United States Patent

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[73] Assignee **General Electric Co.**

[54] **COMBINED MECHANICAL FASTENER AND ELECTRICAL CONNECTOR**
4 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** ..... **339/88 R,** 339/91 R
[51] **Int. Cl.** **H01r 13/54**
[50] **Field of Search** 339/88, 90, 91, 187–190

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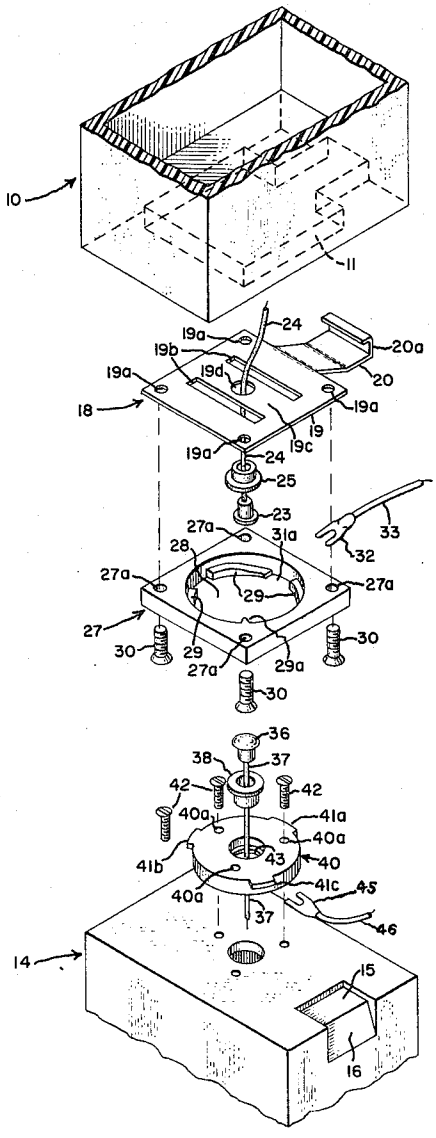
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ABSTRACT: Two objects are mechanically fastened together by a first retaining plate that has locking members and that is attached to one object; and by a second retaining plate that has locking tabs for engaging the locking members and that is attached to the other object. The objects are mechanically fastened by positioning the tabs in the spaces between the locking members and rotating the two objects so that the tabs pass behind the locking members and mechanically fasten the two objects together. Contacts may be respectively positioned on the two objects for connecting electrical circuits when the two objects are fastened.

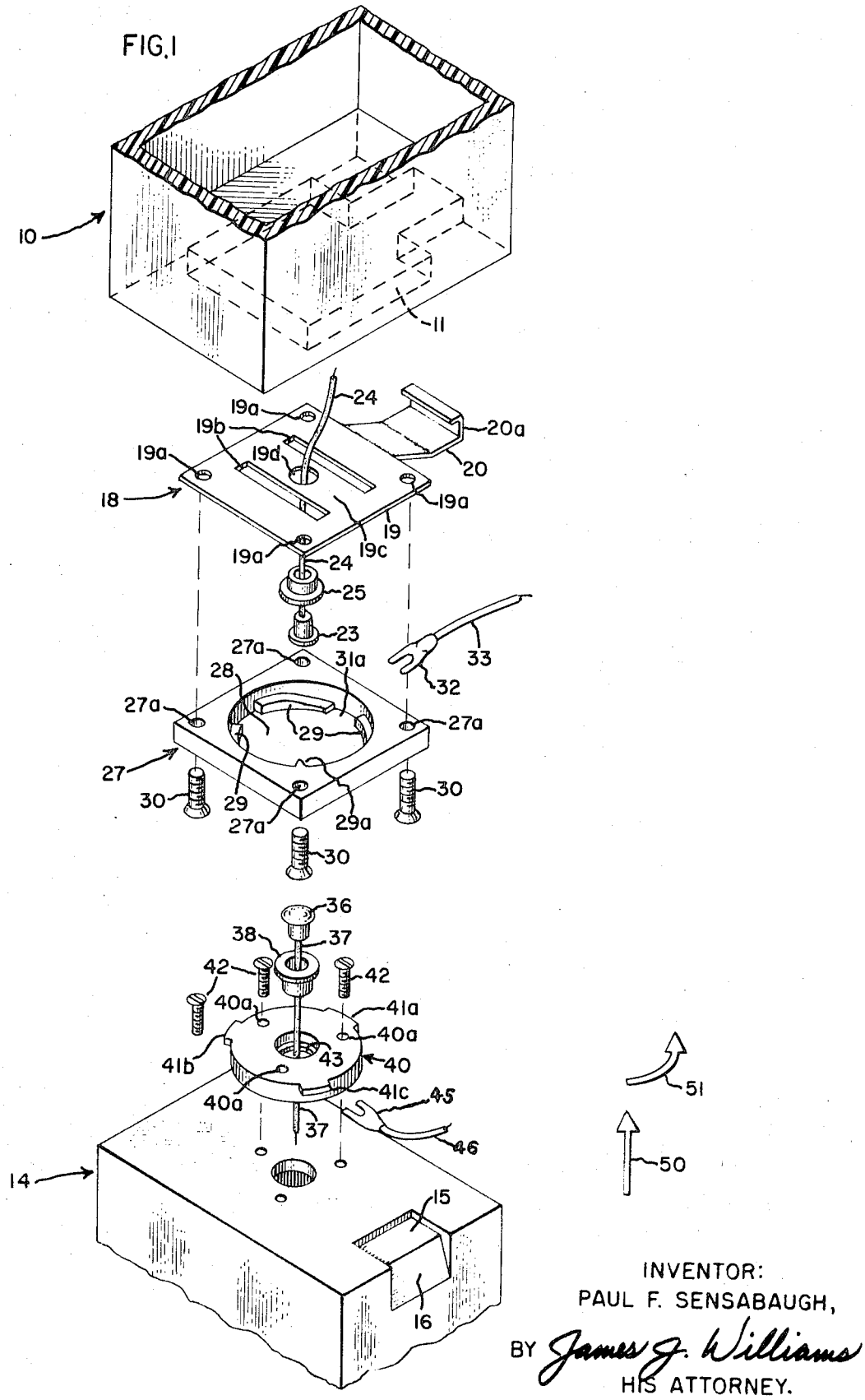


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SHEET 1 OF 2

FIG. 1



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FIG.2

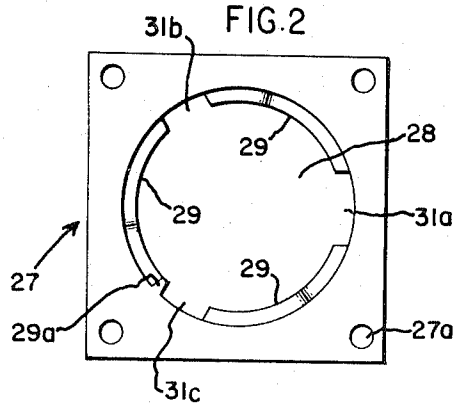


FIG.3

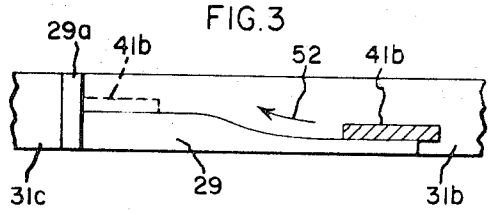
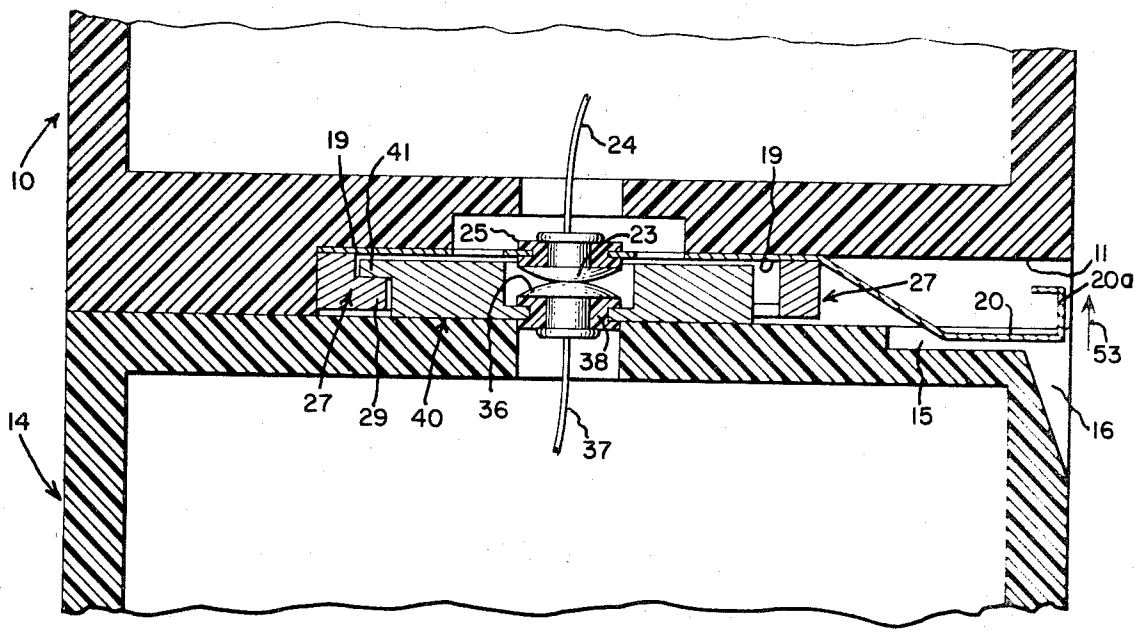


FIG.4



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COMBINED MECHANICAL FASTENER AND ELECTRICAL CONNECTOR

BACKGROUND OF THE INVENTION

My invention relates to combined mechanical fastener and electrical connector, and particularly to such a combined fastener and connector that provides quick and reliable mechanical fastening and unfastening of two parts, and that provides an electrical connection and disconnection.

Some portable radios, particularly small personal communications transmitters and/or receivers, are powered by batteries located in a small container that is mechanically fastened to the radio. Electrical connections are provided between the battery and radio. When one battery is discharged, it must be removed and a new or recharged battery connected to the radio in its place. There thus exists a need for a device that fastens and unfastens a battery container from a radio, and also makes and breaks electrical connections between the battery and radio.

Accordingly, an object of my invention is to provide a new and improved mechanical fastener and electrical connector, particularly for radios and battery containers.

Another object of my invention is to provide a novel device which serves the combined function of quickly fastening two objects and connecting electrical circuits in the two objects, and quickly unfastening the two objects and disconnecting the electrical circuits in the two objects.

Another object of my invention is to provide a novel combined mechanical fastener and electrical connector that is relatively simple in construction and reliable in operation.

SUMMARY OF THE INVENTION

Briefly, these and other objects and achieved in accordance with my invention by a first retaining plate that has locking members and that is attached to one object. A second retaining plate having tabs for engaging the locking members of the first plate is attached to the other object. The objects are mechanically fastened by positioning the tabs in the spaces between the locking members and rotating the two objects so that the tabs pass behind the locking members and mechanically fasten the two objects together. Contacts are respectively positioned on the two objects for engagement and connection of electrical circuits when the two objects are fastened. A retaining spring may also be provided on the first object and shaped to fit in a recess in the second object so that the two objects may be locked in their fastened position.

BRIEF DESCRIPTION OF THE DRAWING

The subject matter which I regard as my invention is particularly pointed out and distinctly claimed in the claims. The structure and operation of my invention, together with further objects and advantages, may be better understood from the following description given in connection with the accompanying drawing, in which:

FIG. 1 shows an exploded, perspective view of a radio and battery container, and a fastener and connector in accordance with my invention for fastening and connecting the radio and battery;

FIG. 2 shows a plan view of a retaining plate used in a fastener and connector in accordance with my invention;

FIG. 3 shows an elevation view of a portion of the retaining plate of FIG. 2 for illustrating a feature of the fastener and connector of my invention; and

FIG. 4 shows a cross-sectional view of a radio and battery container fastened together and electrically connected by a fastener and connector in accordance with my invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIG. 1, I have shown an exploded perspective view of a fastener and connector in accordance with my invention used, by way of example only, with a radio **10** and a battery container **14**. The radio **10** is not shown in its entirety, but it may be assumed to contain either a radio transmitter, or a radio receiver, or both a transmitter and receiver, with associated elements such as an antenna, a loudspeaker, or a microphone. The case housing the radio **10** is provided with a recess **11** which receives a portion of my fastener and connector as will be explained. The battery container **14** is likewise not shown in its entirety, but it may be assumed to contain one or more suitable batteries, such as the rechargeable storage type or the dry-cell type. The battery container **14** is provided with suitable mounting holes and openings, and with a recess **15** on its upper surface and a recess **16** on the side of the container **14**. These recesses **15**, **16** serve to receive a locking or retaining spring, as will be explained.

The parts of my fastener and connector which are mounted on the radio **10** comprise a generally flat retaining spring **18**. The spring **18** is made of a relatively thin resilient metal, and has a main portion **19** which is shaped to fit in the large part of the recess **11** in the radio **10**. The main portion **19** is provided with mounting holes **19***a*, with two parallel slits **19***b* which provide a central section **19***c*, and with a clearance hole **19***d* for an electrical wire. A locking portion **20** is integrally formed with the main portion **19**, and is shaped to fit in the small part of the recess **11**, and also to fit in the recess **15**, **16** in the battery container **14** for locking the radio **10** and the battery container **14** together. The retaining portion **20** is offset by a bend, and the end of the retaining portion **20** is bent to provide an operating tab or finger **20***a*. A first connector is provided for the radio **10** in the form of a metallic contact or button **23** which has an attached wire **24**. The wire **24** passes through an insulating sleeve or part **25** which is shaped to receive the contact **23** and hold it in insulated fashion in the clearance hole **19***d* in the retaining spring **18**. A first retaining plate **27** is made of suitable conductive material such as steel and shaped to fit in the large part of the recess **11** in the radio **10**. Additional views of the plate **27** are shown in FIGS. **2** and **3**. I prefer that the plate **27** have the same size and shape as the main portion **19** of the spring **18**. The plate **27** is provided with a central circular hole or opening **28**. The periphery of the hole **28** is provided with three locking members or cams **29**. Each of these locking members **29** extends arcuately around the hole **28** for approximately 90°, and is separated from adjacent members by respective spaces **31***a*, **31***b*, **31***c*. The space **31***a* is larger and extends for approximately 40°, while the other two spaces **31***b*, **31***c* extend approximately 25°. The lower surface of each of the members **29** is flush with the bottom of the plate **27**. The upper surface of each of the members **29** is below the top of the plate **27**, and as shown particularly well in FIG. **3**, part of the upper surface is sloped and part of the upper surface is flat. This upper surface provides a cam action, as will be explained. A stop or projection **29***a* is positioned at one end of one of the flat surfaces on a member **29**, for reasons that will also be explained. The plate **27** is provided with mounting holes **27***a* which preferably align with and correspond with the holes **19***a* in the retaining spring **18**. Suitable mounting screws **30** are provided to pass through the holes **27***a* in the plate **27** and the holes **19***a* in the spring **18** and thread into suitably positioned holes at the bottom of the recess **11**. A second connector **32**, which may be in the form of a spade lug, is provided and connected to a suitable wire **33**. This connector **32** is positioned at one of the holes **27***a* and is electrically connected to the plate **27** by soldering, welding, or mechanical contact pressure. This wire **33**, as well as the wire **24**, are connected to appropriate parts of the circuit in the radio **10**.

The parts described so far, namely the retaining spring **18**, the first connector **23**, the second connector **32**, and the first retaining plate **27** are mounted on the radio **10**. The parts to be mounted on the battery container **14** will now be described. These parts comprise a third connector in the form of a metallic contact or button **36** which is connected to a suitable wire **37** to provide an electrical connection. The contact **36** fits in a suitable insulating sleeve or part **38**, so as to keep the contact **36** electrically insulated from other metallic parts and ele-

ments. A second retaining plate **40** is made of a suitable conductive material such as steel, and has a circular shape to pass through the opening **28** in the plate **27** with slight clearance. The second plate **40** has a plurality of locking tabs or projections **41***a*, **41***b*, **41***c* around its circumference. These tabs **41***a*, **41***b*, **41***c* are shaped and positioned to correspond and conform with the spaces **31***a*, **31***b*, **31***c* between the locking members **29** in the first retaining plate **27**. The second plate **40** has a plurality of mounting holes **40***a* for receiving mounting screws **42** which pass through the holes **40***a* and thread into suitably positioned holes in the top of the battery container **14**. The second plate **40** also has a central opening or hole **43** for receiving the insulating sleeve **38** and the contact **36**. A fourth connector **45**, which may also be a spade lug, is attached to a suitable wire **46**. This connector is positioned beneath the second plate **40** and connected to the plate **40** by soldering, welding, or contact pressure. The wire **37** and the wire **46** are connected to a battery or other device in the container **14**.

In the assembly of the fastener and connector shown in FIG. **1**, the contact **23** is placed in its insulating sleeve **25**, and the two are placed in the hole **19***d* in the spring **18** and held in place by crimping or swaging the small end of the contact **23**. The wires **24**, **33** are connected to the contact **23** and the first plate **27**, and led into the radio **10** for suitable connection. The plate **27** is positioned on top of the retaining spring **18** in the recess **11**, and the two are held in place on the radio **10** by the screws **30**. Similarly, the contact **36** is placed in its insulating sleeve **38** in the hole **43** in the second plate **40**, and the two are held in place by crimping or swaging the small end of the contact **36**. The wires **37**, **46** are connected to the contact **36** and the plate **40**, and led into the battery container **14** for connection to suitable points. The second plate **40** is held in place on the container **14** by the screws **42**.

When the radio **10** and the container **14** are to be fastened and connected in accordance with my invention, the assembled parts are moved together (such as moving the container **14** upward in the direction of the arrow **50**) so that the locking tabs **41***a*, **41***b*, **41***c* pass through their respective spaces **31***a*, **31***b*, **31***c*. The tab **41***a* is larger than the other tabs **41***b*, **41***c* so that this tab **41***a* can only pass through the larger space **31***a*, thus ensuring proper relative positions of the radio **10** and the container **14**. The retaining portion **20** of the spring **18** must be pushed upward by this movement. The parts are then rotated relative to each other (such as rotating the container **14** in the direction of the arrow **51**) so that the tabs **41** move over the cam surfaces of the locking members **29** and also in an upward direction as shown by the tab **41***b* and the arrow **52** in FIG. **3**. The upward movement draws the radio **10** and the container **14** together and causes firm and positive engagement of the two contacts **23**, **36** to provide a closed electrical circuit between the wires **24**, **37**. Similarly, there is firm and positive engagement between the two plates **27**, **40** to provide a second closed electrical circuit between the wires **33**, **46**. Any necessary clearance or tolerance is provided by the central section **19***c* in the retaining spring **18** which allows some movement of the contact **23** but urges the contact **23** toward the contact **36**. The relative rotation of the radio **10** and the container **14** is limited by the stop **29***a* located at the end of one of the locking members **29**. This stop **29***a* also prevents the parts from being rotated in the wrong direction relative to each other. With respect to FIG. **2**, the tab **41***c* which is positioned in the space **31***c* can only rotate in a counterclockwise direction. The tab **41***b* will be stopped when it reaches the stop **29***a*. This stop action is also shown by the tab **41***b* shown in phantom in FIG. **3**. As mentioned earlier, the tab **41***a* may be made larger than the other two tabs **41***b*, **41***c*, so that this tab **41***a* can only pass through the opening **31***a*. Thus, proper alignment and keying is provided. When the two parts (i.e., the radio **10** and the container **14**) are rotated until the tab **41***b* hits the stop **29***a* (this preferably being 90°, the retaining portion **20** of the spring **18** moves downward into the recess **15** and locks the two parts so that they cannot rotate.

FIG. **4** shows a cross-sectional view of the radio **10** and the battery container **14** fastened and connected with the fastener and connector of my invention. The first connection is provided through the contacts **23**, **36** which are in firm engagement, particularly because of the resiliency of the central section **19***c*. The second connection is provided by the engagement of the tabs **41***a*, **41***b*, **41***c* which are in firm engagement with their respective locking members **29**. The radio **10** and the container **14** are held against accidental rotation and possible separation by the retaining portion **20** of the spring **18** fitting in the recess **15** in the battery container **14**. The radio **10** and the container **14** may be rotated for release only if the operating tab **20***a* on the spring **18** is pushed upward, as indicated by the arrow **53** in FIG. **4**. This action removes the retaining portion **20** from the recess **15** so that the parts may then be rotated and unfastened and disconnected. The recess **16** permits a person's finger to reach the operating tab **20***a* more readily.

It will thus be seen that my invention provides a new and improved fastener and electrical connector which is both simple in construction and reliable in operation. While I have shown only one embodiment of my combined fastener and connector, persons skilled in the art will appreciate that modifications may be made. For example, more than three or less than three locking tabs and locking members may be provided. Different-shaped cam surfaces may be provided so as to provide a different relative movement. Also, the angle of relative rotation may be varied, although I prefer 90°. Therefore, while my invention has been described with reference to a particular embodiment, it is to be understood that modifications may be made without departing from the spirit of the invention or from the scope of the claims.

What I claim is new and desire to secure by Letters Patent of the United States is:

1. A combination device for mechanically fastening two objects and providing an electrical connection therebetween, said device comprising:

a. a flat retaining spring mounted on one object, said retaining spring having an elongated portion for movably fitting in an appropriately shaped recess in the second object;

b. a first retaining plate mounted on said retaining spring, said first retaining plate having a generally circular opening therethrough;

c. a plurality of circumferential locking members mounted on said first retaining plate around said circular opening and separated by spaces, each of said locking members having a sloped cam surface facing said one object;

d. a second retaining plate mounted on said second object, said second retaining plate being generally circular and having circumferential locking tabs shaped and positioned around said second retaining plate to fit in said spaces between said locking members and respectively engage said sloped cam surfaces, thereby mechanically pulling and fastening said first and second objects together when said first and second objects are rotated relative to each other in a selected direction;

e. one of said locking tabs and one of said spaces between said locking members being configured to permit said one locking tab to pass through only said one space;

f. a stop positioned on said first retaining plate near one of said spaces to permit relative rotation of said first and second objects in said selected direction and to prevent relative rotation of said first and second objects in an opposite direction;

g. a first electrical contact mounted on and insulated from said retaining spring at substantially the center of said circular opening;

h. and a second electrical contact mounted on and insulated from said second retaining plate at substantially the center thereof;

i. said first and second electrical contacts engaging each other and providing an electrical connection therebetween when said first and second objects are mechanically fastened together.

2. The device of claim 1 wherein said second object has a recess to receive said elongated portion of said retaining spring and hold said first and second objects in a selected rotational relation.

3. The device of claim 1, and further comprising means connected to said first retaining plate and means connected to said second retaining plate for providing an added electrical connection when said first and second objects are mechanically fastened together.

4. The device of claim 1 wherein said second objects has a recess to receive said elongated portion of said retaining spring and hold said first and second objects in a selected rotational relation, and further comprising means connected to said first retaining plate and means connected to said second retaining plate for providing an added electrical connection when said first and second objects are mechanically fastened together.

* * * * *