(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 041 680 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
04.10.2000 Bulletin 2000/40

(51) Int. Cl.[7]: **H01R 13/648**, H01R 13/646

(21) Application number: **00106233.0**

(22) Date of filing: **22.03.2000**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **30.03.1999 EP 99106470**

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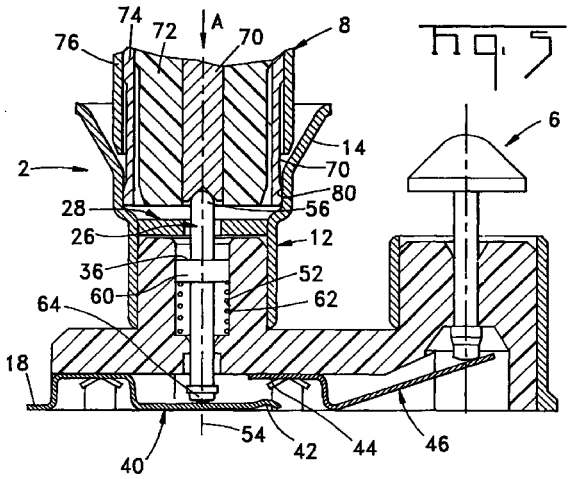
(54) Electrostatic discharge protection for a coaxial connector

(57) A coaxial connector (2) for mating with a complementary connector (8), the coaxial connector (2) having an insulative housing with a passageway therethrough an inner contact (26) positioned in the passageway and being resiliently biased (62) and moveable along the longitudinal axis, the inner contact (26) has a mating end (56) and a connecting end (64) opposite thereto with a shoulder (36) therebetween; an outer contact (14) mounted to the housing and generally concentric to the inner contact (26), the outer contact (18) having a grounding contact for connection to a ground and a coupling end (14) for mating with the complementary connector (8), the coupling end including a fixing surface therealong; and, an electrostatic discharge protection member (28) in contact with the fixing surface and located relative the inner contact (26) such that prior to mating with the complementary connector (8), the shoulder (36) contacts the electrostatic discharge protection (28) member and upon mating with the complementary connector (8), the inner contact (26) is displaced such that the shoulder (36) is moved out of contact with the electrostatic discharge protection member (28).



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Description

[0001] This invention relates to coaxial connectors and in particular providing electrostatic discharge protection to those coaxial.

[0002] There are various communication devices, such as hand-held cellular phones that incorporate electrical connectors along their outer surfaces. These electrical connectors enable the device to be connected to peripheral support devices, such as battery chargers, data communication devices for example, modems and antennas, such as would be incorporated into a cradle in an automobile. While these connectors enable the communication device to be even more useful, they do present some problems. For example, as the communication devices may be carried around with a user, it is possible that the user builds up a static charge. These connectors represent a path into the electronics of the communication device by which it is possible for the static charge on the user, or elsewhere, to enter the device and damage the electronics. While it is typical for these devices to incorporate electrostatic discharge protection circuitry within the electronics, it is also desirable to incorporate this in the connector in an electromechanical form to further protect the electronics therein.

[0003] One example of an electrical connector incorporating electrostatic discharge protection is disclosed in WO/96/13926. This is an input/output data style communications connector that would be part of a cradle wherein a hand-held cellular phone is seated. In the disclosed connector, a plurality of contacts having a central resilient spring section are biased against a shorting bar prior to connection with the mating connector. The shorting bar creates a path the ground which prevents any static charge from passing through the exposed contacts of the connector and reaching the circuitry of the base station. Upon mating with the complementary connector, the contacts are depressed away from the shorting bar. The aforegoing provides adequate protection for input/output style connectors. However, there are other connectors incorporated into devices of this type.

[0004] One such connector is a coaxial switching connector, as disclosed in WO/98/31078. While cellular phones typically comprise their own antennas, when they are mounted in a cradle in an automobile, the cellular phone connects to an auxiliary antenna that is part of the automobile. As these connectors also provide an entrance pathway into the electronics of the connector, it would be desirable to provide electrostatic discharge protection therein also.

[0005] It is desired is for the electrostatic discharge protection to be provided in a simple and inexpensive manner, as high qualities of these connectors will be used and it is desirable not to increase the price of these products. Furthermore, while it is known to incorporate electrostatic discharge protection in coaxial connectors, it is more difficult to accommodate both electrostatic discharge protection and a functional switching feature, such as may be required in these cellular applications.

[0006] The aforegoing objects are accomplished by providing a coaxial connector for mating with a complementary connector, the coaxial connector comprising: an insulative housing having a passageway therethrough and a mounting surface outward therefrom, where the passageway defines a longitudinal axis that corresponds generally to the mating direction of the connectors; an inner contact that is positioned in the passageway and is resiliently biased by a spring member, the inner contact being moveable along the longitudinal axis, the inner contact having a mating end extending outward of the passageway and a connecting end opposite thereto with a shoulder therebetween; an outer contact mounted to the housing upon the mounting surface to be generally concentric to the inner contact, the outer contact having a grounding contact for connection to a ground and a coupling end for mating with the complementary connector, the coupling end including a fixing surface therealong; and, an electrostatic discharge protection member in contact with the fixing surface and located relative the inner contact such that prior to mating with the complementary connector, the shoulder contacts the electrostatic discharge protection member in response to the resilient biasing of the inner contact and upon mating with the complementary connector, the inner contact is displaced such that the shoulder is moved out of contact with the electrostatic discharge protection member.

[0007] It is an advantage of this invention that electrostatic discharge protection is provided in a simple manner.

[0008] It is yet another advantage of this invention, that by forming the coupling end of the outer contact as a guide cup, the electrostatic discharge protection member may be formed in a disc-like shape with an inner opening therethrough for inner contact access, and then be press-fit within the coupling end.

[0009] It is yet another advantage of this invention that as the inner conntact is displaceable within the passageway, by incorporating a switching contact in line with the connecting end of the inner contact, a switching function may be achieved.

[0010] An example of the invention will now be described with reference to the following drawings wherein:

Figure 1 is a side view of an electrical connector according to the present invention;

Figure 2 is a top view of the electrical connector of figure 1;

Figure 3 is a bottom view of the electrical connector according to figure 1;

Figure 4 is a partially cutaway side view of the electrical connector of figure 1;

Figure 5 is a partially cutaway side view corre-

sponding to figure 4 showing mating with a complementary connector.

[0011] With reference first to figure 1, a coaxial connector according to the present invention is shown generally at 2. In this exampletory embodiment, the coaxial connector 2 includes a first coaxial connector 4 and a second coaxial connector 6. The first coaxial connector 4, is adapted to the connected with a complementary connector 8 (figure 5) that would be included in a cradle or other type of docking device (not shown). The second coaxial connector 6 could be used for an antenna that would be normally affixed to the device. As will be described below, the antenna that is normally connected to the second connector 6 will need to be disconnected by way of a switching mechanism when the complementary connector 8 of the docking device is connected therewith. In this embodiment, while the connector 2 incorporates both the first coaxial connector 4 and the second coaxial connector 6, both of which will be described below, it is not necessary to incorporate the second connector 6.

[0012] The connector 2 includes an insulative housing 10 that forms part of each of the first and second coaxial connectors 4, 6. The first connector 4 includes an outer contact 12 with a cup-like lead-in section 14 for receiving the complementary connector 8 and a grounding contact 16 for connection to a ground. Additionally, the connector 2 includes a signal contact 18. The second coaxial connector 6 includes a conductive outer shell 20 and dome-shaped inner contact 22. The conductive outer shell 20 includes a grounding tab 24.

[0013] With reference now to figure 2, the first coaxial connector 4 includes an inner contact 26 disposed within the outer contact 12. An electrostatic discharge protection member 28 is seated within the cup-like portion 14 of the outer contact 12. The electrostatic discharge protection member 28 is advantageously formed as disc having an outer surface 20 which is press-fit into the outer contact 12 to be in contact with a fixing surface 32 therealong. The electrostatic discharge protection member 28 further includes an inner hole 34 through which the inner contact 26 extends. Furthermore, the inner contact 26 includes a shoulder 36 which extends beneath the electrostatic discharge protection member 28 beyond the bounding of the inner hole 34 such that the shoulder 36 is in contact with the electrostatic discharge protection member 28, as will be described in more detail below.

[0014] With respect to figure 3, the insulating housing 10, at the first coaxial connector 4, includes a passageway 38 wherein the inner contact 26 is disposed. The first coaxial connector 4 further includes a resiliently biased switching contact 40, which will be described in greater detail below, having the signal contact 18 of the coaxial connector 2. The switching contact 40 also includes a contacting end 42 that is normally resiliently biased against tang 44 of a second switching contact 46 that is associated with the second connector 6. The second switching contact 46 also includes a resiliently biased tab 48 that is normally set against a bottom 50 of the inner contact 22.

[0015] With respect now to figure 4, the electrical connector 2 is shown such that the functions thereof may be more clearly described. As mentioned above, the electrical connector 2 includes a switching function that utilises a first switching contact 40 and a second switching contact 46 such that the connection to the second coaxial connector 6 is normally coupled to the signal contact 18 of the connector 2. This is accomplished by having a resilient tab 48 of the second switching contact normally engaged with the bottom 50 of the inner contact 22 of the second coaxial connector 6 and the resilient tab 42 of the first switching contact 40, which incorporates the signal contact 18, normally engaged with the tang 44 of the second switching contact 46. As can be seen, this completes the circuit between the second connector 6 and the signal contact 18. It is important to note, that while this connector 2 envisions a second coaxial connector 6, the switching function may also result in coupling to internal antenna circuitry or other structure which would not be connected to an external device.

[0016] The electrostatic protection feature is incorporated into the first coaxial connector 4. The insulative housing 10 includes a passageway 52 that defines a longitudinal axis 54 which corresponds generally to the mating direction, shown as Arrow A in figure 5. The inner contact 26 is disposed within the passageway 52 such that a mating end 56 extends outward from an upper surface 58 of the electrostatic discharge protection member. The inner contact further includes a flange 60 having a shoulder 36 thereupon, it is normally biased by a resilient spring member 62 against a bottom surface 64 of the electrostatic discharge protection member. In this case, the resilient member 62 is a coil spring that is located within the passageway 52. It would also be possible to utilise the first switching contact 40 to bias the inner contact 26. The inner contact 26 further includes a connecting end 64. In this embodiment, the resilient member 62 biases the inner contact 26 away from the switching contact 40 so that there is gap 66 therebetween. However, the electrostatic discharge protection member is still needed because for a static charge may jump the gap 66. The outer conductor 12 is mounted upon a mounting surface 68 of the insulative housing 10 so that it is generally concentric with the inner contact 26 in a manner that is well know within the coaxial arts.

[0017] With reference now to figure 5, the mating connector 8 is shown inserted into the cup-like portion 14 of the outer contact 12 by mating insertion in the direction of Arrow A. The mating connector 8 includes an inner contact 70, a concentric insulator 72 an outer contact 74 and a housing portion 76. The outer contact 74 includes resilient contact arms 78 having contacting

portion 80 thereupon that engage with the outer contact 12 of the connector 2. As can be seen, in response to inserting the mating connector 8 in the direction of Arrow A, the inner conductor 70 of the mating connector 8 engages the mating portion 56 of the inner contact 26 and displaces the inner contact 26 within the passageway 52 generally along the longitudinally axis 54. As a result of this displacement, the coil spring 62 is compressed. Furthermore, the shoulder 36 of flange 60 is moved away from the electrostatic discharge member 28. Additionally, with respect to the switching function, the first switching contact 40 is now engaged by the connecting end 64 of the contact 26. This depresses the first switching contact 40 such that the contacting tab 42 is moved away from the contacting tang 44 of the second switching contact 46. This effectively decouples the second coaxial connector 6 from the signal contact 18.

[0018] Therefore, advantageously, a coaxial connector is provided with electrostatic discharge protection in a simple and effective manner. Furthermore, this electrostatic discharge protection feature may be easily incorporated in a switching coaxial connector.

Claims

1. A coaxial connector for mating with a complementary connector, the coaxial connector comprising: an insulative housing having a passageway therethrough and a mounting surface outward therefrom, where the passageway defines a longitudinal axis that corresponds generally to the mating direction of the connectors; an inner contact that is positioned in the passageway and is resiliently biased by a spring member, the inner contact being moveable along the longitudinal axis, the inner contact having a mating end extending outward of the passageway and a connecting end opposite thereto with a shoulder therebetween; an outer contact mounted to the housing upon the mounting surface to be generally concentric to the inner contact, the outer contact having a grounding contact for connection to a ground and a coupling end for mating with the complementary connector, the coupling end including a fixing surface therealong; and, an electrostatic discharge protection member in contact with the fixing surface and located relative the inner contact such that prior to mating with the complementary connector, the shoulder contacts the electrostatic discharge protection member in response to the resilient biasing of the inner contact and upon mating with the complementary connector, the inner contact is displaced such that the shoulder is moved out of contact with the electrostatic discharge protection member.

2. The coaxial connector of claim 1 wherein the electrostatic discharge protection member is a disc having an outer surface that is engaged with the fixing surface of the outer contact, the disc having an inner opening through which the inner contact is assessable by the mating connector.

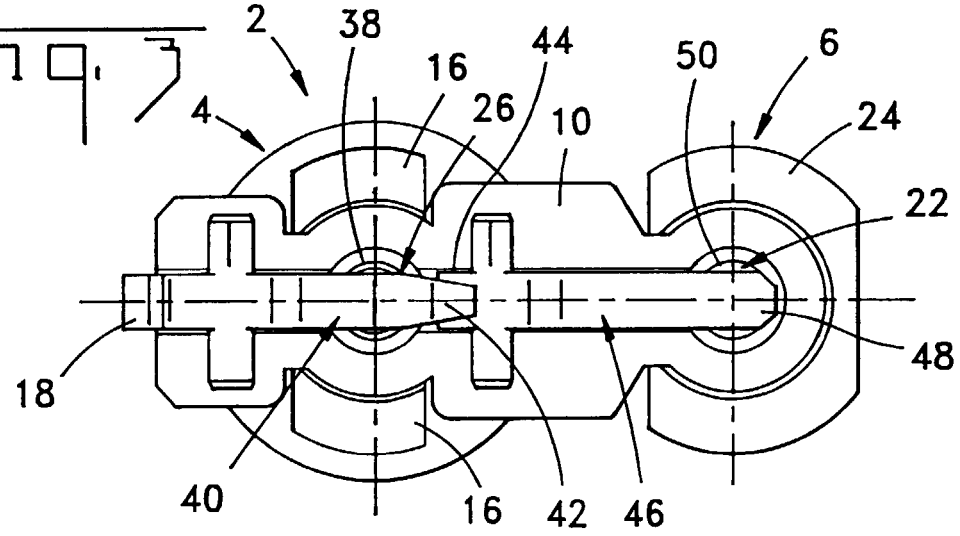
3. The coaxial connector of claim 1 or 2, wherein the disc is press-fit into the outer contact and in engagement with the fixing surface.

4. The coaxial connector of any one of the preceding claims, wherein the inner contact includes a spring located in the passageway of the housing to resiliently bias the contact.

5. The coaxial connector of any one of the preceding claims, wherein the connector further includes a first switching contact having a resilient end to engage a mating tang of second switching contact and a signal contact, where the inner contact as a result of mating with the complementary connector, deflects the first switching contact out of engagement with the second switching contacts.

6. The coaxial connector of claim 5, wherein the coaxial connector includes a second coaxial connector and the second switching contact is connected to an inner contact thereof.

Фиг. 3



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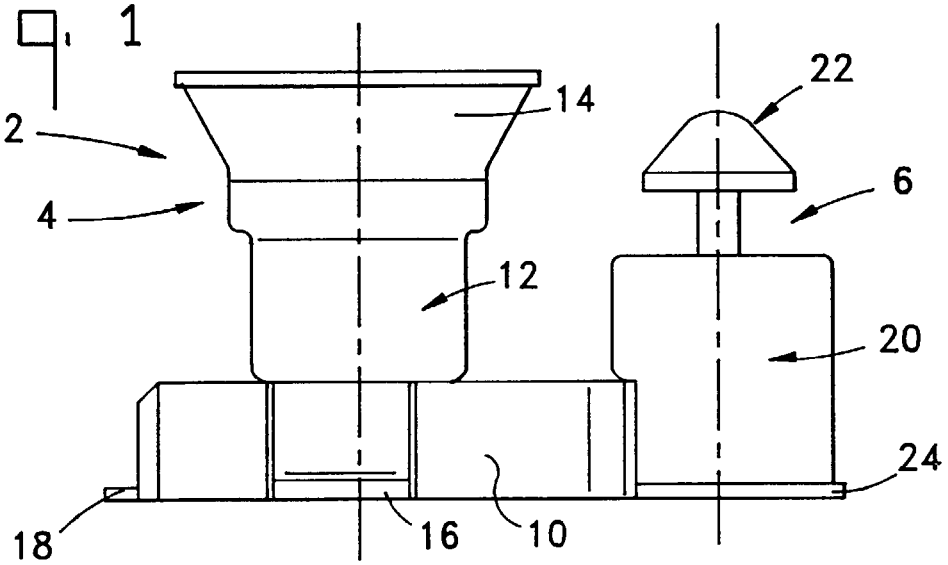

Фиг. 2

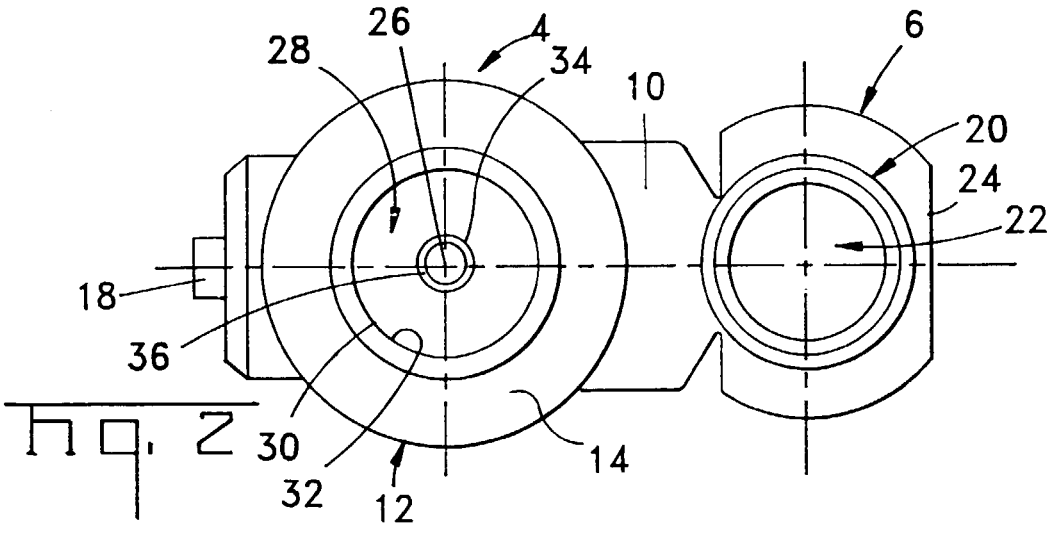

Fig. 4

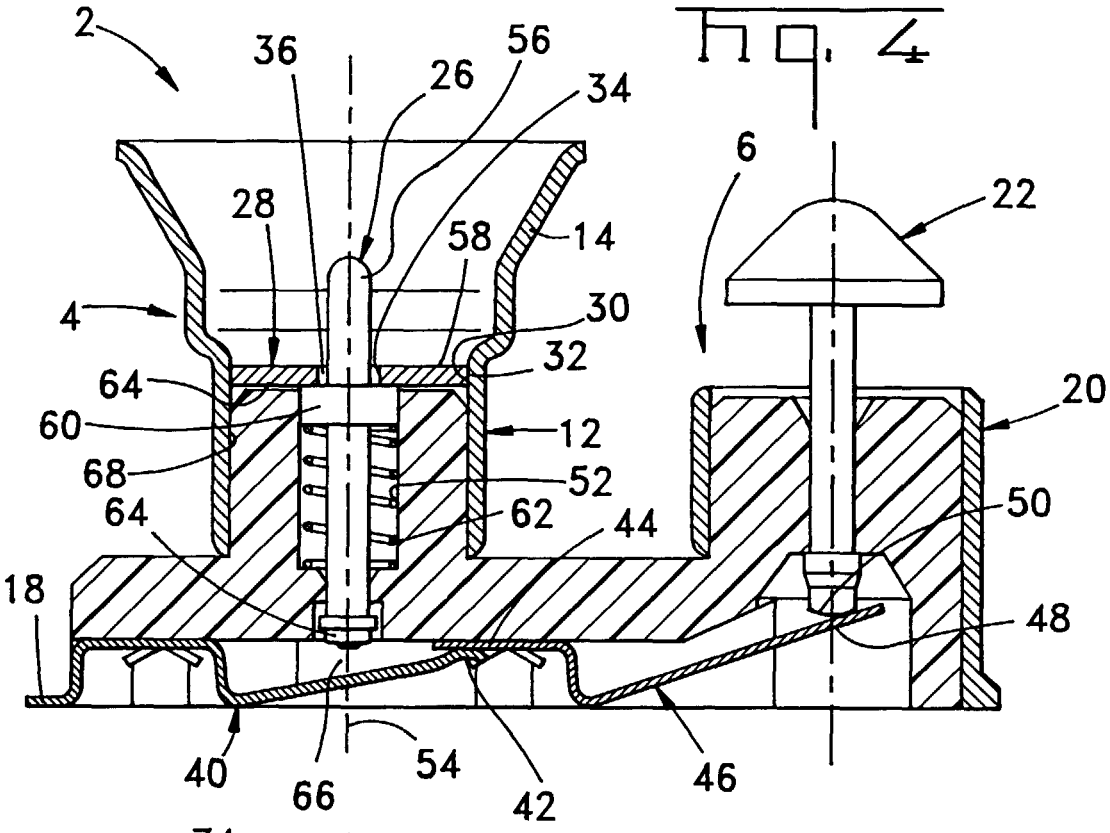
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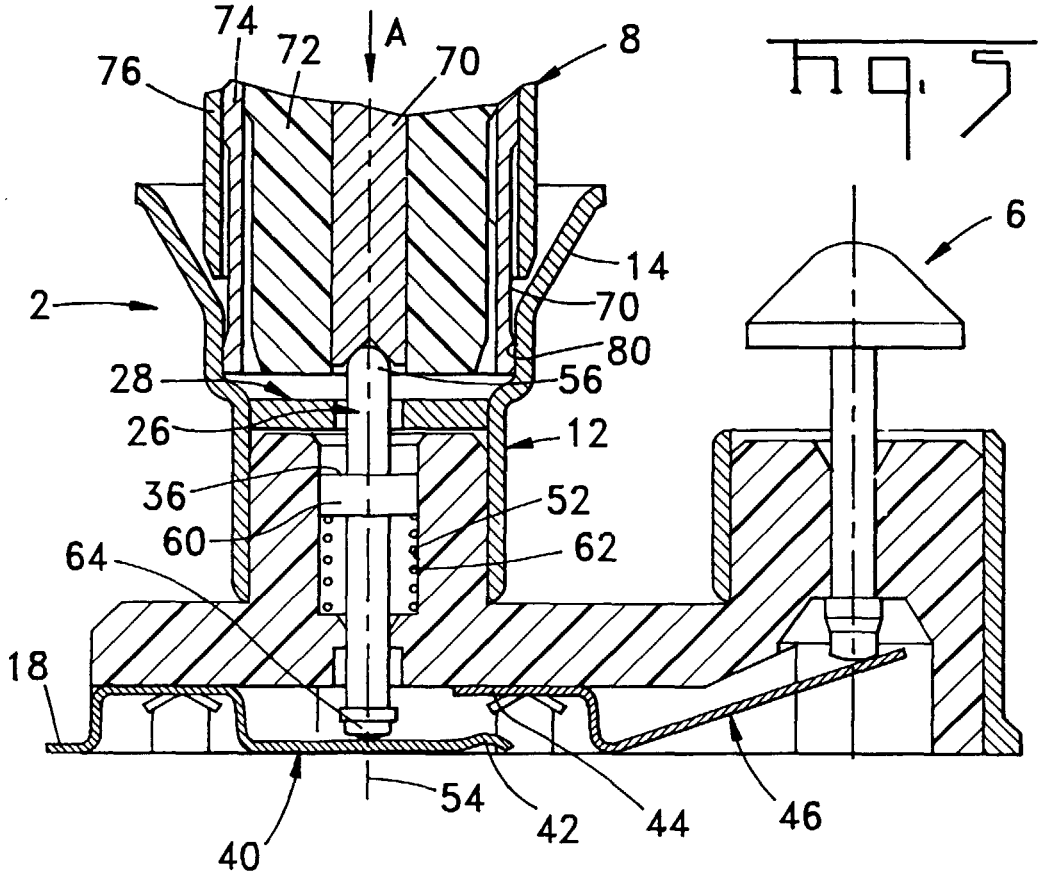
Fig. 5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