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D. D. GRIMES ET AL

2,997,682

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6 Sheets-Sheet 1

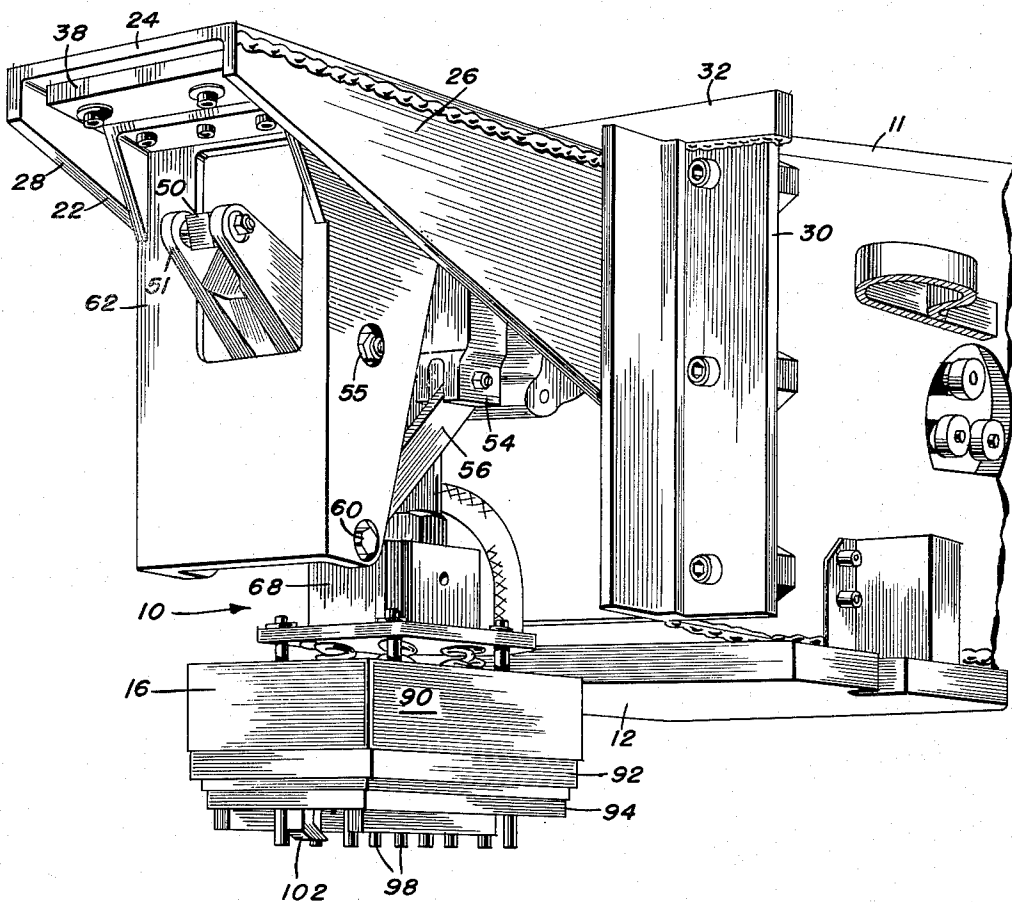


FIG. 1

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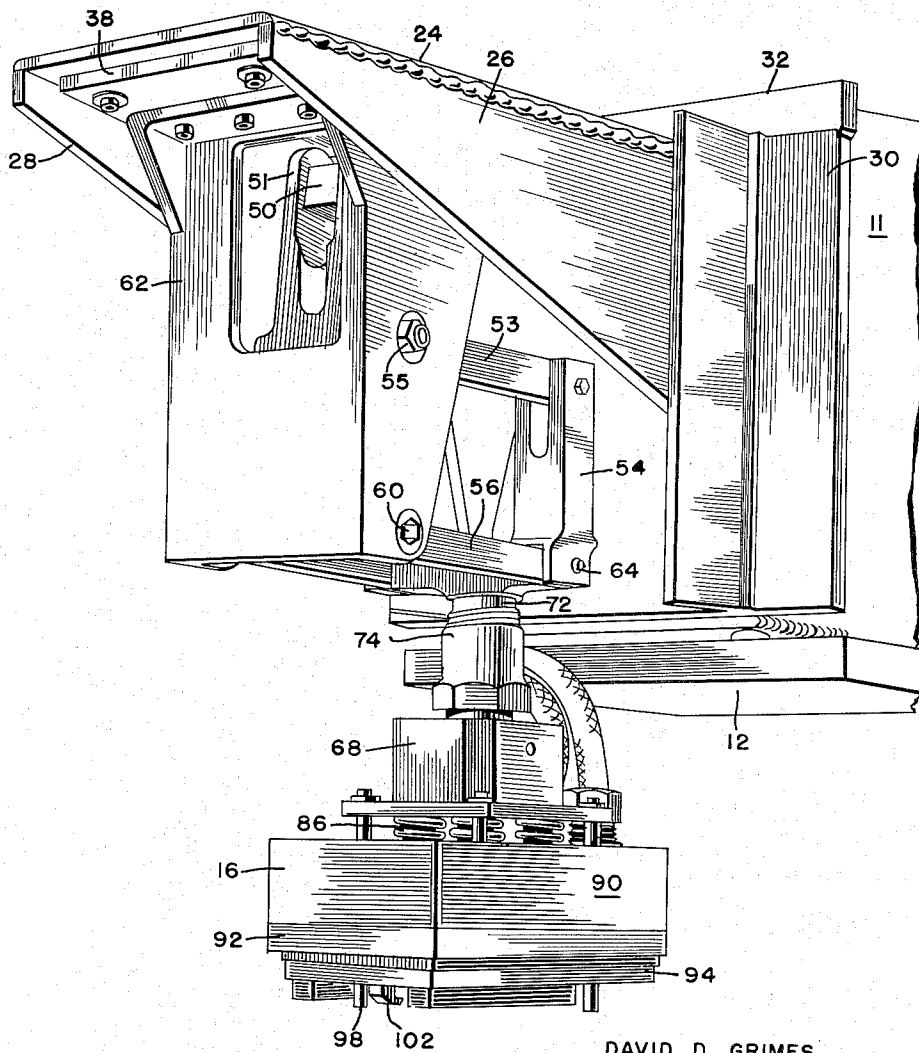


FIG. 2

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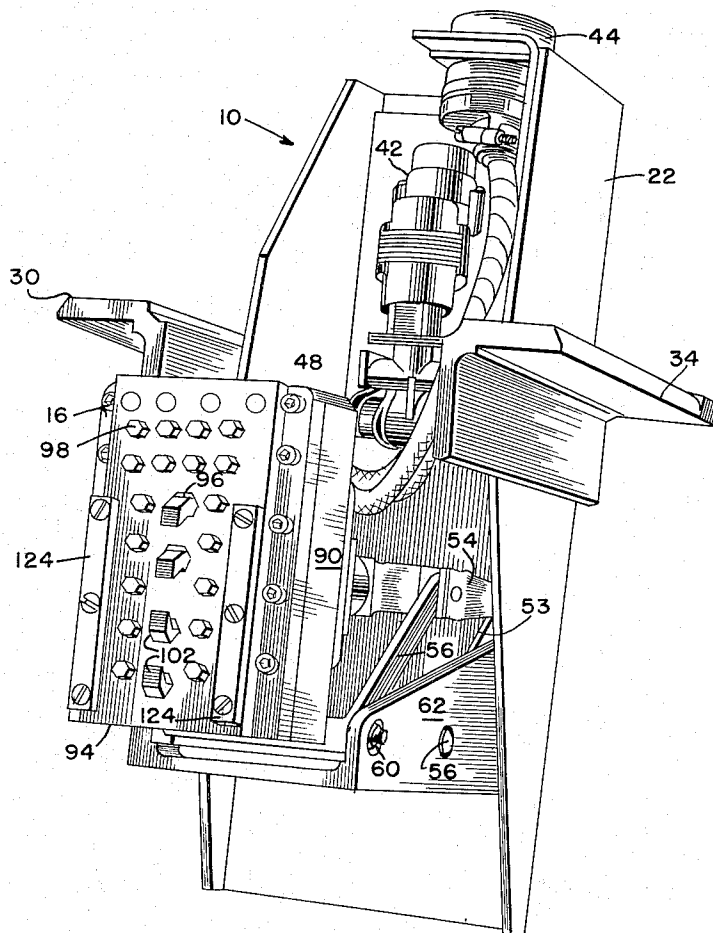


FIG. 3

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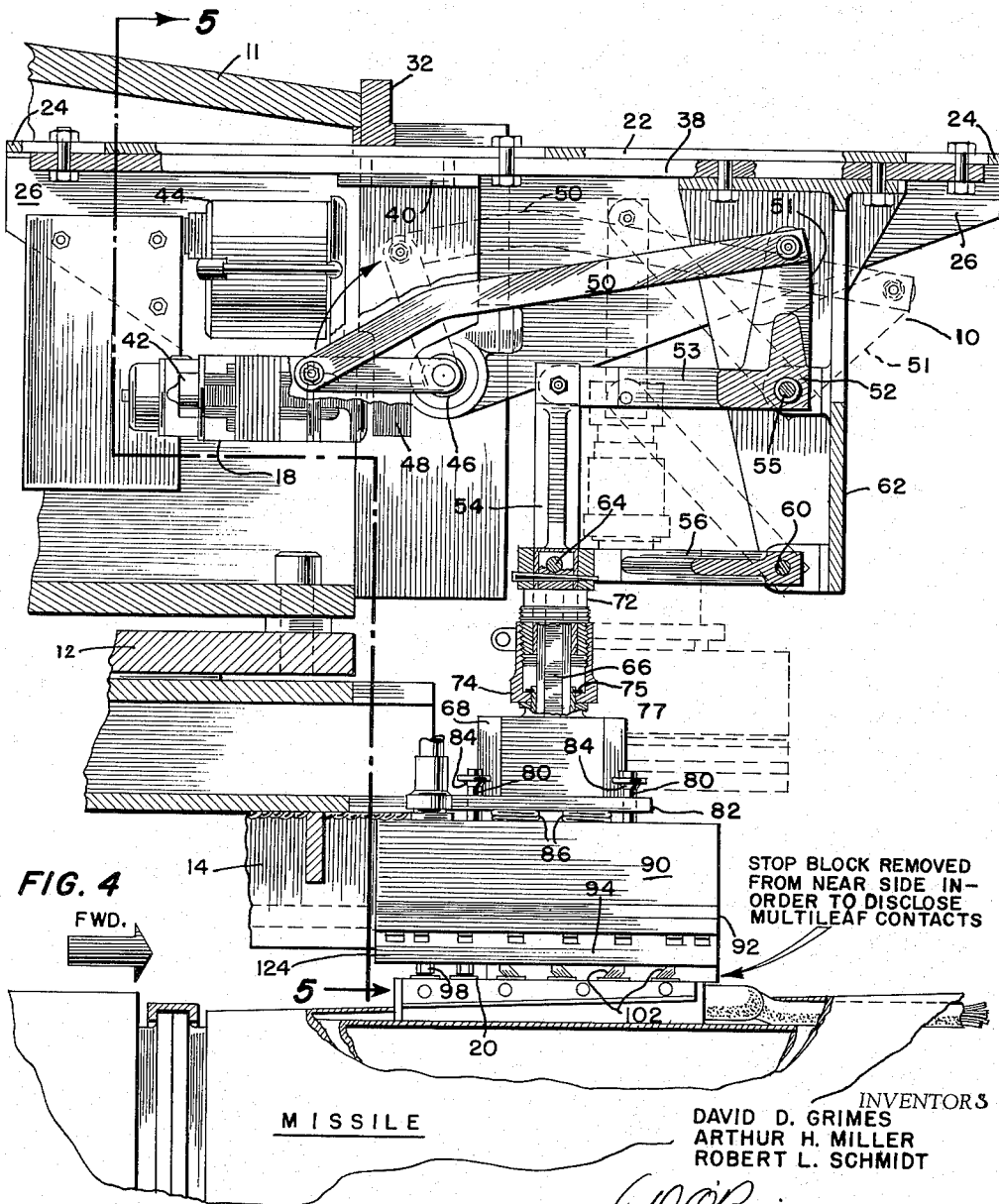
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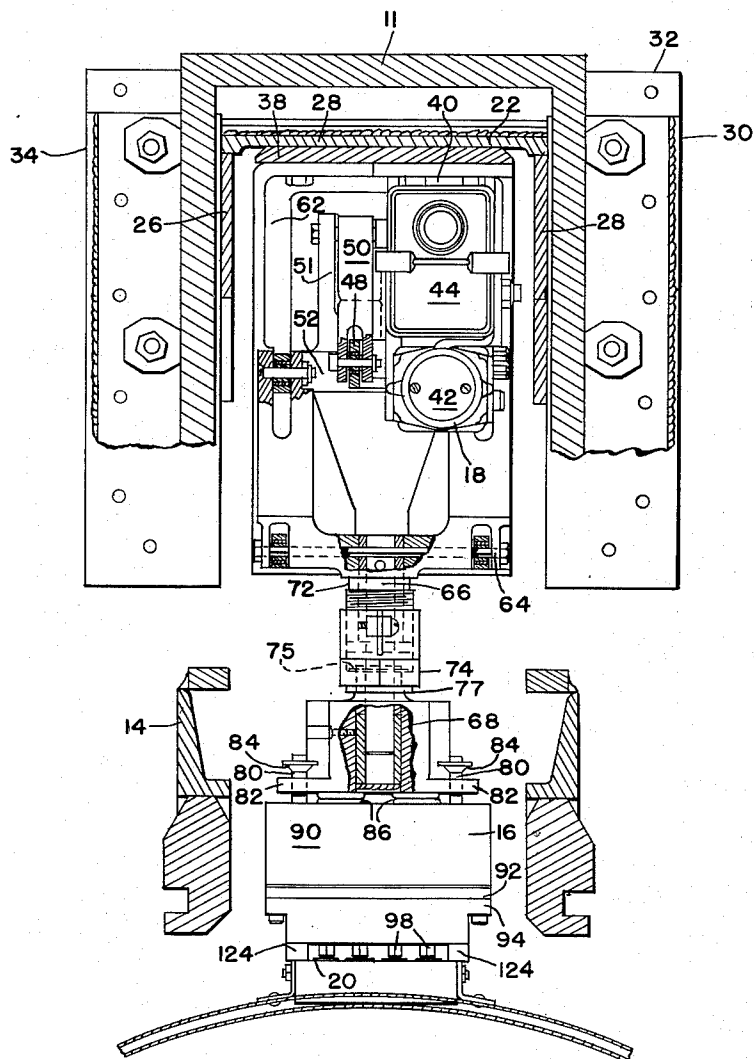
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FIG. 5



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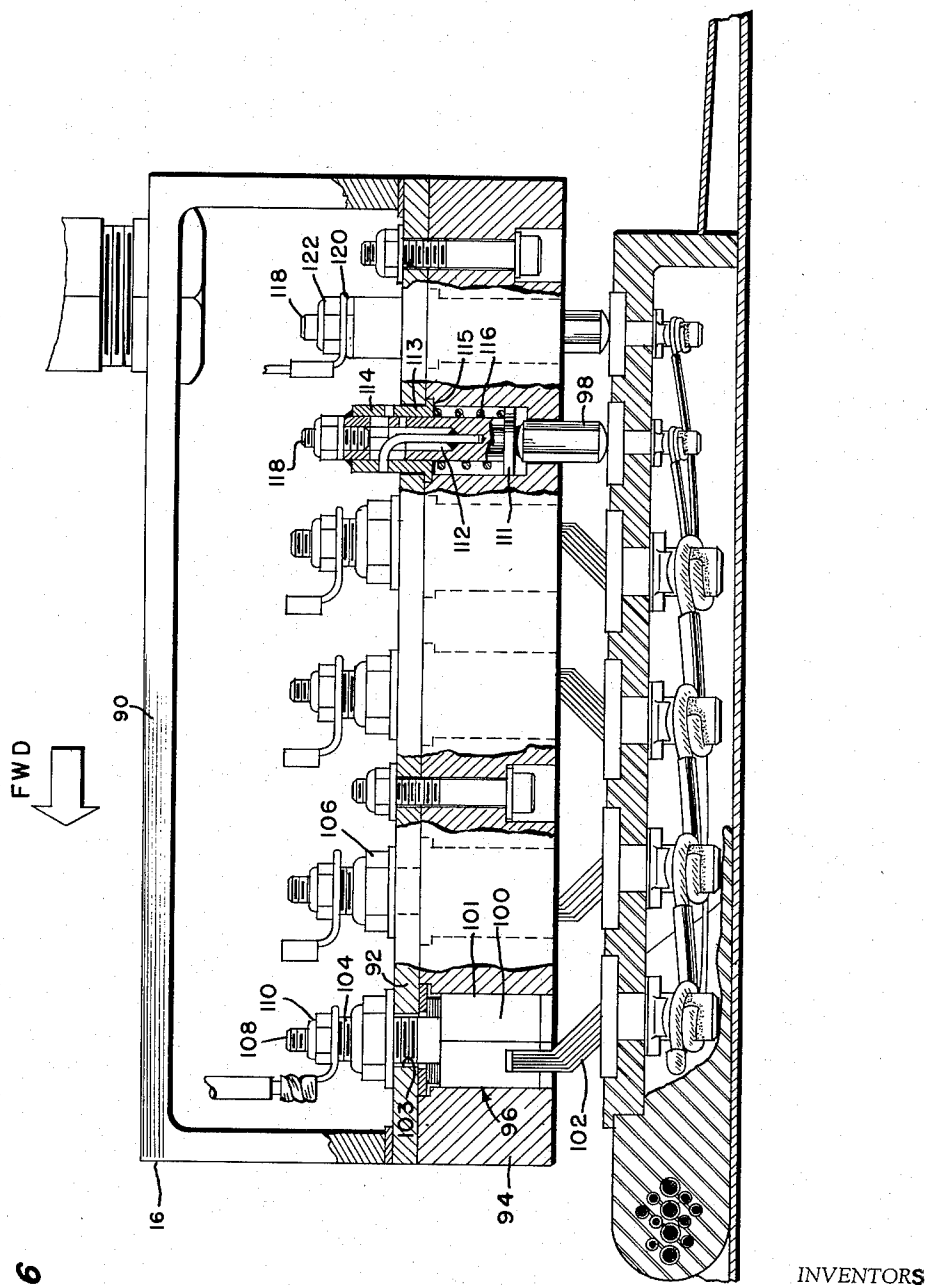
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CONNECTOR

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3 Claims. (Cl. 339-75)

The present invention relates to electrical connectors. In more detail, it relates to apparatus carried on a missile launcher by which electrical connections can be made between circuits in the missile and external equipment for final pre-flight testing.

The final pre-launching tests of a guided missile are usually made with the missile in firing position on the launcher. Formerly, to make the connections between the missile circuits and test circuits, a monitoring cable was used which was adapted to be plugged into a receptacle provided on the underside of the missile.

The cable was supported by a mechanism of the type disclosed in patent application Serial No. 459,568, filed September 30, 1954, by David D. Grimes, now Patent No. 2,786,393 for "Monitoring Cable Release Mechanism" so that its weight did not tend to pull the plug out of the receptacle. This mechanism included a solenoid which could be remotely actuated upon completion of the tests to release the cable.

This arrangement was not suited to use in a tactical launcher. Tactical operations require a connector which is carried on the launcher and which can be remotely actuated to make good electrical contact with the terminations of the missile circuits, after the missile has been moved into position on the launcher. Furthermore, a connector for tactical operations must enable the connections to be made quickly despite the variations in missile dimensions within manufacturing tolerances.

It is the primary object of the present invention to provide a connector which can be remotely actuated to make contact with the terminations of the missile test circuits.

It is a further object of the invention to provide a connector of the type indicated, and actuating means for the connector which will allow for variations in missile dimensions within manufacturing tolerances.

Still another object of this invention is to provide apparatus for making electrical connections between the terminations of missile circuits and external test circuits after the missile is in position on a launcher.

Other 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 drawings, wherein:

FIG. 1 is a perspective view showing the connector in its retracted position on the launcher arm;

FIG. 2 is a perspective view similar to FIG. 1, but showing the connector in its extended position;

FIG. 3 is a perspective view showing the connector removed from the launcher arm;

FIG. 4 is a side elevation of the connector, with some parts being shown in section;

FIG. 5 is a vertical section of the connector taken along line 5-5 of FIG. 4; and

FIG. 6 is an elevation, partially in section, showing the details of the plug of the present invention.

In accordance with the invention, apparatus is provided for making electrical connections between the terminals of missile circuits and external test circuits after the missile is in position on a launcher. This apparatus includes a plurality of contacts mounted on the plug, and remotely controlled means for moving the plug so that the

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contacts engage the terminations of the missile and external test circuits to make the desired electrical connections.

Specifically, a new type electrical connector is provided which consists of a plug, a plurality of resilient contacts on the plug, and guides carried on the plug for aligning the latter with a receptacle. In addition, means are provided for mounting the plug, including a spring housing, together with means for movably attaching the plug to the housing. A plurality of compression springs are interposed between the housing and the plug to preload the plug; together with means for moving the plug linearly into engagement with the receptacle.

Referring now to FIGS. 1, 2, and 3, it will be seen that a connecting means 10 is attached to the outer end of an arm 11 of a missile launcher. The launcher is of the type disclosed in U.S. patent application Serial No. 437,016, filed by Arthur H. Miller, on June 15, 1954, now Patent No. 2,981,150 for a "Launcher," and forms no part of this invention. It includes a mounting plate 12 attached to the underside of the launcher arm 11. As shown in FIG. 4, the mounting plate 12 carries rails 14 which receive the launching shoes carried on the missile booster.

The connecting means 10 comprises a plug 16, an actuator 18 for moving the plug into contact with the terminations of the missile circuits indicated by reference numeral 20 (FIGS. 4, 5, and 6), and a channel shaped bracket 22 for mounting the plug and actuator on the arm 11 of the launcher.

The bracket 22 includes a top plate 24, and side plates 26 and 28, as seen in FIGS. 4 and 5, which serve as a partial housing for the actuator. The bracket 22 is also provided with flanges 30, 32 and 34 by which it may be attached to the launcher arm 11. A second plate 38 is bolted to the underside of the top plate 24 and a mounting bracket 40, which carries the actuator 18, and an electrical receptacle 44, is attached by bolts to the plate 38.

The actuator 18 is a commercially available device and includes an electric motor 42 and an output shaft 46 connected to the motor shaft by intermediate gearing suitable for actuating the output shaft at the desired speed. The receptacle 44 receives a mating plug to complete the electrical connections between the motor and an external source of power as well as the connections between the plug 16 and the external test circuits. As shown best in FIG. 4, the output shaft 46 mechanically actuates plug 16 by means of connecting arms 48 and 50, one arm 51 of bell crank 52, and a parallel linkage including the other arm 53 of bell crank 52, arms 54 and 56, and a mounting bracket 62 which is supported from the plate 38.

The details of the connecting arms and the parallel linkage are best seen in FIGS. 3, 4, and 5. The arm 48, which is mounted on one end of shaft 46, is pivotally connected at its other end to the arm 50 which is a bent lever. The remaining end of arm 50 is pivotally received in a bifurcation provided on arm 51 of bell crank 52. The latter is pivotally mounted at 55 on the bracket 62 and also includes the bifurcated arm 53. Arm 53 is pivotally attached to the arm 54. Arm 54 is pivoted at its other end to a bifurcated portion of arm 56 which is pivoted to bracket 62 at 60.

A shaft 66 is pinned to the arms 54 and 56 at their common pivot point 64. A spring housing 68 is adjustably mounted on the shaft 66. A sleeve 72, having external threads, is carried on the shaft 66 to adjustably mount the spring housing 68. The spring housing 68 may be adjusted vertically by means of the collar 74 which has a flange retained between a washer 75 and a retaining ring 77 on the housing 68.

The spring housing 68 is provided with flanges which

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are apertured at 82 to receive bolts 79 by which the plug 16 is attached to the spring housing. The bolts 79 carry sleeves 80 having tapered bearing surfaces 84 which tend to center the bolts in the apertures 82 in the flanges on the spring housing 68. A plurality of compression springs 86, as shown in FIG. 4, for preloading the plug 16 are interposed between the spring housing 68 and the plug 16. The compression springs 86 are held in place by having their ends received in suitable recesses (not shown) provided in the surfaces of the spring housing 68 and the plug 16.

The apertures 82 are oversized to permit a limited amount of wobbling of the plug 16 in case the missile dimensions are such that the contacts carried on the plug 16 are not guided into position immediately. The compression springs 86 preload the plug 16 to permit the wobbling and at the same time maintain the desired pressure between the contacts carried on the plug 16 and the terminations 20 on the missile shell.

The details of the plug 16 are shown in FIG. 6. The plug 16 comprises a housing 90 having a bottom plate 92 of insulating material and a contact mounting plate 94, also of insulating material, attached to the housing and bottom plate 92. The plug includes a number of multi-leaf contacts 96 which are designed to carry relatively heavy loads and a number of spring loaded contacts 98 for making other connections to the circuit terminations 20 provided at the missile surface.

Each of the multi-leaf contacts 96 includes a block 100 of conducting material to which a plurality of bent leaves 102 of conducting material are attached. The block 100 is received in recesses 101 in block 94. It has a threaded sleeve 104 which is adapted to be inserted through an aperture 103 provided in the bottom plate 92 and it receives a nut 106. Suitable washers are provided to insure that the contact is firmly mounted. Electrical connections are made to the contact by means of a threaded terminal bolt 108 carried in the sleeve 104 and adapted to receive a nut 110.

Each of the spring loaded contacts 98 includes a pin contact 112 slidably carried in a sleeve 114 and received in an aperture 113 in the bottom plate 92. A suitable compression spring 116 is interposed between a flange 115 on the sleeve 114 and a flange 111 on the pin 112. Electrical connection is made by means of a threaded stud 118 adapted to receive a lug 120 held in place by a nut 122. A pair of spaced guides 124 are carried on the underside of the mounting plate 94 to align the plug.

In the operation of the device, the missile, which is provided with terminations 20, is mounted on the launcher arm 11, being supported by shoes attached to the missile engaging the rails 14 so that the terminations 20 are spaced from the plug 16. The motor 42 of the rotary actuator 18 is energized from a remote point to make electrical connections between contacts 98 carried on the plug 16 and the terminations 20.

This causes rotation of the output shaft 46 whose motion is transmitted through the mechanical linkage including arms 48 and 50, bell crank 52 and arms 54 and 56, to the shaft 66 carrying the spring housing 68 and the plug 16. The guides 124 carried on the plug align the contacts 98 with the terminations 20.

In the event of slight variations in missile dimension, which causes misalignment between the contacts 98 on the plug 16 and the receptacle contacts, the mounting permits the plug to wobble as described above. The multi-leaf spring contacts 96 and the spring loaded contacts 98 allow for variations in missile diameter.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. An electrical connector including a plug and a re-

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ceptacle for said plug, said connector being utilized for making connections between an electrical circuit terminating in said plug and a second electrical circuit terminating in said receptacle, a housing spaced from said plug, means including a plurality of compression springs interposed between said plug and housing for preloading said plug, means for attaching said spring housing to said plug to permit limited movement of said plug in case of misalignment in said plug engaging said receptacle, a plurality of resiliently mounted contacts on said plug for engagement with terminations on said receptacle, means including a plurality of guide elements carried by said plug and said receptacle for aligning said plug with said receptacle, and means including an actuator and a mechanical linkage connected to said spring housing for moving said plug with said contacts linearly into engagement with said terminations of said receptacle.

2. An electrical connector including a plug and a receptacle for said plug, said connector being utilized for making connections between an electrical circuit terminating in said plug and a second electrical circuit terminating in said receptacle, a housing spaced from said plug, means including a plurality of compression springs interposed between said plug and housing for preloading said plug, said compression springs being maintained in position by having their ends received in suitable recesses provided in the surfaces of said spring housing and plug, means for attaching said spring housing to said plug to permit limited movement of said plug in case of misalignment in said plug engaging said receptacle, a plurality of resiliently mounted contacts on said plug for engagement with terminations on said receptacle, means including a plurality of guide elements carried by said plug and receptacle for aligning said plug with said receptacle, and means including an actuator and a mechanical linkage connected to said spring housing for moving said plug with said contacts linearly into engagement with said terminations of said receptacle.

3. An electrical connector including a plug and a receptacle for said plug, said connector being utilized for making connections between an electrical circuit terminating in said plug and a second electrical circuit terminating in said receptacle, a housing spaced from said plug, means including a plurality of compression springs interposed between said plug and housing for preloading said plug, said compression springs being maintained in position by having their ends received in suitable recesses provided in the surfaces of said spring housing and plug, means for attaching said spring housing to said plug to permit limited movement of said plug in case of misalignment in said plug engaging said receptacle, a plurality of resiliently mounted contacts on said plug for engagement with terminations on said receptacle including multi-leaf contacts and spring-loaded contacts, means including a plurality of guide elements carried by said plug and receptacle for aligning said plug with said receptacle, and means including a rotary actuator and a mechanical linkage connected to said spring housing for moving said plug with said multi-leaf and spring-loaded contacts linearly into engagement with the terminations of said receptacle.

References Cited in the file of this patent

UNITED STATES PATENTS

65	1,567,474	Tomlinson	Dec. 29, 1925
	1,827,909	Pumphrey	Oct. 20, 1931
	2,068,399	Dash et al.	Jan. 19, 1937
	2,289,514	Mastney et al.	July 14, 1942
	2,476,249	Payne	July 12, 1949
70	2,692,972	Edgerton et al.	Oct. 26, 1954
	2,710,384	Dupre et al.	June 7, 1955

OTHER REFERENCES

Tele-Tech & Electronics Industries, May 1954, Guided Missiles, pp. 70, 71, 129, 130, 131.