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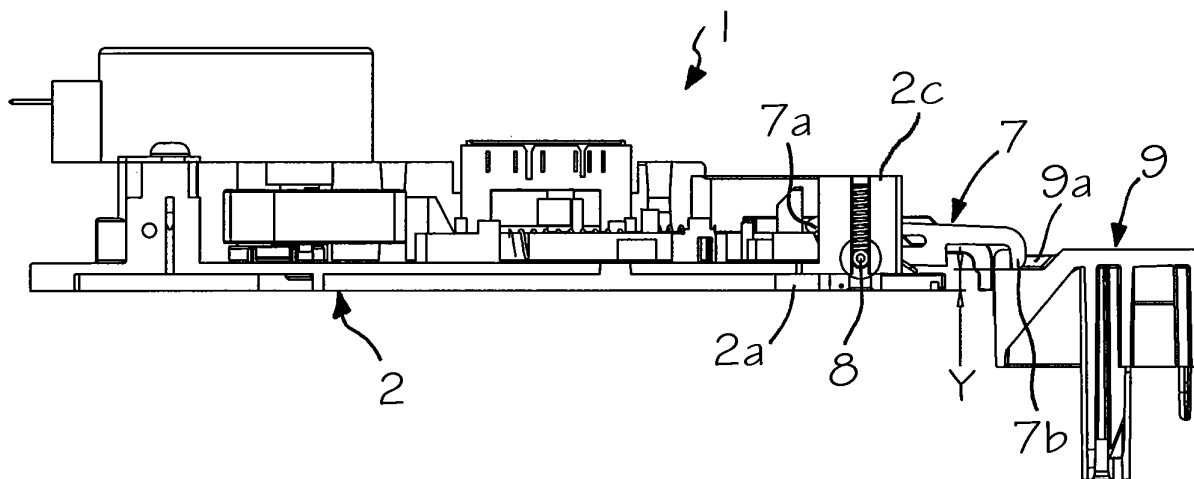
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(54) **Door-lock device for a household appliance, in particular an oven**

(57) A door-lock device for an electrical household appliance, in particular an oven, comprises a body (2) to which there is hinged, via a pin (8), a catch (7) that is capable of angular movement, as well as an actuating system (3-5) having actuator means (3) that can be controlled to determine passage of the locking member (7)

between a first inoperative condition, in which opening of the door (9) of the household appliance is enabled, and an operative condition, in which opening of the door (9) is prevented. Means (14) are provided for enabling translation of the pin (8), and hence of the catch (7) in order to enable manual release of the device (1) and/or compensation of any possible assembly allowances.

Fig. 18



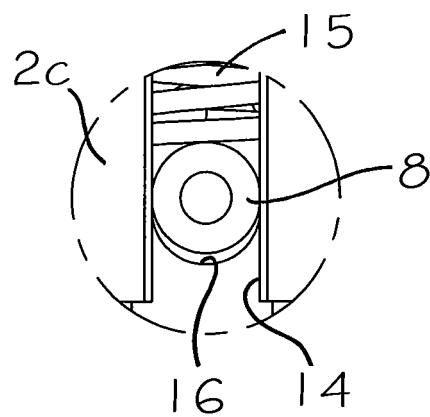


Fig. 20

Description

TEXT OF THE DESCRIPTION

[0001] The present invention relates to a door-lock device for a household appliance, in particular an oven.

[0002] Various types of household appliances are equipped, for reasons of safety, with door-lock devices. For example, washing and/or drying machines, whether of the front-loading type or of the top-loading type, are equipped with a door, through which the user has access to a drum for the normal operations of loading and unloading of the laundry. In these cases, the door-lock device is provided to prevent opening of the door during the cycle of operation of the machine, and, on the other hand, to prevent operation of the machine with the door open. Door-lock devices are typically used also on ovens for cooking equipped with a program or step of pyrolytic self-cleaning, i.e., self-cleaning at a high temperature, to prevent opening of the door of the oven in the course of the aforesaid program, or else to prevent start-up of the program itself in the condition where the door is open or not correctly closed. Similar safety devices are also used for preventing the door being opened by small children, during normal operation of the oven.

[0003] The devices of the type referred to above usually comprise a main body to which there are associated a movable locking member and the actuation system thereof. Usually, the main body is fastened to the fixed structure of the household appliance, with the locking member that is designed to co-operate with a retention element of the door; in some instances, the main body of the device is fastened to the door, and the retention element is associated to the fixed structure.

[0004] The locking system thus requires co-operation of members assembled on different parts of the structure of the household appliance, one part being movable with respect to another part. In order to ensure proper operation of such a system, the locking member and the retention element thereof have to co-operate in a precise manner, i.e., consistently with the design specifications. This requirement imposes the need for particular care and precision in assembly of the components of the locking system on the respective parts of the household appliance, as well as in assembly of said parts with respect to one another (i.e., the door with respect to the fixed structure of the appliance), which leads to an increase in the production times.

[0005] It is also possible that, on account of possible manufacturing and/or assembly allowances of the components of the system, the final position of the locking member with respect to the retention element differs to some extent from the optimal one, or does not guarantee proper and safe operation of the device over time. In addition, imprecise positioning between the parts may, on the other hand, fail to be detected immediately if the device, during product testing, temporarily operates as it should; in such cases, the problems deriving from the

imprecise positioning of parts involved can emerge at a later date, for example when the product is installed, or after a certain period of use, on account of even minimal settling of the structure of the household appliance or of its the components (such as the door hinges).

[0006] It is also known that in the devices of the type referred to there is, in certain situations, the need to release the door of the household appliance manually, for example in the case of malfunctioning of the actuator that actuates the mechanical part of the device, or else of malfunctioning of the control system that governs said device, or again of a fault in the electrical system of the household appliance.

[0007] From the document No. EP-A-0 977 104 a bistable actuating system is known, actuated via a wax electrothermal actuator, which can be used in combination with a door-lock device for a household appliance. The device described can be released manually, via a purposely provided mechanical system, should the need arise, for example in the case of absence of mains supply or malfunctioning of the control system of the household appliance. Said system comprises a slit formed in the casing of the device, accessible from outside the household appliance, in which the end of a purposely provided implement can be inserted for the purpose of re-setting or modifying the working condition of the device itself, enabling passage thereof into a respective position of release of the door. Albeit reliable, the system referred to in the aforementioned prior document, in addition to requiring the use of a purposely designed implement, is complex from the standpoint of production and use, moreover requiring a particular arrangement of the household appliance that uses it, such as, for example, the presence of a slit that can alter the aesthetic appearance of the household appliance itself.

[0008] In its general terms, the present invention is aimed at overcoming one or more of the aforesaid drawbacks by providing a door-lock device for a household appliance that is simple and inexpensive to manufacture, as well as easy and quick to install and easy to use and service.

[0009] The above and other purposes, which will emerge clearly from what follows, are achieved according to the present invention by a door-lock device for a household appliance having the characteristics specified in the annexed claims, which are understood as forming an integral part of the present description.

[0010] Further purposes, characteristics and advantages of the present invention will emerge clearly from the ensuing detailed description and from the annexed plate of drawings, which are provided purely by way of explanatory and non-limiting example and in which:

- Figure 1 is a first perspective view of a device according to the invention;
- Figure 2 is a side view of the device according to the invention;
- Figure 3 is a second perspective view of the device

according to the invention, with a respective lid removed;

- Figure 4 is an enlarged detail of Figure 3;
- Figure 5 is a side view of a main body of the device according to the invention;
- Figure 6 is a view from above of the main body of Figure 5;
- Figure 7 is an enlarged detail of Figure 5;
- Figure 8 is a cross-sectional view according to the line VIII-VIII of Figure 6;
- Figure 9 is a cross-sectional view similar to the view of Figure 8, but wherein an articulation means and elastic means are also associated to the body of the device;
- Figure 10 is a side view of the device according to the invention, in a first inoperative condition;
- Figure 11 is an enlarged detail of Figure 10;
- Figure 12 is a simplified view aimed at illustrating the position assumed by an articulation means of the device in the condition of Figure 10;
- Figure 13 is a cross-sectional view of the device according to the invention, in the condition of Figure 10;
- Figure 14 is a side view of the device according to the invention, in an operative condition;
- Figure 15 is an enlarged detail of Figure 14;
- Figure 16 is a cross-sectional view of the device according to the invention, in the condition of Figure 14;
- Figures 17 and 18 are partially sectioned side views of the device according to the invention, in two different possible conditions of use;
- Figures 19 and 20 are enlarged details of Figures 17 and 18, respectively;
- Figure 21 is a side view of the device according to the invention, in a second inoperative condition, or condition of release;
- Figure 22 is an enlarged detail of Figure 21;
- Figure 23 is a simplified view aimed at illustrating the position assumed by an articulation means of the device in the condition of Figure 21;
- Figure 24 is a cross-sectional view of the device according to the invention, in the condition of Figure 21.

[0011] With particular reference to Figures 1 to 3, the reference number 1 designates as a whole a door-lock device according to the invention, provided for use on a household appliance equipped with a door. For the purposes of the present description, it will be assumed that said household appliance is an oven for cooking and that the device 1 is provided for locking the door of the oven in the respective condition of closing when an operation program or a program of pyrolytic self-cleaning is run.

[0012] The device 1 comprises a main body 2, made, for example, of moulded thermoplastic material, designed to be fixed to the cabinet of the oven or in any case to its fixed structure or chassis, the latter being represented only schematically and partially in Figure 2, where it is designated by M. An electric actuator 3 is fixed with known means to the body 2; in the case exemplified,

the actuator is constituted by a rotary motor, equipped with terminals 3a for the necessary electrical supply.

[0013] Associated to the shaft of the motor 3 is an eccentric 4, for instance a three-lobed cam, designed to bring about the displacement of a slider, designated as a whole by 5 in Figure 3 (the shaft and the eccentric are shown in Figures 13, 16 and 24, where they are designated by 3b and 4). The slider 5 is constrained to the body 2 so as to be able to slide linearly between two limit positions, as will emerge from what follows. For this purpose, the end wall 2a of the body 2 defines projections for positioning and guiding the slider, some of which are designated by 2b in Figure 3.

[0014] The end of the slider 5 opposite to the eccentric 4 has a front surface 5a defining an inclined plane designed to co-operate with a movable locking member, which, in the case exemplified, is constituted by a catch which can turn through an angle and is designated as a whole by 7, said locking member being preferably made of metal material. The catch 7 is constrained in a movable way or hinged to the body 2, in particular by means of a pin 8 which extends between two parallel walls 2c of the front portion of the body 2. In the case exemplified, the cylindrical, preferably metal, pin 8 is a component distinct from the body of the catch 7 and inserted in a transverse through hole of the catch itself. In a possible variant, the pin 8 could be formed by two reliefs or protrusions projecting from opposite sides of the body of the catch 7, which are cylindrical and are coaxial with respect to one another.

[0015] The catch 7 comprises a substantially arched rear portion, designated by 7a in Figure 3, which has an end with a rounded profile and is designed to co-operate with the inclined surface 5a of the slider 5, and a substantially L-shaped or hook-shaped front portion, designated by 7b, the terminal stretch of which is designed to engage in a respective seat 9a, defined in a door of the oven on which the device 1 is assembled. Said door, represented limitedly to the part in which the seat 9a is formed, is designated by 9 in the figures. In the area of joining between its two portions 7a, 7b, the catch 7 is provided with a transverse through hole, from which there project the ends of the pin 8. It should be noted that, for certain applications, the arrangement could be reversed, i.e., with the body 2 fixed to the door and with the seat 9a, or other retention element designed to co-operate with the catch 7, provided in the fixed or movable structure of the household appliance.

[0016] In the case exemplified, the device 1 is further equipped with at least one sensor, such as a microswitch, for instance of a normally closed type, designated by 10 in Figure 3, connected or interfaced to the control system of the oven and having a respective sensitive element or feeler 10a, which can be actuated via a corresponding actuation element, such as a shaped rod, designated by 11, constrained to the body 2 so as to be able to slide linearly; for this purpose, projections are defined in the end wall 2a of the body, for positioning and guiding the

rod 11, some of which are designated by 2e in Figure 3.

[0017] The microswitch 10, with the respective rod 11, has the function of detecting whether the door 9 is in the correct closing position, irrespective of the operative condition of the catch 7, in order to issue a command to the control system of the oven for enabling start up of an operation program or a program of pyrolytic self cleaning. In particular, in the position of correct closing, the door 9 maintains the rod 11 in a retracted position, counteracting the action of a spring 12. In said position, as may be seen, for example, in Figure 3, an appendage 11a of the rod 11 is displaced from the feeler 10a in such a way that the microswitch 10 enables supply of the motor 3 (in the case of a microswitch 10 of the normally closed type, when the appendage 11a does not press the feeler 10a, the supply circuit is closed); in this condition, in the case where the user selects a program and/or pyrolytic self-cleaning, the control system of the oven will supply the motor 3 to enable movement of the slider 5 and hence of the catch 7 so as to bring the latter into the respective operative position, in which it locks the door 9. Instead, in the case where the door 9 is open, or not correctly closed, the rod 11 will be located in an advanced position by virtue of the action of the spring 12, in which position the appendage 11 a presses the feeler 10a, leaving the microswitch 10 free or in the opening position, in which it opens the supply circuit of the motor 3. In said condition, the control system of the oven will not enable start-up of the program and/or pyrolytic self-cleaning even in the case of a specific selection in this sense by the user.

[0018] The reference number 13 designates as a whole a lid, which is not represented in Figure 3. In the case exemplified, the lid 13 comprises at least one portion 13a, designed to close at the top the area of the body 2 extending between the walls 2c, where the inclined surface 5a of the slider 5 co-operates with the rear portion 7a of the catch 7. As may be seen in Figures 1 and 2, said portion 13a of the lid 13 has two symmetrical side projections, one of which designated by 13b, which are designed to extend parallel on the outside of the walls 2c of the body 2, and preferably each having a lower end designed for hooking in a respective seat formed in the bottom wall of body 2 (not shown). The projections 13b have the function of ensuring correct positioning of the pin 8 in the various conditions of operation of the device 1, as will emerge from what follows.

[0019] In Figure 4 a detail of Figure 3 is represented, from which it is possible to note that a seat or housing 14 is formed in the side wall 32c. In the example, said housing is vertical or, in more general terms, it extends in a direction that is substantially perpendicular to the axis of the pin 8. The housing 14 is delimited at the top by a wall portion 2c' and inside it an elastic element is positioned, in the example shown, a helical spring 15. As may be noted, one end of the spring 15 rests on the surface of the wall portion 2c', whereas the opposite end rests on an end portion of the pin 8 that protrudes within the housing 14. An arrangement similar to the one shown

in Figure 4 is provided at both of the walls 2c.

[0020] Figures 5 and 6 show only the main body 2 of the device 1, in a side view and a plan view, respectively (note that, in Figure 6, projections 2b and 2e, as well as some further positioning and fixing elements formed in the body 2 are not represented). Figure 7 shows an enlarged detail of Figure 5, at a housing 14. Figure 8 illustrates instead a cross section of Figure 6, substantially according to the axis VIII-VIII.

[0021] As may be noted in particular from Figure 8, each housing 14 is substantially constituted by a cavity formed within the respective wall 2c. Said cavity is delimited, at the rear part thereof, by a vertical wall portion 2c", wherein a through opening or seat is formed, hereinafter also referred to as "slot" and designated by 16, having a generally oblong section of passage or profile.

[0022] When the pin 8 is assembled, as may be noted for instance in Figure 8, it extends through the two slot-shaped seats 16 so that the respective end portions are each within a housing 14. In this way, with the springs 15 in position, each of them is operatively set between a respective upper wall portion 2c' and an end region of the pin 8.

[0023] In Figures 10-13 the device 1 according to the invention is represented in a normal operative condition, with the door 9 open. It should be noted that in some of said figures, as well as in some of Figures 14-16 and 21-24, the lid 13, the rod 11 and certain internal components of the device 1, such as the microswitch 10, are not represented.

[0024] In the condition illustrated in Figures 10-13, the pin 8 of the catch 7 is kept, owing to the normal elastic reaction of the springs 15, in contact with the lower profile of the slot-shaped seat 16, as may be seen in Figure 11 and, more in detail, in Figure 12, wherein the spring 15 has not been represented. It should be noted that a torsion spring is also installed on the pin 8, the terminal branches 17a and 17b of which react, respectively, against the body 2 and the catch 7 in order to bias the latter in its respective inoperative position or position of release. As may be seen in Figure 13, in said phase the action of the spring 17a-17b is such that the end of the rear portion 7a of the catch 7 is set resting upon the end wall 2a of the body 2, given the retracted condition of the slider 5. In said inoperative condition of the device 1, opening of the door 9 can be performed by applying thereon a tensile force in the direction of normal opening of the door itself, as indicated by the arrow F in Figure 13.

[0025] In the case where the user of the oven selects a program of pyrolytic self-cleaning, the control system enables controlled supply of the motor 3, as previously mentioned with reference to the microswitch 10 and to the rod 11, in order to bring the device 1 into the respective operative condition, or condition of locking of the door 9 in the closed position.

[0026] The motor 3 is controlled in such a way that its shaft 3b determines an angular movement of the eccentric 4 (through about 120° with an eccentric 4 having a

three-lobed cam), with the consequent advance of the slider 5 (towards the right, as viewed in Figure 16). As may be seen in Figure 16, following upon advance of the slider 5, its inclined front surface 5a can penetrate underneath the rounded end of the rear portion 7a of the catch 7. In this way, the catch 7 is induced to move angularly about the pin 8, countering the action of the spring 17a-17b. At the end of said angular movement, the end of the portion 7a of the catch 7 comes to rest upon the top surface of the slider 5. Preferably, reaching of the closing position by the slider 5 is detected by a micro-switch, partially visible in Figure 3, where it is designated by 10'.

[0027] Basically, the aforesaid angular movement of the catch 7 is such that the rear portion 7a rises, with consequent lowering of the front portion 7b of the catch itself. The end of said front portion 7b then penetrates within the seat 9a of the door 9, resting on the bottom thereof, blocking the door in the closing condition; in said condition, as represented in Figures 14-18, a normal tensile force exerted on the door 9 does not enable opening of the latter.

[0028] The operative condition illustrated in Figures 14-18 is maintained throughout the cycle of pyrolytic self-cleaning. At the end of said cycle, the control system of the oven determines a new activation of the motor 3 in order to bring about a new angular movement of the eccentric 4. As a result, recession of the slider 5 is obtained, followed by the return of the catch 7 into the position indicated in Figures 10-13, by virtue of the action of the spring 17a-17b. The device 1 then returns into the respective inoperative position, in which the door 9 can be freely opened by the user.

[0029] In conditions of normal operation, in the passage from the condition of door open and released illustrated in Figures 10-13 to the condition of door closed and locked illustrated in Figures 14-16, the ends of the pin 8 are always in contact with the lower profile of the respective slots 16, as may be noted for instance in Figure 12, by virtue of the rigidity of springs 15, which is appropriately defined in the design stage.

[0030] In Figures 17-20, the device 1 according to the invention is represented in two different possible conditions, always in a locking position. Figures 17 and 19 refer in particular to a condition of installation of the parts similar to that of Figures 14-16 (and hence of Figures 10-13). We shall assume that said condition regards the case of correct installation both of the device 1 on the structure of the household appliance and of the door 9 with respect to said structure.

[0031] As has been said, thanks to the normal elastic reaction of the springs 15, the pin 8 of the catch 7 is kept in contact with the bottom profile of the slot-shaped seats 16, as may be seen in Figure 19 (or in Figures 11, 12 and 15). As has been explained previously, moreover, in the locking condition represented, the front portion 7b of the catch 7 is inside the seat 9a of the door 9, in contact with its bottom, blocking the latter in the closed condition.

[0032] Figures 18 and 20 regard, instead, a situation in which, for example, on account of production and/or assembly allowances, one or more of the parts represented are assembled in a slightly different way as compared to that of Figures 17 and 19. In particular, in the condition represented here, in which the door 9 is closed, the bottom of the seat 9a lies on a plane higher than that of Figure 17, or at a greater distance from the wall 2a of the body 2. The two different positioning heights are designated by X and Y in Figures 17 and 19.

[0033] In this situation of assembly, when the device 1 is passing from the position of release (see, for example, Figures 10-13) to the closed position (see for example Figures 14-16), at a certain point of the angular motion of the catch 7 the portion 7b of the latter will come to rest on the bottom surface of the seat 9a sooner as compared to the case illustrated in Figure 17. In the further course of the angular movement, determined by the advance of the slider 5, the catch 7 will then tend to behave as a whole as a second-class lever, with the point of resting of its portion 7b on the bottom of the seat 9 which functions as fulcrum.

[0034] In this way, a load is applied to the pin 8 such as to cause yielding or compression of the springs 15, with the progressive displacement upwards of the pin itself. Owing to the shape of the slot-shaped seats 16, the pin 8 is thus free to translate upwards, for example as far as the position shown in the detail of Figure 20, where the pin itself is no longer resting on the bottom profile of the seats 16, but is in an intermediate position of the latter. The position thus reached by the pin 8 and by the catch 7 is such as to guarantee proper operation of the device 1.

[0035] It should be pointed out how, with a relative arrangement between the parts similar to the one represented in Figure 19, a door-lock device with a fixed pin, for example of the type illustrated in EP-A-0 977 104, would probably be able to operate and pass a possible testing step in the production stage, without giving rise to particular drawbacks in the short term. The operating cycles of the device would, however, give rise to repeated mechanical stresses exerted on its pin, catch and body, as well as on the door, said stresses possibly causing, in the long run, permanent damage to the locking/release system, with the consequent need for interventions of servicing and/or repair.

[0036] The arrangement according to the invention enables, instead, independent compensation of any possible imprecise relative positioning of the parts involved - in particular between the body 2, the structure M, the door 9, and the seat 9a - thus guaranteeing precise and safe operation over time. Said compensation is obtained by enabling the pin 8 to perform controlled displacements within the oblong seats 16, countering the action of the elastic means 15 tending to keep the pin itself in the operating position that has been reached.

[0037] According to a further and independent aspect of the invention, the device 1 is provided with release

means, to be used in situations where the need arises to release the door manually. In the preferred embodiment of the invention, said means are the same that allow recovery or compensation of any possible imprecision in positioning of the components, i.e., the pin 8, the seats 16, and the springs 15, with their corresponding housings 14.

[0038] Suppose, for example, that the device 1 is in the operating condition illustrated in Figures 14-16, i.e., with the door 9 blocked in its closed position by means of the catch 7. In said situation, if for any reason (such as, for example, malfunctioning of the control system or a power cut), the motor 3 is not in a condition to operate in the way described above, release of the device 1 can be obtained manually, on account of the particular way in which the seats 16 are made and on account of the presence of the elastic means constituted by the two springs 15, which operate in their respective housings 14.

[0039] For this purpose, a tensile force must be exerted on the door 9, i.e., a force in the direction of normal opening of the door itself, as indicated schematically by the arrow F' in Figure 16. The device 1 is conceived in such a way that the force F' necessary for obtaining manual release of the device is considerably higher than the force F required for opening the door 9 in conditions of normal use, i.e., a force such as to meet the safety parameters. Merely by way of example, for said purpose a tensile force F' of at least 20 kg must be applied on the door 9.

[0040] The arrangement between the catch 7 and the seats 9 is such that the torque exerted on the door 9 will determine a vertical component of force on the catch itself, with the end 7b of the latter that will tend to move angularly in a counterclockwise direction, as viewed in the figures, or upwards. Preferably, at least some of the mutually co-operating surfaces of the end of the portion 7b of the catch 7 and of the seat 9a of the door 9 will be shaped as slightly inclined planes, in order to obtain the components or forces necessary for the movement of release of the catch 7.

[0041] As has been said, in the situation in question (device 1 which locks the door - Figure 16) the portion 7a of the catch 7 is resting on the top surface of the slider 5. Consequently, following upon the aforesaid vertical component of force that is applied on the portion 7a (approximately 4 kg, with reference to the example cited of a tensile force F' of approximately 20 kg), the catch 7 tends to behave as a whole as a second-class lever, with the point of rest of its portion 7a on the slider 5, which functions as fulcrum.

[0042] The pin 8 is thus loaded upwards within the slot-shaped seats 16, or rather its end areas are pushed in the direction of the top profile of the seats themselves. Also in this case, then, a load is applied on the springs 15 such as to cause yielding or compression thereof, with the progressive displacement upwards of the pin 8, until its end areas come at the most into contact with the top profile of the slot-shaped seats 16, as may be seen in Figure 22 and in greater detail in Figure 23, where the

spring 15 is not represented. The translation of the pin 8 upwards has the effect of displacing also the spring 17a-17b upwards. The slot-shaped seats 16 may be shaped in such a way (for example, with a slight narrowing) as to prevent the pin 8 from coming into contact with said profile, even in the limit conditions, in order to leave a safety margin.

[0043] Following upon said displacement of the pin 8, also the front portion 7b of the catch 7 will shift upwards, and its end will come out of the seat 9a of the door 9, as may be seen in Figures 21 and 24, thus releasing the latter, which can thus be opened.

[0044] The housings 14, with the respective springs 15 and seats 16 thus constitute also temporary-release means, designed to enable momentary translation of the pin 8, and hence of the catch 7, between a position of normal operation and a position of special operation. In the position of normal operation, the actuating system provided by the electric actuator 3, the eccentric 4 and the slider 5 enables the catch 7 to be brought from a first inoperative condition (Figures 10-13) to an operative condition (Figures 14-16), whereas in the position of special operation the catch 7 assumes a second inoperative condition, in which the catch itself is not engaged by the retention element constituted by the seat 9a. Actuation of the aforesaid release means, which is necessary to bring about said translation from the position of normal operation to the position of special operation, can be obtained by applying on the door, in its normal direction of opening, a force that is considerably higher than the minimum force necessary for opening the door itself when the catch is in said first inoperative condition represented in Figures 10-13.

[0045] Restoring of the device 1 into the condition of normal operation then occurs in an automatic or independent way as a result of the elastic reaction of the springs 15, which will push the pin 8 downwards again, until it returns to resting on the bottom profile of the slot-shaped seats 16, thus eliminating any need for intervention on the part of specialized staff to restore proper operation of the device 1.

[0046] As mentioned previously, the projections 13b of the lid 13 illustrated in Figures 1 and 2, when coupled in their respective seats on the body 2, are each set up against a wall 2c, in a position corresponding to the respective seat 14. In this way, the projections 13b contribute to the function of guaranteeing the correct position of the pin 8 and/or of the springs 15 in the various possible operating conditions, and in particular in the course of passage between the positions represented in Figures 12 and 19, thus preventing them from being slid out of the slots 16, or from being misaligned or slanted. Proper positioning of the springs 15 is on the other hand substantially guaranteed also by the conformation of the housings 14.

[0047] From the above description, it emerges how the device 1 according to the invention is easy to build and economically advantageous. It is pointed out, in particu-

lar, that the system, which is designed to enable both compensation of any possible imprecision in the course of assembly and manual release of the device, is in effect obtained through the particular conformation of the seats 16, of the housings 14, and of the springs 15, said seats and housings being elements that can be obtained during the operation of moulding of the body 2 using thermoplastic material, the springs being on the other hand components that are commercially available at a minimal cost.

[0048] It should be pointed out how the functions referred to, of compensation and manual release, can be present either together or individually in a device 1 according to the production choices, with the major advantage that from one and the same basic structure there may be obtained devices having different functional characteristics (compensation and release; just release; just compensation). For example, during production just one catch 7 having a shape different from the one illustrated (with the end 7b more curved or hook-shaped) could be installed, which, instead of translating as a result a tensile force exerted on the door, maintains the locking position; in this case there would be just the function of compensation of the production allowances.

[0049] Manual release of the device does not render necessary the use of specific implements and can be obtained in an extremely convenient way directly by the user of the electrical household appliance, should the need arise. The subsequent step of restoration of the device 1 is obtained independently or automatically, without any need for specific operations, replacement of components of the mechanism, or intervention of specialized staff.

[0050] Of course, without prejudice to the principles of the invention, the details and materials of construction and the embodiments may vary with respect to what is described and illustrated herein. Furthermore, the individual items described previously may be produced or obtained with any other known technique and may in part be omitted or be present in a different number and with a different arrangement, in order to achieve the purposes of the present invention.

[0051] It is pointed out in particular that the actuator of the device 1 could be of a different type from the one described herein by way of example. In such a perspective, the actuator 3 could also be a linear actuator. The actuator could be of an electromagnetic type, or a thermal type, or an electrothermal type, for example with its operation based upon the use of a material designed to expand and/or contract (such as a wax), or other monostable actuator, or again a bistable actuator, i.e., one that is able to vary its own operating condition between a stable resting position and a stable working position, according to the presence or otherwise of a power supply. In the case of use of a monostable actuator, this could be associated to a bistable mechanism of a known type, for example as described in EP-A-0 663 633.

[0052] The springs 15 could possibly be positioned fac-

ing the inside of the body 2, or else in the direction of the catch 7. In this case, the housings for the springs may be obtained in the part of the walls 2c facing the pin 8. Furthermore, with said arrangement each end of the pin 8 does not need to project on the outside, beyond the profile of the respective slot-shaped seat 16; the seats 16 may hence be closed or present a blind recess or groove (for example, in the form of guides or furrows formed on the inside of the walls 2c), and hence not configured as through holes.

Claims

1. A door-lock device for an electrical household appliance, particularly an oven, of the type having a structure (M) to which a door (9) is associated, the device (1) comprising:

- a movable locking member (7), mounted via means of constraint (8) on a main body (2), where the main body (2) is designed to be rendered fixed to one of said structure (M) and door (9), and the locking member (7) is designed to co-operate with at least one retention element (9a) of the other of said structure (M) and door (9);

- an actuating system (3-5) having actuator means (3) designed to determine the passage of the locking member (7) between:

- a first inoperative condition, in which the locking member (7) is not engaged with said retention element (9a) so as to enable opening of the door (9) by applying a first force (F) thereon in a direction of opening; and

- an operative condition, in which the locking member (7) is engaged with said retention element (9a), so as to keep the door (9) in a respective closed position even when said first force (F) is applied;

wherein at least said main body (2), structure (M), door (9), and retention element (9a) are pre-arranged for being assembled or mounted in relative positions that are substantially pre-defined or according to design, said device (1) being **characterized in that** it comprises at least one of:

- compensation means, provided to enable to at least one of the locking member (7) and the means of constraint (8) to adapt the respective working position according to the effective relative positions of assembly or installation of said main body (2), structure (M), door (9), and retention element (9a), should said effective positions differ from the ones substantially pre-de-

fined or according to design; and

- means of release, which can be operated to determine the passage of the locking member (7) from said operative condition to a second inoperative condition, in which the member itself is not engaged with said retention element (9a), where said means of release are provided to enable a momentary translation of said locking member (7) from a position of normal operation to a position of special operation following upon application to the door (9) of a second force (F') higher than said first force (F), said means of release being likewise arranged for restoring independently said position of normal operation of said locking member (7) when said second inoperative condition is reached,

where in particular said compensation means also embody said means of release and/or vice versa.

2. The device according to Claim 1, wherein said compensation means (14-16) and/or said means of release (14-16) comprise elastic means (15) arranged for applying a constant force upon said locking member (7) in the direction of said working position or said operative condition.
3. The device according to Claim 1, wherein the locking member (7) is angularly movable about a respective axis, where in particular said axis is translatable.
4. The device according to Claim 3, wherein said locking member (7) can operate as a second-class lever with a fulcrum different from said axis, in order to adapt the working position of the means of constraint (8) and/or in order to enable passage of the locking member (7) between said position of normal operation and said position of special operation.
5. The device according to Claim 1, wherein said second force (F') is higher than the minimum force necessary for opening the door (9) when the locking member (7) is in said first inoperative condition.
6. The device according to Claim 1, wherein said means of release (14-16) are operative to enable, following upon application to the door of said second force (F'), also a translation of said means of constraint (8) between a first position and a second position, which correspond, respectively, to said position of normal operation and said position of special operation of the locking member (7), where in particular:

- in the first position of said means of constraint (8), the movement of the locking member (7) between said operative condition and said first inoperative condition is determined by said ac-

tuating system (3-5) via control of said actuator means (3);

- in the second position of said means of constraint (8), the locking member (7) assumes said second inoperative condition, in which the member itself is not engaged with said retention element (9a).

7. The device according to Claim 1, wherein said means of constraint comprise pin means (8) having at least one portion projecting from said locking member (7).
8. The device according to Claim 1, wherein at least one of said compensation means and said means of release comprise at least one passage or seat (16) formed in a respective wall (2c) of said body (2), where in particular:
 - in said seat (16) there is at least in part inserted a portion of pin means (8) of said locking member (7), and/or
 - said seat (16) has a substantially oblong cross section, such that said portion of the pin means (8) is able to translate therein.
9. The device according to Claim 3, wherein said axis is formed by pin means (8) projecting from two opposite sides of said locking member (7) and wherein at least one of said compensation means and said means of release comprise a first passage or seat (16) and a second passage or seat (16), each seat (16) being formed in a respective wall (2c) of said body (2), there being inserted within each seat (16) a respective portion of said pin means (8), each seat (16) having a substantially oblong section of passage.
10. The device according to Claims 2 and 7, wherein said elastic means (15) operate on said projecting portion or portions of the pin means (8).
11. The device according to Claim 2, wherein said body (2) comprises positioning means (14) for said elastic means (15), which comprise at least one housing (14) formed in a respective wall (2c) of said body (2), where in particular said housing (14) extends axially in a direction substantially perpendicular to an axis of rotation of said locking member (7).
12. The device according to Claims 8 and 11, wherein the seat or seats (16) has/have an end open on one said housing (14) and in the latter there extends a respective region of said projecting portion of the pin means (8), where in particular said projecting region extends in a direction transverse to the housing and/or said elastic means (15) are operatively set between said region of the projecting portion of the

pin means (8) and a bottom (2c') of said housing (14).

13. The device according to Claim 2, wherein said elastic means comprise at least one spring (15) set in an axially extended respective housing (14) formed in a wall (2c) of said body (2), there being formed in said wall, in a position corresponding to the housing (14), a seat of oblong cross section (16), in which a portion of a pin (8) of said engagement member (7) is inserted, such that a part of the pin (8) extends through the housing (14) and the spring (15) extends substantially perpendicular to the pin (8), where in particular said elastic means comprise two of said springs (15) substantially parallel to one another, each set in one said housing (14), which is provided with a said seat (16), in which a respective portion of the pin (8) is inserted.

14. The device according to Claim 1, wherein

- said actuating system (3-5) comprises at least one slider (5) constrained to the fixed structure (2) so as to be able to slide linearly between two limit positions following upon actuation of said actuator means (3), where in particular said slider (5) comprises an end defining an inclined plane (5a) that is able to co-operate with said locking member (7), and/or

- said locking member comprises an angularly mobile catch (7), which has a rear portion (7a), with an end having a rounded profile and being designed to co-operate with an inclined surface (5a) of a slider (5) making part of said actuating system (3-5); and a front portion (7b), having a terminal stretch that is able to engage with said retention element (9a), where in particular, both in said operative condition and in said second inoperative condition, the rear portion (7a) of the locking member (7) is locally resting on a top surface of the slider (5), whilst in said inoperative condition it is locally resting on a first wall (2a) of said body (2), and/or

- further elastic means (17a-17b) are provided for applying a constant force upon said locking member (7) in the direction of said first inoperative condition, and/or

- associated to said body (2) is a lid (13) having portions (13b) that are operative for contributing to the maintenance of a correct working position of said means of constraint (8), and/or

- said actuator means (3) comprise at least one from among a rotary or angular actuator, a linear actuator, a bistable actuator, a monostable actuator operatively associated to which is a bistable mechanism, an electrical actuator, a thermal actuator, an electromagnetic actuator, an electrothermal actuator, and/or

- said locking member (7) and said retention el-

ement (9a) have co-operating surfaces that are at least in part shaped like an inclined plane.

15. A household appliance, particularly an cooking oven, comprising a fixed structure, (M), a door (9) associated to the fixed structure, and a door-lock device made in accordance with one or more of Claims 1 to 19.

Fig. 1

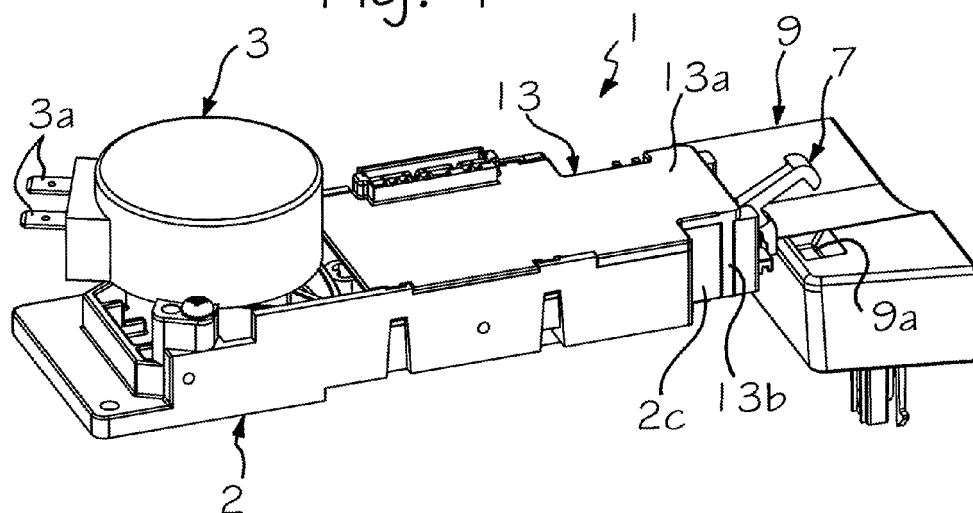


Fig. 2

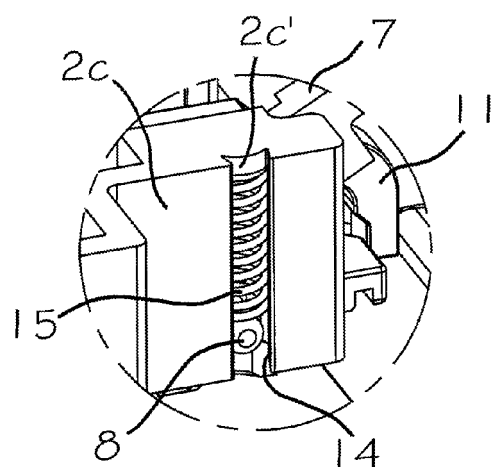
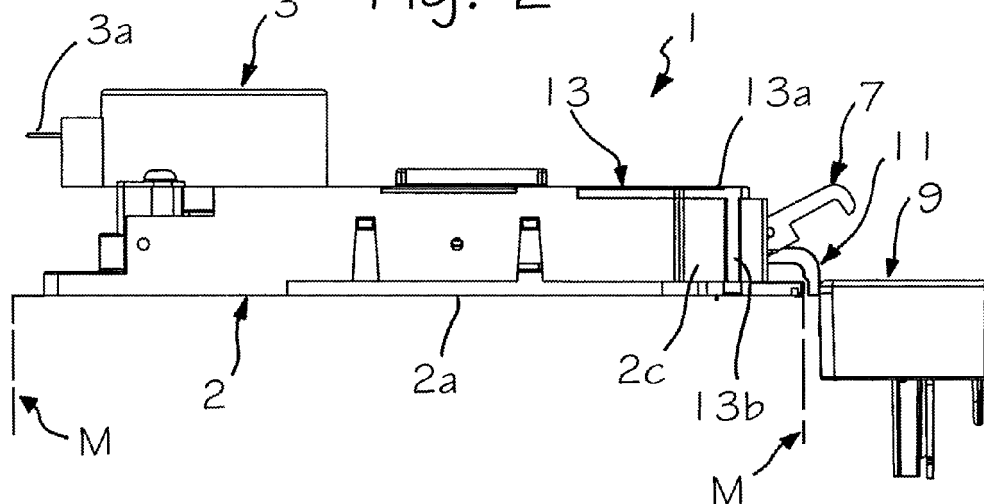
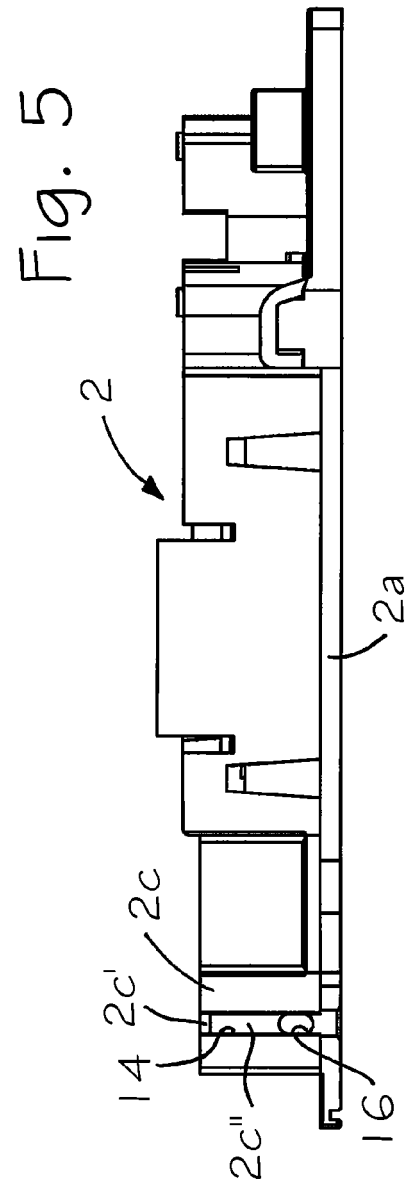
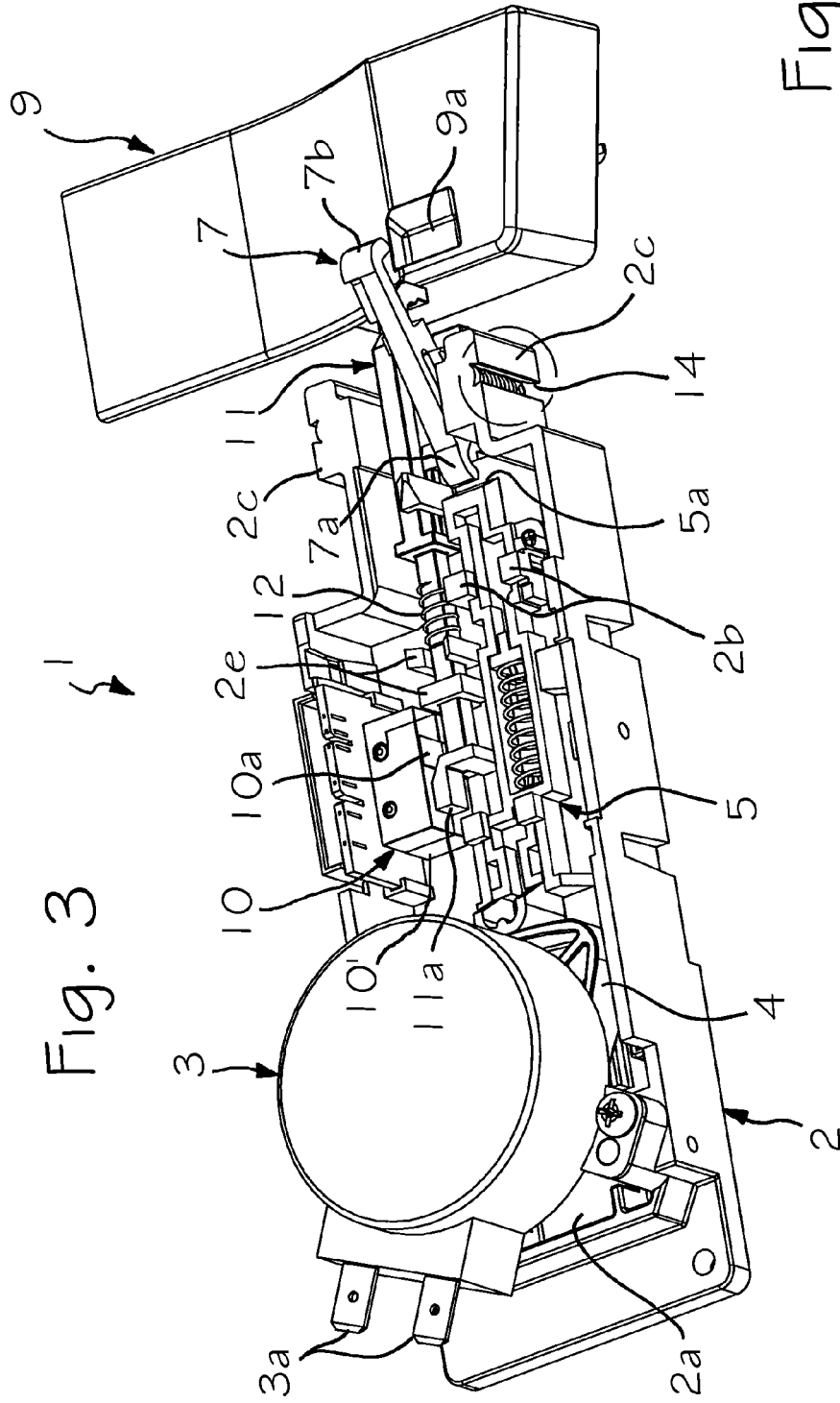
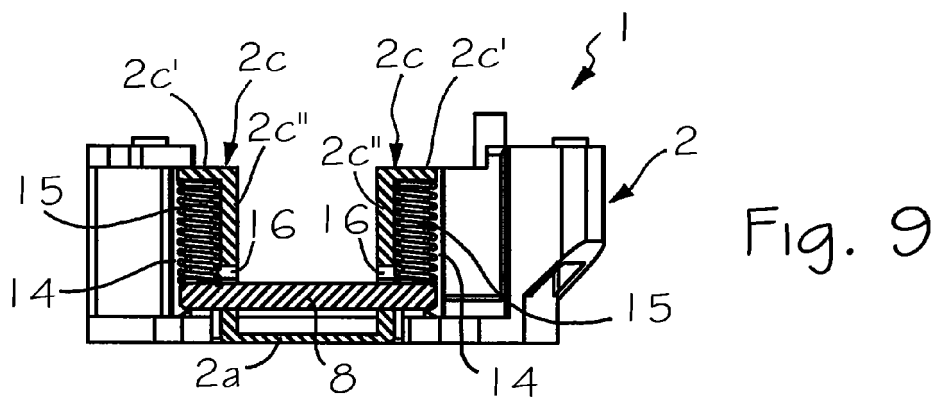
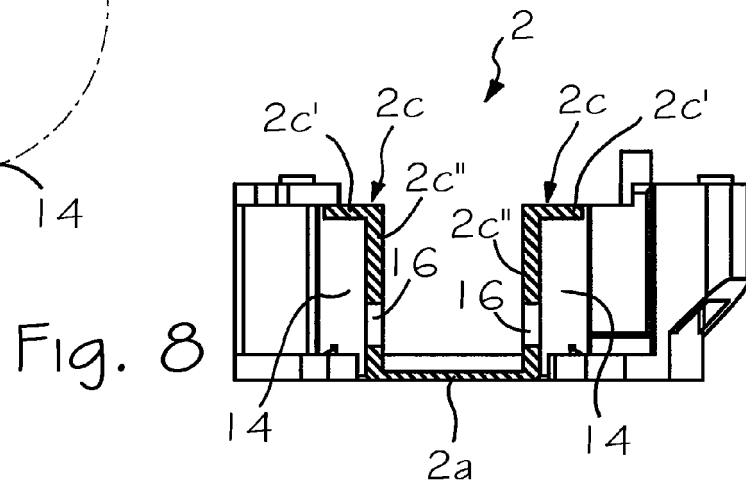
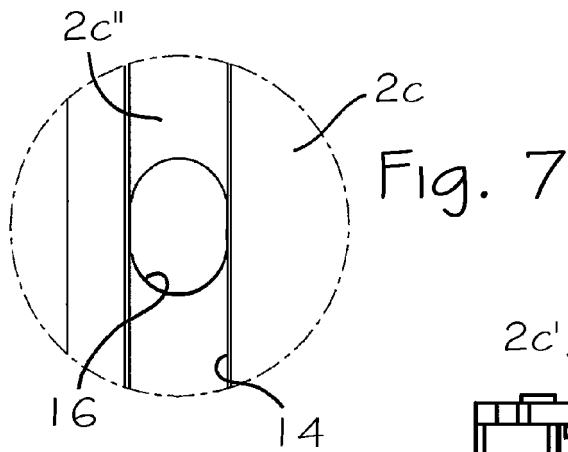
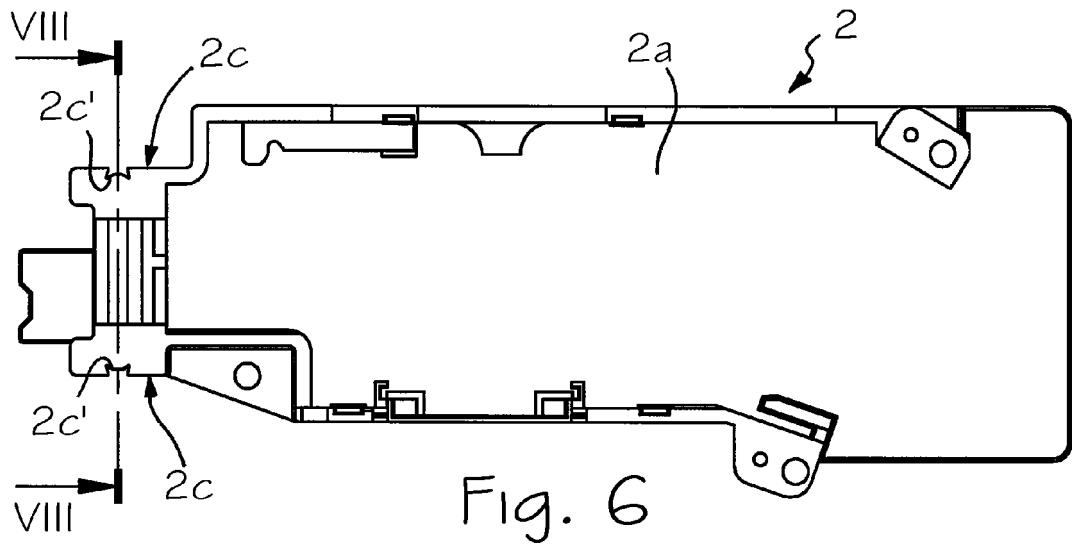


Fig. 4





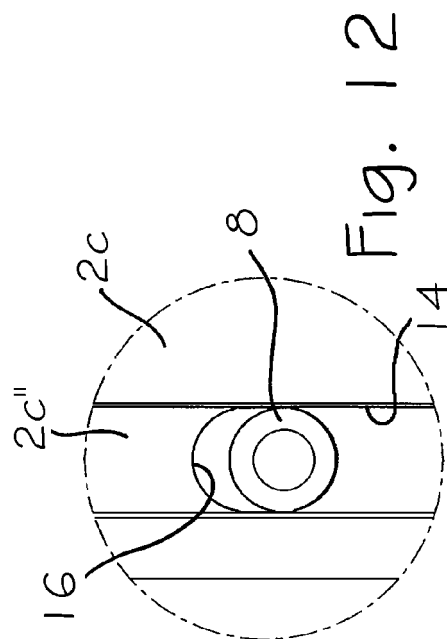
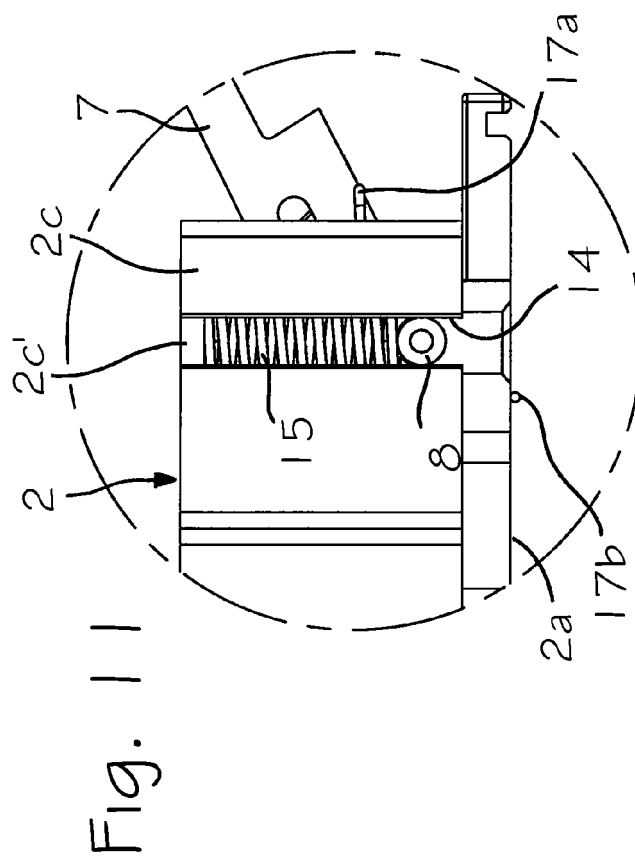
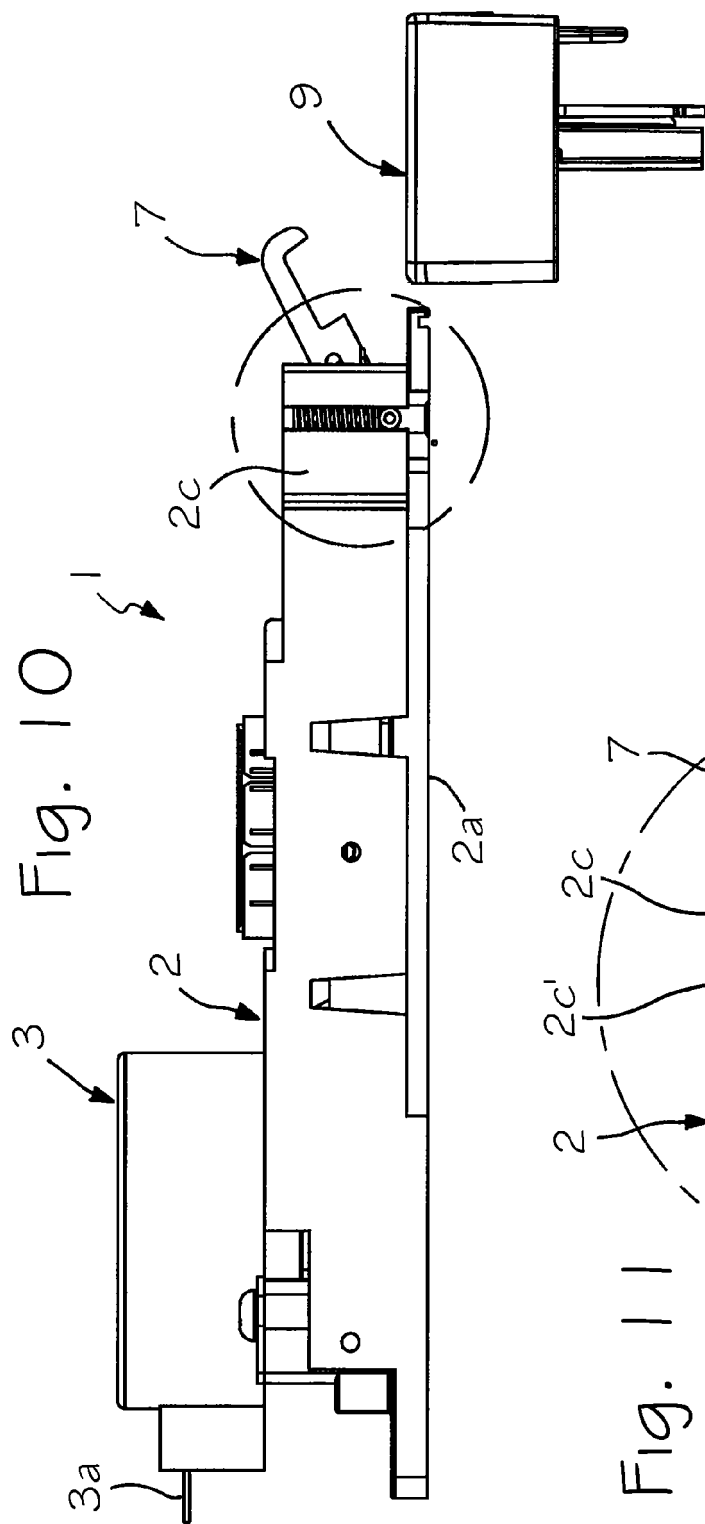
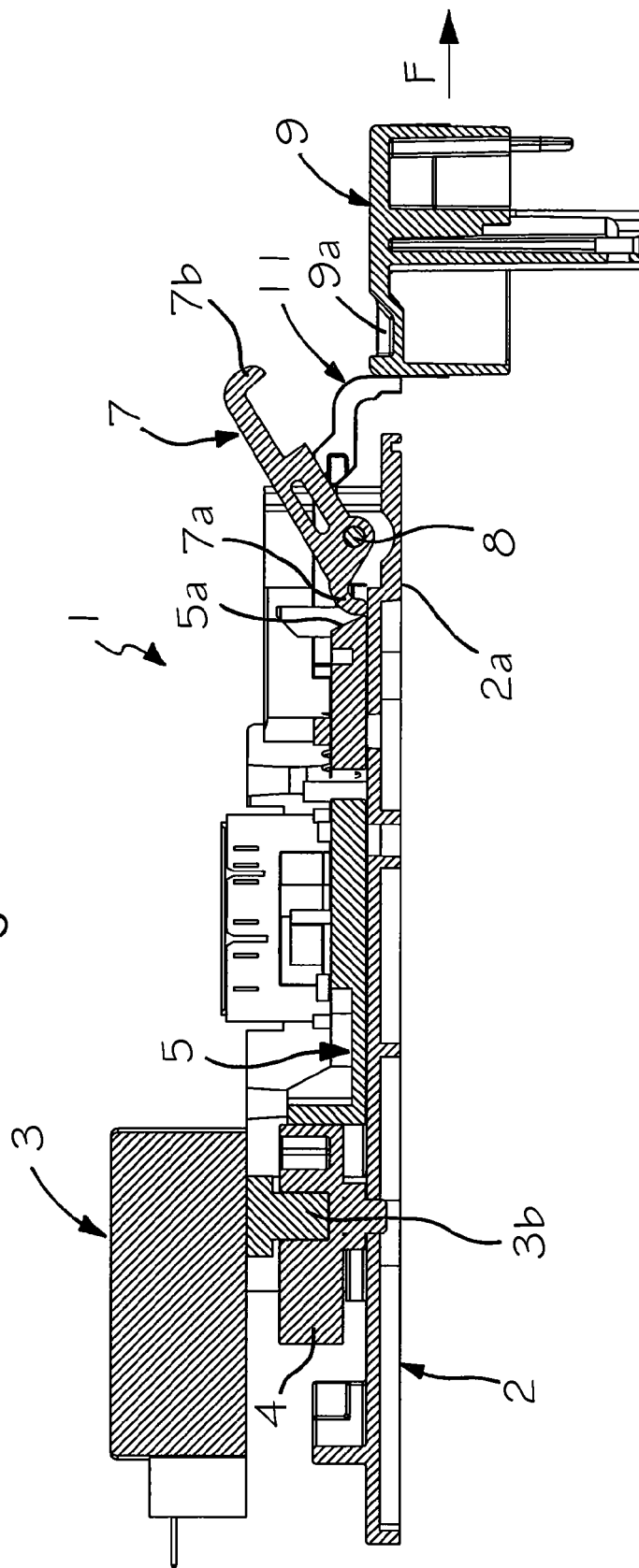


Fig. 13



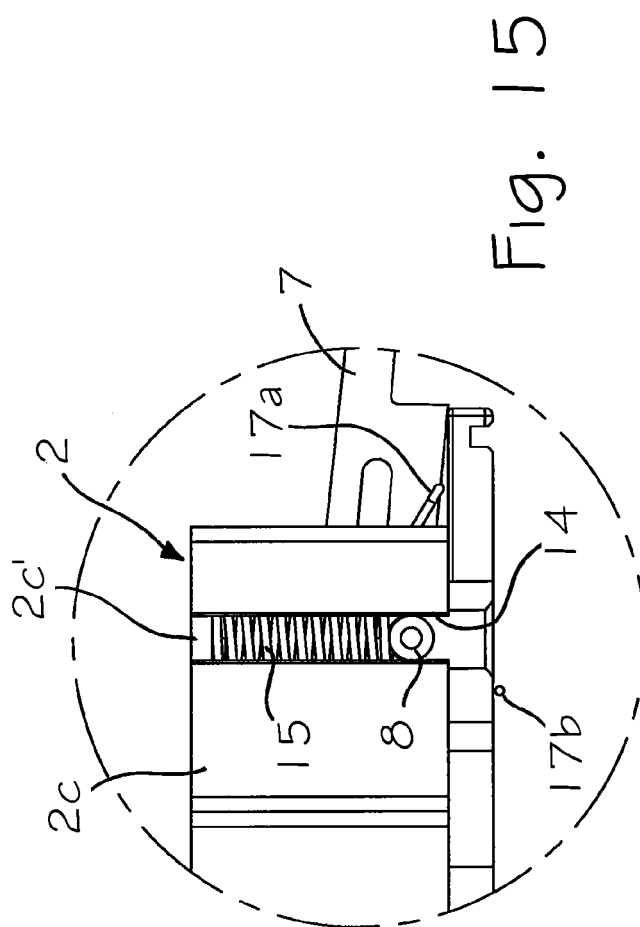
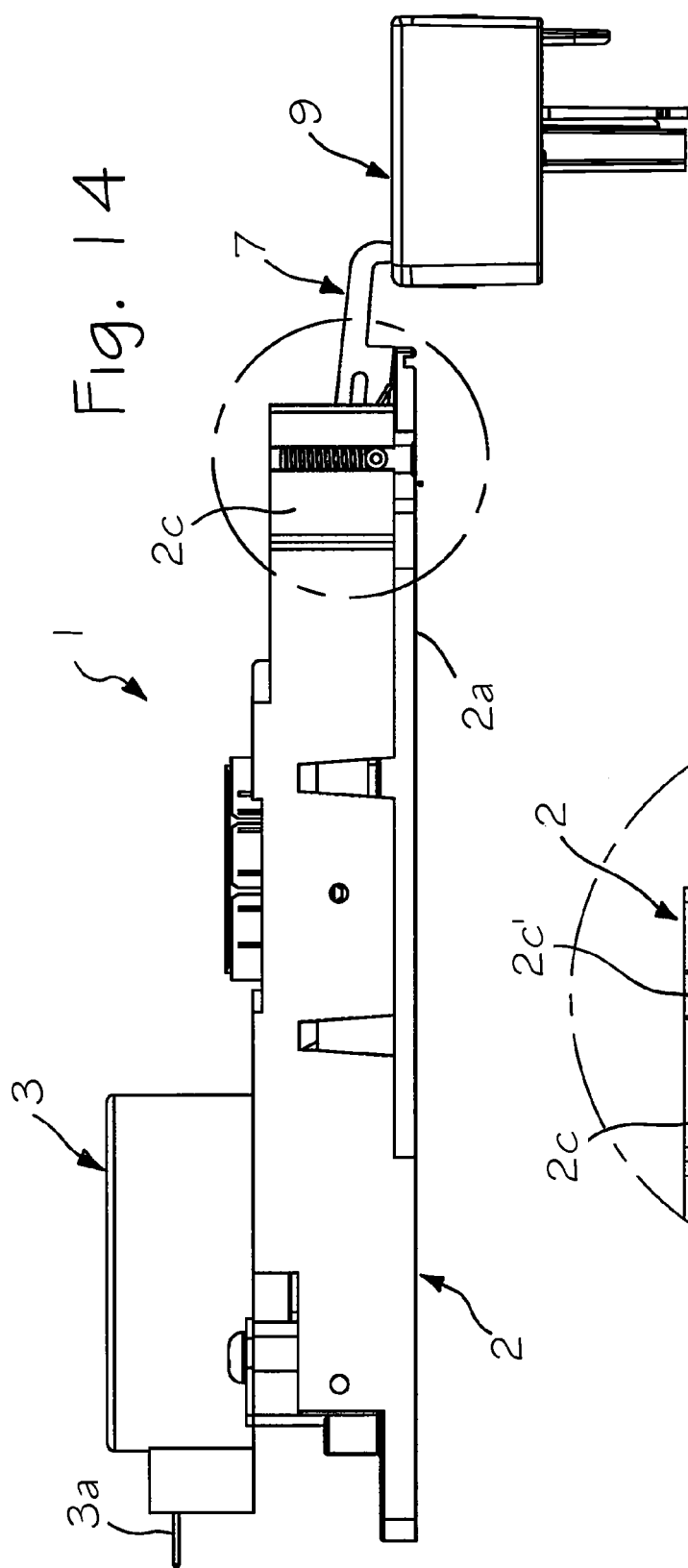


Fig. 16

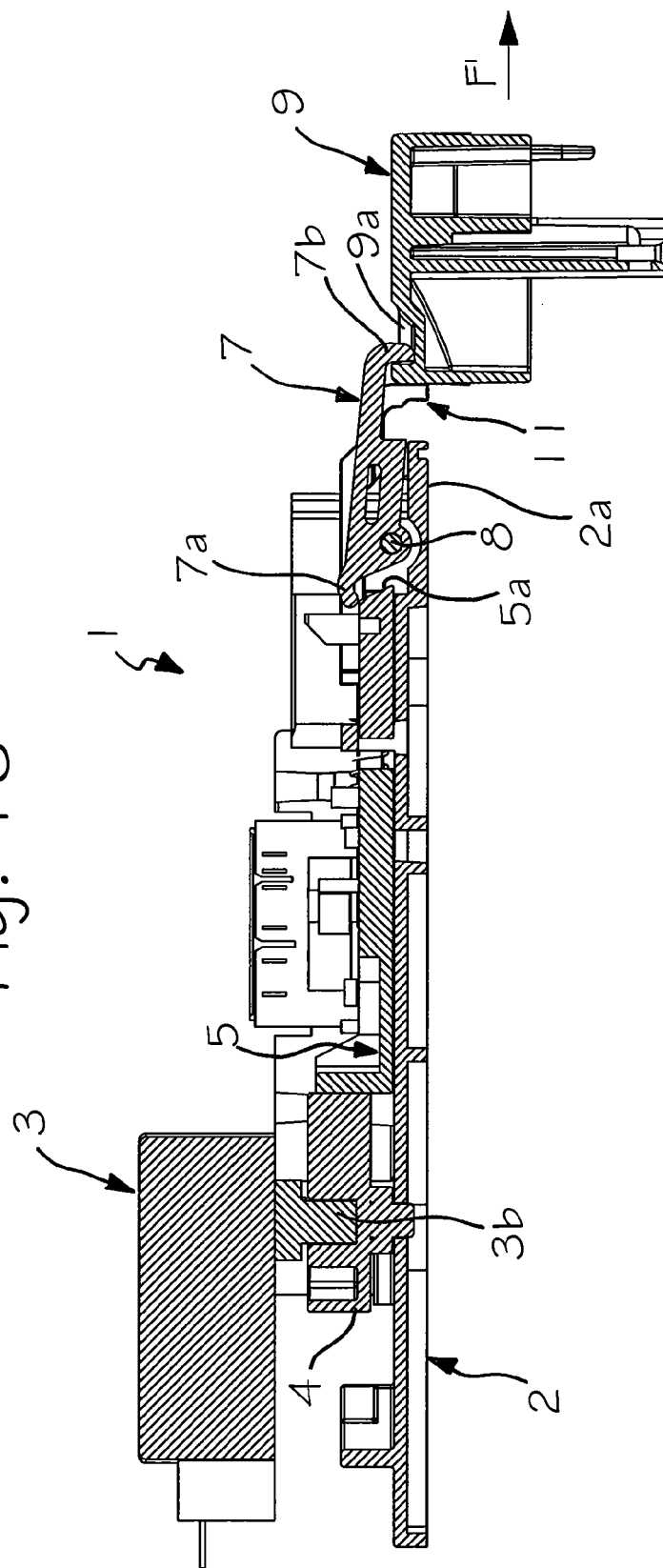


Fig. 17

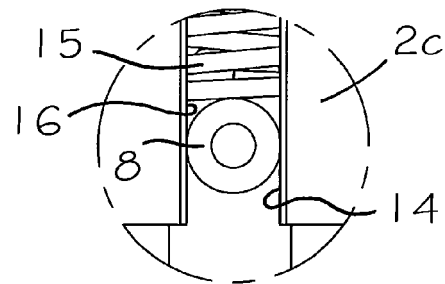
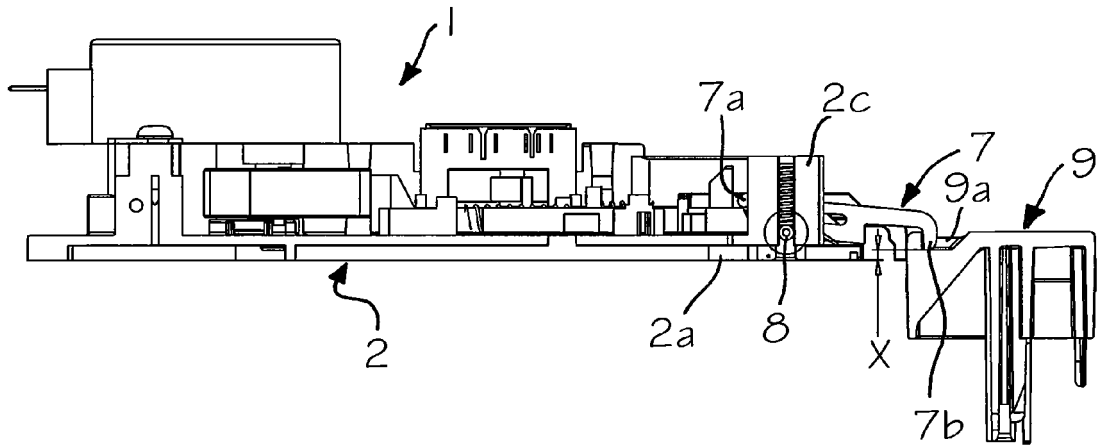


Fig. 19

Fig. 18

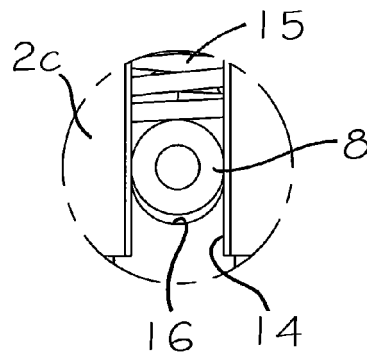
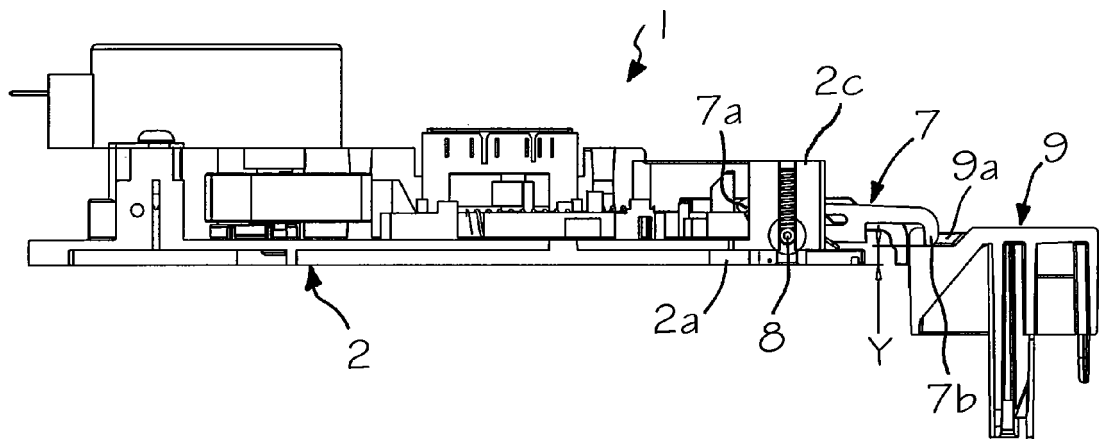


Fig. 20

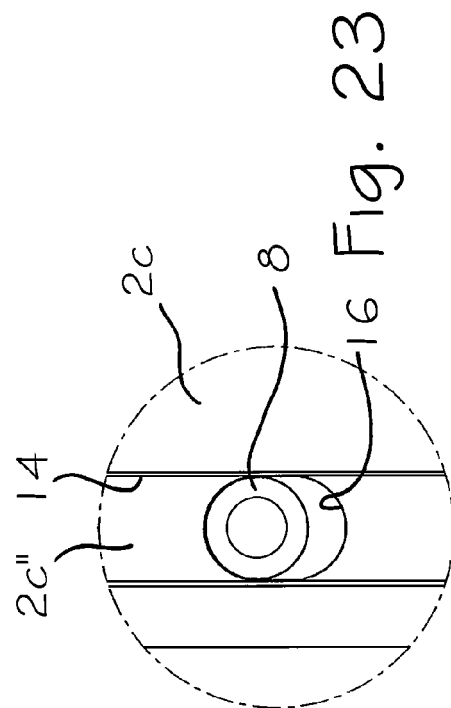
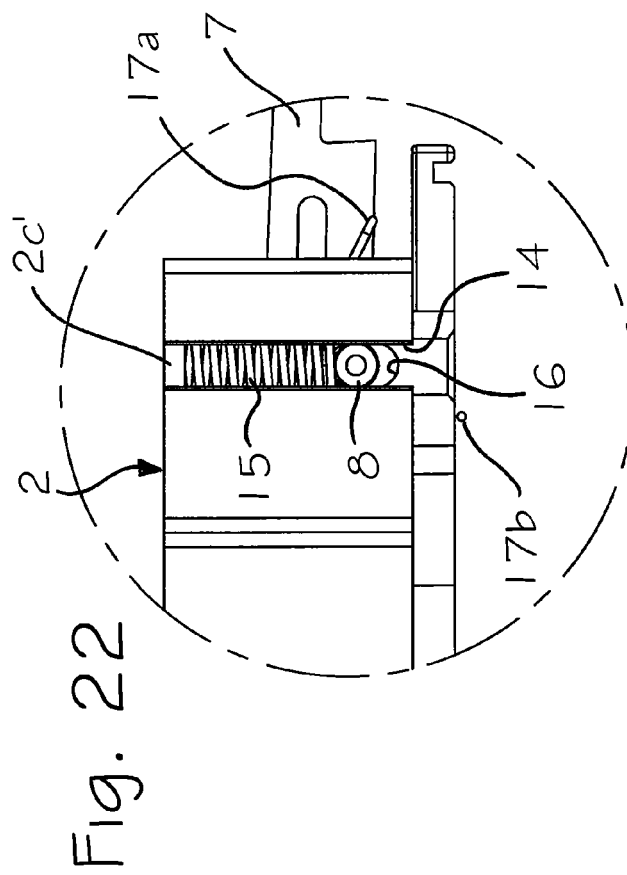
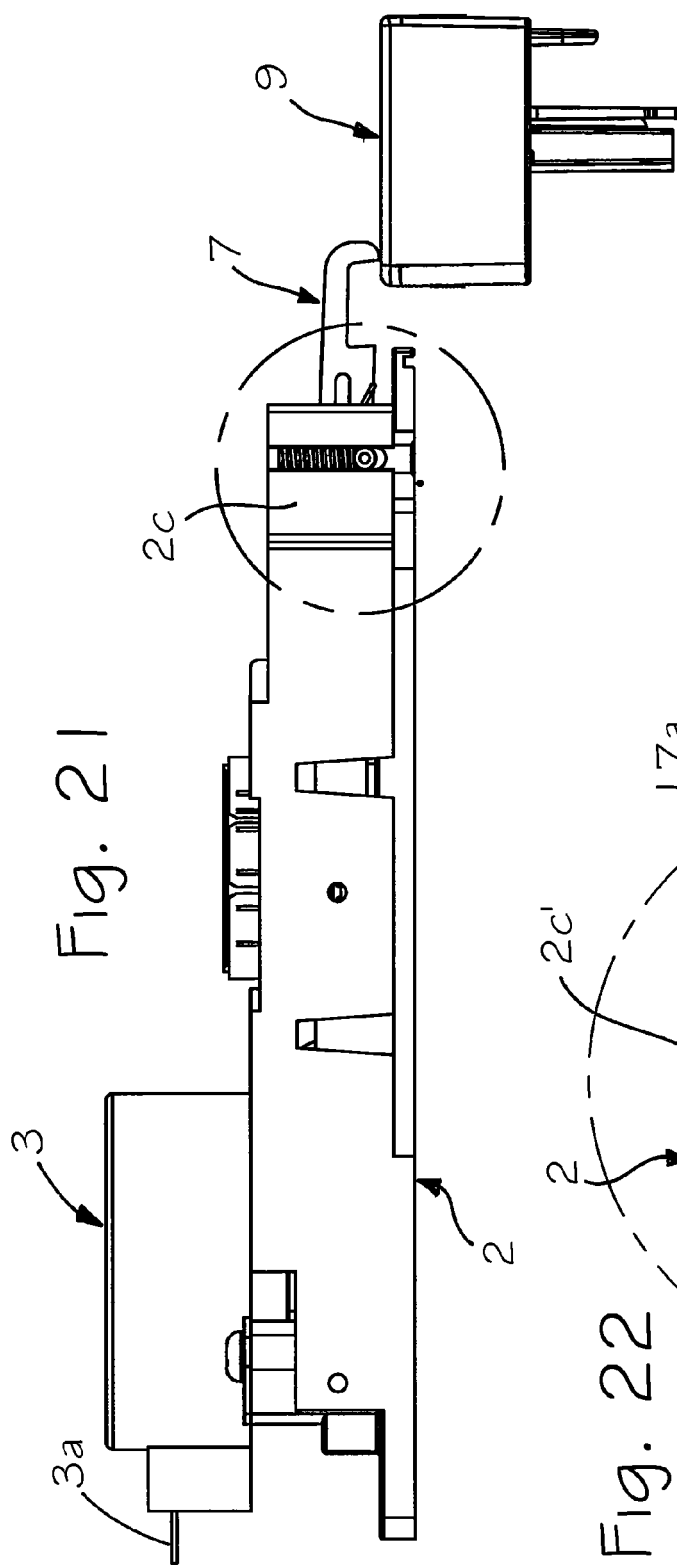
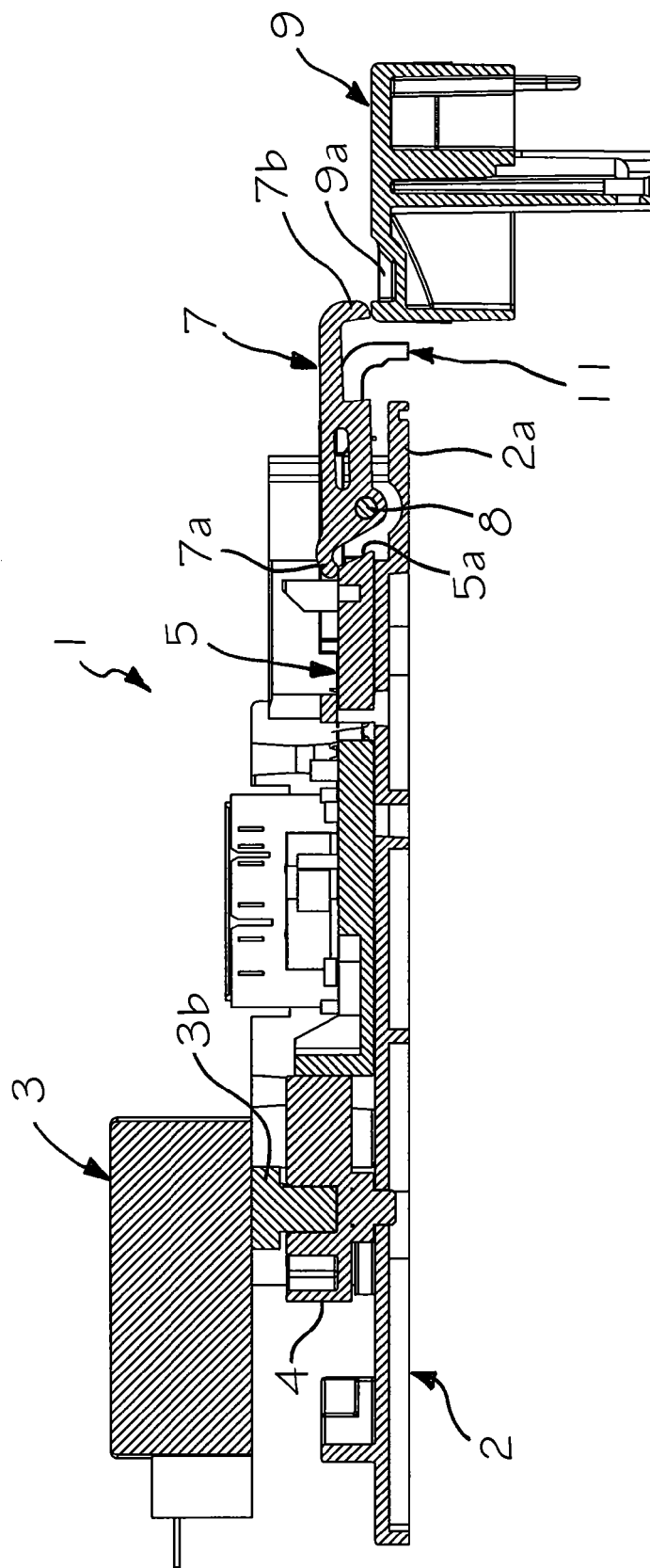


Fig. 24



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 0977104 A [0007] [0035]
- EP 0663633 A [0051]