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P. NEILL

2,432,120

ELECTRICAL CONNECTOR

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2 Sheets-Sheet 1

FIG. 1

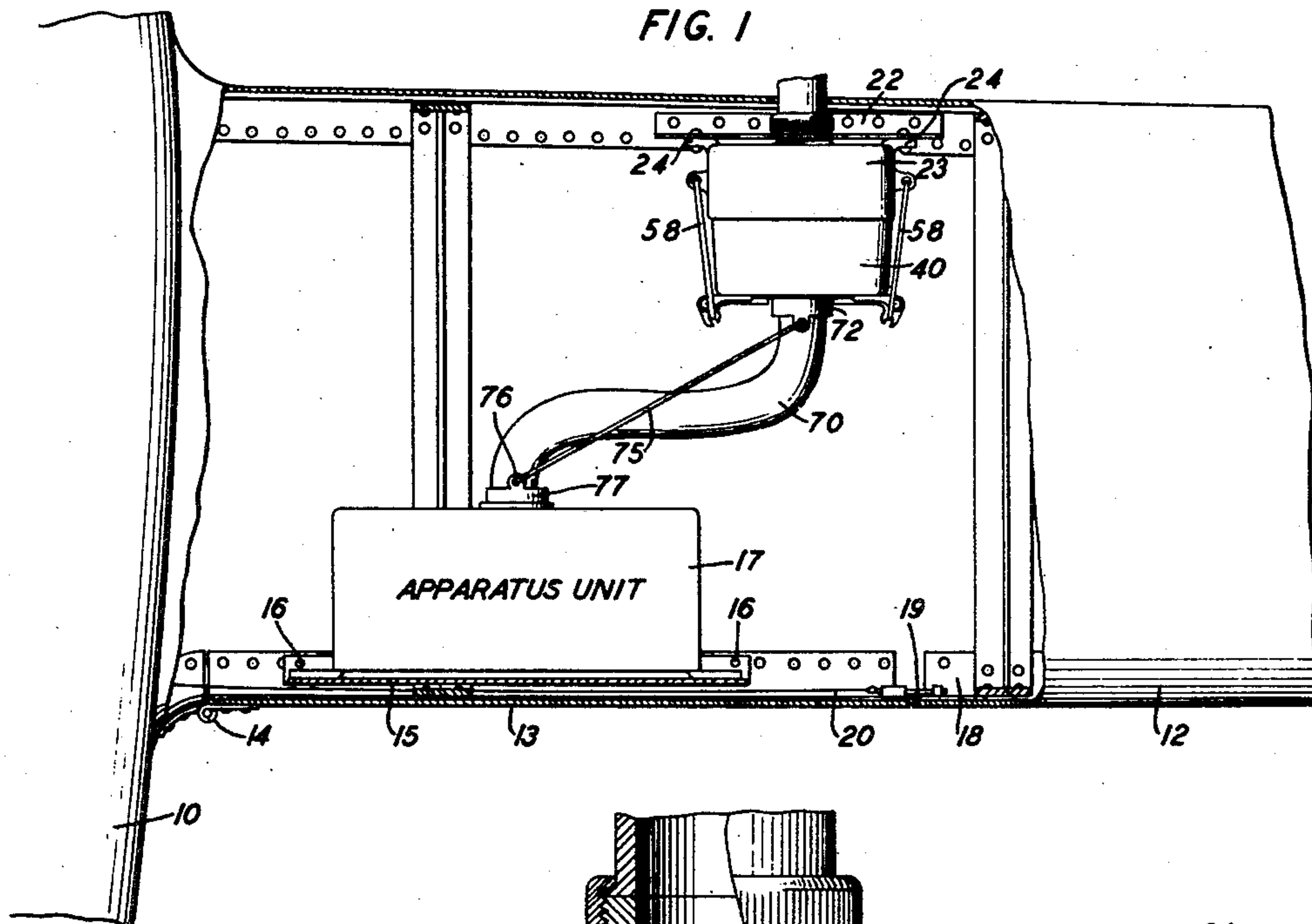
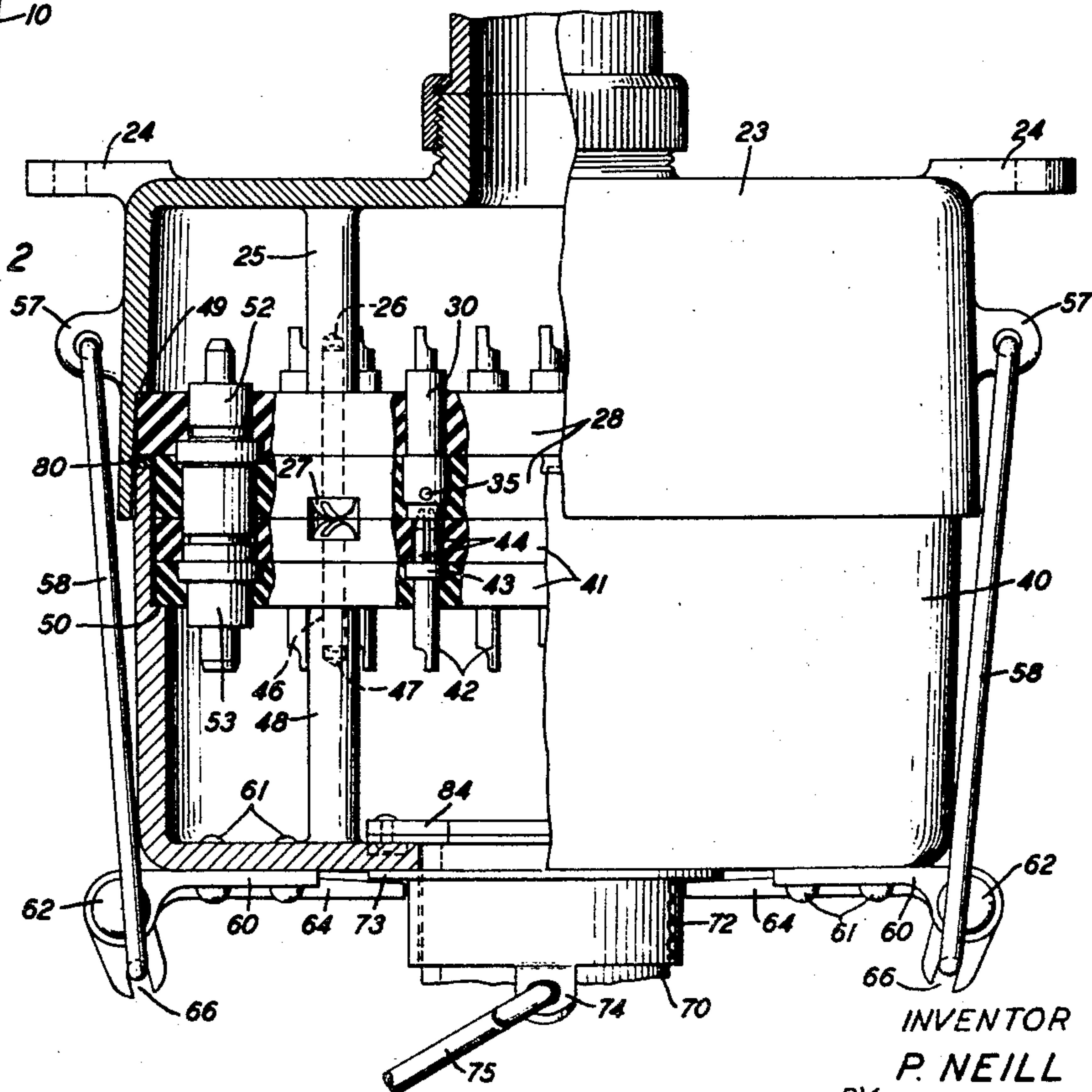


FIG. 2



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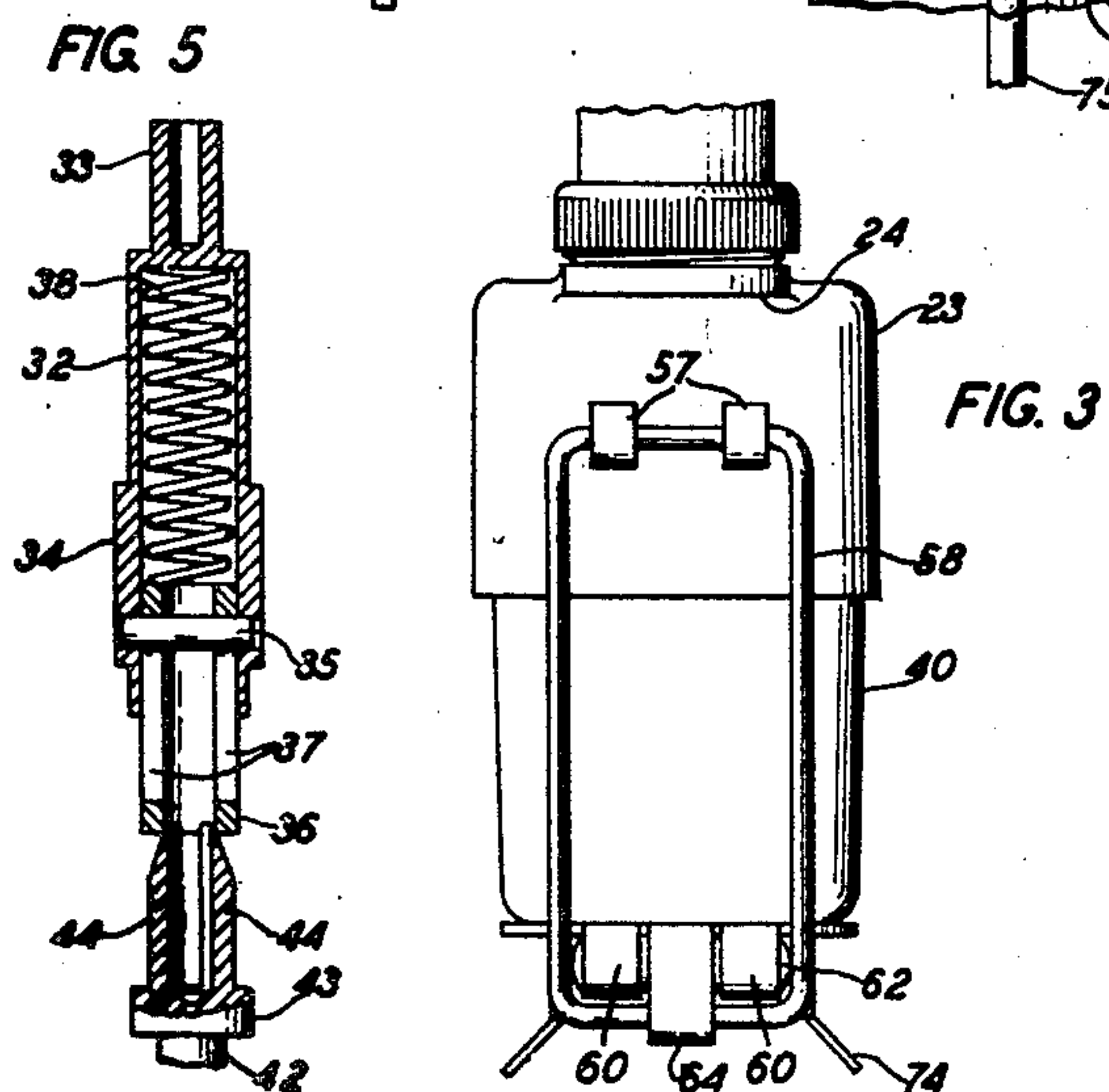
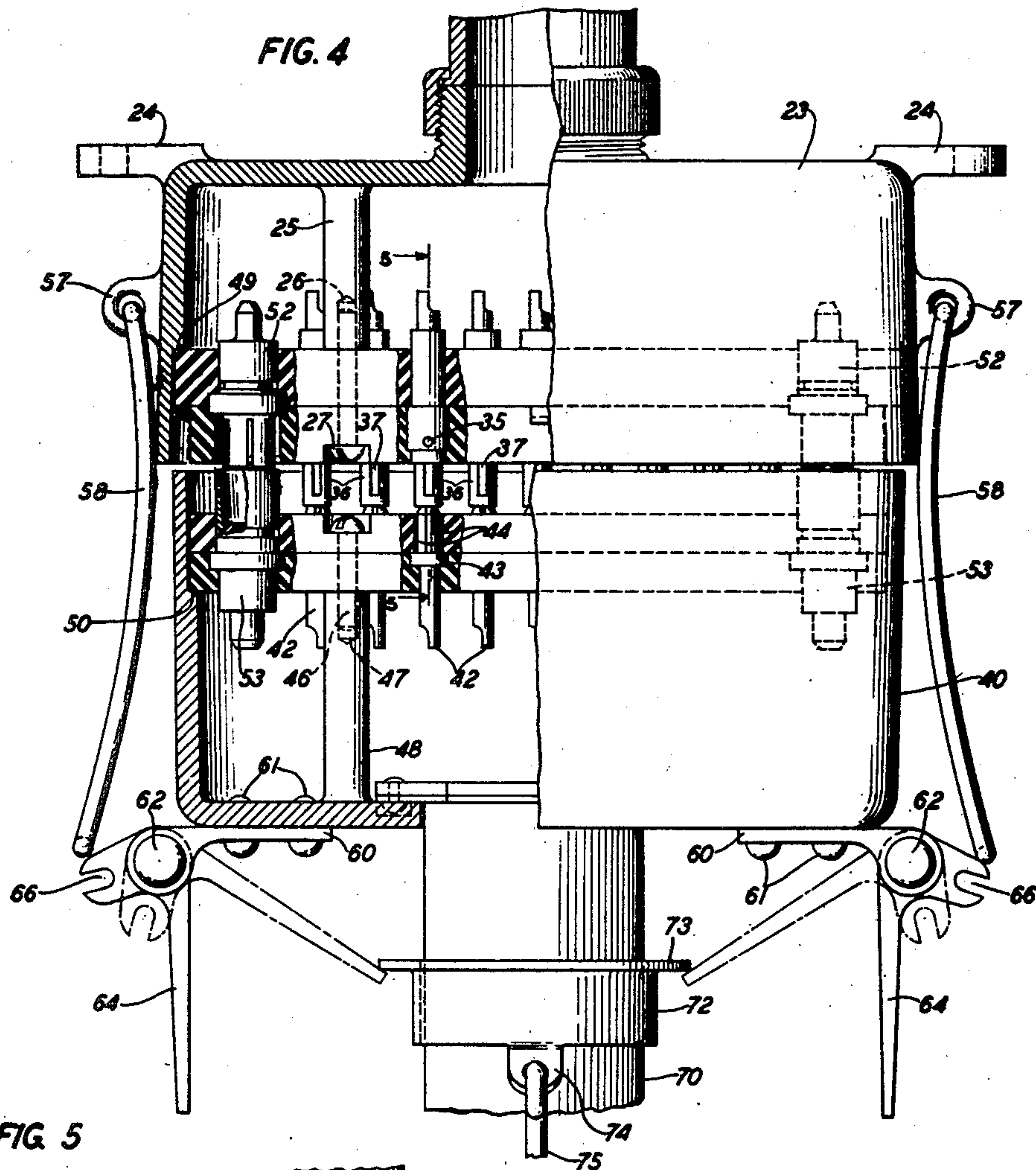
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ELECTRICAL CONNECTOR

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6 Claims. (Cl. 173—328)

1

This invention relates to electrical connectors, or terminals of the jack and plug type which are normally maintained locked in cooperative association by a latching mechanism, and more particularly to means for automatically operating the connector latching mechanism to effect the separation of the connectors.

Jack and plug type connectors are commonly used in electrical installations and constitute practical media whereby electrical connections between two or more devices, or circuits may be completed and interrupted in an expeditious manner. In some installations it is essential that precautions be taken lest the connections effected by the jack and plug terminals be disturbed by the accidental disassociation of the plug from the jack which may be caused, for example, by vibration. Other installations require connectors whose contact elements involve the use of springs which function to insure good electrical contact between the contacts of the cooperating connectors and which have a normal tendency to separate the connectors. In such cases it is essential that provision be made whereby the plug may be locked in cooperative engagement with the jack and thereby preclude accidental disconnection of the plug from the jack and the consequent untimely interruption of the circuits completed thereby.

In certain installations involving connectors which are normally locked in cooperative engagement it has been found desirable and necessary that provision be made whereby, under certain predetermined conditions, the connectors may be expeditiously and automatically unlatched. Such an installation may be found, for example, in aeroplanes, particularly of a military character wherein military expediency requires the "dumping" of secret apparatus from the aeroplane to preclude its falling into the hands of the enemy when it appears inevitable that the aeroplane carrying the secret apparatus will land in territory controlled by the enemy.

It is the object of this invention to facilitate the intentional release and consequent disposal of apparatus units carried by vehicles, such as aeroplanes, which are normally electrically connected to other equipment in the aeroplane through the media of interlocked jack and plug type connectors.

This object is attained in accordance with a feature of the invention by the provision of means which functions, incident to the release of an apparatus unit from a vehicle, to automatically operate the latching mechanism, normally hold-

2

ing plug and jack type connectors in cooperative engagement, to its unlatching position.

Another feature of the invention resides in the use of spring tensioned contact elements in one of the connectors which when the cooperating connectors are unlatched, react upon the contact elements of the other connector in a manner such as to force the connectors out of engagement.

These and other features of the invention will be better understood from the following detailed description when read in connection with the accompanying drawings, in which:

Fig. 1 illustrates the invention in its particular application to electrical installations found in aeroplanes. In this figure, the plug and jack connectors, the apparatus unit to be disposed of, the interconnecting electric cable and the medium for controlling the unlatching of the connectors are shown housed within the wing structure of an aeroplane. This figure also illustrates a simple release control whereby an occupant of the aeroplane may initiate the release of the apparatus unit;

Fig. 2 is an enlarged view of the jack and plug terminals shown in Fig. 1 with sections of the connector housings broken away to expose the internal structure of the connectors. In this figure the connectors are shown in latched engagement;

Fig. 3 is a partial side view of the plug and jack combination in the same position illustrated in Fig. 2;

Fig. 4 is a view similar to that of Fig. 2 showing the connectors unlatched; and

Fig. 5 is a view taken along the line 5—5 of Fig. 3 looking in the direction of the arrows and illustrates the structure of the jack and plug contact elements.

In the showing of Fig. 1, which illustrates the plug and jack terminals mounted within the wing structure of an aeroplane and the secret apparatus unit positioned on a hinged section of the lower face of the wing, no attempt has been made to show the precise mechanism which would be used in actual practice to effect the release of the apparatus unit from the aeroplane. It is contemplated that in actual usage the apparatus unit would be released in a manner similar to that followed in releasing bombs from a bomb rack. The means illustrated in the drawing for releasing the apparatus unit from the aeroplane is deemed satisfactory for present purposes, and it is understood that any other suitable releasing mechanism may be employed

3

without departing from the spirit of the present invention.

In Fig. 1 a portion of an aeroplane fuselage or body is indicated at 10 to which is affixed, in any well-known manner, a wing, a portion of which is indicated by the numeral 12. The wing structure comprises the usual vertical and horizontal supports on which the wing covering is supported. For purposes of illustration the lower face of the wing 12 is provided with a door 13 hinged to the fuselage structure at 14. The door 13 is provided with a shelf-like member 15 fixed thereto in any suitable manner, as by the rivets indicated at 16. Upon the shelf 15 the apparatus unit 17 is set. The door 13 is shown bolted to the frame member 18 by means of a slidable bolt 19 to one end of which is fixed a cable 20 which extends within the fuselage 10 for manual operation by an occupant thereof. When the cable 20 is pulled from within the fuselage or body of the aeroplane, the bolt 19 is disengaged from the frame member 18 so that the door 14 opens due to gravity and to the weight of the apparatus unit 17. The unit 17 then slides off its shelf support 15 and falls into space.

Upon the upper horizontal frame member of the wing there is fixed a bracket 22 which serves as a support for the jack connector whose casing or housing 23 is provided with two oppositely disposed integral lugs 24 which are bolted or otherwise fixed to the bracket 22. In this manner the jack connector is rigidly fixed to the wing 12.

Referring now particularly to Figs. 2 and 4, the inner periphery of casing 23 of the jack connector is provided with a plurality of integral semicylindrical bosses 25, only one of which is disclosed in the drawings. These bosses, actually four in number, are rectangularly disposed and each has its lower end tapped at 26 to receive a screw-bolt 27. These screw-bolts 27 serve to secure an insulating mounting block 28 to the four cylindrical bosses 25. The mounting block 28 is substantially rectangular and provides means for mounting a plurality of jack contact members 30 one of which is shown enlarged in Fig. 5. The mounting block 28 is made up of two substantially similar blocks in superposed relation and held together by rivets (not shown) or by any other suitable means. The two blocks are provided with a plurality of aligned holes, the holes in the upper block being of slightly smaller diameter than the holes in the lower block. Into these holes are fitted the jack contact elements 30, each of which, as more clearly shown in Fig. 4, comprises a hollow cylindrical sleeve 32 terminated at one end in a terminal portion 33 and at the other end in a shoulder portion 34. A pin 35 extends through the shoulder portion 34 which supports a slidable cylindrical member 36 which is provided on each of two oppositely disposed sides with a slot 37. By virtue of the slots 37 and the pin 35, the member 36 is capable of sliding longitudinally in the sleeve 32, being normally held in a fully extended position by the coil spring 38, one end of which impinges on the under surface of the sleeve at its juncture with the terminal portion 33 and its other end impinges on the inner edge of the slidable member 36.

In assembling the jack contacts, they may be slipped into the lower block so that the shoulder portions 34 snugly fit into the holes provided for their accommodation in the lower block and then the upper block may be superposed on the lower block with the sleeve portions 32 fitting into corresponding holes in the upper block. This mount-

4

ing of the jack contacts is clearly illustrated in Figs. 2 and 4. It is to be understood that the mounting block accommodates a plurality of the jack contacts just described and that after the two blocks are placed in superposed relation, they may be secured together by means of rivets (not shown).

The plug member consists essentially of a casing or housing 40, two superposed mounting blocks 41 and a plurality of plug contacts 42. Each plug contact, as shown in Fig. 5, is in effect a pin provided with a shoulder portion 43 and a plurality of fingers 44 extending longitudinally therefrom. The fingers may be effected by longitudinally slotting the portion of the pin extending above the shoulder 43, viewing Fig. 4. The over-all diameter of the slotted or furcated portion of the plug contact is in excess of that of the internal diameter of the slidable member 36 of the jack contact so that the plug contact cannot be fully inserted in the jack contact. The ends of the fingers 44 are tapered or beveled so that they are capable of being inserted slightly within the hollow in the jack contact. The fingers are flexible, and as the plug and jack connectors are brought into cooperative association the plug fingers, due to the wedging thereof by the internal periphery of the jack member 36 are forced towards each other so that a plurality of firm contacts are made between the plug and jack elements.

The plug contacts are carried by the mounting blocks 41 which are riveted together after the contacts are assembled therein. These blocks are secured to the casing by means of screw-bolts 46 which screw into tapped holes 47 in the integral bosses 48 of the casing 40. As shown in Figs. 2 and 4, the inner surfaces of the casings 23 and 40 are provided with shoulders 49 and 50, respectively, against which the jack and plug mounting blocks 28 and 41 respectively abut.

The terminal ends of the jack and plug contacts are provided with a bore which accommodates a pin type terminal secured to the conductors, or the ends of the conductors with which the connectors function.

To the left center of Figs. 2 and 4 there are shown a plug contact 52 and a jack contact 53 which are larger than the contacts 30 and 42. The general design of these contact elements is not of importance in connection with the present invention but, aside from serving as conductor terminals they also constitute guide means for insuring precise alignment of the smaller jack and plug contacts when the two connector elements are brought together. Suffice it to say that the upper portion of the contact member 53 is cup-shaped or cylindrically hollow and accommodates the furcated end of the contact member 52, and that there are in all four sets of such contact members, one set only of which is shown in full line in Figs. 2 and 4, another set being shown in broken line in Fig. 4. It will also be observed that the jack casing 23 is slightly flared so that it telescopes the upper end of the plug casing 40 as shown in Fig. 2, when the two connectors or terminals are brought into engagement. An annular gasket is indicated at 80.

On each of two opposite sides of the jack casing 23, there are integrally formed two lugs 57 which are apertured to receive a substantially rectangularly-shaped wire hasp 58, which as will appear from a later description serves as a medium for firmly latching the plug and jack con-

5

nectors and also pulling the two connections together.

On the lower face of the plug casing 40 and located on oppositely disposed ends thereof are rigidly fixed two bracket members or holders 60 by means of rivets 61. These brackets, which if desirable, may be formed as integral portions of the casing, extend beyond the edges of the casing 40 and the portions thus protruding are centrally apertured to receive a rivet or pin 62. Located between each pair of holders 60 and pivotally supported on the pin 62 carried thereby is a clasp 64 which consists essentially of a relatively long arm having a short angular offset portion whose end is bifurcated to provide a notch. Each clasp 64 pivots or rotates on its associated pin 62, the axis of rotation being substantially through the juncture of the long arm and the angular offset portion. The notch, indicated by the numeral 66, is of such a dimension as to be capable of receiving the wire hasp 58.

When the plug housed in casing 40 is to be placed in service with the jack housed in casing 23 the two elements are brought together so as to assume the relative positions illustrated in Fig. 4. In this position the tapered ends of the plug contact fingers 44 engage the internal peripheries of the corresponding slidable members 36 of the jack contacts 30 and the four contacts 52 are in alignment with their corresponding contacts 53. The clasps 64 are then in a position substantially as indicated by the full line showing thereof in Fig. 4. The two clasps are then rotated each in a direction such that the hasp 58 on either side of the plug and jack combination falls into the notch 66 of their associated clasp. When the hasps are thus engaged the clasps are manually rotated on their respective pins 62 so as to cause the notched ends thereof to move downwardly and to exert a pull on the hasps 58. This action causes the plug to be moved towards the jack so that the furcated ends of the four contacts 52 become seated in the sleeves or sockets of the corresponding contacts 53, and the jack members 36 are forced into their respective sleeves 32 by the plug contacts 42 against the action of the coil springs 38. This relative movement of the jack and plug continues until the clasps 64 snap into their fully operated or latching positions illustrated in Fig. 2. In this position it will be noted that the vertical axis of each of the hasps 58 has shifted from one side of the axis of rotation of the clasps 64 to the other so that the hasps serve to pull the connectors together and to securely latch the jack and plug, and any pull exerted on the plug in a direction such as to urge it to be separated from the jack will be ineffective and the two conductors cannot be separated except by actuating the clasps 64 to release the hasps 58 as will appear presently. The hasps 58 are slightly bowed to allow for adjustment.

The jack housed in the casing 40 is connected to the apparatus unit 17 by means of a flexible cable 70 which carries the conductors extending from the jack contacts 53 and 42 to the apparatus unit 17. This cable is fed through an opening in the base of the casing 40 and its conductors are fanned out and connected to the terminal ends of the contacts 53 and 42. A bushing fastened to the end of cable 70 is provided with an annular flange 84 which is secured to the casing 40. The cable 70 in a similar manner is fed through an opening in the apparatus unit enclosure 17 and its conductors connected

6

to the equipment housed therein. The nature of this equipment is immaterial in so far as the present invention is concerned. A collar 72 fits loosely over the cable 70 and is adapted to slide thereon for a purpose to be presently described. This collar is provided with a flange 73. When the plug and jack connectors are brought into engagement in the manner described above, the collar 72 is first moved up on the cable 70 so that the flange 73 thereof abuts the underside of the plug casing 40 and when the clasps 64 snap into their locking positions as described, the ends thereof engage the flange 73 at opposite points and effectively locks the collar 72 in engagement with plug casing. This position of the collar is shown in Fig. 2. The lower edge of the collar 72 is provided with two oppositely disposed lugs 74, only one of which appears in the drawings, to each of which is attached one end of a rod or cable 75, the other ends of which are fixed to similar lugs 76 carried by the collar 77 permanently secured to the apparatus unit 17. The release rods, only one of which appears on the drawings, are shorter in length than the cable 70.

When the apparatus unit 17 and the plug and jack connectors are assembled on the aeroplane, they assume relative positions substantially as shown in Fig. 1. Should circumstances warrant the "dumping" of the apparatus unit 17, an occupant of the aeroplane would pull the cable 20 to actuate the bolt 19 whereupon the door 13 in the aeroplane wing 12 swings downwardly on its hinges 14 due to the weight of the apparatus unit 17. The unit 17 thereupon slides off the shelf 15 and falls into space.

As the unit 17 falls, the release rod 75, being of shorter length than the cable 70, exerts a pull on the collar 72, before the cable 70 does, causing it to slide down on the cable 70. By virtue of the engagement of the collar flange 73 with the ends of the clasps 64, the latter are rotated to a position indicated by the broken line illustration in Fig. 4. In this position, the hasps 58 tend to further rotate the clasps due to the contact-separating action of the compression springs 38. When the plug and jack connections become unlatched by the action of the collar flange 73 on the clasps 64, the springs 38, through their associated slidable members 36 function to drive the plug away from the jack and this action further causes the hasps to rotate until the hasps 58 disengage themselves from the clasp notches 66. Thus the apparatus unit 17, plug 40 and the interconnecting cable 70 and rod 75 are released from the aeroplane and fall into space. It is essential that the release rod 75 be of shorter length than the electric cable 70 to insure the unlatching of the plug from the jack before the cable 70 becomes fully extended, since the latching mechanism is so designed that any pull exerted on the plug by the cable 70 will be ineffective to operate it.

As hereinbefore indicated, the nature of the apparatus comprising the unit 17 and of the equipment with which it is electrically associated by the jack and plug connectors is immaterial in so far as the present invention is concerned. It is to be understood also, that the means illustrated for initiating the release of the apparatus unit from the aeroplane has been employed in this disclosure merely to illustrate the general principle involved and in the particular application is not intended to depict the more involved release apparatus that would be resorted to in actual practice. The housing in which the secret apparatus

is contained may be, of course, of any desirable shape The rectangular form shown in Fig. 1 is adopted for illustrative purposes only.

While the invention has been described and illustrated in its particular application to the disposal of equipment from an aeroplane, it is to be understood that it is capable of other uses.

What is claimed is:

1. In combination, a fixed terminal, an apparatus unit, another terminal flexibly connected to said apparatus unit by means of an electric cable and adapted to cooperate with said fixed terminal to electrically connect said apparatus unit with said fixed terminal, a latching device carried by said fixed terminal, a clasp rotatably mounted on said other terminal and adapted to engage said latching device whereby said terminals are locked in cooperative engagement when said clasp engages said latching device and is rotated to a latching position, a collar slidably carried on said cable and adapted to be engaged by said clasp and held thereby when said clasp is rotated to its latching position, and a connection extending from said collar to said apparatus unit of shorter length than said electric cable and operable to slide said collar on said cable to thereby actuate said clasp from its latching position.

2. In combination, a fixed terminal, an apparatus unit having a definite location relative to said fixed terminal, means interconnecting said apparatus unit and said fixed terminal comprising a second terminal in cooperative engagement with said fixed terminal and a slack electric cable extending therefrom to said apparatus unit, means latching said second terminal to said fixed terminal, and means for operating said latching means to unlatch said other terminal from said fixed terminal comprising a collar in operative association with said latching means and slidably carried on said cable, and means for sliding said collar on said cable comprising a connection secured at one end to said collar and fixed at the other end to said apparatus unit, said connection being of shorter length than said cable whereby it functions to cause said collar to operate said latching means in response to a predetermined displacement of said apparatus unit from its definite location and before said slack cable is fully extended.

3. In combination, an apparatus unit, a fixed terminal, a second terminal, a flexible cable fixed at one end to said apparatus unit and at the other end to said second terminal, latching mechanism holding said second terminal in operative engagement with said fixed terminal, means for tripping said latching mechanism comprising a collar slidably mounted on said flexible cable and in operative association with said latching mechanism, and means for sliding said collar on said cable in a direction such as to cause it to trip said latching mechanism, comprising a connection of shorter length than said cable extending between said collar and said apparatus unit.

4. In combination with a vehicle, an electric terminal fixed thereto, an apparatus unit, means for supporting said unit on said vehicle in a predetermined position relative to said fixed terminal and adapted to be operated so as to displace said unit from its predetermined position on said vehicle, a second terminal fixed to said apparatus unit by means of a slack cable and adapted to be associated with said fixed terminal so as to electrically interconnect said unit and said fixed terminal by way of said cable, a latching mechanism fixed to said fixed terminal and operably engage-

able with said second terminal so as to lock said second terminal to said fixed terminal, tripping means for said latching mechanism slidably mounted on said cable, and a rod of shorter length than said cable interconnecting said apparatus unit and said tripping means when the latter is in operative engagement with said latching mechanism, whereby said tripping means is operated by said rod to trip said latching mechanism when said apparatus unit supporting means is operated so as to displace said apparatus unit from its predetermined position on said vehicle in a direction such as to tend to render said slack cable taught.

5. In combination, a fixed terminal, an apparatus unit, a second terminal, a flexible electric cable interconnecting said apparatus unit and said second terminal, means including a releasing clasp for latching said second terminal to said fixed terminal, and means responsive to the displacement of said apparatus unit from said fixed terminal by a predetermined distance for automatically tripping said latching means comprising a collar slidably carried by said electric cable and having a flange thereon interposed between said releasing clasp and said second terminal, and a connecting rod of shorter length than the said predetermined distance connecting said apparatus unit to said collar whereby, when said apparatus unit is displaced from said fixed terminal by the said predetermined distance said collar is slid on said electric cable to trip said releasing clasp and, with said connecting rod is disassociated from said second terminal.

6. In combination, a fixed terminal, an apparatus unit, a second terminal connected to said apparatus unit by means of an electric cable and adapted to cooperate with said fixed terminal to electrically connect said apparatus unit with said fixed terminal, a pair of latching hasps carried by said fixed terminal, a pair of clasps rotatably mounted on said second terminal each engageable with a different one of said hasps so as to cooperate therewith in locking said terminals in engaged relation when said clasps are rotated to latching positions, a flanged collar slidably carried on said cable the flanges of which are adapted to be engaged by said clasps and held thereby in fixed relation to said second terminal when said clasps are rotated to latching positions, and means for displacing said collar on said cable so as to cause it to operate said clasps and cause them to be disengaged from said hasps comprising a connection between each of two opposite sides of said collar and said apparatus unit operable to perform the collar displacing function only when said apparatus unit is displaced from said fixed terminal by an amount in excess of the length of said connection means.

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