of said tube and near the back thereof to limit the movement of the connector into a connector-receiving opening, and a detent spring of generally hairpin shape slidably mounted within said tube and having a pair of outer V-shaped ears which protrude through and engage the end walls of said slots, the distal ends of said spring being so shaped that they act as fulcrum points which insure that the connector will be held in a board having connector-receiving openings by the engagement behind the back surface of said board of the opposite ears of the said detent spring.

4. In a jack plug of one piece tubular construction, a detent spring of generally hairpin shape slidably mounted therein having in each of its legs an outer V-shaped ear formed near the bend of said spring and opposite to each other, slots formed in the walls of said tube to accommodate the said ears therethrough with the said ears engaging the end walls of said slots, while the distal ends of said spring engage each other along a short length thereof.

5. In a jack plug as recited in claim 4, wherein the back portion of the plug is open to accommodate the crimping of an electric conductor therein, and further wherein the outer ends of the said spring are oppositely bent so that they lie within a common plane and in contact with the end of the said conductor.

6. In a jack plug of one piece tubular construction, having a pair of diametrically opposed slots formed near one end thereof, this said end having a rounded nose, the opposite end being open so that an electric conductor may be attached therein, and a detent spring of generally hairpin shape slidably mounted within said tube and having a pair of outer V-shaped ears which protrude through and engage the end walls of said slots, the distal ends of said springs being arranged in contact with each other and finally being bent in opposite directions so that they lie within a common plane, whereby when the plug is inserted into a plug-receiving opening, the detent spring slides backwardly until it abuts against the end of the conductor attached to the plug.

7. In a jack plug of one piece tubular construction comprising a rounded front portion and an open back portion in which a conductor is connected, a pair of diametrically opposed slots formed in the walls of said plug and toward the front portion thereof, a detent spring of generally hairpin shape slidably mounted within the said plug with its rounded portion located near the back end of said plug, the legs of said spring being provided with outer V-shaped ears to protrude through and engage the end walls of said slots in the plug, the distal ends of said spring being spaced from each other a slight amount when the said ears are in their outermost position.

8. In a jack plug as recited in claim 7, wherein the spacing between the distal ends of the spring is about equal to the thickness of the spring.

9. In a jack plug of one piece tubular construction comprising a rounded front portion and an open back portion, an electric conductor attached in the open back portion of said plug, a pair of diametrically opposed slots formed in the walls of said plug and near the front portion thereof, and a detent spring of generally hairpin shape slidably mounted in said plug, the bend in said spring being located near the back portion of the plug, the legs of said spring being provided with outer V-shaped ears which protrude through and engage the end walls of said slots, the distal ends of said spring being staggered so that they cross each other whereby when the said ears are depressed inwardly of the plug, the ends of the detent spring move into engagement with the inner walls of the plug.

10. In a jack plug as recited in claim 9, wherein the ends of the said spring are provided with rounded ends which are adapted to engage with the inner walls of the plug.

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