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(54) **Anti-fall safety device for rolling shutters with torsion springs**

(57) The present invention refers to an anti-fall safety device for rolling shutters with torsion rings, of the type commonly used to close garages and shops.

The device of the invention comprises two main elements (A and B), with a torsion spring (M) placed and attached between them; the failure of the spring (M) actuates a retention pawl (8) that interferes with the free rotation of a rotating drum (5) joined to the top slate of the rolling shutter.

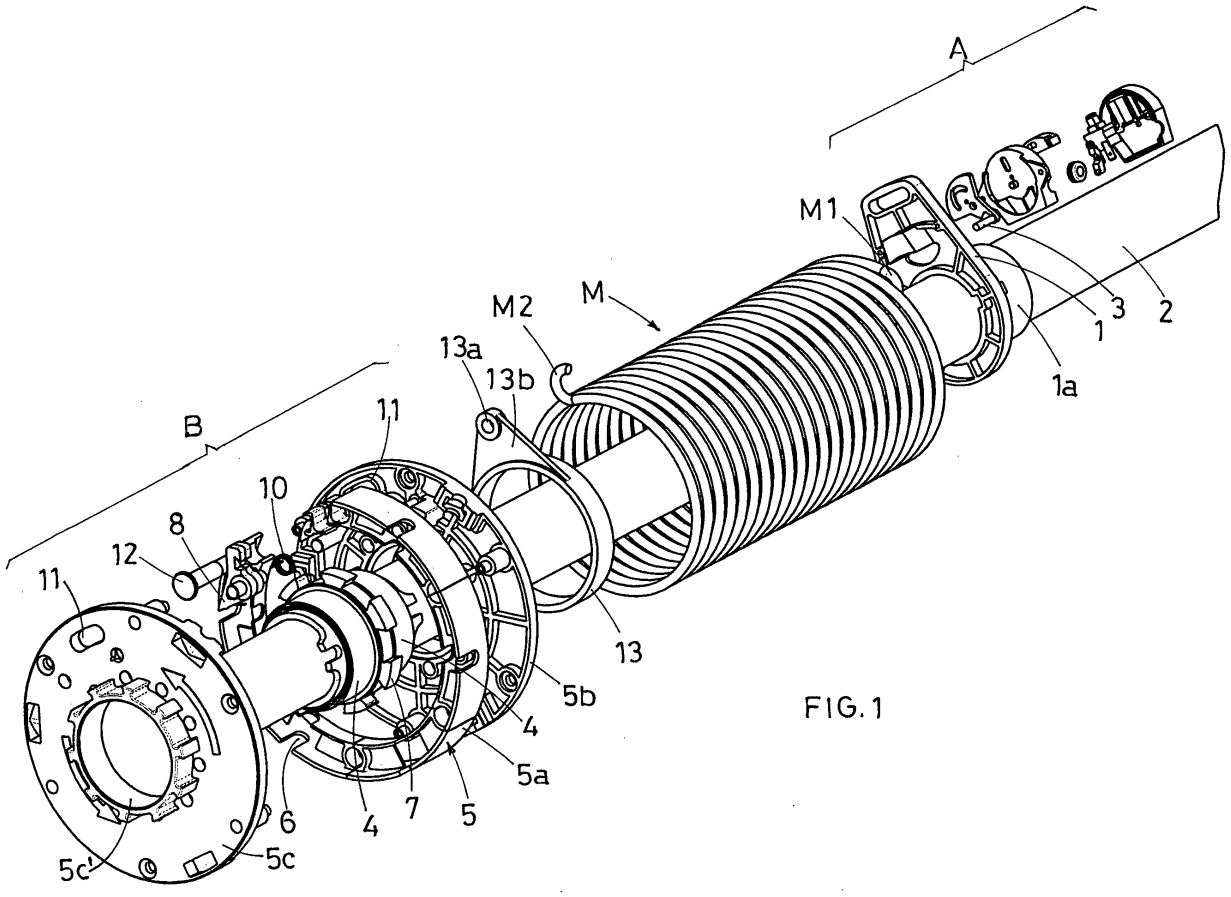


FIG. 1

EP 1 760 251 A2

Description

[0001] The present patent application refers to an anti-fall safety device for rolling shutters with torsion rings, of the type commonly used to close garages and shops.

[0002] This type of shutters is rolled around a series of rotating pulleys inserted along a fixed support shaft, on which the top slate of the rolling shutter is fixed, it being normally provided with compensation means to balance the weight of the rolling shutter and consequently minimize the effort needed to raise the shutter, both in case of manual or motorized operation.

[0003] The said compensation means basically consist in a spring, which can be either a torsion spring or a hinge spring, and is always associated with one of the said pulleys, whose shape depends on the type of spring used.

[0004] For instance, in case of hinge springs, the pulley has a box-shaped configuration, designed to house a steel belt wound in a spiral and suitably loaded to generate a reaction torque able to balance the force exercised by the rolling shutter on the pulleys due to its weight.

[0005] In case of torsion springs, the pulley has a simple, traditional configuration, with spokes and is attached to the end of a traditional torsion spring, of helicoidal type, inserted outside the fixed shaft.

[0006] In compliance with the recent accident-prevention legislation, said rolling shutters must be provided with a safety device designed to prevent them from collapsing suddenly and uncontrollably in case of spring failure.

[0007] The purpose of the present invention is to design an anti-fall safety device to be installed in rolling shutters around a series of rotating pulleys supported by a fixed shaft and attached to a torsion spring.

[0008] Another purpose of the present invention is to devise an anti-fall device of the aforementioned type, characterised by simple and convenient construction, easy installation, removal and repair.

[0009] Last but not least, another purpose of the present invention is to devise an anti-fall device of the aforementioned type that does not require to modify or adjust the rolling shutter, being designed to be installed both on new and existing rolling shutters.

[0010] The device of the invention comprises two main elements, with a torsion spring placed and attached between them: the first element consists in a bracket fitted to the fixed shaft that supports the series of rotating pulleys around which the shutter is rolled; and the second element consists in a special pulley designed to be joined with the top slate of the rolling shutter, in such a way that the ascending and descending travels of the rolling shutter depend on the free rotation, both anticlockwise and clockwise, of the special pulley.

[0011] The special pulley is formed of a fixed hub, which is inserted and stopped against the fixed support shaft, and a drum, which rotates freely in two directions around the fixed hub, which is characterised by an external toothed profile that cooperates with a balancing retention pawl contained in said drum, which is automatically actuated when the torsion spring breaks, since the pawl is held in rest position by the torsion spring itself.

[0012] In view of the above, when the torsion spring breaks, the balancing pawl leaves its rest position under the thrust of a special return spring and engages with the said toothed section, thus making it impossible for the drum to rotate around the fixed hub, it being evident that the prohibited direction is the direction of the descending travel of the rolling shutter.

[0013] Finally, it must be noted that the device of the invention comprises a microswitch designed to immediately inform the user of the failure of the spring (by means of indicator lights or acoustic means), thus simultaneously cutting out the electrical power supply of the motor, in case of a motorized rolling shutter.

[0014] The said microswitch is housed in the fixed bracket and actuated by a fluctuating pawl, which is constantly subject to the opposite action of the return spring and slowed down by the same fixing pin of the torsion spring.

[0015] The fixing pin is free to slide within a slot, thus being unable to oppose the movement of the said fluctuating pawl as soon as the torsion spring breaks.

[0016] For major clarity, the description of the device according to the invention continues with reference to the enclosed drawings, which only have an illustrative, not limitative value, whereby:

- fig. 1 is an axonometric exploded view of the device of the invention;
- fig. 2 is a view of the device of the invention installed on the support shaft of the rolling shutter and cut with a vertical plane passing through the said fixed shaft;
- fig. 3 is a view of the retention pawl in rest position, after the torsion spring has been loaded and attached to the device of the invention;
- fig. 4 is a view of the retention pawl in operating position, when the torsion spring breaks;
- fig. 5 is a view of the retention pawl in rest position, after the torsion spring has been loaded and attached to the device of the invention;
- figs. 6, 7 and 8 are views of the retention pawl in the positions taken during the replacement of the broken torsion spring with a new spring;
- fig. 9 is an axonometric exploded view of the drum area that houses the aforementioned retention pawl;
- fig. 10 is a perspective view of a constructive detail of the drum that houses the aforementioned retention pawl;
- figs. 11 and 12 are sequential views that show the automatic release of the pawl from the retention tooth, when the torsion spring is attached to the device of the invention.

[0017] With reference to figs. 1 and 2, the device of the invention comprises two main elements (A and B), with a torsion spring (M) placed and attached between

them.

[0018] The first element (A) consists in a bracket (1) with a hub (1a) designed to be inserted and held against the fixed shaft (2) that supports the series of rotating pulleys around which the rolling shutter is rolled.

[0019] A pin (3) protrudes from the bracket (1), in parallel position to the axis of the shaft (2), which is used to attach one end (M1) of the spring (M).

[0020] The second element (B) consists in a special pulley with a hub (4) designed to be inserted and held against the fixed shaft (2) that supports the series of rotating pulleys around which the rolling shutter is wound.

[0021] A drum (5) is inserted outside the hub (4) and free to rotate in both directions, which is peripherally provided with a series of slots (6) used as fixing points for the top slate of the rolling shutter.

[0022] In the preferred embodiment shown in fig. 2, the rotating drum (5) is formed of a central collar (5a) and an opposite pair of closing plates (5b and 5c), which are mutually tightened and fixed to the intermediate collar by means of a series of screws.

[0023] Each plate (5b and 5c) is provided with a corresponding collar (5b' and 5c') inserted and free to rotate around the hub (4).

[0024] A toothed crown (7) is obtained outside the hub (4), around which the drum (5) rotates, housing a balancing pawl designed to interfere with the toothed crown (7) in case of failure of the spring (M), in order to prevent the free, uncontrolled descending travel of the rolling shutter.

[0025] More precisely, the pawl (8) is supported astride the plates (5b and 5c), which have corresponding housings (9) on the internal sides, which house the two ends of the pivoting pin (8a) of the pawl (8), as shown in fig. 9. Fig. 9 also shows the return spring (10) inserted into the pin (8a) and attached to a hole (8b) of the pawl (8) on one side and to a hole (9b) obtained in one of the housings (9).

[0026] The two plates (5b and 5c) are provided with opposite slots (11) used to insert a pin (12) that externally protrudes on the plate (5b) in order to be attached to the other end (M2) of the spring (M), as shown in fig. 1.

[0027] In particular, it must be noted that the end section (12a) of the pin (12) is inserted into an eye (13a) on the tip of a wing (13b) moulded in one piece with a collar (13), in parallel position outside the plate (5b) and inserted, around the collar (5b') with possibility to rotate freely.

[0028] As shown in fig. 3, when the pin (12) is attached to the spring (M) and subject to the thrust of the spring (M),

[0029] the pawl (8) is blocked in rear position (rest position) with respect to the toothed crown (7), since the return spring (10) cannot overcome the opposed thrust of the pin (12) against the pawl (8).

[0030] As shown in fig. 4, when the spring (M) breaks, the thrust of the pin (12) against the pawl (8) disappears, and the pawl (8) is released under the thrust of the spring (10), reaching a forward position (operating position) that corresponds to the insertion of the tip of the pawl (8) between the teeth of the crown (7), thus stopping the rotating drum (5) and the rolling shutter joined to it.

[0031] As shown in fig. 4, following to the failure of the spring (M), the pin (12) slides inside the slots (11) and loses contact with the pawl (8), which becomes free to oscillate downwards, under the thrust of the spring (10).

[0032] As mentioned above, the device of the invention has been designed in order to facilitate installation and replacement of the torsion spring (M).

[0033] In fact, attention is drawn on the fact that the pawl (8) automatically occupies the operating position (see fig. 4), until it is not subject to the thrust of the pin (12), as, for example, when the spring (M) breaks and an intact spring (M) is not attached to the pin (12).

[0034] Since the replacement of a broken spring (M) involves the complete descending travel of the rolling shutter, the device of the invention has been provided with means that allow the operator in charge of installation and repair to exclude the braking action of the pawl (8), also when the pin (12) is released from the spring (M).

[0035] To that end, the pawl (8) has been provided with a hooked head (8c), whose hook engages with the teeth (14a) of a forked appendix (14) obtained inside the collar (5a) of the drum (5).

[0036] Moreover, the pawl (8) has been provided with a flexible tongue (8d) situated near its tip (8e), designed to release the pawl (8) from the toothed crown (7) during replacement of the broken spring (M).

[0037] As mentioned above, the said replacement requires to lower the rolling shutter completely, whose descending travel is instead prevented by the pawl (8), being momentarily engaged with the toothed crown (7).

[0038] As sequentially shown in figures 4, 6, 7 and 8, the operator in charge of repair can easily release the pawl (8) from the toothed crown (7) and then lower the rolling shutter completely.

[0039] In this case, the operator simply needs to lift the rolling shutter manually, in such a way that the drum (5) is forced to rotate in the direction shown by the arrow (F), i.e. clockwise.

[0040] During the said clockwise rotation, the tip (8e) of the pawl (8) is moved away from the engagement tooth (7a), while the elastic tongue (8d) engages against the tooth (7b) immediately next to the engagement tooth (7a), thus causing the backward turnover, in clockwise direction, of the pawl (8), whose tip (8e) disengages from the toothed crown (7).

[0041] Attention is drawn on the fact that the teeth of the toothed crown (7) are laterally provided with small notches (15) that act as a stable housing for the tip of the flexible tongue (8d) during the turnover of the pawl (8).

[0042] At the end of the turnover of the pawl (8), the hooked head (8c) engages and snaps with the teeth (14a) of the forked appendix (14), as shown in figs. 7 and 8.

[0043] Once the pawl (8) is permanently released from the toothed crown (7), the operator can lower the rolling shutter completely and install a new torsion spring (M).

[0044] Fig. 8 shows the blocking position of the pawl (8) until a spring (M) is not attached to the pin (12), which

is not shown in figs. 6, 7 and 8 deliberately.

[0045] When the spring (M) is attached to the pin (12) and loaded, the pin (12) slides inside the slot (11) until it presses against the bottom of the said slot, as sequentially shown in figs. 11 and 12, where the pawl (8) is shown with a broken-dotted line to identify a partition (14b) in rear position, which is an integral part of the forked appendix (14), as shown in fig. 10.

[0046] As shown in fig. 12, at the end of travel the pin (12) interferes against the partition (14b) that acts as a lever to determine the downward flexion of the forked appendix (14), thus releasing the tooth (14a) from the hooked head (8c) of the pawl (8), which moves forward under the return action of the spring (10) and stops against the pin (12) in the position shown in fig. 3.

[0047] Finally, it must be said that the device of the invention comprises a microswitch (15) designed to immediately cut out the electrical power supply of the motor, in case of a motorized shutter, as soon as the torsion spring (M) breaks.

[0048] As shown in figs. 1A and 2A, the microswitch (15) is housed in a protection hood (16) and is supported by a box (17) fixed to the bracket (1).

[0049] The microswitch (15) is actuated by means of a balancing cam (18), which is provided with a hole (18a) where the pivoting pin (17a) is inserted, used to match the cam (18) with the box (17).

[0050] The fixing pin (3) protrudes from the cam (18), which is provided with a slot (18b) on the opposite side with respect to the pin (3), which houses a sliding peg (19a) that protrudes from a cursor (19) acting on the microswitch (15).

[0051] A return spring (20) between the cam (18) and the box (17) constantly tends to make the cam (18) oscillate in the direction in which the coupling between the slot (18b) and the peg (19a) brings the cursor (19) closer to the microswitch (15).

[0052] The said oscillation is not possible until the fixing pin (3) is subject to the thrust of the torsion spring (M).

[0053] As soon as the spring (M) breaks, the return spring (20) rotates the cam (18) and simultaneously makes the peg (19a) slide with respect to the housing slot (18b) and the fixing pin (3) inside a slot (1b) of the bracket (1).

Claims

1. Anti-fall safety device for rolling shutters supported by a fixed shaft (2), around which a series of pulleys rotates freely, on which the top slate of the rolling shutter is fixed, whose weight is compensated at least by means of a torsion spring (M) attached o one of the rotating pulleys,
   device being **characterised in that** it comprises:

   - a first element (A) designed to be inserted and stopped against the shaft (2) and provided with a first fixing pin (3), which is used to attach the end (M1) of the spring (M);
   - and a second element (B) consisting in a special pulley with means (6) used to fix it to the top slate of the rolling shutter, formed of a hub (4) designed to be stopped against the fixed shaft (2) and a rotating drum (5) provided with a second fixing pin (12) used to attach the other end (M2) of the spring (M);

   it being provided that the drum (5) houses means (7, 8, 10, 11) designed to instantaneously and automatically prohibit the rotation direction of the drum (5) that corresponds to the descending travel of the rolling shutter when the pin (12) is no longer subject to the thrust of the spring (M).

2. Device as defined in the preceding claim, **characterised in that** the drum (5) houses a balancing pawl (8) subject to the action of a return spring (10) that tends to make the pawl (8) oscillate in such a way that its tip (8e) engages with the teeth of a toothed crown (7) obtained externally on the hub (4); it being provided that the drum (5) has an opposite pair of slots (11) in which the second fixing pin (12) is inserted and slides, interfering with the said pawl (8) - and blocking it in the rest position - until it is subject to the thrust of the torsion spring (M).

3. Device as defined in claim 2, **characterised in that** the rotating drum (5) is formed of a central collar (5a) and an opposite pair of closing plates (5b and 5c), which have corresponding housings (9) on the internal sides, which house the two ends of the pivoting pin (8a) of the pawl (8), whose return spring (10) is inserted into the pin (8a) and attached to a hole (8b) of the pawl (8) on one side and to a hole (9b) obtained in one of the housings (9).

4. Device as defined in one or more of the preceding claims, **characterised in that** the pawl (8) is provided with a hooked head (8c), whose hook engages with the teeth (14a) of a forked appendix (14) obtained inside the collar (5a) of the drum (5).

5. Device as defined in the preceding claim, **characterised in that** the pawl (8) is provided with a flexible tongue (8d) situated near its tip (8e), designed to release the pawl (8) from the toothed crown (7) during replacement of the broken spring (M) with an intact one.

6. Device as defined in the preceding claim, **characterised in that** the teeth of the toothed crown (7) are laterally provided with small notches (15) that act as a stable housing for the tip (8e) of the flexible tongue (8d) during the turnover of the pawl (8).

7. Device as defined in claim 4, **characterised in that** the forked appendix (14) has a partition (14b) designed to receive the thrust of the pin (12) when the pin (12) is attached to the spring (M) and determine a flexional deformation of the said forked appendix (14) sufficient to cause the release of the hooked head (8c) of the pawl (8) and the tooth (14a) of the appendix (14).

8. Device as defined in claim 1, **characterised in that** the first element (A) comprises a microswitch (15) that is automatically actuated, by means of a mechanism (18, 19, 20) fitted to the fixing pin (3), when the pin (13) is no longer subject to the thrust of the spring (M), it being provided that, when pressed, the microswitch cuts out the electrical power supply that actuates the motor of the roller shutting.

9. Device as defined in claim 8, **characterised in that** the microswitch (15) actuates indicator lights or acoustic means in order to identify anomalies.

10. Device as defined in claim 8, **characterised in that** the microswitch (15) is housed in a protection hood (16), is supported by a box (17) fixed to the bracket (1) and is actuated by means of a balancing cam (18), which is provided with a hole (18a) where the pivoting pin (17a) is inserted, used to match the cam (18) with the box (17), which is provided with a slot (18b) on the opposite side with respect to the pin (3), which houses a sliding peg (19a) that protrudes from a cursor (19) acting on the microswitch (15); it being provided that a return spring (20) is positioned between the cam (18) and the box (17), and constantly tends to make the cam (18) oscillate in the direction in which the coupling between the slot (18b) and the peg (19a) brings the cursor (19) closer to the microswitch (15)..

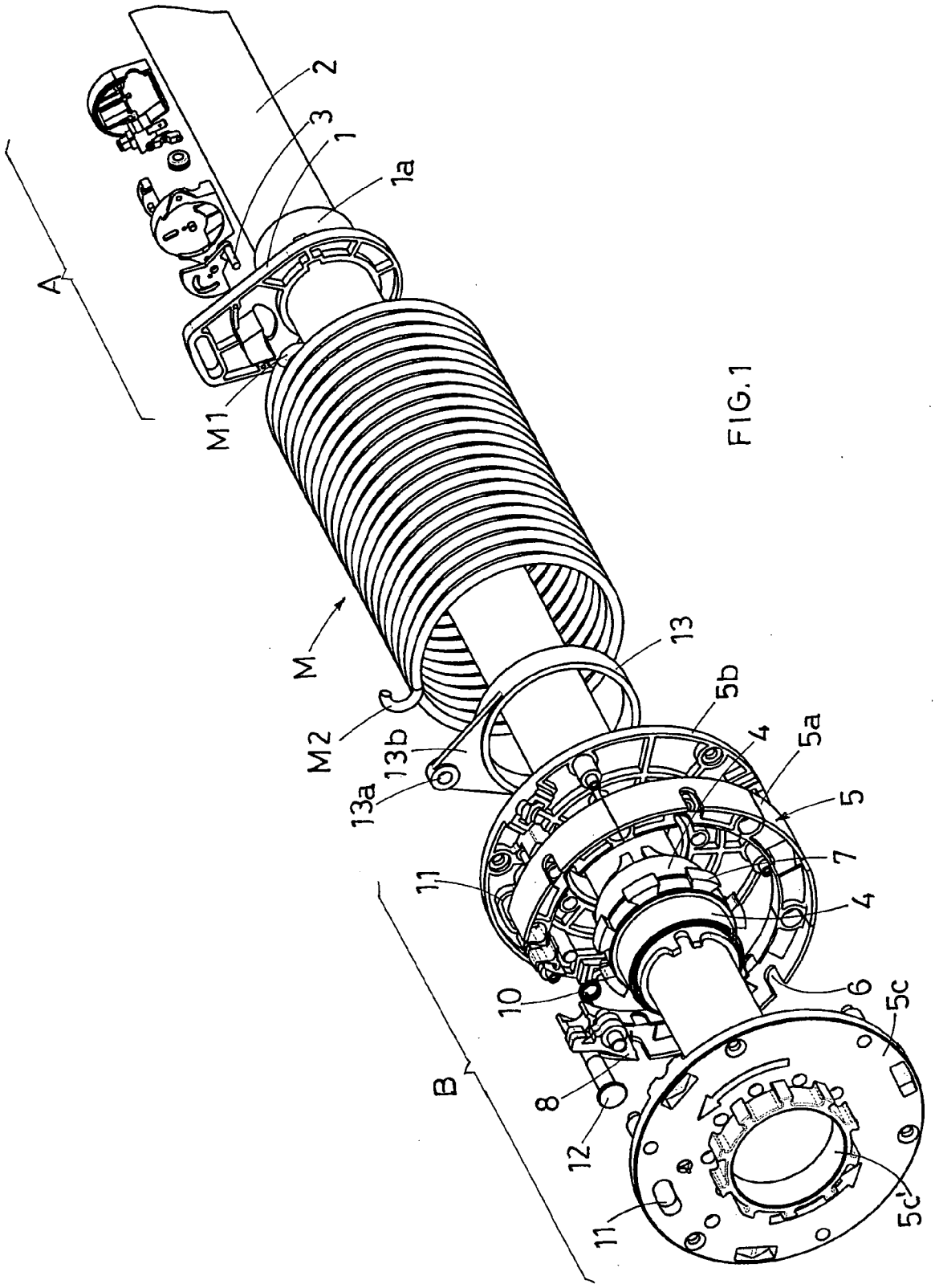


FIG.1

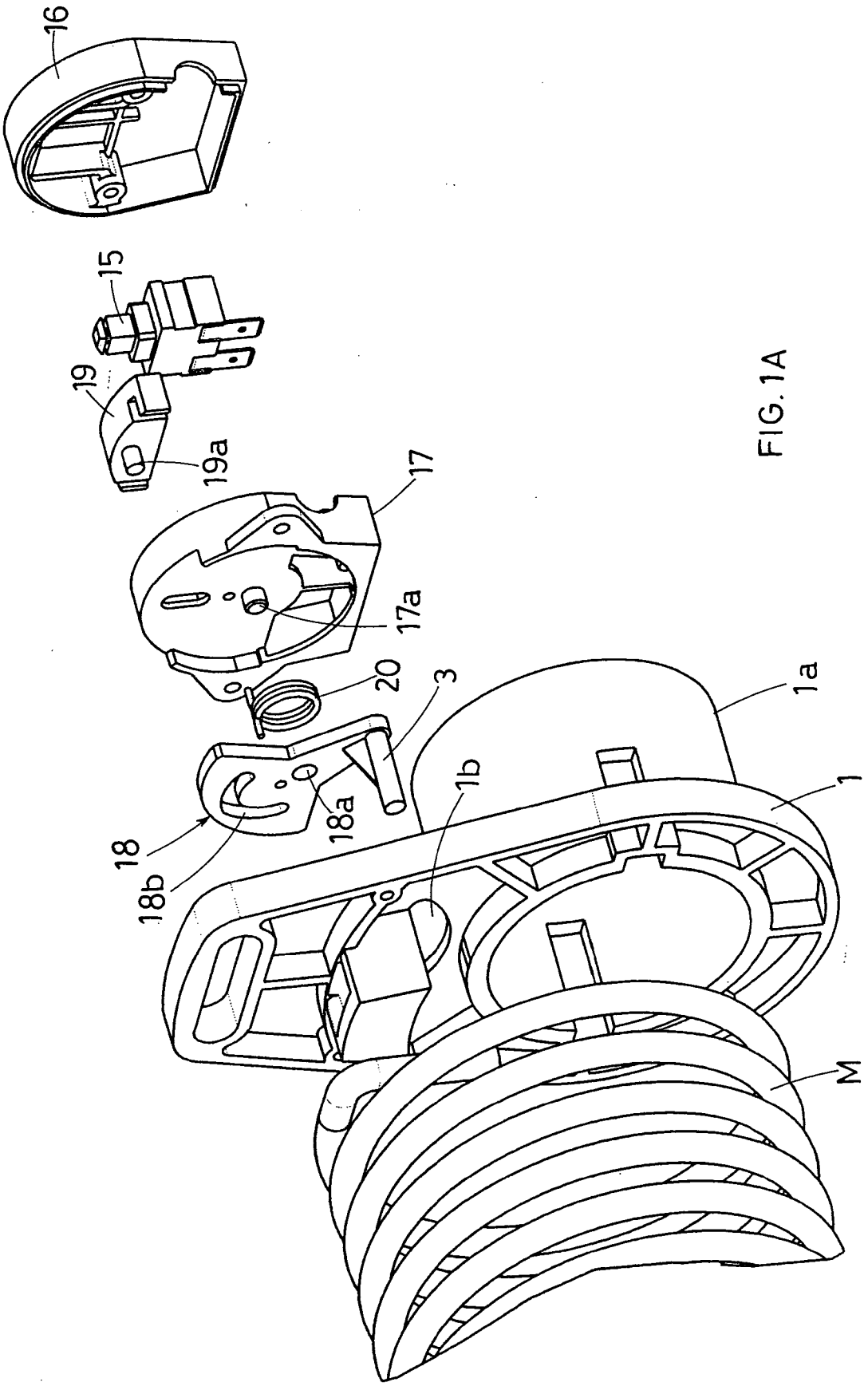
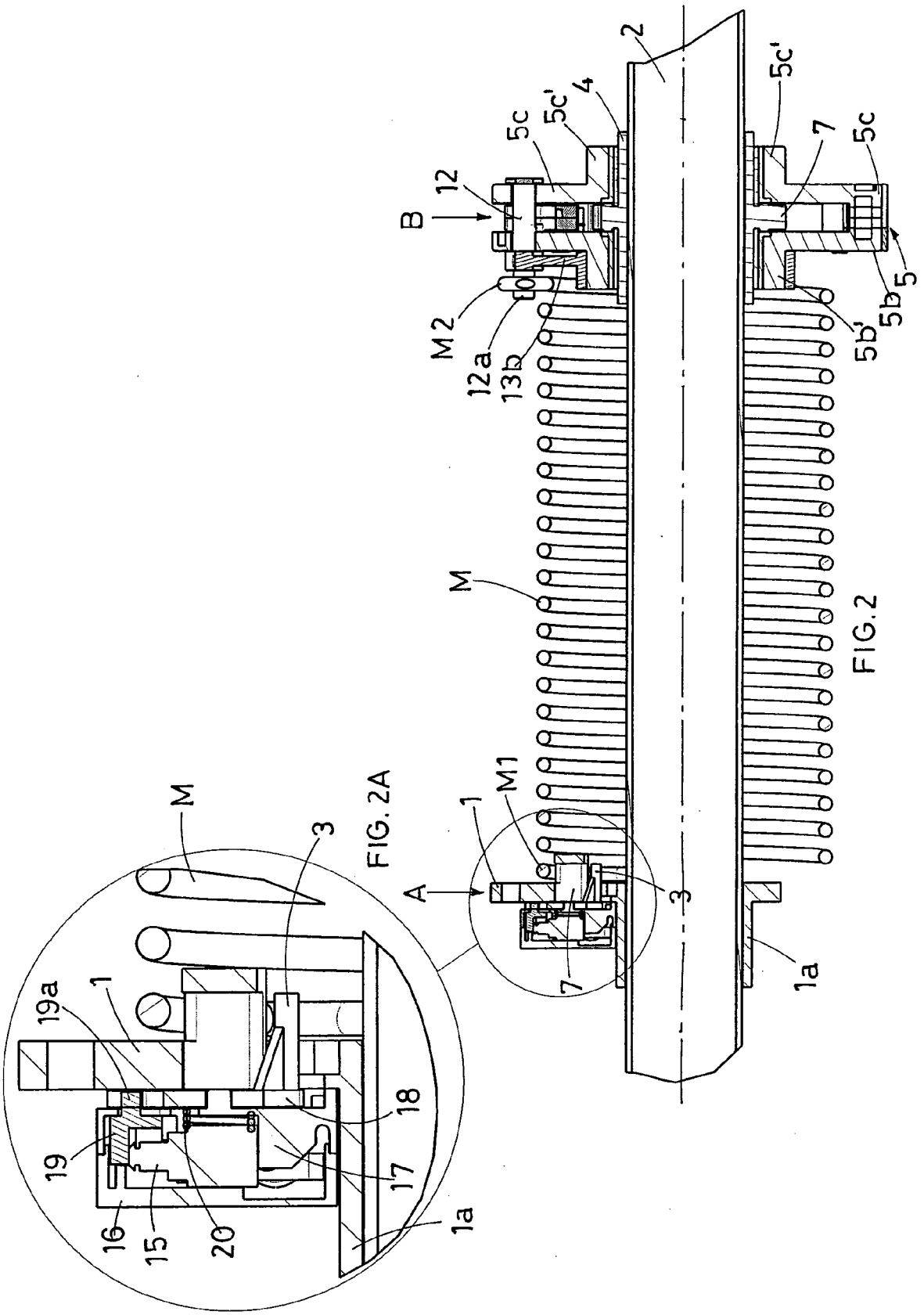


FIG. 1A


2
5c'
5c
4
5c'
5c
7
B
12
M2
12a
13b
10
5
5b
5b'
M
M1
1
A
3
7
1a
FIG. 2
M
3
19a
1
19
18
17
16
15
20
1a
FIG. 2A

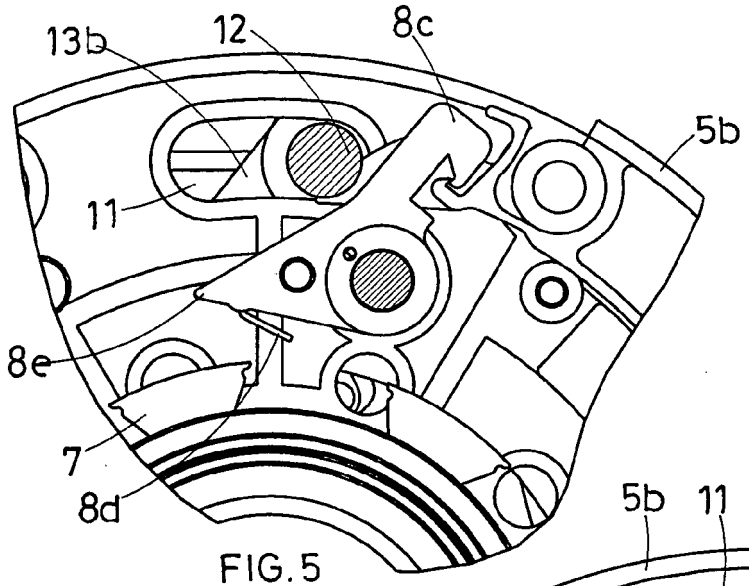


FIG. 5

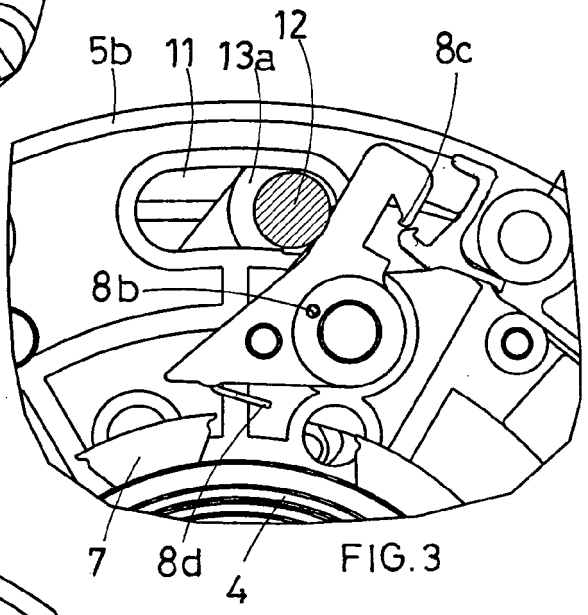


FIG. 3

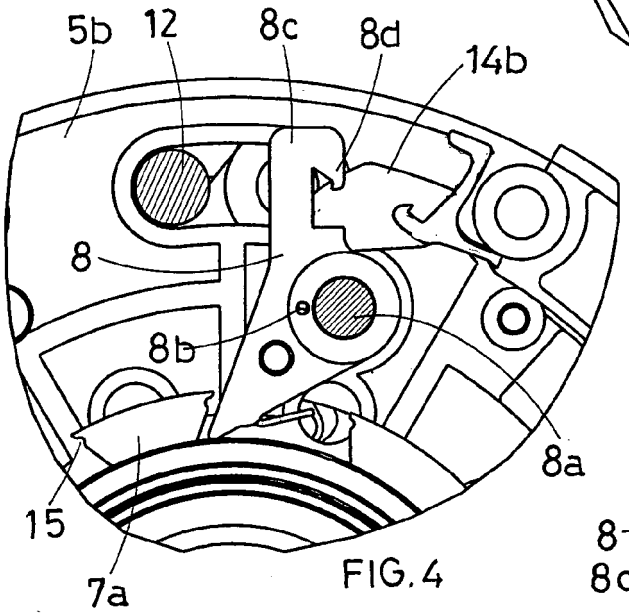


FIG. 4

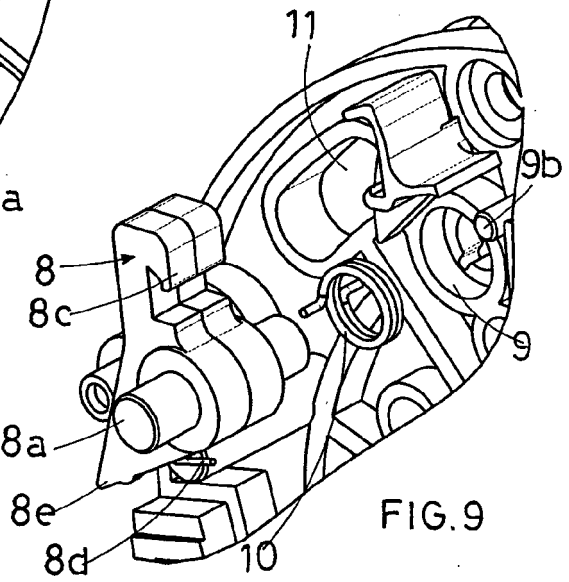


FIG. 9

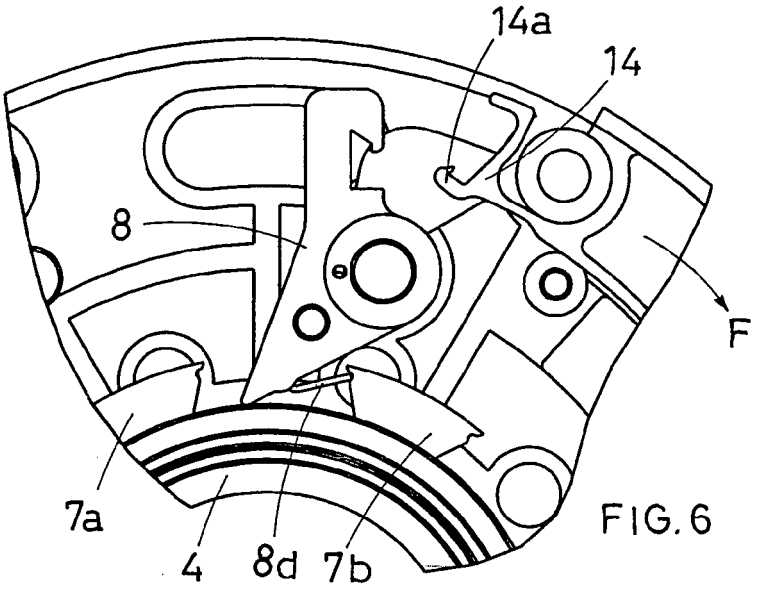


FIG. 6

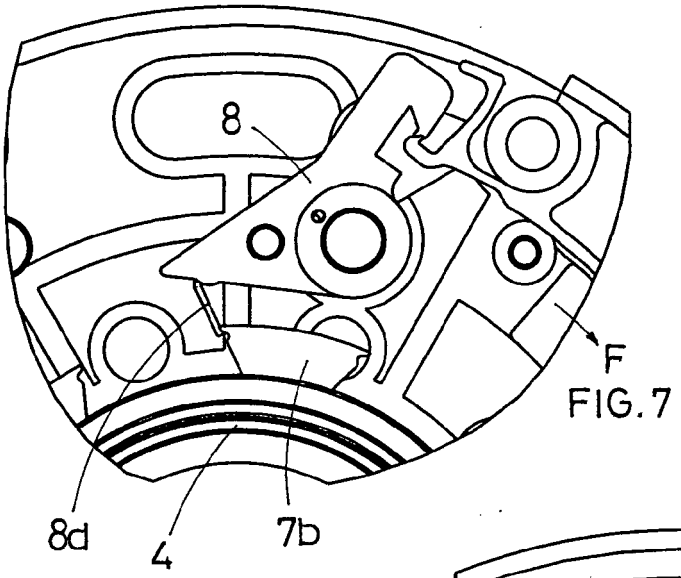


FIG. 7

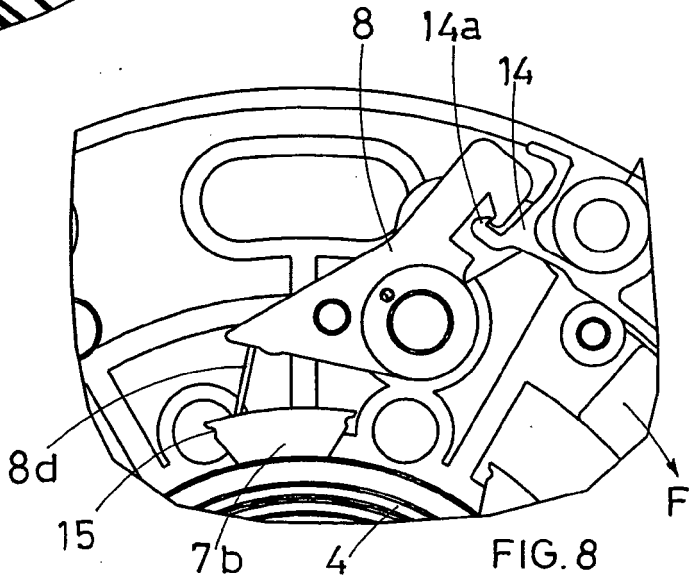


FIG. 8

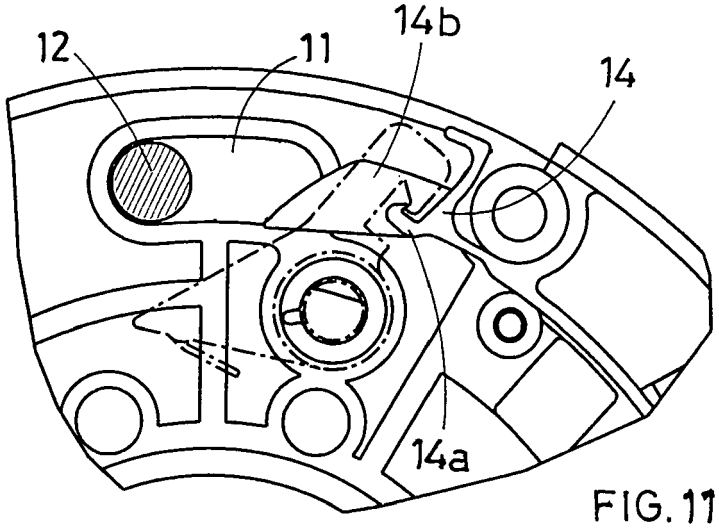


FIG. 11

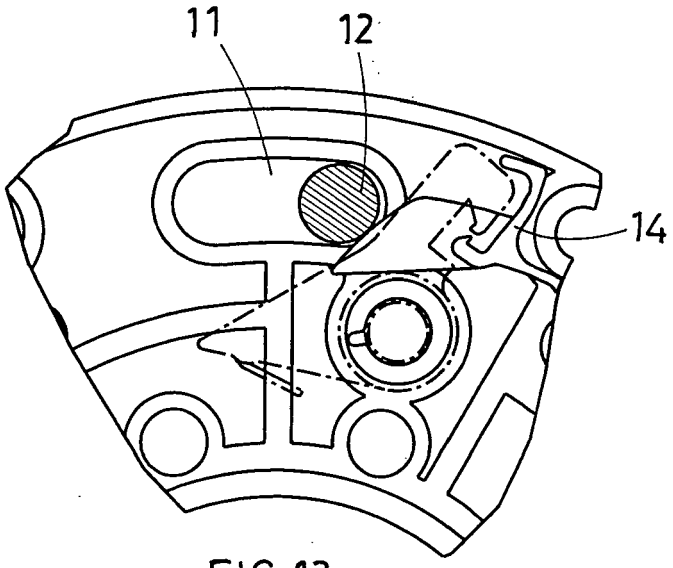


FIG. 12

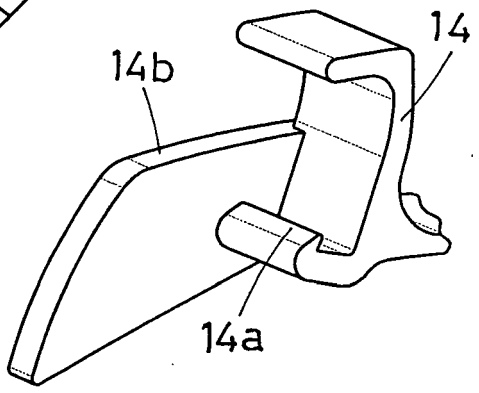


FIG. 10