Aug. 14, 1951 H. DORJEE 2,564,098

PLUG PIN

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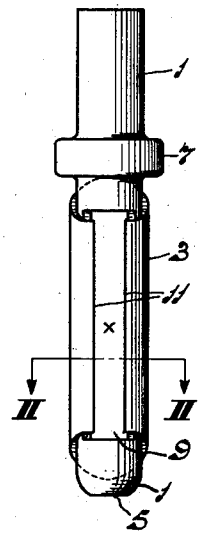


Fig. 1

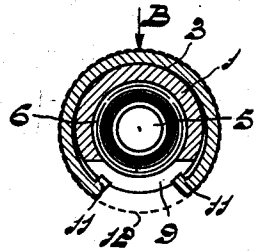


Fig. 2

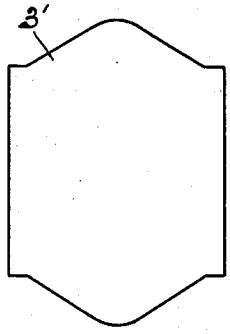


Fig. 3

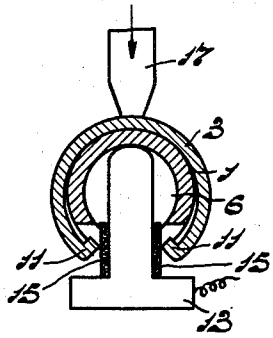


Fig. 4

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PLUG PIN

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3 Claims. (Cl. 173—363)

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This invention relates to plug pins used for making electrical contact connections with associated contact sockets, and more particularly to that type of plug pin comprising a central pin and a resilient sheath attached to the pin to surround it with a somewhat liberal amount of clearance, the said sheath being split in the axial direction.

An example of the above described type of plug pin is the well-known "banana plug," the sheath of which usually consists of two crossed metal strips having a small central aperture in which fits the narrowed end of the central pin of the plug. The metal strips are riveted to the said narrowed end of the pin by axial pressing thereof against the flat side of the strips. Subsequently, or previously to such riveting, as the case may be, the four halves of the crossed strips may be folded along the pin.

This construction has practically been abandoned, since excessive difficulties have been experienced owing to bad contact results with said plugs. Furthermore, with such construction, it often happens that the rivet joint becomes detached. Additionally, a screw joint construction is known as shown, for example, in British Patent Specification 311,452, but such construction, as a matter of course, is expensive. Generally speaking, it has been found to be impossible to provide a joint which is sufficiently cheap and nevertheless reliable.

In a further known construction the central pin is axially split. Within the split a resilient plate is secured, after which the parts of the plate laterally extending beyond the pin are bent to surround the pin. The difficulty with such a construction, as with the others, is the attachment of the sheath plate to the pin. Spot welding is rendered difficult owing to the fact that the portion of the plate which is most suitable for such purpose is located inside the pin.

One of the main objects of the present invention is to obviate the aforesaid difficulties encountered with the prior art plugs.

Another object is to provide a durable plug comprising but two parts which are adapted to be easily connected by a welding apparatus.

Still another object is to provide a plug comprising a tubular pin portion having an aperture therein for receiving the bent edges of a resilient sheath attached thereto whereby the resiliency of the sheath is both enhanced and made reliable.

A further object is to correlate the dimensions of the pin aperture and the sheath edges so that

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there is no interference therebetween while, at the same time, the insertable pin is not weakened.

Another object is to provide the plug-in with an easily insertable plug end while assuring a location for a point of contact to which the conductor wire of the plug may be soldered.

The plug pin according to the invention comprises a central pin having a tubular portion provided with an aperture and a resilient tubular sheath surrounding the pin and having a single axial slit, the sheath surrounding the pin with the slit and aperture together and being secured, for instance welded, to the pin at least at one point substantially diametrically opposite the aperture and slit.

The difficulties inherent in welding the prior art plugs, as mentioned hereinbefore, are readily solved in the present invention, since the sheath plate is accessible from all sides while the advantages of a construction comprising a resilient sheath are fully retained. These advantages become manifest more particularly if, in accordance with the invention, the edges of the sheath adjacent to the slit are bent inwardly and extend for the most part, clear of the pin, since the said inwardly bent parts extend into at least one recess provided in the pin. Such a recess preferably extends through a portion of the length of the pin but does not extend so far as to be adjacent one of the ends of the pin. Furthermore, the recess is provided slightly longer than the bent edges of the sheath. The welding of the sheath is furthermore facilitated if the pin is tubular, that is to say, hollow. In such case, the said recess is formed by an elongated aperture, preferably rectangular, in the tube wall. The welding electrode used to weld the sheath to the pin may then be passed through the aperture so that the welding point will be opposite the aperture.

In order that the invention may be more clearly understood and readily carried into effect, it will now be described more fully with reference to the accompanying drawing, in which one embodiment of the invention is shown by way of example.

Fig. 1 is a side elevational view of a plug pin according to the invention.

Fig. 2 is, on a larger scale, a cross-sectional view taken on the line II—II of the plug pin shown in Fig. 1.

Fig. 3 shows the sheath element as a sheet prior to bending and application to the pin.

Fig. 4 illustrates a phase of the manufacture

of the plug pin showing the positioning of the welding electrodes.

The plug pin shown comprises a tubular, central pin 1, for example, of brass, and a surrounding resilient sheath 3 preferably of phosphor bronze. The plug-in end intended to be introduced into an associated contact socket, not shown, is narrowed by rolling so as to leave a reduced aperture 5 as compared to the diameter of the space 6 in the tubular pin 1. In such reduced aperture, a connecting wire passed through the hollow 16 of the pin may be secured by soldering. Adjacent the attachment end of the pin 1, there is provided a thicker portion 7, preferably made by clenching. Between this thicker portion and the plug-in end, but not adjacent the latter end, a segment-shaped part of the pin (Fig. 2) is removed by milling, so that a primarily rectangular aperture 9, the long sides of which are approximately parallel to the axis of the pin, is formed in the wall of the pin. The reason for not having the aperture 9 adjacent the plug-in end, is to prevent the pin 1 from lacking the firmness necessary for rendering facile the insertion of the plug in its usual associated contact socket which may be of the conventional tubular shape and is not shown.

The sheath 3, which surrounds the pin 1 with a liberal amount of clearance, is provided by bending over a substantially rectangular plate 3', such as shown in Fig. 3, to leave a single, axially directed slit between the edges 11 thereof, as shown in Fig. 1. The two relatively parallel edges 11 adjacent this slit are bent inwardly to extend within the recess 9, as may be seen from Figs. 2 and 3. The sheath 3 is secured to the pin 1 and electrically connected thereto by means of a spot weld at the centre of the sheath plate 3 (at the cross in Fig. 1 and the arrow in Fig. 2). If desired, a plurality of spot welds may be provided on an axially directed line which is approximately diametrical to the slit in the sheath.

The recess 9 is, in the axial direction, slightly longer than the bent edges 11 of the sheath 3, the latter being secured in such manner that the bent edges are out of engagement and do not even touch the pin 1 upon insertion thereof into an associated contact sleeve, not shown. Pinching of the plug pin and damage to the contact sleeve are thus impossible. Theoretically the contact between the plug pin and contact sleeve (the inside surface 12 thereof is shown in dotted line in Fig. 2) may take place over the whole surface of the sheath 3. This ideal condition of course cannot be realized in practice but still, since the connecting weld is provided diametrically opposite the slit of the sheath 3, the contact takes place on three lines, viz. on the two axially directed border lines between the bent edges 11 and the remaining portion of the sheath 3, and on the rear line of the sheath at the arrow of Fig. 2. The advantage of the resilient sheath construction, that is a large contact surface, is realized to a large extent in the present construction, which is conductive to a plug pin contact having a low and constant contact resistance and favorable slight wear and tear characteristics.

The sheath 3 is preferably longer at the rear side than at the bent edges 11, as may be seen from Fig. 1. The bilaterally contoured shape of the sheath 3 at the plug-in end as seen in Fig. 1, facilitates insertion into the associated contact socket whilst, at the other end, the edge of the sheath 3 in the position thereof in which the edges 11 keep clear of the edges of the recess 9

in the pin 1, engages the thickened portion 7 on the rear side of pin 1, as viewed in Fig. 1. This facilitates the attachment of the sheath 3 at the right area on the pin 1.

Although the pin 1 may be solid, the use of a hollow pin is preferable, since this readily permits correlation of the thermal capacity of the pin 1 to that of the sheath 3 in such manner that the conditions for welding one to the other are most favorable. On the other hand, the pin 1 must not become unduly slack and it is advisable not to make the recess 9 extend to one of the ends of the pin, as already pointed out hereinbefore. Furthermore, it is preferable not to give it a smaller width than half the circumference of the pin, for the same reason. It is also possible to use a plurality of recesses located behind one another in the axial direction.

Fig. 4 is a sectional view of the manner in which the plug pin may be assembled. After the sheath 3, previously manufactured, has been slipped on it in an axial direction, the pin 1 is placed on an elongated welding electrode 13, the edges 11 of the sheath engaging insulated flanks 15 of the electrode 13. The relative position of pin 1 and sheath 3 is then completely fixed and the welding operation may be carried out in an extremely simple manner with the use of an ordinary counter electrode 17. The welding point or the welding points are diametrically opposite the opening 9 as shown in Fig. 2.

It may appear from the foregoing that the invention enables cheap manufacture of a reliable plug pin having a resilient sheath. The plug pin according to the invention may be made in a small size that is suitable for use in all kinds of apparatus, such as electronic tubes, household apparatus, amplifiers, telephone apparatus, measuring apparatus, and so forth.

It is to be understood that the present invention is not limited to the specific embodiment shown and that various deviations may be made therefrom without departing from the spirit and scope of the appended claims.

What I claim is:

1. A plug pin comprising a central pin having a tubular portion provided with an axially-extending aperture having one end spaced back from the end of the pin and a tubular resilient sheath surrounding said tubular portion with a slight clearance and provided with a slit extending in an axial direction and located adjacent the aperture in the pin, said sheath being welded to said pin at least at one point substantially diametrically opposite said aperture and slit.

2. A plug pin comprising a central pin having a tubular portion provided with an axially-extending aperture having one end spaced from the end of the pin, and a tubular resilient sheath surrounding said tubular portion with a slight clearance and having two portions defining a slit extending in an axial direction and located adjacent the aperture in the pin, said sheath being welded to said pin at least at one point substantially diametrically opposite said aperture and slit, said two portions having an axial length less than the axial length of said aperture and extending inwardly toward said aperture.

3. A plug pin comprising a central pin having a tubular portion provided with an axially-extending aperture having a cross-section in the form of a segment extending less than half the circumference, one end of said aperture being spaced from the end of the pin, and a tubular resilient sheath surrounding said tubular portion

with a slight clearance and having two portions defining a slit extending in an axial direction and located adjacent the aperture in the pin, said sheath being welded to said pin at least at one point substantially diametrically opposite said aperture and slit, said two portions having an axial length less than the axial length of said aperture and extending inwardly toward said aperture.

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