July 6, 1948. G. H. ERB 2,444,433

ELECTRICAL CONNECTOR

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Fig: 1.

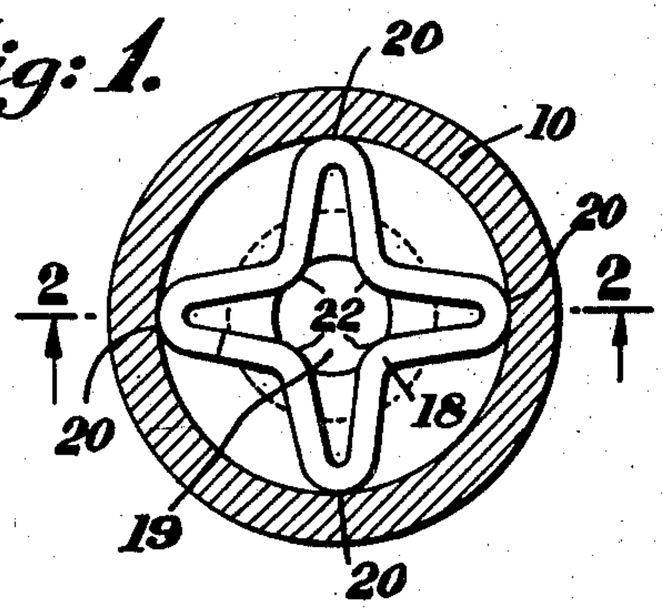


Fig: 3.

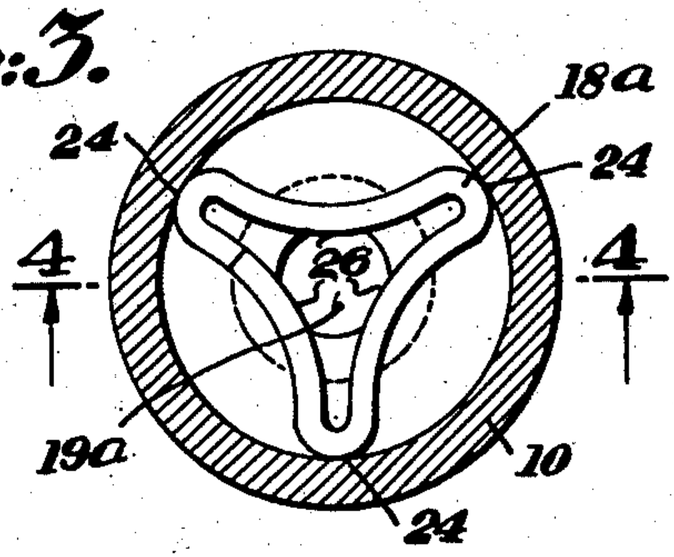


Fig: 2.

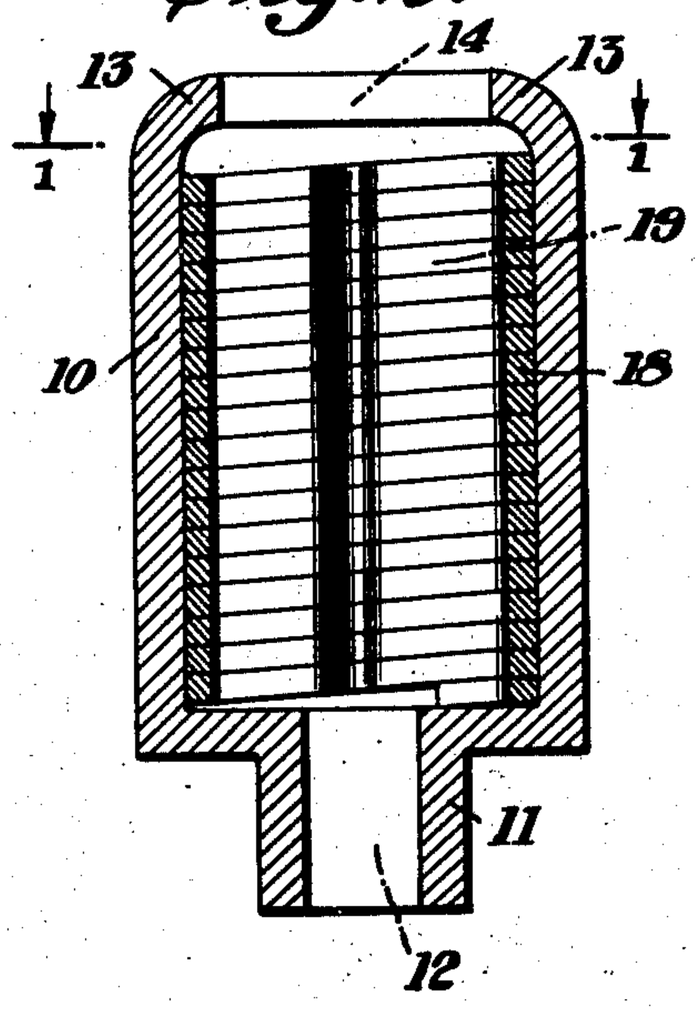


Fig: 4.

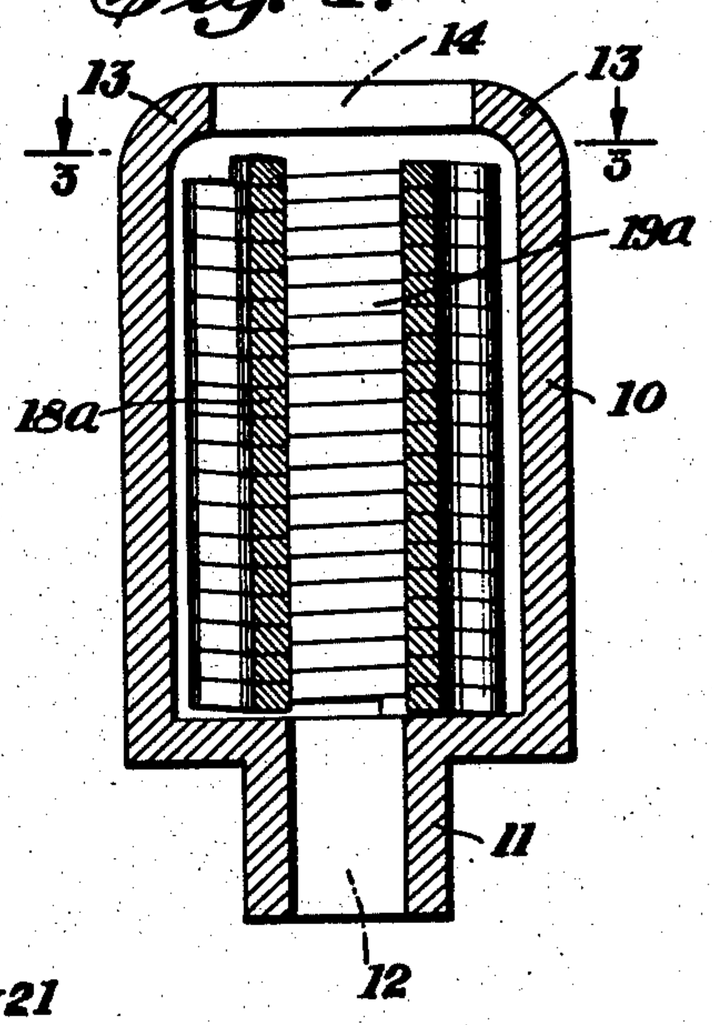
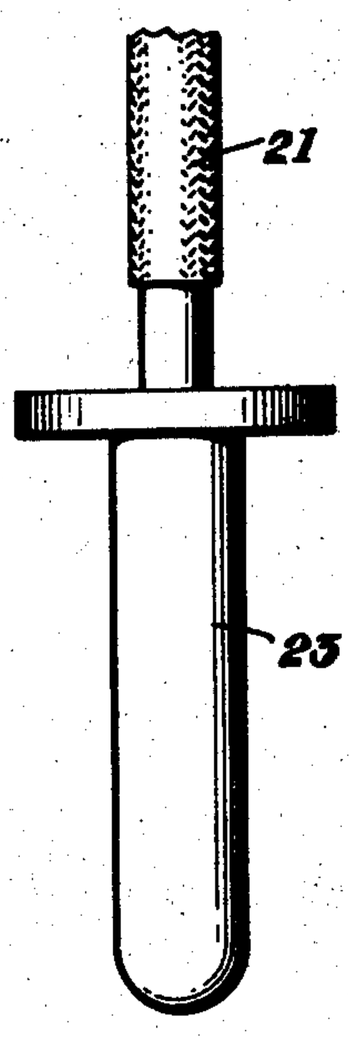


Fig: 5.



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ELECTRICAL CONNECTOR

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8 Claims. (Cl. 173—363)

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The present invention relates to electrical connectors.

One object of the invention is to provide a plug and socket assembly for connecting two electrical circuits, the assembly possessing both a high current-carrying capacity and a high resistance to overheating.

Another object of the invention is to provide a plug and socket assembly in which a plurality of high pressure current-conducting points of contact are created between the assembled members.

A further object of the invention is to provide a socket formed of conducting material and containing a spring wire member coiled in such a manner that insertion of a plug within the coil will result in the wire being forced outwardly against the inner wall of the socket.

A still further object of the invention is to provide a coiled spring contact member designed to receive a plug, the contact points between the spring and the plug being automatically cleaned by the abrasive action of the latter whenever it is inserted or withdrawn.

Other objects and advantages will be apparent from the following description of a preferred form of the invention and from the drawings, in which:

Fig. 1 is a top view, partly in section, of a preferred form of socket assembly in accordance with the present invention taken along the line 1—1 of Fig. 2 and showing the configuration of the spring member;

Fig. 2 is a section through 2—2 of Fig. 1;

Fig. 3 is a top view, partly in section, of a modification of the socket assembly of Fig. 1 taken along the line 3—3 of Fig. 4;

Fig. 4 is a section through 4—4 of Fig. 3;

Fig. 5 is a side elevation of one type of plug that may be used with the sockets of Figs. 1 through 4.

Conventional plug and socket assemblies have a current-carrying capacity that is limited both by the contacting area between the two conducting parts and also by the pressure between these parts. For this reason it is highly desirable to have a comparatively large number of points of contact, and also to have as high a pressure as practicable between the conducting elements at such points.

The standard cylindrical plug and socket cannot meet the above conditions due to the limitation on the pressure obtainable in such a structure between the two contacting surfaces. In a like manner the conventional coil spring contact is limited to the maximum current-carrying capacity of a single turn of the wire constituting the coil, since all of the current conducted by the coil must pass through each convolution of the wire.

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With the above conditions in view, the present invention provides a plug and socket assembly having a large number of current-conducting points of contact, the pressure between the members at such points being substantially increased when the plug is inserted in the socket. This increase in pressure is obtained through the particular construction of the spring member engaged by the plug, so that insertion of the plug forces the spring member outwardly against the inner wall of the socket. The multiple high-pressure points of contact thus obtained provide an exceptionally good current-conducting device with low resistance connections in which the tendency to heating is reduced to a minimum.

In Figs. 1 through 4 of the drawings is shown a socket 10 formed of conducting material and having an axially extending portion 11. A spring wire member 18 or 18*a* shaped in a manner hereinafter to be described is positioned within the socket 10 so that it contacts the inner wall of the latter at a plurality of points. In order to hold the resilient wire 18 or 18*a* in place along the axis of the socket, the top lip of the latter is preferably spun over as shown at 13 to form a circular opening 14, but it is clear that other means of holding the wire in the socket may be employed, such for example as a retaining ring positioned in a slot in the socket wall. The opening 12 defined by extending portion 11 of the socket is preferably designed to receive the end of an electrical conductor, which is then secured in place by any well-known manner such as soldering. It will be also understood that any known means of connecting the socket to an electrical circuit is within the scope of the invention, such for example as threading the portion 11 for connection as a binding post, or inserting the portion 11 through a panel opening and the peening over the projecting end of such portion. A plug 23, shown in Fig. 5, receives the extremity of another electrical conductor 21 in the usual manner. This plug has been illustrated as being of substantially round configuration, but a plug of any other cross-sectional shape which produces the results hereinafter to be described may be employed in place thereof.

From Figs. 1 and 2 it will be seen that the spring wire member 18 is shaped somewhat in the form of a rectangle, so that it contacts the inner wall of socket 10 at four points 20 for each convolu-

tion of the wire. When the tip of the plug 23 is inserted in the recess 19, it will contact the wire at four points 22 (see Fig. 1). Due to the bowed shape of the wire 18, and also to the relative size of the plug and recess, further insertion of the plug will force apart the walls of the recess and substantially increase the pressure at points 20 between the wire and the inner wall of socket 10. The pressure will also be high between the wire 18 and plug 23 at points 22. The resulting connection will have excellent current-conducting properties for the reasons mentioned above. Furthermore, each time that the plug 23 is inserted in the recess 19 it acts to clean the surface of wire 18 at points 22, thus eliminating the possibility of dirt or corrosion interfering with the conduction of current at such points.

In Figs. 3 and 4 is shown an alternative construction of Figs. 1 and 2 in which the spring wire member 18*a* has an approximately triangular shape. Due to the curved surface of the wire at points 26, insertion of the plug 20 in recess 19*a* will force the wire 18*a* against the inner wall of socket 10 at points 24 in a manner similar to that described above. Thus, three high pressure contacting points between the wire 18*a* and each of the members 10 and 23 are established for each convolution of the wire 18*a*.

It will be noted that in each of the modifications of Figs. 1 and 3 the wire member 18 is shaped so that the inwardly-projecting portions are "bowed," or bent in such a manner that the external diameter of the spring member at points 20 or 24 is increased when the plug is inserted in the recess 19 or 19*a*. This "bowed" construction is clearly not limited to any specific number of projecting portions, but any polygonally-sided recess defined by the spring member may be used as long as the above-mentioned principle of operation is present.

While I have described above the principles of my invention in connection with certain articles and particular modifications thereof, it is to be clearly understood that this description is made only by way of example and not as a limitation on the scope of my invention as set forth in the objects and the accompanying claims.

I claim:

1. In an electrical connector, a tubular socket of conducting material, a spring wire member coiled in irregular fashion to define a recess of smaller diameter than the diameter of said socket, said spring member being positioned within said socket with its periphery contacting the inner surface of the latter at a plurality of points throughout its entire length, said spring member being completely inwardly-bowed between said points of contact with said socket, and a plug receivable in said recess, said plug being of a radius larger than the smallest radial dimension of said spring member, whereby upon insertion of said plug in said recess said plug will first contact the apices of said inwardly-bowed spring portions and then compress said spring outwardly to increase the pressure of said spring against the inner surface of said socket at said plurality of points.

2. In an electrical connector, a socket of conducting material, a helically formed resilient wire insert in said socket, each turn of said insert pressing against said receptacle at four points, said insert being bowed inwardly in the form of a continuous arc from contact point to contact point so as to define an approximately rectangular recess having its opposite sides separated by a distance substantially smaller than the smallest internal diameter of said socket, and a plug adapted for insertion in said recess, said plug having a diameter slightly greater than the longest distance between opposite sides of the rectangle defined by the recess formed by said insert, whereby insertion of said plug in said recess will cause the pressure of said insert against said socket to be substantially increased.

3. In an electrical connector, a substantially tubular receptacle, said receptacle being formed of conducting material, a helically formed resilient wire insert in said receptacle, each turn of said insert contacting the interior surface of said receptacle at three points, said insert being bowed inwardly in the form of a continuous arc from contact point to contact point to define a substantially triangular opening axially disposed with respect to the axis of said tubular receptacle, and a plug adapted for insertion in the opening of said insert, said plug being of a radius larger than the smallest radial dimension of said spring insert, whereby insertion of said plug in the opening of said insert will increase the pressure of said insert against said receptacle at said points of contact.

4. In an electrical connector, a substantially tubular socket, a spring wire within said socket, said wire being in the shape of an irregular coil contacting the inner wall of the socket more than twice in each convolution thereof, said coil being substantially coaxial with said socket, said coil being formed to outline a recess substantially coaxial with said socket and smaller in cross-sectional area than the cross-sectional area of the latter, and a plug receivable in said recess, said plug being of a radius larger than the smallest radial dimension of said spring wire coil, whereby insertion of said plug in said recess will cause a substantial increase in the pressure of said wire against said socket.

5. In an electrical socket assembly, a socket of conducting material, and a coiled spring contact member within said socket, said coiled spring contact member having a maximum radial dimension approximately equal to the internal radius of the socket, said spring radial dimension being of sufficient magnitude to make possible a high pressure contact of spring and socket when a plug of a radius larger than the smallest possible radial dimension of said spring is inserted, each convolution of said coiled spring member being sprung inwardly to define a substantially polygonal opening having completely inwardly bowed faces.

6. In an electrical socket assembly, a socket of conducting material, and a coiled spring contact member within said socket, said coiled spring contact member having a maximum radial dimension approximately equal to the internal radius of the socket, said spring radial dimension being of sufficient magnitude to make possible a high pressure contact of spring and socket when a plug of a radius larger than the smallest possible radial dimension of said spring is inserted, each convolution of said coiled spring member being sprung inwardly to define an opening having four completely inwardly bowed faces.

7. In an electrical socket assembly, a socket of conducting material, and a coiled spring contact member within said socket, said coiled spring contact member having a maximum radial dimension approximately equal to the internal radius of the socket, said spring radial dimension being

of sufficient magnitude to make possible a high pressure contact of spring and socket when a plug of a radius larger than the smallest possible radial dimension of said spring is inserted, each convolution of said coiled spring member being sprung inwardly to define an opening having three completely inwardly bowed faces.

8. In an electrical connector of the class wherein a plug is inserted in a socket having a plug-receiving coiled spring defining an opening of smaller diameter than the diameter of the plug, the combination of a socket formed of conducting material and a coiled spring insert member in said socket, each convolution of said coiled spring insert member being sprung inwardly in the form of a continuous arc to define a substantially polygonal opening having completely inwardly bowed faces, said coiled spring insert member having a maximum radial dimension approximately equal to the internal radius of the socket so that the insertion of said plug forces said insert member against the wall of said socket.

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