Feb. 11, 1941. F. M. JOSEPH 2,231,124

ELECTRICAL APPARATUS

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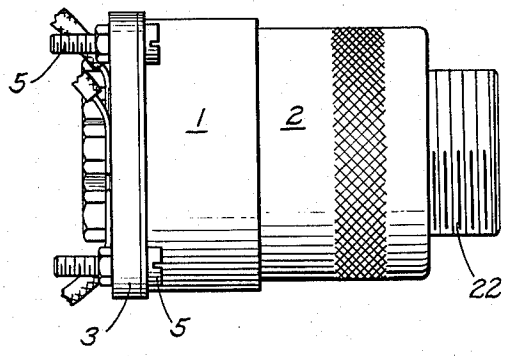

Fig. 1

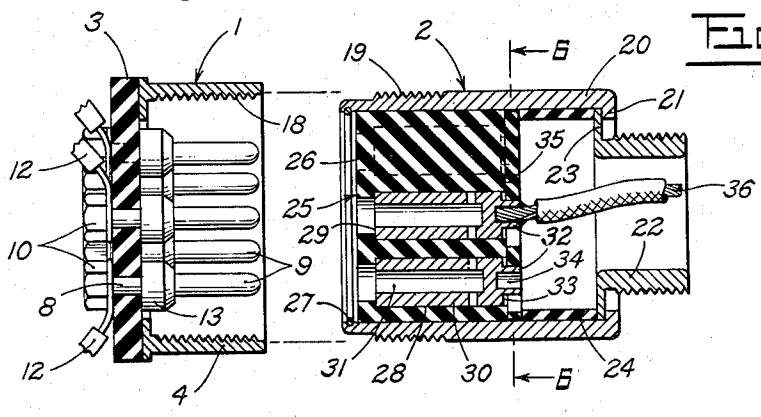

Fig. 2

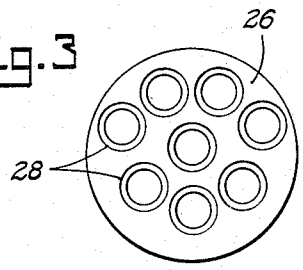

Fig. 3

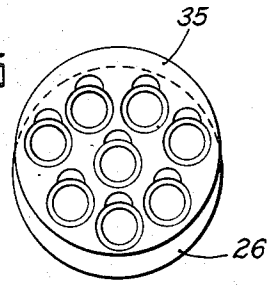

Fig. 5

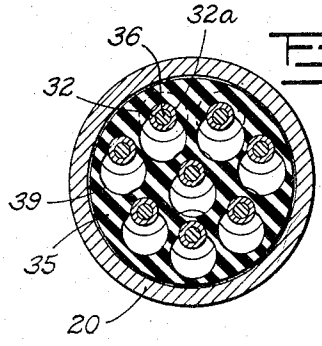

Fig. 6

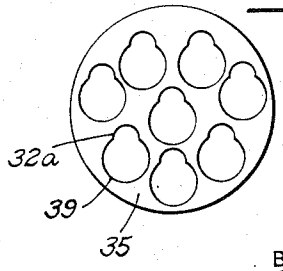

Fig. 4

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2,231,124

ELECTRICAL APPARATUS

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2 Claims. (Cl. 173—328)

This invention relates to electrical connectors adapted to be used, for example, in the control of current supply to various instruments and accessories used on a motor vehicle or aircraft, and more particularly to a connector in which the mating contact elements are housed and shielded within separate, complementary metallic shell members.

Such mating elements may house a plurality of plugs and sockets and be relatively rotatable so that one may be screwed into the other; and—as in Patent No. 2,095,254, granted to T. B. Holliday and R. K. Stout on October 12, 1937—one of these may be rotatable in relation to the circuit making contact members enclosed within it.

In the Holliday and Stout patent there is disclosed a retainer plate engageable with shoulders on the plug to hold the latter against displacement longitudinally of the insulating block in which said sockets are confined; the said retainer plate having parallel slots extending to the periphery of said plate to permit it to be moved into position across the reduced ends or "neck" portions, of the sockets, the positioning movement being transversely of the assembled sockets; such transverse movement being possible, of course, only by reason of the provision of the slots which extend to the periphery of the retainer plate and thereby permit such a method of positioning the plate.

These slots at the periphery necessarily reduce the ability of the retainer plate to resist displacement due to pull on the conductors, for the material remaining between the slots is readily flexible and may accordingly be bent backward and out of position. To combat this tendency the patentees Holliday et al. found it necessary to resort to additional retaining means, in the form of a set screw passed through the center slot, and gripping the insulating block itself. Such a set screw is shown at **36** in the drawings of the Holliday et al. patent.

The use of parallel slots, as in the Holliday et al. patent, requires that all conductor terminals be in corresponding parallel rows; and where the unit is circular in shape the use of such parallel rows involves a sacrifice of space, necessitating enlargement of the overall dimensions of the unit if additional circuit elements are demanded; it being well known that a circular area will accommodate a greater number of smaller circular units when such smaller units are placed in staggered, or offset, alignment, rather than in parallel rows. Moreover, where an additional retaining screw becomes necessary, such as the screw **36** of the Holliday et al. patent, this screw further reduces the space available for circuit terminals.

It is an object of the present invention to provide terminal retaining means of a construction such that its use in a circular unit of the Holliday et al. type will make it possible: (1) to stagger the terminal alignment and thereby increase the number of circuit elements that can be housed in a unit of a given diameter; and (2) to eliminate the set screw retainer of Holliday et al. and thereby further increase the total number of circuit elements that can be housed in such a unit.

Other objects of the invention will become apparent from inspection of the following specification when read with reference to the accompanying drawing wherein is illustrated the preferred embodiment of the invention. It is to be expressly understood, however, that the drawing is for the purpose of illustration only, and is not designed as a definition of the limits of the invention, reference being had to the appended claims for this purpose.

In the drawing:

Fig. 1 is a view in elevation of a device embodying the invention;

Fig. 2 is a longitudinal sectional view of the plug of Fig. 1, separated into two units, spaced one from the other;

Fig. 3 is an end view of the insulating block forming part of the assembled right-hand unit of Fig. 2;

Fig. 4 is a view in elevation of the retainer plate forming another part of the assembled right-hand unit of Fig. 2;

Fig. 5 is a view indicating the position of the retainer plate in relation to the insulating block, during passage of the terminal sockets through the former, into position in the latter; the electrical leads (conductors) having previously been soldered or otherwise secured to the respective terminal sockets; and

Fig. 6 is a transverse view along line **6—6** of Fig. 2, showing the retainer plate shifted, laterally, from the eccentric position shown in Fig. 5 to a position of concentricity with respect to the insulating block and housing.

The plug is composed of two principal units, as seen in Fig. 2, namely, a jack unit **1** and a socket unit **2**.

The jack unit comprises a base block **3** of suitable insulating material such as "Bakelite" and a shell member **4** which may be desirably

made of aluminum. The jack unit may be attached to the junction or other box by means of screws 5, which extend through openings on the shell base 3, as shown. The base 3 serves as an abutment for heads 13 of terminal posts 9, and is provided with a number of passages for receiving the shanks 8 of said terminal posts. Nuts 10 are threaded on the outer ends of the terminal posts 9 for clamping conductive terminal members of wires 12 to the respective posts.

Shell member 4 is provided with an internal thread 18 for coacting with an external thread 19 formed on a shell member 20, the latter shell member forming the housing member of the socket unit. The shell member 20 is cylindrical in form and is provided at the rear end thereof with an internal annular shoulder 21. A bushing 22 has an external flange 23 thereof disposed within the shell 20 against the shoulder 21, and the body of the bushing projects outward through an opening in the rear end of the shell. A cylindrical spacer sleeve 24 of insulating material is set in the shell against the flange 23 of the bushing 22. A socket assembly 25, which will be described in detail presently, is set in the shell against the spacer sleeve 24, and the elements are retained in place by means of a resilient split retaining ring or wire 27 which is snapped into a groove formed in the shell 20, adjacent the mouth thereof. The described parts may be readily taken out of the shell for inspection, repair or replacement by first removing the retaining ring 27.

The socket assembly 25 comprises a cylindrical socket block 26 which is free to rotate relative to the shell 20. The socket block has a plurality of bores 28 extending through it, each bore being reduced in size at its forward end to provide a rearwardly facing annular shoulder 29. The socket bores correspond in number and position to the jacks or terminal posts of the jack assembly. A metallic socket member 30 may be inserted in each bore 28 through the rear of the socket block 26. Each socket member 30 engages at its forward end against the shoulder 29 of the bore in which it is inserted, and each socket member 30 is provided with a bore 31 in axial alignment with the reduced forward portion of the bore in the block.

Each socket member 30 has a reduced rear end portion 32 and is provided with an abrupt annular shoulder 33 surrounding such reduced portion. The shoulders 33 stand substantially flush with the rear face of the socket block 26, and the reduced portions 32 protrude beyond the rear face of the socket block. Each of the reduced portions 32 has a central, axial recess 34 formed in it, in which an electric wire may be soldered.

The sockets 30 are all held in place in the socket block 26 by the retainer plate 35, best shown in Fig. 4, with holes 39, each having a contour corresponding in part to the contour of the main section of the terminal sockets, and in part to the contour of the reduced end portions 32 of said sockets; and each hole being spaced from its neighbors by an amount identical with the spacing of the holes in the block 26. Thus it is possible, by offsetting the plate 35 slightly in relation to the block (Fig. 5) while holding one in abutment with the other, to pass each wire, with its terminal, through its proper hole in plate 35 and into the proper hole in the block 26; it being understood that the wires (one of which is shown at 36 in Fig. 2) are passed into the recesses 34 of the terminals, and soldered thereto, in advance of being passed into the preassembled fitting elements 20, 21 and 22. When all have been installed, the plate 35 is shifted back to the concentric position (Fig. 6) thereby locking the terminals in the block 26, since the shoulders 33 thereof prevent—in the position of Fig. 6—the passage of any terminal through any hole of plate 35, and the smaller parts 32*a* of each plate hole now fit snugly about the reduced ends 32 of the terminals. After the wires 36 are inserted into the plate and socket block, the plate 25 is shifted laterally, as above described, and then—and only then—is the assembly 20, 21 and 22 drawn along the wires and into its final longitudinal relationship to the block 26; the said elements 20, 21 and 22 having theretofore been loosely disposed at some distance back from the terminal ends of the wires, although in surrounding relation thereto.

It will be observed that, due to the unbroken periphery of the plate 35, there is a uniform retaining pressure evenly distributed along the end surface of thrust-reaction sleeve 24; hence there is no need for additional retaining means such as set screws or the like.

The final operation, as in the Holliday et al. patent above identified, is to screw member 30 into member 4, thus producing the completed assembly as viewed in Fig. 1. This screwing together of the shell members forces the terminal jacks 9 into the sockets 31 of the socket members 30, and causes good electrical connections to be made. During this screwing up, block 26 is held against rotation (by the inter-engagement of jacks 16 therewith), there being a smooth, free fit of the block within the shell.

What I claim is:

1. In an electrical connector, a socket unit comprising a shell member, a socket block therein, a plurality of conductive socket members set in the socket block from the rear and each having a rearwardly facing shoulder and a reduced rear end portion, a retaining plate having openings spaced in staggered relationship and away from the periphery of said plate, the contour of said openings conforming in part to the contour of the major portion of said socket members, and in part to the reduced rear end portion thereof whereby the retaining plate can be moved laterally into embracing relation to all of said reduced portions, and means for holding the retaining plate against the back of the socket block, said holding means comprising a cylindrical sleeve against which the retaining plate bears along the entire unbroken surface of its periphery.

2. In an electrical connector, a socket unit comprising a shell member, a socket block therein, a plurality of conductive socket members set in the socket block from the rear and each having a rearwardly facing shoulder and a reduced rear end portion, a retaining plate having openings spaced in staggered relationship and away from the periphery of said plate, the contour of said openings conforming in part to the contour of the major portion of said socket members, and in part to the reduced rear end portion thereof whereby the retaining plate can be moved laterally into embracing relation to all of said reduced portions.

FRANCIS M. JOSEPH.