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ELECTRICALLY CONDUCTIVE COUPLING

Filed Jan. 4, 1966

FIG. 1

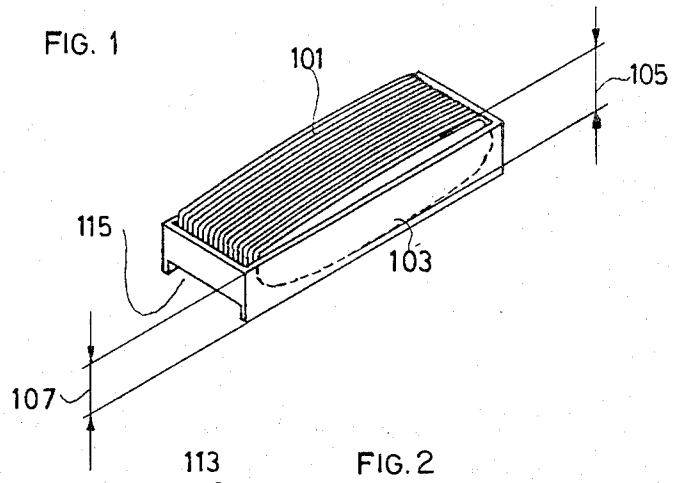
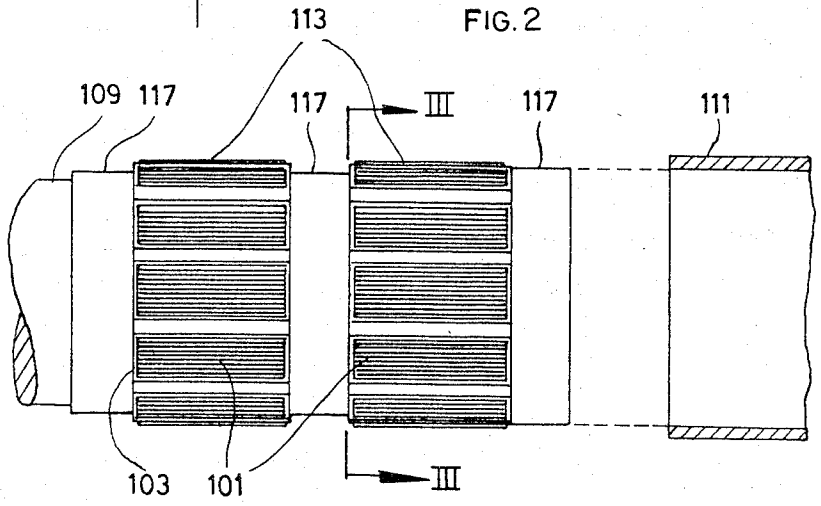


FIG. 2



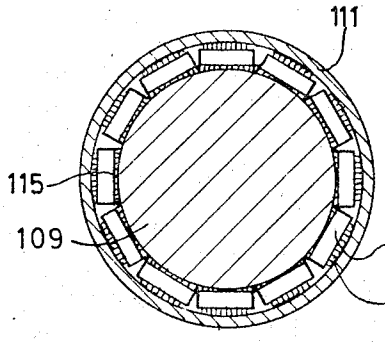


FIG. 3

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ELECTRICALLY CONDUCTIVE COUPLING

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8 Claims. (Cl. 339—255)

ABSTRACT OF THE DISCLOSURE

An electrically conductive coupling in which a cylindrical plug is connected to a socket by stacks of spring wire turns flattened so as to be elongated in the axial direction of plug movement. The longitudinal portions of each wire turn abuttingly engage, under their resilient force, conductive faces of the plug and socket. The stacks are secured to the plug face by axially elongated frames which are radially open, and are circumferentially uniformly spaced on the plug face.

This invention relates to couplings for connecting electrical conductors, and particularly to a coupling of the plug-and-socket type in which a plug or male coupling member may be inserted into a recess of a socket or female member for connecting conductors attached to the coupling members.

An object of the invention is the porvision of a coupling particularly useful for connecting rigid conductors and allowing for limited relative movement of the conductors due to thermal expansion and contraction and the like without impairing the conductivity of the coupling.

Another object is the provision of a coupling suitable for carrying heavy currents, yet capable of being engaged in a simple manner without requiring tools nor much manual effort.

With these and other objects in view, as will become apparent hereinafter, the invention in one of its aspects mainly resides in the provision of a resilient contact arrangement including several stacks of spring wire, each stack having several wire turns elongated in the direction of inward and outward movement of the plug in the recess of the socket. The plug and socket have respective conductive faces which spacedly face each other when the plug is inserted in the recess of the socket. The contact arrangement is secured to one of these faces in such a position that the two longitudinal portions of each turn abuttingly engage the two conductive faces when the plug is in the recess of the socket, the turn portion engaging the plug being spaced inward of the recess from the turn portion engaging the socket. When the longitudinal portions of a turn simultaneously abuttingly engage the afore-mentioned conductive faces, each turn is resiliently deformed from its relaxed condition.

The turns of each stack are juxtaposed transversely of the direction of plug movement and transversely of the afore-mentioned inward direction, and the stack as such is elongated in the direction of plug movement, and its length is greater than its width, and greater than its height which is in the afore-mentioned inward direction.

Each stack is secured to the associated conductive face by a frame which is open in the inward direction and oppositely thereto, and whose height is smaller than that of the received stack. The several stacks are preferably spacedly distributed in a plane perpendicular to the direction of plug movement. The ratio of length and height of each turn must be at least 2:1, but is preferably between 5:1 and 8:1 for best results.

Other features, additional objects, and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawing in which:

FIG. 1 shows a detail of the coupling of FIG. 2 in enlarged perspective view;

FIG. 2 shows a disengaged coupling of the invention in side elevation; and

FIG. 3 shows the coupling of FIG. 2 in the engaged condition in section on a line corresponding to line III—III in FIG. 2.

Referring now to the drawing in detail, there is seen a coupling of the invention including a solid, cylindrical, conductive plug **109** and a tubular, cylindrical, conductive socket **111** whose internal diameter is greater than the external diameter of the plug **109**. In the engaged position of theco upling in which the male plug **109** is coaxially received in the bore of the female socket **111** contact between the coupling members is provided by multiple spring stacks **101** of which one is shown in FIG. 1 in perspective view. The stack consists of a multiplicity of identical wire turns each of which is substantially elliptic in the relaxed condition illustrated. The several turns have a common perpendicular axis and are axially contiguously juxtaposed. The height **105** of the stack is less than one fifth of its length, the height and length of the stack corresponding to the major and minor axes of the ellipse formed by each turn. The stack has about 15 turns of silver-plated round beryllium copper wire, and the width of the stack perpendicular to its height and length is greater than the height, but smaller than the length.

The stack is enveloped by a frame **103** which extends about the stack in the direction of length and width of the latter, but is open in the direction of stack height. The corresponding height **107** of the frame **103** is smaller than the height **105** of the stack. The narrow walls of the frame **103** have marginal recesses **115** the purpose of which will presently become apparent.

FIGS. 2 and 3 show two groups of spring stacks **101** arranged in respective annular zones **113** of the plug **109** and axially secured by retaining rings **117**. Each stack **101** is held in its frame **103** which is oriented in such a manner that its longitudinal walls extends in the direction of the plug axis and abuttingly engage the plug surface. The recesses **115** in the narrow walls of the frame **103** accommodate the curvature of the plug surface as best seen in FIG. 3.

The several turns of each stack **101** are elongated in the direction of the plug axis, and each turn projects from the associated frame **103** in opposite radial directions simultaneously to engage the plug and the socket **111** under compressive stress. The rings **117** are radially dimensioned to guide the plug **109** during coaxial insertion into the socket **111**. It will be appreciated that the outer faces of the several spring stacks **101**, when in the relaxed condition, define a cylindrical surface having a greater diameter than the internal diameter of the socket **111**. When compressed, their turns are approximately kidney-shaped.

The stacks **101** and the associated frames **103** may be employed with plug-and-socket type couplings whose members may have any configuration, and the showing of cylindrical members in FIGS. 2 and 3 will be understood to be merely illustrative. The number of stacks **101** which occupy but very little space may be selected freely to obtain the necessary current-carrying capacity. The useful length of life of the spring stacks **101** depends to a substantialy extent on the orientation of the wire

turns in the direction of relative movement of the coupling members during engagement and disengagement.

It should be understood, of course, that the foregoing disclosure relates to only a preferred embodiment of the invention, and that it is intended to cover all changes and modifications of the examples of the invention herein chosen for the purpose of the disclosure which do not constitute departures from the spirit and scope of the invention set forth in the appended claims.

We claim:

1. A conductive coupling comprising, in combination:
(a) a male coupling member;
(b) a female coupling member formed with a recess therein, said recess being shaped for inward and outward movement of said male coupling member in said recess in a predetermined direction,
(1) said coupling members having respective conductive faces extending in said direction and spacedly facing each other when said male coupling member is inserted in said recess;
(c) resilient contact means including a plurality of stacks of spring wire,
(1) each stack including a plurality of wire turns elongated in said direction, each turn having two longitudinal portions; and
(d) securing means securing said contact means to one of said faces in a position in which one of said longitudinal portions of each turn abuttingly engages said one face, the other longitudinal portion of each turn being spaced from said one portion in a direction inward of said recess for abutting engagement with said other face when said male coupling member is in said recess,
(1) each of said turns being resiliently deformed from the relaxed condition thereof when simultaneously abuttingly engaging said faces.

2. A coupling as set forth in claim 1, wherein said turns are elliptic.

3. A coupling as set forth in claim 1, wherein the length of each turn is at least twice the greatest dimension of the turn at right angles to the direction of elongation thereof.

4. A coupling as set forth in claim 1, wherein the length of each turn is between five and eight times the greatest dimension of the turn at right angles to the direction of elongation thereof.

5. A coupling as set forth in claim 1, wherein said turns of each stack are juxtaposed transversely of the direction of elongation thereof, and transversely of said inward direction, the stack being elongated in said predetermined direction, and the length thereof being greater than the width thereof and greater than the height thereof in said inward direction.

6. A coupling as set forth in claim 5, wherein said securing means include a plurality of frames, each frame being open in said inward direction and oppositely thereto, and receiving a respective stack therein, the height of said frame in said inward direction being smaller than the height of the received stack.

7. A coupling as set forth in claim 6, wherein said securing means secure said stacks to said one face in a common plane perpendicular to said predetermined direction in spaced relationship, said one face having an annular zone in said plane, said stacks being substantially uniformly distributed over said zone.

8. A coupling as set forth in claim 6, wherein said one conductive face is of convexly arcuate across section about an axis extending in said predetermined direction, said frame has two axial walls and two narrow walls transverse of said axial walls and connecting the same, each narrow wall having a recess accommodating the curvature of said one face.

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