



(12)

EUROPEAN PATENT APPLICATION

(21) Application number : **95301362.0**

(51) Int. Cl.⁶ : **E05B 47/00, E05B 17/00, E05B 63/00**

(22) Date of filing : **03.03.95**

(30) Priority : **08.03.94 IL 10889894**

(43) Date of publication of application :
11.10.95 Bulletin 95/41

(84) Designated Contracting States :
DE ES FR GB IT SE

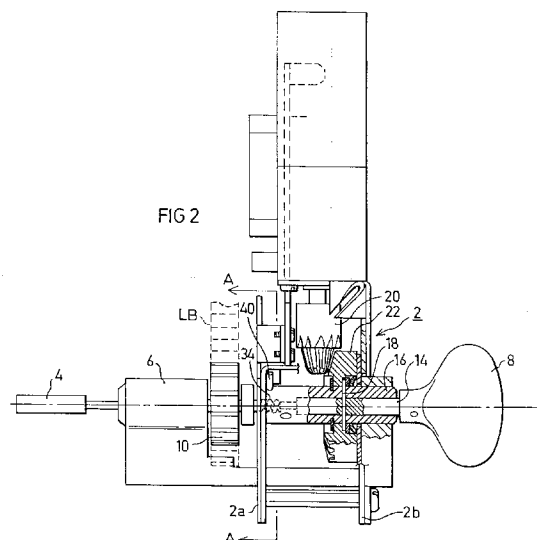
(71) Applicant : **MIVZARIT HIGH-TECH SYSTEMS (1994) LTD.**
20 Hamezuda
58001 Azor (IL)

(72) Inventor : **Aharoni, Mordechai**
11 Derech Zahal
IL-70300 Beer Yacov (IL)
Inventor : **Aharoni, Shimon**
43 Katzenelson
IL-59512 Bat Yam (IL)
Inventor : **Novik, Avraham**
12 Aliyat Hanoar
IL-67450 Tel Aviv (IL)

(74) Representative : **Thomson, Paul Anthony et al**
Potts, Kerr & Co.
15, Hamilton Square
Birkenhead Merseyside L41 6BR (GB)

(54) **Lock assembly actuatable by an electrical motor and/or a mechanical key.**

(57) A lock assembly which includes a key-driven shaft rotatable by a key and a lock drive shaft coupled to a locking bolt for driving the locking bolt to locking and unlocking positions. The assembly further includes an electrical motor having a motor transmission. Finally, the assembly includes a yieldable coupling which normally couples the motor transmission to the lock drive shaft in order to drive the locking bolt to locking or unlocking positions. The yieldable coupling is yieldable upon overload of the lock drive shaft to decouple the motor transmission therefrom. The key-driven shaft is axially displaceable to decouple it from the motor transmission, thereby enabling the key-driven shaft to drive the lock drive shaft and the locking bolt to locking or unlocking positions.



The present application relates to lock assemblies, and particularly to lock assemblies which may be actuated either by an electrical motor or by a mechanical key.

Conventional lock assemblies are generally actuable by a mechanical key. However, many locks, particularly in computer-controlled doors, are operated by electrical motors. An example of such a motor-actuated electrical lock in a computer-controlled door is described in our U.S. Patent 4,972,182.

An object of the present invention is to provide a lock assembly which may be actuated either by an electrical motor or by a mechanical key.

According to the present invention, there is provided a lock assembly, comprising: a key-driven shaft rotatable by a key; a lock drive shaft coupled to a locking bolt for driving the locking bolt to locking and unlocking positions; an electrical motor including a motor transmission; and a yieldable coupling normally coupling the motor transmission to the lock drive shaft to drive the locking bolt to locking or unlocking positions, but yieldable upon overload of the lock drive shaft to decouple the motor transmission therefrom; the key-driven shaft being axially displaceable to decouple it from the motor transmission, and thereby to enable the key-driven shaft to drive the lock drive shaft and the locking bolt to locking or unlocking positions.

According to further features in the preferred embodiment of the invention described below, the motor transmission includes a gear rotated by the motor, and the yieldable coupling includes a pin normally spring-urged to seat in a recess formed in the gear but unseatable therefrom to decouple the gear from the lock drive shaft upon overload of the latter shaft.

More particularly, in the described preferred embodiment the lock drive shaft is a hollow shaft and encloses the key-driven shaft; the pin passing through the key-driven shaft and being received within slots formed in the hollow lock drive shaft permitting the pin to be moved from the recess in the gear and to remain coupled to the hollow lock drive shaft when the key-driven shaft is moved axially.

According to another aspect of the present invention, there is provided a lock assembly, comprising: a key-driven shaft rotated by a key; a lock drive shaft coupled to a locking bolt for driving the locking bolt to locking and unlocking positions; and a condition sensor for sensing the condition of the lock drive shaft whether it is in its locking position or its unlocking position; the condition sensor comprising a magnetic member movable in one direction by the rotation of the lock drive shaft to the locking position, and in the opposite direction by the rotation of the lock drive shaft to the unlocking position; and reed switches carried by the fixed part of the lock assembly and actuated by the movable magnetic member according to its moved position.

According to further features of the described preferred embodiment, the lock assembly includes electrical terminals connected to the reed switches, and programming jumpers selectively connectible to the terminals for programming them for operation according to whether the lock assembly is located on the right side or left side of a door.

Further features and advantages of the invention will be apparent from the description below.

The invention is herein described, by way of example only, with reference to the accompanying drawings, wherein:

Fig. 1 is an exploded perspective view illustrating one form of lock assembly constructed in accordance with the present invention;

Fig. 2 is a side elevational view, partly in section, illustrating the lock assembly of Fig. 1;

Fig. 3 is a view, partly in section, along line III--III of Fig. 2;

Fig. 4 is a fragmentary view of a part of the lock assembly of Figs. 1 and 2, more particularly illustrating the mounting of reed switches used in that assembly;

Fig. 5 is a perspective view illustrating the yieldable coupling in the lock assembly of Figs. 1 and 2;

Fig. 6 is a view similar to that of Fig. 5 but with parts broken away to better show internal structure;

and Fig. 7 is a view, partly in section, of the yieldable coupling included in the lock assembly of Figs. 1 and 2.

The lock assembly illustrated in the drawings includes a housing, generally designated 2, adapted to be mounted within a door (not shown) or the like, with side 2a of the housing facing the outside, and side 2b facing the inside. The door is opened from the outside by a mechanical key 4 insertable within a cylinder 6. It is opened from the inside by a knob or captive key 8. Both keys are coupled to a pinion 10 such that rotation of either key in one direction will drive a locking bolt, shown schematically at LB, coupled to pinion 10 to a locking position, and rotating the respective key in the opposite direction will drive the locking bolt to an unlocking position. Any suitable cylinder 6 may be used in the illustrated lock assembly, and therefore further details of its construction are not set forth.

The illustrated lock assembly further includes an electrical motor M mounted on a frame member 12 on the inner side of the lock assembly, i.e., the side including the captive key 8. Captive key 8 is fixed to a shaft 14 which extends partly through a hollow shaft 16 and is coupled thereto by a pin 18 passing through both shafts. Hollow shaft 16 constitutes a lock drive shaft, as it is coupled to pinion 10. Rotating hollow shaft 16 in one direction will drive the locking bolt 12 to its locking position, and rotating the hollow shaft in the opposite direction will drive the locking bolt to its

unlocking position.

Electric motor M drives a vertical bevel gear 20 which meshes with a horizontal gear 22 formed with a central opening for accommodating the lock drive shaft 16, as well as the key-driven shaft 14. Gear 22 is coupled to the lock drive shaft 16 by a coupling which is yieldable upon overload of the lock drive shaft 16 to decouple the motor-driven gear 22 from the lock drive shaft 16.

The yieldable coupling between gear 22 and the lock drive shaft 16 is more particularly illustrated in Figs. 5, 6 and 7. As shown in these figures, gear 22 is formed with teeth 22a on one face meshing with the teeth of bevel gear 20. On the opposite face 22b, gear 22 is formed with a cylindrical cavity 24 facing the captive key 8. Face 22b of gear 22 is further formed with a pair of recesses 26 on opposite sides of the opening through the gear accommodating the lock drive shaft 16. Pin 18, which couples the key-driven shaft 14 with the lock drive shaft 16, is normally received within recesses 26 formed within cavity 24 of gear 22, and is urged into those recesses by a spring washer 28 interposed between a bearing washer 30 within cavity 24 and a closure plate 32. Plate 32 closes the cavity and is formed with an opening for receiving the key-driven central shaft 14, and the outer lock drive shaft 16.

It will thus be seen that pin 18, received within recess 26 in gear 22, and also passing through the inner key-driven shaft 14 and the outer lock drive shaft 16, normally couples gear 22 to the lock drive shaft 16, such that rotation of the motor will also rotate the locking bar 12 via the lock drive shaft 16 and pinion 10. Recesses 26, however, are dimensioned such that, upon an overload in the lock drive shaft 16, pin 18 will unseat from these recesses, against the force of the spring washer 28, to decouple gear 22 from the lock drive shaft 16 so that the overload will not be applied to the motor. Thus, should an overload condition occur, the motor will merely rotate gear 22, causing pin 18 to snap in and out of recesses 26, such that the snapping of the pin into and out of recess 26 will provide a clearly audible signal of this overload condition.

The key-driven shaft 14 may also be manually decoupled from gear 22, and thereby from the electrical motor M, to permit the locking bolt 12 to be manually driven to its locking position or unlocking position by rotating either the captive key 8 on the inside, or the inserted key 4 on the outside. For this purpose, the key-driven shaft 14 extends through the lock assembly and is coupled to cylinder 6 receiving the outer key 4. Shaft 14 is normally urged by a spring 34 (Fig. 2) in the direction of the outer, inserted key 4, but is displaceable in the opposite direction either by pulling the inner captive key 8, or by pushing the outer inserted key 4.

As shown particularly in Figs. 5 and 7, the lock

drive shaft 16 is formed with a pair of slots 36 in the portion thereof received within the opening in gear 22. These slots 36 are arranged to accommodate the coupling pin 18 when the key-driven shaft 14 is displaced (rightwardly in Fig. 2) by either pulling the captive key 8 or pushing the inserted key 4.

The arrangement is such that coupling pin 18 is normally received within recesses 26 to couple the lock drive shaft 16 to the motor-driven gear 22, to enable the motor to drive the locking bolt 12; however, when it is desired to drive the locking bolt manually, either by the inner captive key 8 or the outer inserted key 4, the key-driven shaft 14 may be displaced rightwardly, by either pulling key 8 or pushing key 4, to unseat pin 18 from recesses 26, but to retain the pin coupling between the key-driven shaft 14 and the lock drive shaft 16.

The illustrated lock assembly further includes a condition sensor for sensing the condition of the lock assembly, i.e., whether it has been actuated to its locking position or unlocking position. The condition sensor includes a magnetic member 40 (e.g., see Fig. 3) mounted on a carrier member 42 suspended by a pair of springs 44 between two fixed parts of the housing 46 at the gear 22 side of a vertical wall 48 of the housing. Magnetic member 40 may be moved to one side or the other, against the respective spring 44, by a pusher pin 50 fixed to the lock drive shaft 16. The arrangement is such that when lock drive 16 is rotated in one direction (e.g., to unlock the locking bolt 12), magnetic member 40 is pushed in one direction against its respective spring 44, and when the lock drive shaft 16 is rotated in the opposite direction (e.g., to drive the locking bolt to its locking position, magnetic member 40 is pushed to the opposite direction against the force of the spring 44 on that side.

Magnetic member 40 is cooperable with a plurality of reed switches 51, 52, 53, 54 (Fig. 4) mounted on a panel 55 adjacent to magnetic member 40 and along the line of movement of that magnetic member. The two middle reed switches 52, 53 are actuated when the magnetic member 40 is moved by the lock drive shaft 16 to the locking position and unlocking position, respectively, of the locking bolt 12. When the lock assembly is used with a door including a latching tongue operated by the lock drive shaft 16, a reed switch 51 provided on one side of the pair of reed switches 52, 53 is used for lock assemblies installed in the left side of the door; and reed switch 54 provided on the opposite side of the reed switches 52, 53 is used for lock assemblies installed in the right side of the door.

Fig. 4 illustrates four reed switches 51-54 being applied to the door so as to enable the same arrangement to be used for left doors and right doors, it only being necessary to pre-program the electrical terminals to the reed switches according to the location of the lock assembly on the door. The electrical termi-

nals for the reed switches are included in a terminal block 56 in Fig. 1; and the pre-programming jumpers therefore are included in a jumper block 57. Thus, jumper block 57 would be applied to the two terminals at one side of the terminal block 56, e.g., for lock assemblies on the left side of the doors, and to the two terminals at the other side of the terminal block for lock assemblies applied to the right side of the door.

An additional terminal block 58 is included for controlling the direction of rotation of the motor M by applying pre-programming jumpers 59 to one side or the other side of the terminal block, depending on the side of the door in which the lock assembly is installed. Thus, jumper block 59 would be applied to the two rightmost terminals in terminal block 58 where the lock assembly is installed, e.g., in the right side of the door, and to the two leftmost terminals in terminal block 58 where the lock assembly is installed in the other side, e.g., left side, of the door.

The operation of the lock assembly illustrated in the drawings will be apparent from the above description. Thus, when the lock assembly is first applied to the door, jumper blocks 57 would be applied to the reed switch terminal block 56, and jumper block 59 would be applied to the motor terminal block 58, according to the side of the door to which the lock assembly is installed, as described above.

After the lock assembly has been so pre-programmed and installed in the door, the locking bolt LB may be actuated either to its locking position or to its unlocking position by motor M, in any suitable manner such as described in our above-cited U.S. Patent No. 4,972,182. Operation of motor M drives the locking bolt 12 either to its locking position or unlocking position, according to the direction of rotation of the motor. The transmission from motor M to the locking bolt LB includes gears 20 and 22, lock drive shaft 16 coupled to gear 22 by coupling pin 18 being received within recesses 26 of gear 22, and pinion 10 coupled to the lock drive shaft 16 and in turn coupled to the locking bolt LB.

Should there be an overload on the lock drive shaft 16, coupling pin 18 will snap out of recesses 26 of gear 22; therefore, the motor and its gears 20 and 22 will freely rotate decoupled from the lock drive shaft 16, pinion 10 and locking bolt LB. Accordingly, this overload will not injure the motor or any other mechanism connected between the motor to the locking bolt; rather, it will produce a clearly audible sound, by the snapping-in and snapping-out of pin 18 with respect to recesses 26, to indicate this condition.

If it is desired to drive the locking bolt LB to either its locking position or to its unlocking position by the inner captive key 8, this may be done by pushing in the key. This displaces the key-driven shaft 14 axially against spring 34 to unseat coupling pin 18 from recesses 26 in gear 22. Accordingly, the key-driven shaft 14 may then be manually rotated to rotate the

lock drive shaft 16, together with pinion 10 and locking bar 12, without any interference from gear 22, gear 20 or motor M.

The locking bolt LB may also be driven to its locking or unlocking position by pushing in the outer key 4. This also moves the key-driven shaft 14 axially in the rightward direction, to thereby also move coupling pin 18 out of recesses 26 in gear 22, enabling the key-driven shaft 14 to be manually rotated without interference from gear 22, gear 20, or the motor M.

The condition of the lock assembly is sensed by the reed switches 51-54, which reed switches are actuated according to the position to which the magnetic member 40 has been moved by push pin 50 of the lock drive shaft 16. Thus, assuming the reed switches have been pre-programmed by their jumper blocks 57 for a right side door, clockwise rotation of the lock drive shaft 16 will move magnetic member 40 rightwardly (Fig. 4) from alignment with reed switch 52, actuated when the door was locked, to then actuate reed switch 53 unlocking the door, and then to actuate reed switch 54 to remove the tongue latch on the door.

While the invention has been described with respect to one preferred embodiment, it will be appreciated that this is set forth merely for purposes of example, and that many other variations, modifications and applications of the invention may be made.

Claims

1. A lock assembly, comprising: a key-driven shaft rotatable by a key; a lock drive shaft coupled to a locking bolt for driving the locking bolt to locking and unlocking positions; an electrical motor including a motor transmission; and a yieldable coupling normally coupling said motor transmission to said lock drive shaft to drive the locking bolt to locking or unlocking positions, but yieldable upon overload of the lock drive shaft to decouple the motor transmission therefrom; said key-driven shaft being axially displaceable to decouple it from the motor transmission, and thereby to enable the key-driven shaft to drive the lock drive shaft and the locking bolt to locking or unlocking positions.
2. The lock assembly according to Claim 1, wherein said motor transmission includes a gear rotated by the motor, and said yieldable coupling includes a pin normally spring-urged to seat in a recess formed in said gear but unseatable therefrom to decouple said gear from the lock drive shaft upon overload of the latter shaft.
3. The lock assembly according to Claim 2, wherein said lock drive shaft is a hollow shaft and enclosed said key-driven shaft; said pin passing

through said key-driven shaft and being received within slots formed in said hollow lock drive shaft permitting the pin to be moved from said recess in the gear and to remain coupled to the hollow lock drive shaft when the key-driven shaft is moved axially.

4. The lock assembly according to Claim 3, wherein said motor gear is formed with an opening there-through for accommodating said hollow lock drive shaft and said key-driven shaft, said recess being formed in a face of the gear on opposite sides of said opening.

5. The lock assembly according to Claim 4, wherein said face of the gear is formed with an annular cavity circumscribing said recess and receiving a spring which urges said pin into said recess, but permits the pin to unseat from said recess upon overload of the hollow lock drive shaft.

6. The lock assembly according to Claim 5, wherein the opposite face of the gear is formed with gear teeth meshing with the teeth of a further gear coupled to said motor.

7. The lock assembly according to any one of Claims 3-6, wherein said key-driven shaft is driven by an inserted key which is inserted into one side of the lock assembly and which, when pushed in the axial direction, axially displaces said key-driven shaft.

8. The lock assembly according to Claim 7, wherein said key-driven shaft is also driven by a captive key which is attached to the opposite side of the lock assembly and which, when pulled in the axial direction, axially displaces said key-driven shaft.

9. The lock assembly according to any one of Claims 1-8, further including a condition sensor for sensing the condition of said lock drive shaft whether it is in its locking or unlocking position.

10. The lock assembly according to Claim 9, wherein said condition sensor comprises: a magnetic member movable in one direction by the rotation of the lock drive shaft to the locking position, and in the opposite direction by the rotation of the lock drive shaft to the unlocking position; and reed switches carried by a fixed part of the lock assembly and actuated by said movable magnetic member according to its moved position.

11. The lock assembly according to Claim 10, wherein said magnetic member is mounted for linear movement in either direction by a pair of springs attached to a fixed part of the lock assembly.

12. The lock assembly according to either of Claims 10 or 11, including electrical terminals connected to said reed switches, and programming jumpers selectively connectible to said terminals for programming them for operation according to whether the lock assembly is located on the right side or the left side of a door.

13. The lock assembly according to Claim 12, wherein there are a pair of said reed switches actuated by rotation of the lock drive shaft to its locking and unlocking positions, respectively.

14. The lock assembly according to Claim 13, wherein the lock assembly further includes a latching tongue operated by said lock drive shaft, said lock assembly including two additional reed switches arranged in a line with said pair of reed switches on opposite sides thereof, which additional reed switches are actuated when the lock drive shaft is rotated to move said latching tongue to its unlatching position.

15. A lock assembly, comprising: a key-driven shaft rotated by a key; a lock drive shaft coupled to a locking bolt for driving the locking bolt to locking and unlocking positions; and a condition sensor for sensing the condition of said lock drive shaft whether it is in its locking position or its unlocking position; said condition sensor comprising a magnetic member movable in one direction by the rotation of the lock drive shaft to the locking position, and in the opposite direction by the rotation of the lock drive shaft to the unlocking position; and reed switches carried by a fixed part of the lock assembly and actuated by said movable magnetic member according to its moved position.

16. The lock assembly according to Claim 15, wherein said magnetic member is mounted for linear movement in either direction by a pair of springs attached to a fixed part of the lock assembly.

17. The lock assembly according to Claim 16, including electrical terminals connected to said reed switches, and programming jumpers selectively connectible to said terminals for programming them for operation according to whether the lock assembly is located on the right side or left side of a door.

18. The lock assembly according to Claim 17, wherein there are a pair of said reed switches actuated by rotation of the lock drive shaft to its locking and unlocking positions, respectively.

19. The lock assembly according to Claim 18, where-

in the lock assembly further includes a latching tongue operated by said lock device shaft, said lock assembly including two additional reed switches arranged in a line with said pair of reed switches on opposite sides thereof, which additional reed switches are actuated when the lock drive shaft is rotated to move said latching tongue to its unlatching position.

5

- 20.** The lock assembly according to any one of Claims 15-19, further including an electrical motor having a motor transmission; and a yieldable coupling normally coupling said motor transmission to said lock drive shaft to drive the locking bolt to locking or unlocking positions, but yieldable upon overload of the lock drive shaft to decouple the motor transmission therefrom; said key-driven shaft being axially displaceable to decouple it from the motor transmission, and thereby to enable the key-driven shaft to drive the lock drive shaft and the locking bolt to locking or unlocking positions.

10

15

20

25

30

35

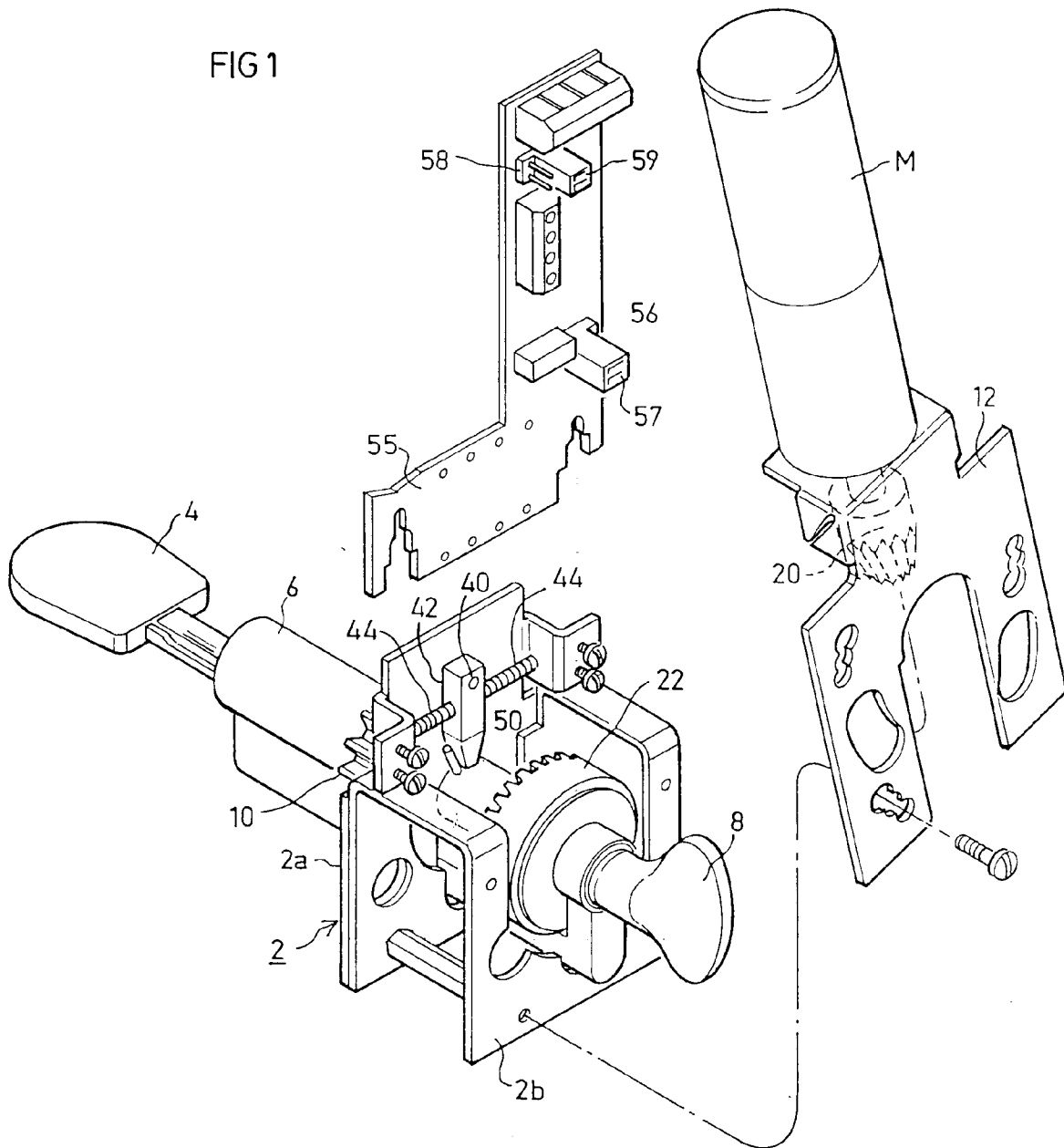
40

45

50

55

FIG 1



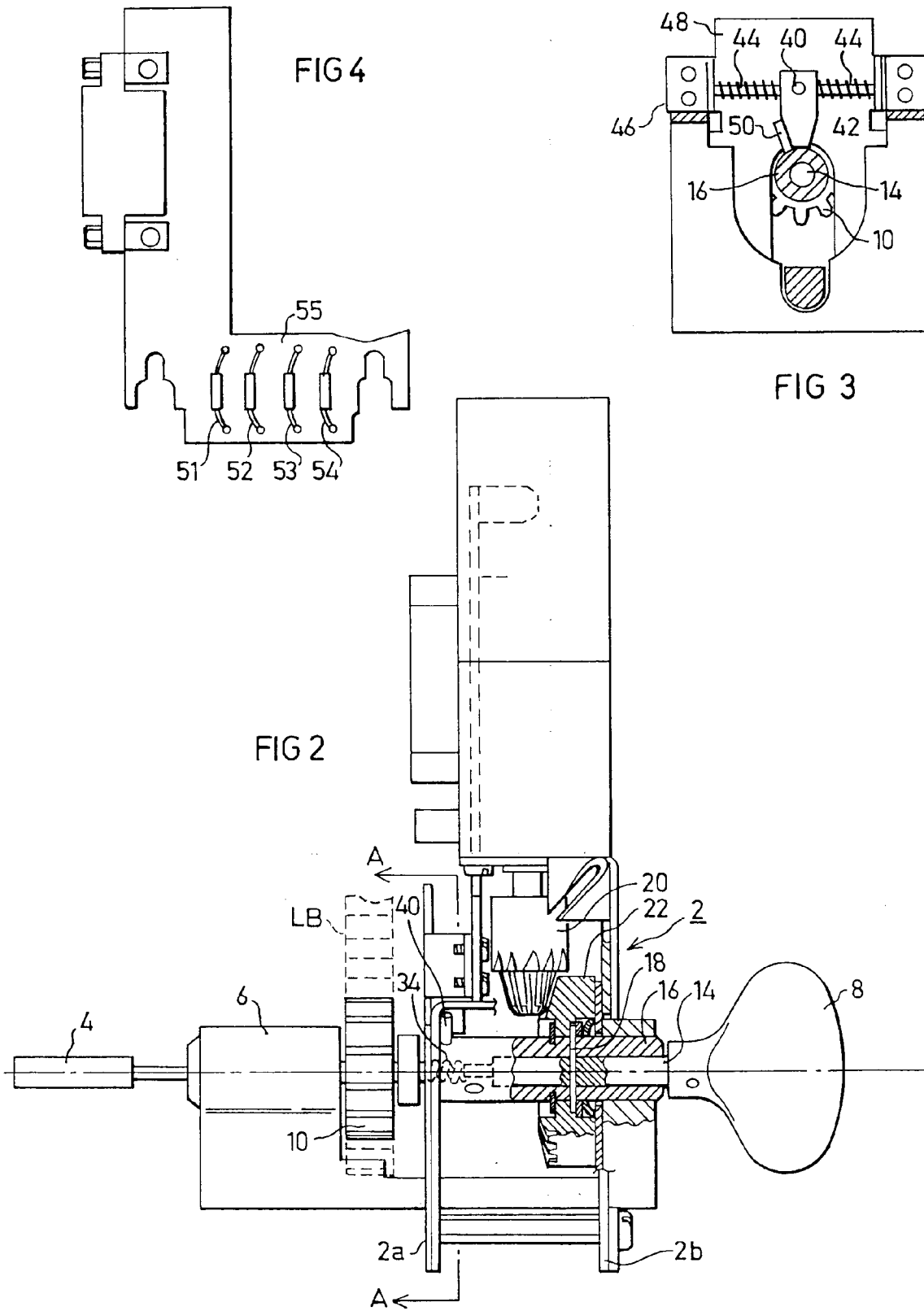


FIG 5

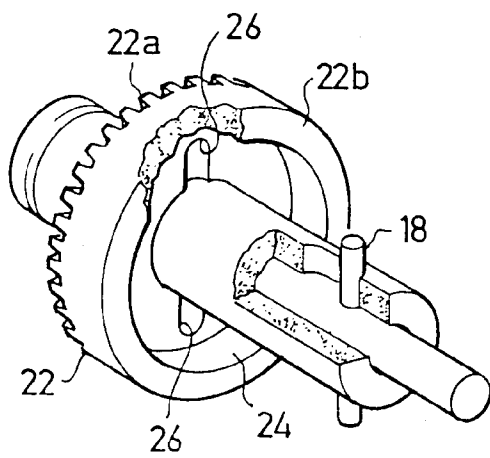
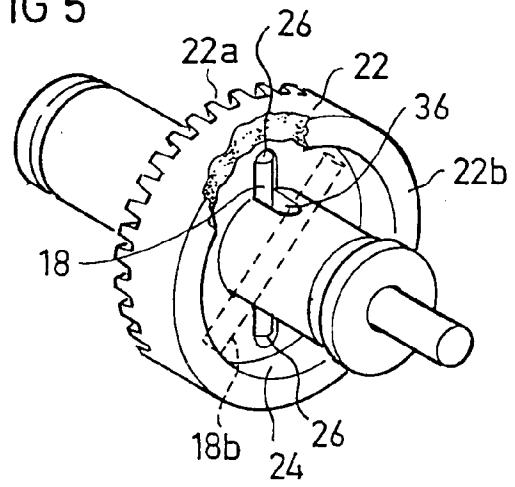


FIG 6

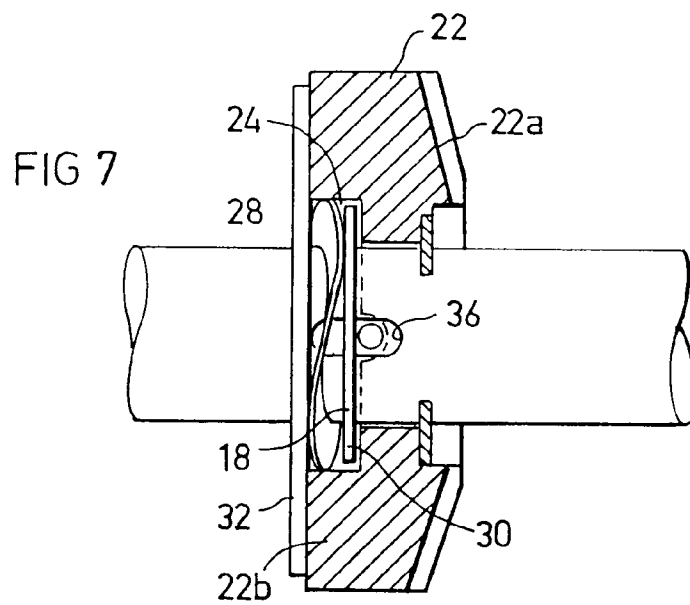


FIG 7