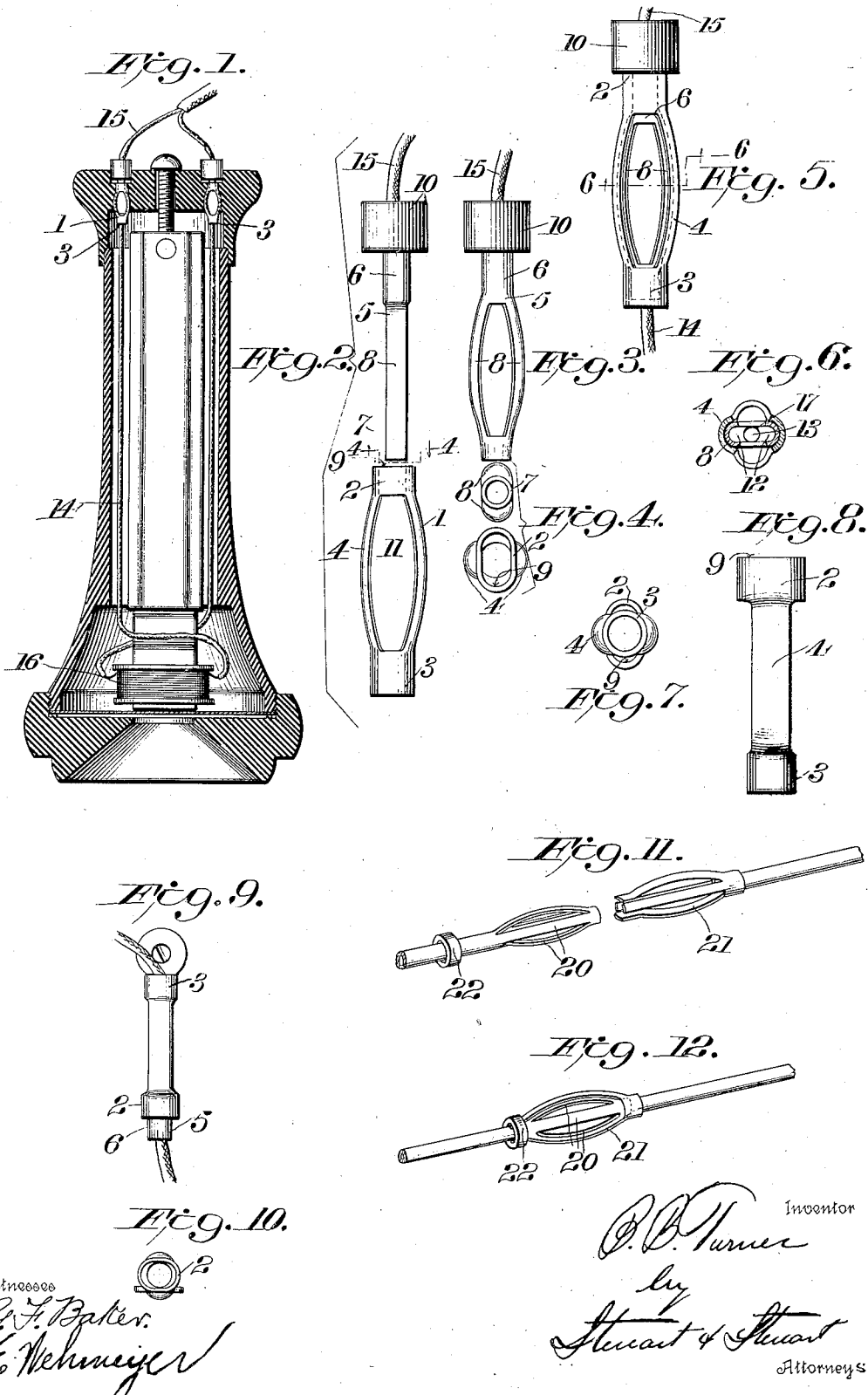


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ELECTRICAL CONNECTION.
APPLICATION FILED MAR. 6, 1913.

1,104,720.

Patented July 21, 1914.



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ELECTRICAL CONNECTION.

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Specification of Letters Patent.

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Application filed March 6, 1913. Serial No. 752,296.

To all whom it may concern:

Be it known that I, BENJAMIN B. TURNER, a subject of the King of Great Britain, residing at the city of Baltimore, State of Maryland, have invented certain new and useful Improvements in Electrical Connections, of which the following is a specification.

This invention relates to a plug and socket connection for electric circuits, and is particularly adapted for use with telephones but capable of various applications.

The binding posts or plugs now in common use for telephone instruments are open to various objections, and in their operation are subject to important difficulties. Of the plugs in use some are defective as to the mechanical connection afforded, and frequently the circuit is broken by failure in this regard. All such plugs present an exposed metallic surface, and the two plugs connected to the coils of the positive and negative poles of the receiver magnet, are immediately adjacent to each other, so that in using the instrument there is a considerable chance of short-circuiting the receiver accidentally and without the knowledge of the operator, whereby the distinctness of the message is materially reduced if it is not rendered altogether inaudible. In addition to this, the telephone companies, in numerous instances, use automatic counters. By making connection between the exposed metallic binding posts on the receiver and a part of the register, registration is prevented. With the terminals or plugs as now used, this is easily accomplished with consequent elimination of the count. Because of this chance of deception and the fact that the exposed connections are a constant source of temptation to various people who are inclined to tamper with the circuit, the exposed plugs are found undesirable. To overcome these various difficulties and produce a plug connection which affords a convenient sure and positive lock for the terminals so that breaking the circuit is out of the question and which has an extended contact which is always maintained by means of a resilient member under compression, which contact is improved as tension is applied to the wires, is the object of my invention. The preferred embodiment of the invention by means of which this result is accomplished, consists of a socket and plug, the intermediate portion of the socket being

formed of a plurality of resilient members or spring arms which are curved or bowed outward in the direction of their length, so that the internal surfaces presented by the socket are in a form approaching that of a cone, the walls of which are resilient to a degree. The plug is likewise formed intermediately of a plurality of resilient members or bands which are bowed outward so that when the plug is inserted through the mouth or opening of the socket, the resilient arms of the plug, which in fact present a section of conical surface, are brought into contact with the internal conical surface presented by the socket. Preferably the mouth of the socket is elongated to form a flat sided ellipse and the resilient arms lead from the flat sides of the ellipse, being spread in a direction at right angles to the long diameter of the ellipse. Also the resilient members or arms of the plug are spread or bowed centrally so they present a section of a conical surface or of a surface approaching the conical.

When the plug is inserted, it is passed through the elliptical mouth of the socket and advanced, the elongated diameter of the ellipse providing for the spread of the bowed arms of the plug, so the plug arms enter the spaces between the socket arms. Then the plug is rotated to bring the arms of the plug and socket into contact. To lock the plug in this position, both the plug and socket arms are curved concentrically on a short radius less than that swung by the plug arms when the plug is rotated. Thus in operative position the plug arms rest each in a curved seat formed by the corresponding socket arms, and the contact between the plug and socket is substantially perfect, being that of internal spring cones with external spring cones. As the contact members are resilient, the plug being, when released, slightly greater in transverse dimension than the socket, the resulting electrical contact is exceedingly good, and, further, it is improved by the tension applied to the wires tending to withdraw the plug, as such tension draws the conical contact surfaces into close contact.

The plug and socket referred to may be produced in any manner within the scope of the invention. In their preferred form they are constructed each of a tubular section, two pieces of tube of different diameter being used, the external diameter of one tube section being substantially equal to

or slightly less than the internal diameter of the other, so that one tube fits inside the other. The tubes thus selected are slotted in a longitudinal direction and cut away to a considerable extent, so that each tube section takes the form of two collars or sleeves connected by one or more, preferably two longitudinal bands or arms substantially parallel to the axis. The bands are then bowed outward intermediately of their length, and the collar at one end of the socket members is slightly flattened or elongated so that it takes an elliptical form, the short diameter being at least equal to the diameter of the tube and the long diameter of the ellipse being at right angles to the line connecting the centers of the diverging bands or arms, so that if two transverse sections of the socket are taken, one near the mouth and the other intermediately of the length of the arms, these sections will in effect be one elliptical and the other a section or two sections of an ellipse, but the long axes of the ellipses will be at right angles to each other. In the case of the plug member both ends are preferably round and the arms are spread centrally. The wires are secured to the plug and socket, being preferably soldered into the circular openings of the ends of the tube sections. When connections are to be made by means of the plug and socket, the free end of the plug, *i. e.*, that to which no wire is attached, is inserted in the elliptical mouth of the socket, and the plug is moved downward until the end of the plug is near the bottom of a socket and takes a bearing in the bottom ring thereof and the diverging arms of the plug are between, *i. e.* in the slots between the diverging arms of the socket. The plug is then rotated bringing the arms of the socket and plug into contact and in this connection the circular arcuate formation of the two sets of arms causes them to lock in operative position as the arms of the plug drop into the hollowed out recesses of the arms of the socket. The lower cylindrical end of the plug turns in the cylindrical end of the socket and serves to position and align the plug.

As we have stated, when the device is used in connection with a telephone, the socket is seated well down in the insulation; in fact, the socket extends inward from the bottom of an aperture in the insulation and the plug is formed with a head of insulating material through which the wire is passed, the head being of a size to fit the aperture in the insulating material of the receiver. Thus the plug and all portions of the connections which are composed of conducting material are completely covered with insulation, and all chance of short-circuiting the receiver by accident is eliminated. It is also rendered so difficult to tamper with

the connections as heretofore described, that the average person will not make the attempt for the purpose of preventing registration and deceiving the telephone company as to the number of calls; but, further, the construction of the device is such that short-circuiting for this purpose can only be conveniently accomplished by scratching away the insulation on the wires, and if this is done, the deception will be apparent to the inspectors.

In the accompanying drawings I have illustrated a telephone receiver to which a set of plugs and sockets constructed in accordance with my invention in its preferred form has been applied.

In the drawings Figure 1 is a transverse, vertical section of the receiver showing the connections and the magnet. Fig. 2 is an elevation showing the plug and socket removed. Fig. 3 is a side elevation of the plug taken at right angles to Fig. 2. Fig. 4 is a view on the line 4, 4, Fig. 2, looking up at the plug and down at the socket. Fig. 5 is an elevation showing the plug and socket in their operative relation. Fig. 6 is a transverse section on the line 6, 6 of Fig. 5. Fig. 7 is a bottom plan of the device as seen in Fig. 5. Fig. 8 is a view of the socket taken at right angles to Fig. 2. Figs. 9 and 10 are views of a similar but slightly modified form of the device; and Figs. 11 and 12 represent a cable connection constructed on principles somewhat similar to those embodied in the plug which is shown in the other views.

Referring to the drawings by reference numerals, each of which is used to indicate the same or similar parts of the different figures, the socket 1, as shown, consists of two collars or rings 2 and 3 connected by means of spring arms or bands 4, and to this extent the plug 5 is similar to the socket in that it consists of two rings or collars 6 and 7 connected by means of longitudinal spring arms 8. The plug 5 is adapted to fit inside the socket 1 and the parts are constructed of suitable dimensions to provide for this relation. Aside from this, while the bottom collar or ring 3 of the socket is round, the top collar or ring 2 is flattened or elongated so that the mouth of the socket indicated by reference character 9 is elliptical. Also the spring arms connecting the top and bottom collars 2 and 3 of the socket are spread or bowed outward centrally of their length between the collars, at right angles to the long diameter of the ellipse 9, so that the arms are given a curve in the direction of their length and caused to converge toward the upper and lower rings or collars 2 and 3. The arms 4 are also curved in a plane at right angles to their length as in the plane 6, 6, see Fig. 5. The plug 5 resembles the socket to a degree and the arms

8 of the plug are bowed outward, but the top and bottom rings or collars 6 and 7 are cylindrical. The arms 8 are also curved laterally as shown in Figs. 4 and 6, and the curvature of the arms is such that the external surfaces of the arms 8 normally fit the internal surfaces of the arms 4, and the radius of the curvature is considerably less than half the distance between the arms of the respective pairs 4, 4 and 8, 8, that of the arms 4 being preferably the same as the curvature of the lower collar 3 of the socket and the curvature of the arms 8 being preferably the same as that of the top circular collar 6 of the plug. Affixed in any convenient manner to the top of the plug 5 is an insulating member or block 10 preferably cylindrical in form.

The plug 5 and the socket 1 may be constructed to the best advantage of sections of ordinary tube, the tube forming the plug being of a size to fit conveniently within that used for the socket. Thus the conical surfaces formed externally of the plug and internally of the socket by bowing out the arms are of substantially the same form, and when the plug is seated within the socket, the most perfect electrical contact results. To make the desired connection, the plug 5 is turned so that the greatest diameter, *i. e.*, that between the most remote portions of the bowed arms 8, is parallel to the long axis of the elliptical collar 2 and the plug is inserted. As it is forced downward as thus presented, the bottom circular ring 7 of the plug passing through the elliptical opening 9 in the top ring 2 of the socket, the bowed arms 8 of the plug passing downward through the ends of the ellipse 9, enter the openings 11 between the bowed arms 4 of the socket, and when the plug has been passed downward sufficiently so that the widest spread of the arms is opposite the corresponding portion of the arms 4, and the ring 7 is seated in the collar 3, the plug is rotated about the arms of the ring and collar which form a journal, bringing the spring arms of the plug and socket into alinement and into engagement, the arms 8 of the socket entering the curved seats formed therefor by the inner surfaces of the spring arms 4 of the plug. However, to accomplish this operation of rotating the plug, it is necessary to spring or bend slightly the arms of the two members. This is because the centers 12 of the lateral curvature of the arms are spaced outward from the center 13 about which the plug rotates, so that to seat the arms 8 in the inner curved surfaces of the arms 4 of the socket, it is necessary to distort one or both of the members. As the socket and plug are constructed of material which is resilient to a greater or less degree, this is conveniently accom-

plished and when the parts have thus been rotated, they are locked in fixed relation as shown in Fig. 6, the arms 8 of the plug being in continuous and perfect contact with the arms 4 of the socket, and, further, if tension is placed on the wires 14 and 15 which are attached to the connecting members, the effectiveness of the electrical contact instead of being reduced, is considerably increased, for the terminals instead of being separated are forced together. The resistive power of the connection thus made is such that it cannot be broken by any stress which is apt to be applied to it.

When the plug is used in connection with a telephone receiver, as shown in Fig. 1, the socket members 1 may be seated in the insulation, one on each side of the center of the receiver, and the wires are introduced into the bottom circular collar 3 of each socket and soldered, one such wire leading to the coil 16 on each leg of the magnet. The wires 15, which may be termed the outside wires, are passed through the insulating blocks 10 for which a suitable seat is formed in the insulation and soldered in the circular opening 17 in the upper collar of the plug. Thus when the connections are made, all metal portions of the circuit, the wires being suitably insulated, are covered and protected by insulating material, and it is impossible to short-circuit the receiver without scraping away the insulation or otherwise making it evident that an attempt to tamper with the circuit has been made.

In Figs. 9 and 10 a socket is shown which in its construction is similar to that illustrated in the other figures, except that instead of being used in connection with a telephone receiver, it is attached externally to a suitable support and is used to serve the function of the ordinary binding post.

Figs. 11 and 12 show a connection for cables or the like consisting of two sets of bowed spring arms 20 on the plug and 21 on the socket, the arms 21 on the socket being separated at their forward ends and locked by means of a sliding ring 22 when the plug 20 is inserted.

The operation of the device will be clearly apparent from the description taken in connection with the drawings. I have thus described specifically a number of embodiments of the invention in order that the nature and operation of the device may be clearly understood; however, the specific terms herein are used descriptively rather than in their limiting sense and the scope of the invention is defined in the claims.

What I claim is:

1. In a plug and socket connection, a socket consisting of an elliptical collar and a circular collar, bowed spring arms connecting the collars and joined to the elliptical

collar at the ends of the short axes, a plug consisting of two collars and bowed spring arms connecting the collars.

2. In a plug and socket connection, a
5 socket consisting of an elliptical collar and a circular collar, bowed spring arms connecting the collars and joined to the elliptical collar at the ends of the short axes, a plug consisting of two circular collars and
10 bowed spring arms connecting the collars, one collar of the plug fitting and taking a bearing in the circular collar of the socket.

3. In a plug and socket connection, a
15 socket consisting of an elliptical collar and a circular collar, bowed spring arms connecting the collars and joined to the elliptical collar at the ends of the short axes, a plug consisting of two circular collars and bowed spring arms connecting the collars,
20 the bowed arms of both the socket and the plug being curved laterally so that in operative position the curves are concentric, the inner surfaces of the socket arms having a radius equal to that of the external surface
25 of the plug arms.

4. In a plug and socket connection, a
socket consisting of an elliptical collar and a circular collar, bowed spring arms connecting the collars and joined to the elliptical collar at the ends of the short axes, a
30 plug consisting of two circular collars and bowed spring arms connecting the collars, the bowed arms of both the socket and the plug being curved laterally so that in operative position the curves are concentric, the
35 inner surfaces of the socket arms having a radius equal to that of the external surface of the plug arms, the bowed arms in their operative position being so placed that the
40 respective centers of curvature of the arms are spaced apart by a considerable distance, so that in rotating the plug about its axis, the arms are distorted as the plug arms enter their seats in the socket arms.

45 5. A socket composed of spring bands having an elongated mouth, the interior of the

socket opening having a transverse dimension at right angles to the long diameter of the mouth, such dimension being of a length less than such diameter, and a plug having a
50 portion of elongated cross-section, the greatest dimension of this portion being slightly less than the long diameter of the mouth of the socket, and a shank of lesser cross-sectional dimension so that the plug can be inserted in the socket, the long dimension of the plug being parallel to the long diameter of the mouth of the socket, the plug being then rotatable to bring the parts into close
55 contact, one member being slightly resilient. 60

6. In a plug and socket connection, a
socket having an elongated opening at the mouth, the dimension of the aperture within the socket taken in the direction of the short diameter of the mouth being greater than
65 said short diameter, and a plug of elongated cross-section having bowed spring arms.

7. In a plug and socket connection, a
socket having an elongated opening at the mouth, the dimension of the aperture within
70 the socket taken in the direction of the short diameter of the mouth being greater than said short diameter, a plug of elongated cross-section having bowed spring arms, and means connecting said arms at both ends
75 thereof.

8. In a plug and socket connection, a
socket consisting of spring arms, means connecting the arms at their rear ends, an elliptical collar connecting the arms at their
80 outer ends, and a plug having a portion of elongated cross-section to pass through the collar, and a reduced end of slightly less diameter than the least diameter of the collar opening.
85

Signed by me at Baltimore, Md., this 25th day of February, 1913.

BENJAMIN B. TURNER.

Witnesses:

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EDWIN F. SAMUELS.