

March 19, 1963

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3,082,396

AUTOMATIC ELECTRICAL CONNECTION DEVICE

Filed July 27, 1960

3 Sheets-Sheet 1

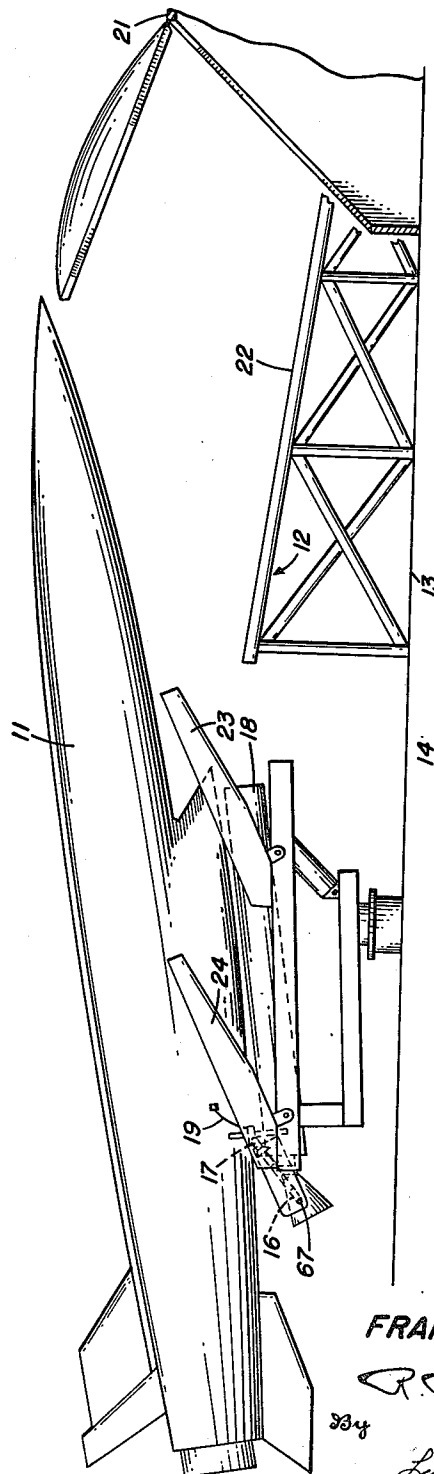


FIG. 1

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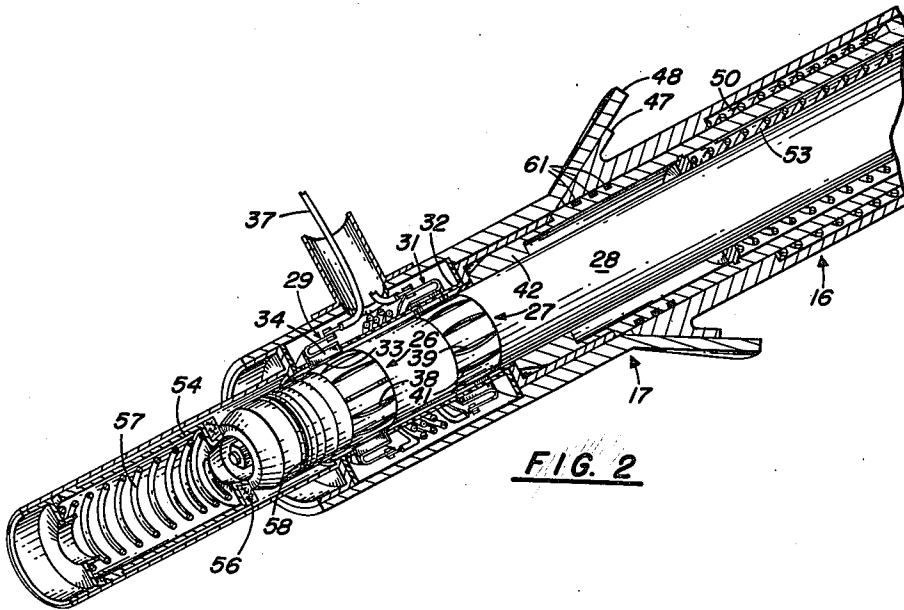
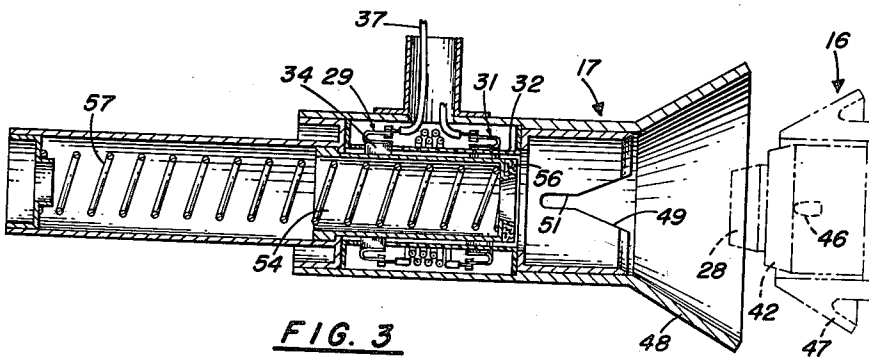
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AUTOMATIC ELECTRICAL CONNECTION DEVICE

Filed July 27, 1960

3 Sheets-Sheet 2



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AUTOMATIC ELECTRICAL CONNECTION DEVICE

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3 Sheets-Sheet 3

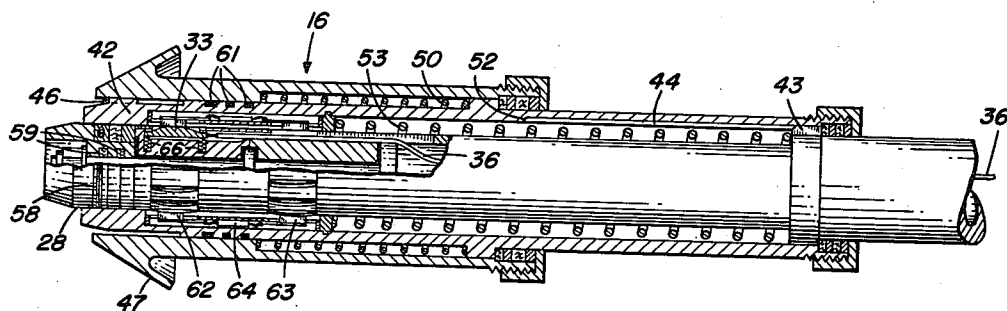


FIG. 4

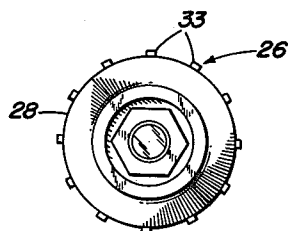


FIG. 5

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1

3,082,396

AUTOMATIC ELECTRICAL CONNECTION DEVICE
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Filed July 27, 1960, Ser. No. 45,772
2 Claims. (Cl. 339-65)

The present invention relates to electrical connection devices and more particularly to a probe-drogue arrangement to effectuate automatic coupling of electrical connectors.

In the launching from a submarine of missiles of the type that may be launched from the submarine only when it has surfaced, it is a well known fact that the shorter the period on the surface the less vulnerable the submarine will be to attack. Also, it is highly desirable that the launching be accomplished without the necessity of placing men on deck to prepare the missile since such men would be in danger of death or injury from exposure to heavy seas.

Thus to decrease the vulnerability of the missile-launching submarine and to preclude exposing its personnel to the hazards of heavy seas, efforts have been made to automate the ram-out, checkout and launching equipment and procedures. Among the devices requiring adaption to automation is the umbilical, which provides the electrical connection between the missile and the submarine. Automation has been accomplished with the present invention by the use of a probe-drogue arrangement, the probe being mounted on the launcher and the drogue being mounted on the carriage for the missile or the missile booster in the event no carriage is employed. Engagement between probe and drogue is effected automatically at the end of the ram-out (the period during which the missile is moved from the submarine hanger, along the launcher rails, and into position for launching). After engagement, the missile can be checked and fired at will as will be further developed in the description to follow.

Thus an object of the present invention is the provision of electrical connector devices which may be automatically coupled.

Another object of the present invention is to provide automatic electrical connection between two bodies by the relative movement of these bodies one of which moves in a fixed path relative to the second.

A further object is to promote speed and safety in completing the umbilical connection of a missile to a submarine which is launching such missile from its deck.

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 shows an application of an embodiment of the present invention, the probe and drogue assemblies having become automatically engaged during the process of readying the missile for launching;

FIG. 2 is an isometric view of an embodiment of the probe-drogue connection, part of the view being cut away;

FIG. 3 is a longitudinal section through the drogue assembly;

FIG. 4 is a longitudinal section through the probe assembly; and

FIG. 5 shows an end view of the probe with the cover removed to expose the contacts.

Referring now to the drawings, wherein like reference characters designate like or corresponding parts throughout the several views, there is shown in FIG. 1 a missile 11 in launching position on the launching device 12 on

2

the deck 13 of submarine 14. The umbilical providing electrical connection between missile 11 and submarine 14 consists of three parts, the probe assembly 16 mounted on launching device 12, the drogue assembly 17 mounted on carrier-booster 18 of missile 11 and the break-away pigtail 19 leading from drogue assembly 17 to missile 11. In the embodiment shown probe assembly 16 and drogue assembly 17 are engaged, the engagement having occurred automatically as missile 11 was moved out of hanger 21 along tracks 22 to its rearmost position prior to being tilted into launch position by flippers 23, 24. While probe assembly 16 and drogue assembly 17 are coupled, electric power can be made available from the submarine to permit execution of the various functions requisite for readying and firing missile 11.

As is shown in FIGS. 2, 3, and 4 when probe assembly 16 and drogue assembly 17 are coupled, probe contact sets 26, 27 which are circumferentially arranged about plug or probe 28 engage drogue assembly contact sets 29, 31 which are circumferentially arranged in the inner periphery of a socket or receptacle 32 of drogue assembly 17. Each of the individual contacts in contact sets 26, 27, 29, 31 has a separate wire leading to it and thus as each of the contact sets is placed in juxtaposition with its proper mating set a separate circuit is completed for each pair of contacts such as contacts 33 and 34 which are connected to wires 36, 37. Further, the individual contacts of probe contact set 26 are angularly displaced from the individual contacts of probe contact set 27. Thus, a line passing through contact 38 along the surface of probe 28 parallel to the axis of probe 28 passes midway between probe contacts 39, 41. In this manner it becomes easy to bring in the wires along probe 28 leading to probe contact set 26. A similar relative positioning is maintained between drogue assembly contact sets 29, 31 in order to affect coincidental contact between the individual contacts of contact sets 26 and 29 and contact sets 27, 31.

To make certain that specific contacts such as contacts 33 and 34 are mated to complete the proper circuits, probe 28 is provided with cover 42 keyed thereto by key 43 in slot 44, cover 42 in turn being provided with alignment cam 46 projecting out from the periphery thereof near its forward end. Thus, as the probe assembly 16 engages drogue assembly 17 when missile 11 is moved along track 22 and reaches launching position, positioning cone 47 of probe assembly 16 enters the entrance cone 48 of drogue assembly 17 providing axial alignment of the two elements. Probe 28 and cover 42 are moved farther into entrance cone 48 and receptacle 32, the alignment cam 46 of cover 42 being engaged by alignment guide 49 recessed into the wall of entrance cone 48. As positioning cone 47 is moved back against spring 50 alignment cam 46 is forced to enter the restricted portion 51 of alignment guide 49. In so doing cover 42 will be forced to rotate within entrance cone 47 in order to enter restricted portion 51. Since probe 28 and cover 42 are keyed together, probe 28 will be rotated together with cover 42. This forced rotation insures the angular engagement of probe 28 so that specific contacts such as contacts 33 and 34 will be placed in juxtaposition for proper engagement as receptacle 32 proceeds over probe 28. The axial position of probe contact sets 26 and 27 relative to drogue assembly contact sets 29, 31 is determined by key 43 and shoulder 52 in slot 44. Spring 53 opposes the axial movement of cover 42 relative to probe 28, of course, but drogue assembly 17 will under the force of moving missile 11 continue to move down over probe 28 pushing cover 42 back and forcing receptacle 32 over probe 28 until shoulder 52 reaches key 43. At this point the contact sets 26, 29 and 27, 31 will be properly juxtapositioned to make the proper circuits and supply electric

power to missile 11. As probe 28 enters receptacle 32, shield 54 with wiper 56 affixed thereto is forced back against the bias of spring 57 exposing and wiping contact sets 29, 31.

Since probe assembly 16 will be exposed to submersion in salt water and since very little leakage of salt water into the probe assembly can be tolerated watertight seals 58, 59 are provided between probe 28 and cover 42 and within the core of probe 28. Additional seals 61 are interposed between cover 42 and positioning cone 47.

Still another function of cover 42 is that of housing peripherally placed sets of checkout contacts 62, 63. By means of these contact sets and resistor 64 a check of the continuity of probe circuits can be rapidly made while probe assembly 16 is still in stowed position prior to mating with drogue assembly 17.

In the embodiment shown, the individual contacts of contact sets 26, 27 are biased outwardly by springs such as springs 66 for contact 33. Other contact sets may, of course, be so biased to insure intimate contact.

Although full details of the mounting of probe assembly 16 are not shown herein it is to be noted that in order to maintain its reference position to enable automatic engagement with drogue assembly 17 and yet be adaptable to temporary realignment to other positions when missile 11 is moved into launch position, probe assembly 16 is spring-mounted on a universal swivel 67. After each launching probe assembly 16 automatically returns to its reference position.

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 automatic electrical connection device comprising in combination an elongated cylindrical plug mounted on a fixed body, a reciprocal cover keyed to said plug, cam means on the forward end of said cover, a positioning cone reciprocally mounted on the cover, a plurality of first electrical contacts circumferentially spaced about the outer periphery of said plug and extending longitudinally along the axis of the plug, said plurality of first electrical contacts being of thin resilient material and having a slightly arcuate configuration extending outwardly from the longitudinal axis of the plug, a socket having a bell-shaped mouth mounted on a second body, said second body being movable in a fixed path relative to said fixed body, an alignment guide cut in one side of the bell-mouth, a plurality of second electrical contacts circumferentially spaced about the inner periphery of said socket and extending longitudinally along the axis of the socket, said plurality of second electrical contacts being rigidly mounted flush with the inner periphery of said socket, and waterproofing means between said plug and said cover whereby when connection is made between the

plug and the socket the cam means enters the alignment guide and rotates the plug until the first electrical contacts are aligned with the second electrical contacts.

2. An automatic electrical connection device comprising in combination an elongated cylindrical plug mounted on a fixed body, a reciprocal cover keyed to said plug, cam means on the forward end of said cover, a positioning cone reciprocally mounted on the cover, a plurality of first electrical contacts spaced circumferentially about the outer periphery of said plug and extending longitudinally along the axis of the plug, a plurality of second electrical contacts also spaced circumferentially about the outer periphery of said plug and also extending longitudinally along the axis of the plug but spaced from said plurality of first electrical contacts, said plurality of first and second contacts being of thin resilient material and having a slightly arcuate configuration extending outwardly from the longitudinal axis of the plug, a socket having a bell-shaped mouth mounted on a second body, said second body being movable in a fixed path relative to said fixed body, an alignment guide cut in one side of the bell-mouth shaped to receive the cam means and rotate the plug, a plurality of third electrical contacts arranged in spaced circumferential positions about the inner periphery of the socket and extending longitudinally along the axis of the socket, a plurality of fourth electrical contacts also arranged in spaced circumferential positions about the inner periphery of said socket and also extending longitudinally along the axis of the socket but spaced from said plurality of third electrical contacts, said plurality of third and fourth electrical contacts being rigidly mounted flush with the inner periphery of the socket, and waterproofing means between said plug and said cover, whereby when connection is made between the plug and the socket the positioning cone enters the bell-mouth, the cam means enters the alignment guide and rotates the plug until the first and second electrical contacts are aligned with the third and fourth electrical contacts.

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