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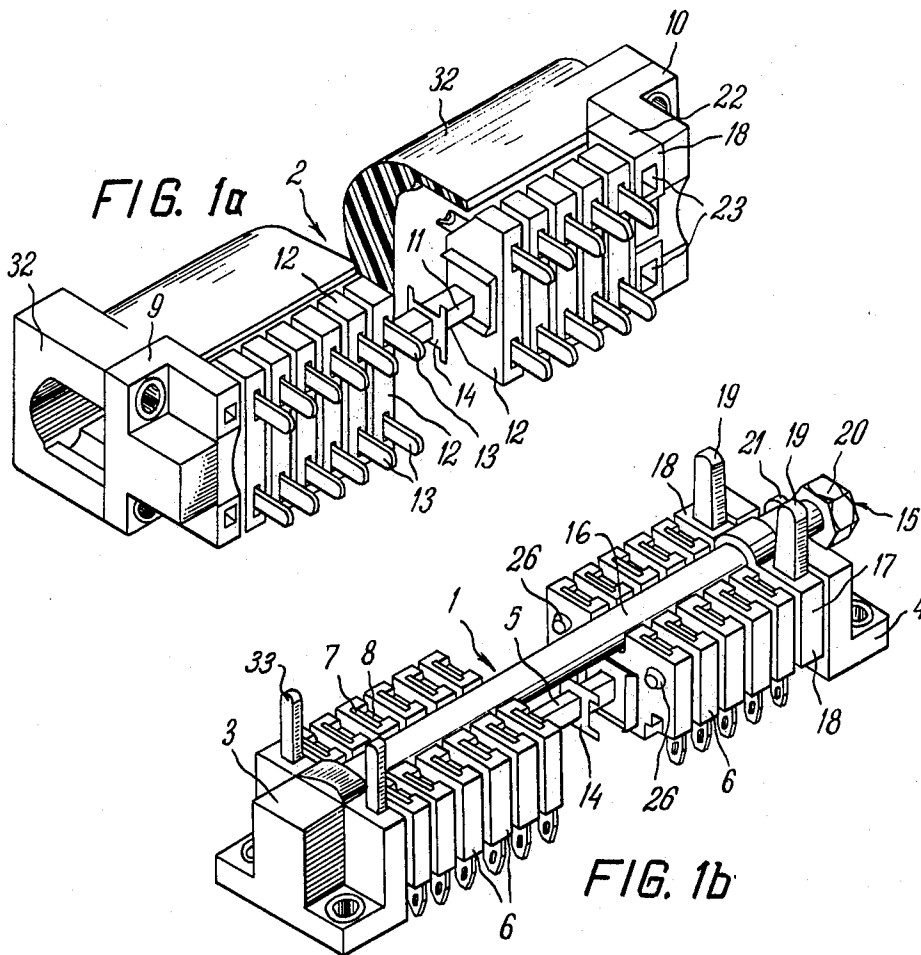
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3,487,352

PLUG-TYPE CONNECTION

Filed May 18, 1967

2 Sheets-Sheet 1



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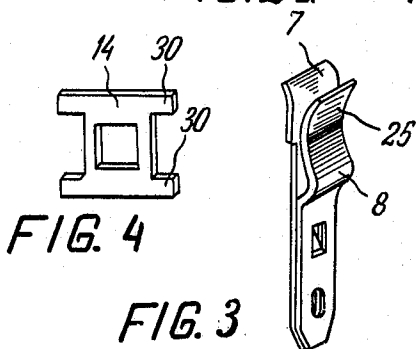
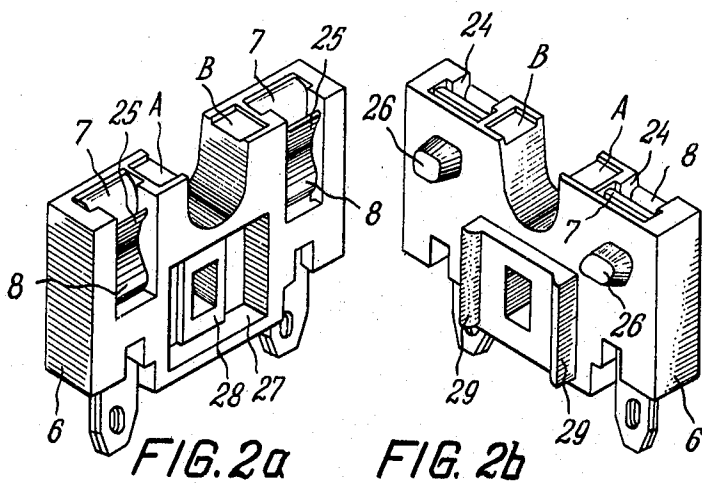
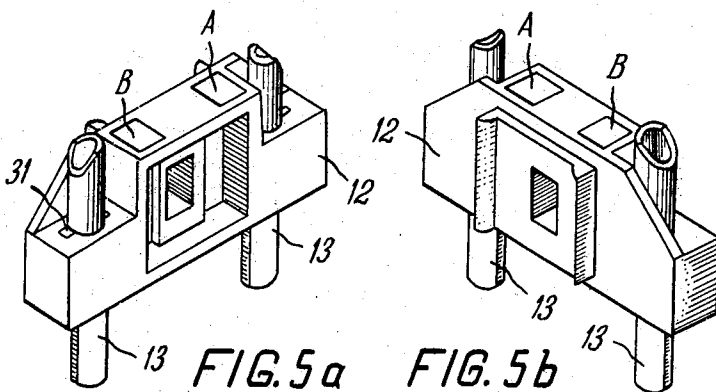
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PLUG-TYPE CONNECTION

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6 Claims 10

ABSTRACT OF THE DISCLOSURE

A plug-type connection intended for use under especially heavy working conditions involving considerable vibrations, impact loads applied at great accelerations, and other factors influencing dependability and stability of a contact resistance, comprising a plug and a socket, and a common clamping mechanism, allowing the contact pressure to be considerably increased on all the contact pairs after joining the plug with the socket, whereby each of the component parts of the plug-type connection, both the plug and the socket, is composed of two fixed bearing plates rigidly interconnected with the aid of a guide rod, on each of which therealong are movably mounted a plurality of plates made of an insulating material, said plates carrying the contacts of the plug and the socket, respectively, whereas between the contact-carrying plates there are movably provided steel blade springs insuring between the said plates a gap which is required for joining; the said plates are also allowed to shift along the guides under the action of the clamping mechanism and to return into their initial position after relieving the compressive effort.

The said plug-type connection is capable, owing to the use of a special pressure plate in the clamping mechanism, of simultaneously carrying out without any misalignment the shifting of the contact-carrying plates both of the plug and socket, whereas the absence in the said clamping of spring elements prevents the contacts of the plug-type connection from jarring when employed under conditions of impact and vibrational loads.

The present invention relates to the field of electrical connections and, more particularly, to plug-type connections.

Now in use are plug-type connections, whose plugs and sockets are composed of separate contact-carrying plates rigidly secured in guides. Such a design facilitates considerably the provision of plug-type connections with varying number of contacts for different current values.

However, the above-mentioned connections suffer from disadvantages inherent in all plug-type connections wherein the elasticity of contacts is made use of, namely, considerably high static and dynamic unstability of the electric contact resistance. Besides, the contact pressure value in such connections is limited, since, the greater the contact pressure, the greater the efforts of joining and separating the plug and the socket of the connection, and the shorter the service life of the contact-protecting coating.

Attempts have been made to use plug-type connections with normal contact pressure when joining, followed by a forced pressing of each pair of contacts with the aid of cams. However, uniform contact pressure in all pairs of contacts of such connections cannot be insured due to unavoidable allowances in the process of manufacture. Besides, the effort required for forced pressing of all pairs of contacts is equal to the sum of efforts required for

forced pressing of each pair of contacts; in the case of a substantial number of contacts this effort may be quite a considerable one.

It is an object of the present invention to provide a plug-type connection, wherein joining and separating the plug and the socket are attained with comparative ease, while the plug and the socket are composed of separate plates, the contacts in said plates being force-pressed, after jointing, to provide for a greater contact pressure.

It is another object of the invention to provide a plug-type connection, wherein the forced pressing of contacts is effected with the aid of a plate shifting mechanism.

It is still another object of the invention to provide a plug-type connection, wherein the shifting of the plates of the plug and of the socket is effected simultaneously, with the aid of a common pressure plate.

It is a further object of the invention to provide a plug-type connection, wherein said pressure plate is made of two parts joined by means of corresponding projections and grooves, said projections serving at the same time as guides when joining the plug with the socket.

It is also an object of the present invention to provide a plug-type connection, wherein contact terminals are protected with a cover that may be placed both on the plug and on the socket whereas conductors are sealed on emerging from the cover.

Moreover, another object of the present invention is to provide such a plug-type connection, in which, after compressing the contacts the pressure applied to all the contact pairs will prove to be equal.

A still further object of the present invention is to provide such a plug-type connection, in which, under conditions of heavy impact and vibrational loads, there is not required any additional securing of the plug to the socket, and there is completely eliminating the jarring of the contacts.

A test model of the device according to the present invention has the following characteristics: the value of contact resistance of a pressed pair of contacts is less than or equal to 6.10^{-4} ohm; the value of static and dynamic unstability of contact resistance of a pair of contacts is less than or equal to 1%; the maximum value of linear acceleration, which a pressed plug-type connection can stand without any additional securing of the plug to the socket, exceeds 1,000 m./sec.².

In accordance with the above and other objects, the present invention consists of a novel device and a combination of parts and elements of the design as described herein-below and presented in the appended claims, and it is to be understood that alterations in the exact embodiment of the device according to the invention disclosed herein may take place without departing from the spirit and scope thereof.

Other objects and advantages of the present invention will be apparent from the detailed description thereof, reference being had to the accompanying drawings, wherein:

FIGS. 1a and 1b illustrates a conditionally separated plug-type connection according to the invention, in axonometric projection;

FIGS. 2a and 2b shows a conditionally separated pair of the socket plates, in axonometric projection;

FIG. 3 shows the socket contacts;

FIG. 4 shows a blade spring; and

FIGS. 5a and 5b shows a conditionally separated pair of the plug plates, in axonometric projection.

The plug-type connection according to the present invention comprises a socket 1 (FIG. 1) and a plug 2. The socket 1 has two bearing plates 3 and 4 connected to each other with the aid of a guide rod 5 manufactured of a dielectric material, for example, glass plastics, having

metal plates embedded therein in order to increase their mechanical strength.

Emerging from the bearing plate 3 are metal parts 33 which function as guides for conjugating plug 2 with the socket 1. The bearing plates 3 and 4 are interconnected by means of a metal guide rod 5 of rectangular cross-section. Movable provided on the rod 5, between the support or bearing plates 3 and 4, are a plurality of plates 6 manufactured of a dielectric material such as, for example, glass plastics. Plates 6 carry contacts 7 and 8. Movable provided between the plates 6 on the guide rod 5 are steel blade springs 14 insuring a specified distance between the plates 6 when inserting the plug 2 into the socket 1. Between one end of a plurality of plates 6 and the bearing plate 4 there is movably mounted a portion 17 of pressure plate 18 manufactured of a dielectric material such as, for example, glass plastics, reinforced with a metal plate embedded therein, the said metal plate having projecting metal ends 19. The portion 17 of the pressure plate 18 is provided with an opening passing the threaded end of a pin 16 therethrough. The second end of the dowel pin 16 is rigidly connected to the bearing plate 3. Provided between the portion 17 of the pressure plate 18 and a nut 20 on the dowel pin 16 is a pressure bushing 21. Each plate 6 and the portion 17 of the pressure plate 18 are provided with projections 26 engaging a portion 25 (FIG. 3) of the contact 8.

The plug 2 also has two bearing plates 9 and 10 manufactured of a dielectric material such as, for example, glass plastics. The bearing plate 9 is provided with recesses, into which enter projecting portions 33 of the bearing plate 3 of the socket 1 when the plug 2 is inserted therein. The bearing plates 9 and 10 are interconnected by means of a metal guide rod 11 of rectangular cross-section. Movable provided on the rod 11 between the bearing plates 9 and 10 are a plurality of plates 12 manufactured of a dielectric material such as, for example, glass plastics, carrying contacts 13.

The steel blade springs 14 are movably mounted on the guide rod 11 between the plates 12 of the plug 2, to provide for the preset distance between said plates 12 when the plug 2 and socket 1 are joined.

For joining, the contact pins 13 of the plug 2 get between the contacts 7 and 8 of the socket 1.

After joining the plug 2 and the socket 1, their contacts (13, 7 and 8, respectively) are pressed with the aid of a mechanism 15 for shifting the plates 6 and 12, which has a dowel pin 16, whose one end is connected to the bearing plate 3 of the socket 1, while the other threaded end passes through a part 17 of a pressure plate 18 with two projections 19, said pressure plate being mounted on the guide rod 5 between the plates 6 on one side and the bearing plate 4 on the other side.

Movable mounted between one end of a plurality of plates 12 and the bearing plate 10 is the portion 22 of the pressure plate 18 manufactured of a dielectric material such as, for example, glass plastics. The portion 22 of the pressure plate 18 is provided with recesses 23 into which enter, during joining of the plug 2 to the socket 1, projections 19 of the portion 17 of the pressure plate 18, thus forming the pressure plate 18 in assembly. Simultaneously, the projections 19 of the portion 17 of the pressure plate 18 function as guides when joining the plug 2 with the socket 1. The clamping mechanism 15, intended for simultaneously shifting the plates 6 and 12 after joining the plug 2 with the socket 1, comprises the following of the above-mentioned units: pin 16, pressure plate 18, pressure bushing 21 and nut 20.

The arrangement of the plates 6 of the socket 1, the contacts 7 and 8 and the steel blade springs 14, as well as the cooperation of all these parts, are shown in detail in FIGS. 2, 3 and 4 to better understand one skilled in the art the principle of operation of the plug-type connection.

Each plate 6 (FIG. 2) has a pair of grooves 24, each of the latter carrying immovable contacts 7 (FIGS. 2 and 3) and movable contacts 8. The movable contacts 8 rest with their upper part 25 against projections 26 of the adjacent plate 6. To provide for a required clearance between the plates 6, as well as for the possibility of their shifting relative each other, each of these plates has on one side a recess 27 with a projection 28 in the middle, to house the steel blade spring 14 (FIG. 4), whereas on the other side of each plate 6 provisions is made for projections 29 resting against ends 30 of the steel blade spring of the adjacent plate 6.

When pressed, the plates 6 are brought together, pressing with the projections 29 the ends 30 of the steel blade springs 14, whereas projections 26 shift the movable contact 8 to the stationary contact 7. The pressing effort relieved, the ends 30 of the steel blade springs 14 straighten out and move the plates 6 apart.

The arrangement of the plates 12 of the plug 2 and their cooperation are shown in detail in FIG. 5.

Each plate 12 of the plug 2 has two grooves 31, each of the latter carrying the contact pins 13.

The mounting of the steel blade springs 14 and their operation correspond to those of the springs 14 of the socket 1.

For joining the plug 2 with the socket 1, the projecting ends 19 of the portion 17 of the pressure plate 18 and the projecting ends 33 of the bearing plate 3 enters the corresponding recesses 23 of the portion 22 of the pressure plate 18 and the recesses provided in the bearing plate 9. The contacts 13 of the plug 2 enter between the contacts 7 and 8 of the plug 1. When screwing on the nut 20, the pressure bushing 21 is shifted, which in turn moves the pressure plate 18. When shifting along the guides 5 and 11, the pressure plate 18 simultaneously moves the plates 6 and 12. Ends 30 of the springs 14 are compressed so that the gaps between the plates 6 of the socket 1 and the plates 12 of the plug 2 decrease. Thus, the projections 26 shift the movable contacts 8 in the direction of the stationary contacts 7, due to which the contact pressure between each contact pair is increased, and since the contact pairs are disposed in succession one after another along the direction of the force application, the value of the contact pressure as applied to all the contact pairs will be the same. In order to separate the plug 2 and the socket 1, the nut 20 will have to be unscrewed. Thus, the tips 30 of the spring 14 will straighten and draw apart the plates 6 and 12, on account of which the plug 2 and the socket 1 can be easily separated.

The plug-type connection according to the present invention has a cover 32 (FIG. 1) mounted on the plug 2 on the side of the contacts in the place where wires are connected thereto. Inside the cover 32 provision is made for a cavity to house conductors connected to the contacts, and the cutout in the place where the conductors emerge from the cover. Provided on the lateral sides of this cutout is a packing (not shown) made of any known resilient material such as, for example, rubber, which, when the cover is secured to the bearing plates, engages tightly with the egressing wires and retains them in the proper plate. The cover may be mounted with the aid of screws on the side of the plug 2, as well as on the side of the socket 1, or both on the side of the plug 2 and the socket 1, since the distance between the fixing screws is the same in the plug 2 and the socket 1. Besides, the cover 32 facilitates the use of the connection and protects the personnel from being injured by electric current.

Although the present invention has been described hereinabove in connection with a preferred embodiment thereof, various alterations and modifications may take place without departing from the spirit and scope of the invention, as those skilled in the art will easily understand.

Such alterations and modifications are to be considered as falling within the essence and scope of the invention.

We claim:

1. A plug-type connection comprising: a socket including bearing plates; at least one guide rod connected to said bearing plates; insulation plates, contacts on said insulation plates, said insulation plates being movable on the said guide rod and including on one side projections engaging at least partially the contacts of the next adjacent contact-carrying insulation plate; resilient elements movably mounted on the said guide rod between the said insulation plates; a plug including bearing plates; at least one guide rod connected between the said bearing plates; contact-carrying insulation plates, movably mounted on the latter said guide rod therealong; elastic elements movably mounted on the latter said guide rod between the second said contact-carrying insulation plates; means for shifting the said contact-carrying plates including a dowel pin, one end of which is rigidly connected to one of the said bearing plates, and the other of which is threaded; a pressure plate including two halves, each of which is movably mounted on corresponding guide rods of the socket and plug, one of the halves of the pressure plate being provided with an opening to pass the said dowel pin therethrough; a pressure bushing disposed on the said dowel pin at said threaded end in corresponding recesses provided in the bearing plates of the socket and plug, between the said pressure plate, and a nut provided on the threaded portion of the said dowel pin.

2. A plug-type connection according to claim 1, wherein one of the halves of the said pressure plate is disposed between the said bearing plate, and one end of said plurality of contact-carrying plates of the socket, and the other half is disposed on the plug part between one of the bearing plates and one end of said plurality of contact-carrying plates, and one-half of the said pressure plate includes at least one projection, and the other half of said pressure plate is provided with at least one recess, disposed in such a manner that when the plug and socket are conjugated the projection enters the respective recess.

3. A plug-type connection according to claim 1, wherein the socket pressure plate half includes at least one projection or recess, and the plug pressure plate half includes a cooperating projection or recess disposed in such a manner that when the plug and socket are conjugated, the projection enters the respective recess.

4. A plug-type connection as claimed in claim 1, wherein the said resilient elements are steel blade springs.

5. A plug-type connection according to claim 1, wherein each said resilient element is disposed in a recess on one side of each said contact carrying plate and the other side of each contact-carrying plate has at least one projection which engages the resilient element of an adjacent plate.

6. A plug-type connection according to claim 1, wherein said plug or socket is provided with at least one cover means having a cutout portion through which output wires, connected to said contacts, extend, said cover means also having a packing of elastic material, which during the securing of the cover means to the plug or socket tightly contacts the output wires, thus retaining them in place.

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