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T. C. STILL ET AL  
ELECTRICAL CONNECTOR

2,393,485

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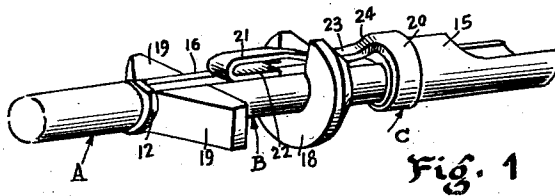


Fig. 1

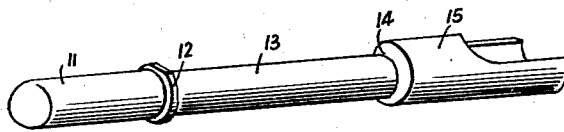


Fig. 2.

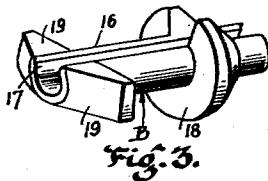


Fig. 3.

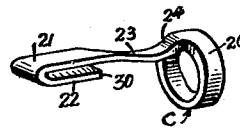


Fig. 4.

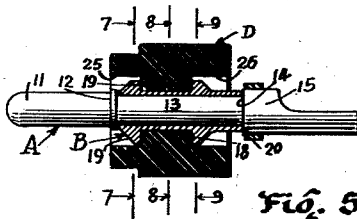


Fig. 5.

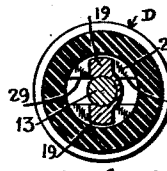


Fig. 7

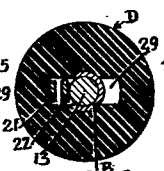


Fig. 8.

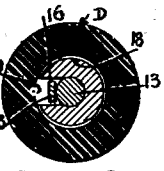


Fig. 9.

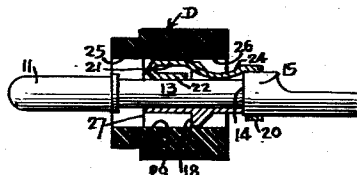


Fig. 6.

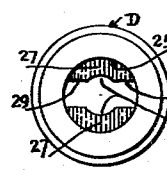


Fig. 11.

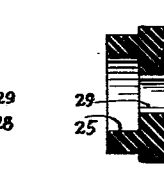


Fig. 12.

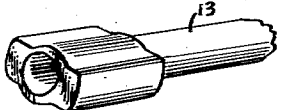


Fig. 10.

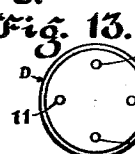


Fig. 13.

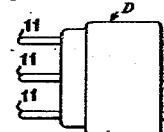


Fig. 14.

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## UNITED STATES PATENT OFFICE

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## ELECTRICAL CONNECTOR

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Application January 22, 1943, Serial No. 473,206

11 Claims. (Cl. 173—361)

This invention relates to electrical connectors and deals particularly with an improvement in the contacts and insulators of such connectors.

The electrical connector to be hereinafter described has been designed to meet the need for a device of this character having contacts that may be removed independently without affecting any of the other contacts or the insulator. The present electrical connector, or electrical plug as it is sometimes called in the art, carries two types of contacts, one of the pin or male form and the other of the socket or female form. In using the word "contact" herein, it shall be taken to mean either of these forms. Also, the words "connector" and "plug" may be used interchangeably.

As stated, the primary purpose of this invention is to provide a plug having independently removable contacts. Other objects of the invention are: to increase the surface distance on the insulator between contacts so that an electrical barrier may be set up without the use of special walls, grooves, or other devices; to provide an insulator for the retaining of such removable contacts that is made of one piece to prevent any adjoining surfaces from retaining moisture, collecting dust, or otherwise offering a possible path for the passage of electricity from one conductor to another; to provide a plug wherein the contacts may be permanently fastened to their respective conductors by soldering or by any one of the present crimp methods; to permit the repeated insertion and removal of individual contacts without the necessity of disconnecting it from its conductor; to allow the contact body to float freely in the insulator so that it may rotate in response to any twisting force carried by the conductor or by its mating contact; to provide a contact having a lock collar thereon which will securely hold the contact in position and is of such form that it will not materially reduce the barrier distance for the passage of electricity; to provide a slide lock for locking the contact in the insulator body so that the contact may be securely mounted in said insulator with a definite amount of play to permit the aligning of the contact with its mating contact and will at the same time allow free rotation of the contact in its position; to provide a slide lock of the character above which is securely locked in position and serves as a key to hold the lock collar in a locking position; to provide a slide lock which not only serves as a means of holding the collar in a locked position but also exerts a constant spring tension between the contact and the insulator, thus eliminating a certain amount of vibration therein and reducing the danger of

breakage resulting from fatigue in the metal; to provide a slide lock which may be grasped externally for unlocking the contact and removing the same from its insulation body.

These and other objects and advantages will become apparent as the description proceeds in conjunction with the drawing in which:

Figure 1 is an enlarged perspective view of a pin, or male contact, having our lock collar and slide lock incorporated thereon;

Figure 2 is an enlarged perspective view of the contact per se;

Figure 3 is an enlarged perspective view of the lock collar;

Figure 4 is an enlarged perspective view of the slide lock;

Figure 5 is a longitudinal section showing a pin contact mounted in our insulator body and held therein by our invention;

Figure 6 is a view similar to Figure 5 with our insulator body rotated 90°;

Figure 7 is a cross section taken on line 7—7 of Figure 5;

Figure 8 is a cross section taken on line 8—8 of Figure 5;

Figure 9 is a cross section taken on line 9—9 of Figure 5;

Figure 10 is a fragmentary perspective view of a socket, or female contact;

Figure 11 is an end elevation of our one-piece insulation body showing the internal wall having a key slot therethrough;

Figure 12 is a longitudinal section of the same;

Figure 13 is an end view of a plug showing a plurality of contacts; and

Figure 14 is a side view of the same.

Referring to the drawing, and particularly to Figures 1 and 11 for a more detailed description of our invention, it will be seen that our invention comprises four novel parts; namely, the pin contact generally designated A, the lock collar generally designated B, the slide lock generally designated C, and the insulator generally designated D. These parts are seen separately in Figures 2, 3, 4, and 11 respectively. A more detailed description of each of these parts will now be given.

As shown in Figure 2, the contact pin A consists of the pin portion 11, which in this instance is of the male type. It is to be understood, however, that in place of the male type pin a female socket may be used for this portion of the pin, while all the other parts and dimensions of the contact remain materially the same. The shape of the female portion of the pin is fragmentarily shown in Figure 10. A small collar 12 may be formed

at the base of the pin 11 and the body of the contact may be slightly reduced to form a shank 13 which extends to a shoulder 14. From the shoulder 14 to the other end of the contact, the body of the contact is shown as being formed into a conventional solder connection 15, or it may be shaped to provide a crimp connection of any of the various types now approved. This part of the contact and the pin part of the contact designated 11 are substantially the same forms now used. Between the collar 12 and the shoulder 14, we mount the lock collar B on the contact by snapping the collar B over the shank 13. For this purpose the collar B may be made of metal or, if desirable, a suitable plastic material may be used. As shown, it is provided with a slot 16, slightly narrower than the diameter of the shank, which opens into a longitudinal bore 17 extending the full length of the collar, and since the bore 17 is slightly larger than the shank 13, the collar is left free to rotate on the shank but is held against end play by the collar 12 and the shoulder 14. In Figure 3 it will be seen that the collar is provided with a flange 18 and a T-head forming arms 19. Also, it will be noted that the slot 16 extends through the flange 18 and that the arms 19 are substantially at right angles to the plane in which the flange 18 is slotted. The reason for this will become obvious later.

The slide lock C is shown in Figure 4. This may be made of any suitable material having definite resilient characteristics. As illustrated, it comprises a ring portion 20 having a tongue extending therefrom generally designated 21. On the outer end of the tongue there is a return member 22 slightly spaced from the tongue itself to provide resilient spring pressure when the end of the tongue is forced into the locking position to be later described. Also, the tongue has a depressed portion 23 which forms a shoulder 24 adjacent the ring 20, which is used for locking the slide lock in position and preventing contact of the slide lock with the walls of the insulator in such a way as to decrease electrical creepage. All the foregoing described features except the insulator can be found in assembled position in Figure 1.

In Figures 5 and 6 we have shown the complete pin assembly, as described and shown in Figure 1, inserted in an insulation body as it would be used in actual practice. It is to be understood, however, that while we have shown but one contact in an insulation body, there are one or more contacts ordinarily in such bodies, and plugs may be manufactured and used having any number of contacts in one body. The body we show, therefore, having but one contact is illustrative only of the way in which we employ our invention and is not to be construed as limiting the invention in any way to the type of plug used or the size or shape of the insulation body. In these views it will be seen that parts A, B, and C are mounted in our insulation body generally designated D, these four parts comprising the complete assembly to which our invention relates. Before explaining in detail the manner in which our contact is mounted in the insulation body, reference will first be had to Figures 11 and 12, showing the construction of this body. Here it can be seen the body consists of a one-piece insulation member generally designated D. The member D is formed of a single piece of insulation to eliminate joining cracks that collect moisture and particles which tend to break down the insulation barrier, with a resultant increase in electrical creepage

and, as above stated, may be of any size or configuration to fit any casing or to hold any number of contacts desired. The fact that only one contact is shown here is not to be taken as limiting the invention in any manner. Therefore, in describing this insulator, the outside shape of the insulator or the shell into which it is mounted will not be discussed, and the inside form for mounting one contact only will be described. It will be noted that the insulator D is formed with two parallel recesses 25 and 26 on opposite ends thereof. These recesses leave a wall 27 substantially in the middle of the member D. The wall 27 is then formed with a round hole 28, and slots 29 extend diametrically opposite each other from the hole 28 through the barrier 27. In mounting the pin contact in the body D, the assembly as shown in Figure 1 is first made up, and the pin 11 is inserted through the hole 28, and the arms 19 are so positioned that they will pass through the slotted openings 29. During the insertion of the contact into the insulator body, the slide lock C which is frictionally held is pulled back on the soldering portion 15 of the pin so that the raised portion 21 is withdrawn behind the flange 18, thus allowing the pin to be inserted through the insulation member D until the flange 18 comes to rest upon the bottom of the recess 26. In this position the members B and C are free to rotate on the contact A, and to lock the pin in position, the collar 20 of the member B is rotated 90°, whereupon the tongue 21 on the collar aligns with one of the slots 29 and the slide lock is then pushed forward which forces the tongue 21 through the groove 16 of the collar B and into the slot 29, thus locking the collar B against further rotation and exerting a spring pressure between the shank 13 and the insulation D by means of the return bend 22 on the end of the tongue. The slide lock C is releasably held against withdrawal by means of the shoulder 24 which snaps over the shoulder 14 on the contact body A. When in this position the collar B and the slide lock C are held against further rotation, and the arms 19 are turned substantially at right angles to the slots 29, thus securely locking the collar B against withdrawal from the insulation member D. The contact body A is free to rotate in the collar B and the collar 20 of the slide fastener C, since the frictional resistance of the collar 20 on the soldering portion 15 of the contact body has been released by dropping the shoulder 24 over the shoulder 14, but the contact body is securely held against withdrawal in the insulation member and is likewise held against vibration by the member 22. To withdraw the entire contact assembly, the collar 20 of the member C is grasped by any suitable instrument, such as a long nosed pair of pliers, and is pulled backwards along the pin until the end 30 of the member 22 engages the shoulder 14, thus forming a definite stop for the movement of this member. In this position the collar B may be turned in the insulation member D until the arms 19 align with the slots 29, whereupon the collar B is free to be withdrawn from the insulation member and the pin is likewise withdrawn without disturbing any of the other parts of the plug.

In Figures 13 and 14, we have shown a plurality of our improved contacts mounted in a single plug. It is to be understood that the construction of each individual contact remains the same as described in the foregoing and that as many contacts as may be needed may be mounted in one plug without interfering with each other. In

these views D represents the plug and 11 shows the same contact points, while on the opposite side of the plug the sleeves 20 for releasing the plug are shown mounted on the end of the contact member 15 adapted to be connected to a conductor. The arrangement and location of the contact members in the plug is immaterial in so far as the contact members are concerned.

The foregoing description deals with a preferred form of our invention. However, we are aware that certain modifications and refinements may be made in the structural part without departing from the premise of the invention. For this reason the invention is to be limited only by the scope of the claims appended hereto.

We claim:

1. In an electrical connector having a plurality of contact members supported in an insulation body, a lock collar rotatably mounted on each of said contact members, said lock collar having arms on one end thereof and a flange on the opposite end, and said insulation body having a wall with a slotted opening therethrough adapted to pass said arms.

2. In an electrical connector having a plurality of contact members supported in an insulation body, a lock collar rotatably mounted on each of said contact members and held against longitudinal movement thereon, said lock collar having arms on one end thereof and a flange on the opposite end, said insulation body having a wall with a slotted opening therethrough adapted to pass said arms and lock said collar in said body against said flange when said collar is slightly rotated in said body, and means for locking said collar in a fixed position of rotation in said insulation body.

3. In an electrical connector having a plurality of contact members supported in an insulation body, a lock collar rotatably mounted on each of said contact members and held against longitudinal movement thereon, said lock collars having arms on one end thereof and a flange on the opposite end, said insulation body having a wall with a slotted opening therethrough adapted to pass said arms, a sleeve rotatably mounted on each of said contact members externally of said insulation body, a resilient tongue on each of said sleeves slidably engaging a slot in each of said lock collars for rotating said collars in said insulation body to bring said arms out of line with said slots, and means for locking said collars against rotation in said last named position.

4. In an electrical connector having a plurality of contact members supported in an insulation body, a lock collar rotatably mounted on each of said contact members and held against longitudinal movement thereon, said lock collars having arms on one end thereof and a flange on the opposite end, said insulation body having a wall with a slotted opening therethrough adapted to pass said arms, a sleeve rotatably mounted on each of said contact members externally of said body, a resilient tongue on each of said sleeves slidably engaging a slot in each of said lock collars for rotating said collars in said insulation body to bring said arms out of line with said slots and align said tongue with said slots whereby said tongues may be slid on said contact members to enter said slots and lock said collars against rotation in said insulation body.

5. In an electrical connector having a plurality of contact members supported in an insulation body, a lock collar rotatably mounted on each

of said contact members and held against longitudinal movement thereon, said lock collars having arms on one end thereof and a flange on the opposite end, said insulation body having a wall with a slotted opening therethrough adapted to pass said arms, a sleeve rotatably mounted on each of said contact members externally of said insulation body, a resilient tongue on each of said sleeves slidably engaging a slot in each of said lock collars for rotating said collars in said insulation body to bring said arms out of line with said slots and align said tongues with said slots whereby said tongues may be slid on said contact members to enter said slots and lock said collars against rotation in said insulation body, said tongues normally exerting a pressure between said insulation body and said contact members.

6. For use in an electrical connector embodying an insulation body having a wall with a slotted opening therethrough, a contact member having a contact element on one end thereof and means on the opposite end for connecting to a conductor, a lock collar rotatably mounted on said contact member intermediate the ends and held against longitudinal movement thereon, arms on one end of said collar adapted to pass through said slotted wall and a flange on the opposite end thereof adapted to bear against said wall, and means on the connecting end of said contact member for rotating said collar on said contact member to lock said member in said insulation body.

7. For use in an electrical connector embodying an insulation body having a wall with a slotted opening therethrough, a contact member having a contact element on one end thereof and means on the opposite end for connecting to a conductor, a lock collar rotatably mounted on said contact member intermediate the ends and held against longitudinal movement thereon, said collar having a longitudinal bore adapted to rotatably receive the intermediate portion of said contact member, and a slot extending full length of said bore for detachably mounting said collar on said contact member.

8. For use in an electrical connector embodying an insulation body having a wall with a slotted opening therethrough, a contact member having a contact element on one end thereof and means on the opposite end for connecting to a conductor, a lock collar mounted on said contact member intermediate the ends and held against longitudinal movement thereon, said collar having a longitudinal bore adapted to receive the intermediate portion of said contact member, and a slot extending full length of said bore for mounting said collar on said contact member, said slot being slightly narrower than the intermediate portion of said contact member so that said collar may be snapped into position on said member.

9. For use in an electrical connector embodying an insulation body having a wall with a slotted opening therethrough, a contact member having a contact element on one end thereof and means on the opposite end for connecting to a conductor, a shank portion on said pin having shoulders at each end thereof intermediate said ends, a lock collar mounted on said shank portion adapted to fit between said shoulders, said collar having a longitudinal slot adapted to yieldingly snap over said shank for mounting said collar on said contact member, a detent member movably mounted on said contact

member, said detent member having a finger arranged to slide in said slot and hold said collar against rotation on said contact member.

10. For use in an electrical connector embodying an insulation body having a wall with a slotted opening therethrough, a contact member having a contact element on one end thereof and means on the opposite end for connecting to a conductor, a shank portion on said contact member having shoulders at each end thereof intermediate said ends, a lock collar rotatably mounted on said shank portion adapted to fit between said shoulders, said collar having a longitudinal slot adapted to yieldingly snap over said shank for mounting said collar on said contact member, a sleeve frictionally mounted on said contact member arranged to be externally accessible when said contact member is mounted in said insulation body, and a finger extending from said sleeve into said slot whereby said collar may be rotated on said contact member.

11. For use in an electrical connector embody-

ing an insulation body having a wall with a slotted opening therethrough, a contact member having a contact element on one end thereof and means on the opposite end for connecting to a conductor, a shank portion on said contact member having shoulders at each end thereof intermediate said ends, a lock collar rotatably mounted on said shank portion adapted to fit between said shoulders, said collar having a longitudinal slot adapted to yieldingly snap over said shank for mounting said collar on said contact member, a sleeve frictionally mounted on said contact member arranged to be externally accessible when said contact member is mounted in an electrical connector, a finger extending from said sleeve into said slot whereby said collar may be rotated on said contact member and means for releasably holding said finger in a predetermined fixed position in said insulation body.

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