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(54) **Lock**

(57) The present invention relates to an espagnolette lock (1), comprising at least one slide bar (G) for manual locking/unlocking, further comprising a manually actuatable locking device (6) by means of which the slide bar (G) is actuated to perform a locking/unlocking operation, wherein said lock (1) also comprises a motor (3) and an operating device (5) being electronically actuatable via the motor, which device cooperates with said locking device (6) for electronically performing said locking/unlocking operation, whereupon the motor (3), after having performed the locking/unlocking operation, returns the operating device (5) to a neutral position where the operat-

ing device (5) is disengaged from the locking device (6), and that the manual locking/unlocking operation can be performed when the operating device (5) is disengaged from the locking device (6), that the operating device (5) comprises a first disc (500) and the locking device (6) comprises a second disc (600), which are concentrically disposed adjacent to each other on a lock axis (A), that said first disc (500) comprises a first operating means (8) on one side (54) of the disc, which operating means (8) cooperates with a first groove (60) in said second disc (600) and is adapted to fit into said first groove (60) and move freely between the ends (60A, 60B) of the groove.

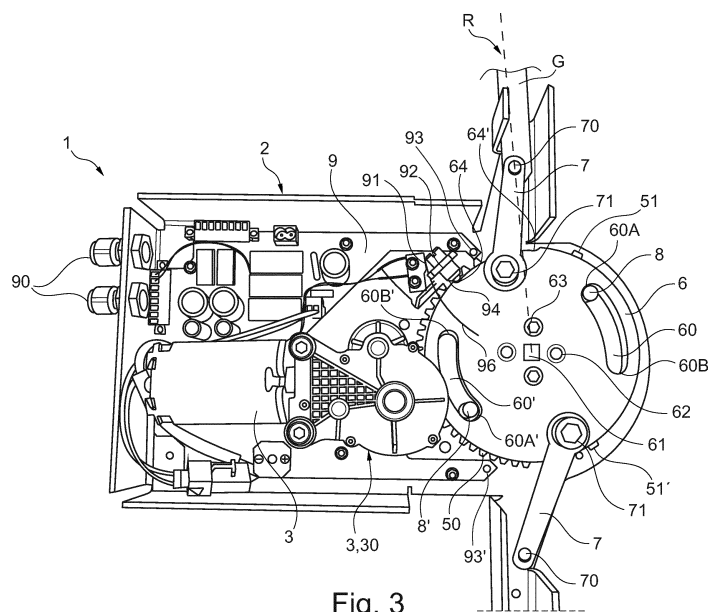


Fig. 3

Description

TECHNICAL FIELD

[0001] The present invention relates to a lock, the locking/unlocking operation of which can be performed both electronically as well as manually. The lock comprises a motor, an operating device and a locking device.

STATE OF THE ART

[0002] A major problem in construction sites, among other places, is to have a simple and flexible locking device on the containers where, for example, tools and machines are stored. Today, usually padlocks are used, which the foreman unlocks in the morning not to lock them again until in the afternoon at the end of the working day. Thus, the doors stay unlocked the entire day, because it is far too time-consuming to lock/unlock a padlock every time someone has to fetch or return a tool in a container. At large construction sites, this means that non-authorized persons easily can get into a container and help themselves to the tools and machines therein. Many companies suffer great economic losses because of these thefts. Also outside working hours, it is relatively simple to break a padlock to get into a tool container.

[0003] A remotely controlled lock apparatus is disclosed in US 2008/0105012. The lock can be unlocked/locked both manually and by remote control and is primarily intended for tool boxes carried by motor vehicles. The lock comprises a manually-operated key cylinder and a remotely-controlled lock assembly, whereby one can choose which one to use.

[0004] In US 6116067 a lock system is disclosed where the unlocking/locking operation can take place both manually and electrically. The manual locking operation can be performed regardless of in which position the electrical device is and is primarily intended for tool boxes/storage cabinets.

[0005] Accordingly, there is a need for a new, strong and durable lock, which is capable of locking large, heavy doors/front doors such as a container door or the door on a goods wagon or a truck, which can be skewed and warped and weighed down by both ice and snow. Furthermore, there is a need for a lock that can be integrated into the door/front door, and that enables the door to be locked as soon as the door has been closed, without the additional steps of fitting external locking devices, such as shackles, chains, etc., which are required when a padlock is used. Furthermore, it is desirable that the lock can be operated electrically to facilitate unlocking/locking. Another requirement is that the lock should be operable manually in case of power failure.

BRIEF DESCRIPTION OF THE INVENTION

[0006] It is an object of the present invention to eliminate or at least minimize the above-mentioned problems,

which is achieved by means of a lock, the locking and unlocking operation of which can be performed both electronically as well as manually. The lock comprises a motor, an operating device and a locking device. The lock performs a motor-driven locking/unlocking operation, whereupon the operating device returns to a neutral position after having performed the operation and is disengaged from the locking device in the neutral position.

[0007] Thanks to the invention, a lock can be provided that locks and unlocks a lock electronically in a simple way. In order to provide a sufficiently strong lock, for example for container doors, the lock is a multi-point lock, preferably an espagnolette lock, the slide bars of which engaging beams in the container frame and providing a sufficiently strong locking action to keep the doors together and also to protect better against break-in attempts. Thanks to the invention, a motor-driven control of an espagnolette lock can be provided, which is achieved thanks to the inventive design of the force-transmitting devices between the motor and the espagnolette lock. The motor is preferably an electric motor with a high gear ratio, to thereby be capable of being relatively small, and still be capable of locking large/heavy doors, for example container doors in harsh exposed environments.

[0008] Due to the high gear ratio, the motor becomes self-braking and it becomes impossible to overcome the force in the motor manually. The invention solves this problem in that the operating device, after having performed an operation, parks in a neutral position so that the lock, despite the strong motor, can be unlocked/locked manually for example in case of power failure.

[0009] According to one aspect of the invention, the operating device and the locking device comprise circular discs that are concentrically disposed adjacent to each other on a lock axis, which enables the discs to cooperate mechanically. When the operating device is in a neutral position, it is disengaged from the locking device and only the locking device can be actuated manually.

[0010] According to another aspect, the operating device comprises a first circular disc having teeth along at least half of the periphery of the disc, said teeth being adapted to cooperate with the motor via a gear wheel with a gear ratio of at least 1:3, which in combination with the powerful motor enables the constituent parts of the structural design solution to be kept down and therefore can be made relatively space-saving.

[0011] According to yet another aspect, the first disc comprises at least one, preferably two, operating means, which operating means cooperate with at least one, preferably two, rotationally symmetrical grooves on the second disc, which enables the two discs to cooperate with each other, alternatively be disengaged from each other.

[0012] Another advantage of the invention is that the operating means moves freely between the ends of the groove and that the length of the groove is equal to or longer than the rotational distance of the locking device

when unlocking and locking, respectively, which provides the advantage that the force required for manual unlocking/locking can be minimized, since the locking device can be operated manually without any actuation of the operating means.

[0013] Yet another advantage of the invention is that the operating means, in the neutral position after unlocking, is located adjacent to the end for locking of the groove, and that the operating means, in the neutral position after locking, is located adjacent to the end for unlocking of the groove, which enables the locking device to be rotated manually without being impeded by the operating means and without having to overcome the force from the motor.

[0014] Another aspect of the invention is that said first and second grooves are diametrically positioned on the second disc, which provides an even force distribution when rotating the locking device.

[0015] According to yet another aspect, said operating device has at least one position indicator for detecting locked and unlocked position, respectively, and the lock comprises at least one sensor intended for interacting with said position indicator, which provides the advantage that when the sensor detects an unlocked/locked position, the operating device rotates back in the opposite direction until it ends up in a neutral position again.

[0016] Another advantage of the invention is achieved in that the lock axis is located at a point of intersection with a linear movement axis of a slide bar in an espagnolette lock. This means that the locking device, when rotating about the lock axis, pulls an actuating bar fixed to the circular disc of the locking device with it, which in its turn pulls down/pushes up the slide bar. This provides a simple mechanical design solution that can be adapted in size in order to obtain the required force on the slide bars and an adaptation of the length of stroke/locking distance of the slide bars.

[0017] Yet another aspect of the invention is that a holder for the actuating bar and the operating groove are located at substantially the same distance in the radial direction from the lock axis, preferably close to the outer edge of the second disc, which provides the longest torque lever.

[0018] According to yet another aspect of the invention, the lock comprises a limit position switch adapted to cooperate with said holder for detecting an unlocked position of the slide bar, wherein the limit position switch comprises a spring extending from the position of the limit position switch next to the second disc in over the second disc and intersecting a rotational path of the holder, which provides the advantage that the power supply can be interrupted if the rotation of the operating device goes too far.

[0019] Yet another advantage of the invention is that when the operating means is in the neutral position, the lock can be locked and unlocked manually by means of a handle actuating the locking device via a profiled hole in the second disc, that said profiled hole is located in

line with the lock axis and is accessible to the handle both from the inside of the lock and from the outside thereof, which enables manual unlocking, for example if locked inside, alternatively in case of power failure.

[0020] According to yet another aspect of the invention, the profiled hole does not become accessible from the outside until a lock cylinder has been removed, which means that only authorized persons having a key to the lock cylinder will be able to unlock and lock the lock manually from outside.

[0021] Another advantage of the invention is that the lock comprises a mounting tube being rotationally symmetrically positioned with respect to the lock axis, said mounting tube comprising a centrally located, profiled second hole positioned in line with said first profiled hole of said second disc and that said mounting tube comprises a peripheral abutment surface for a slide bearing, that said first disc is positioned around the mounting tube and the slide bearing via a through-hole in the first disc, so that a rotation of the mounting tube can occur without the first disc rotating. This provides the great advantage that an external handle, via the profiled holes, can rotate the locking device without actuating the operating device.

[0022] According to yet another aspect of the invention, the motor is a self-braking motor, which provides the advantage that it can be a small motor, which nevertheless, thanks to a large gear ratio, can produce enough power to be capable of locking and unlocking, respectively, the espagnolette lock in the door.

BRIEF DESCRIPTION OF FIGURES

[0023] In the following, the invention will be described in greater detail with reference to the attached figures of the drawings, in which:

- Fig.1 shows an exploded diagram of a lock according to the invention in a view seen obliquely from above;
- Fig.2 shows an exploded diagram of a lock according to the invention in a view seen from the side;
- Fig.3 shows a lock in a preferred embodiment according to the invention in a view from the front;
- Fig.4 shows a lock according to the invention in a view seen obliquely from below;
- Fig.5 shows a close-up view of a lock according to the invention;
- Figs.6 A-D show a locking device and an operating device according to the invention in different positions; and
- Fig.7 shows an exploded diagram of a lock according to the invention in a view seen obliquely from above.

DETAILED DESCRIPTION OF FIGURES

[0024] In the disclosed solution, a preferred embodiment of the invention is described in the following figures. The lock 1 according to the invention is intended to co-operate with a vertically positioned container door, but it should be understood that the invention works equally well on doors/front doors of another kind than the one described here.

[0025] Figure 1 shows in perspective a lock 1 according to a preferred embodiment of the invention. The lock is accommodated in a housing comprising a mounting plate 2, and is mounted on the inside of a container door (not shown). The constituent parts of the lock 1 are disposed on one side 20 of the mounting plate 2, and the other side 21 of the mounting plate is disposed against, as in this case, a container door, for example by being bolted thereto. The mounting plate 2 comprises a mounting opening 22, which is adapted to fit against an opening of a corresponding size in the container door. The lock comprises a motor 3, preferably a conventional electric motor, and a conventional espagnolette lock. A lock/operating structure enabling an espagnolette lock to be motorized has been developed within the scope of the invention. With the purpose of explaining how the structural parts typical of the invention are designed and cooperate with each other in order to achieve the object of the invention, these parts have been illustrated in a sort of exploded diagram, whereas the electric motor, actuating bars 7 for slide bars in the espagnolette lock, and associated parts, are shown substantially in their actual positions. It will be described in greater detail how these are connected to the structural parts typical of the invention. When describing the constituent parts, it will be referred to front and back side, alternatively at the front and at the back, wherein back side and at the back refer to parts and sides of parts facing toward the inside of the container door against which the lock is fixedly mounted, and wherein front side and at the front refers to parts and sides of parts facing inward, toward the interior of the container.

[0026] The lock 1 further comprises a locking device 6 comprising a second circular disc 600, an operating device 5 comprising a first circular disc 500, and a mounting tube 4, which are concentrically disposed adjacent to each other on a lock axis A. The lock axis A is a rotational axis extending through the mounting opening 22. The operating device 5 is adapted to cooperate with the locking device 6 by a rotational movement about the lock axis A. The locking device 6, in its turn, is adapted to cooperate by a rotational movement with two slide bars G running along a linear movement axis R (see Figure 3) along the inside of the door in a so-called espagnolette locking system. The lock axis A is perpendicularly disposed relative to the linear movement axis R of the slide bars G and is located at a point of intersection therewith. In a way known to the skilled person, the slide bars G cooperate with a door frame/case for the locking of the door. The

slide bars G are connected to the locking device 6 via a respective actuating bar 7 mounted on the front side of the second circular disc 600, and when rotating it about the lock axis A, a displacement of the slide bars along the movement axis R is obtained. In the shown embodiment, the two discs 500, 600 have the same diameter. In the centre of the second disc 600, there is a forward profiled through-hole 61 being located in line with the lock axis A. The forward profiled hole 61 is surrounded by four circular through-holes 62 intended for fixing means 63 for the second disc 600, for example in the form of screws. The power of the motor 3 acts on the operating device 5 via a force-transmitting gear wheel 30, cooperating with teeth 50 of the first disc 500 of the operating device 5. The force-transmitting gear wheel 30 and the first disc 500 are located substantially in a common plane, perpendicular to the lock axis A. The lock 1 preferably comprises a housing (not shown) covering all the constituent parts, but has a sufficiently large opening to expose the forward profiled hole 61.

[0027] The mounting tube 4 (see also Figure 2) has a narrower rearward portion 41 being disposed together with a slide bearing 54 in the mounting opening 22 of the mounting plate 2 and the corresponding opening of the door. As previously mentioned, the operating device 5 is placed on the inside of the door, where a centrally located hole H in the first circular disc 500, via an additional slide bearing 53 (see also Figure 2), encloses the wider forward portion 42' of the mounting tube. The second circular disc 600 of the locking device 6 is mounted in front of the mounting tube 4, closely adjacent to the first circular disc 500. Suitably, the mounting is done by screws 63 extending through circular holes 62 in the second disc 600 and which are threaded into the threaded screw holes 43' in the front of the mounting tube. A plastic washer 52 (see also Figure 2) is mounted between the two discs to prevent any play.

[0028] Two operating means 8, 8', in the form of two projecting metal rods, are disposed on the front side 54' of the first disc 500 of the operating device 5 for cooperating with two rotationally symmetrically positioned grooves 60, 60' in the second disc 600. The operating means 8, 8' are disposed about 180 degrees apart and close to the outer edge of the disc 500. Close to the outer edge of the disc means that the operating means 8 are disposed in the radial direction outside at least half of the radius of the first disc 500, preferably at, or outside about $\frac{3}{4}$ of the radius. For reasons evident below, it is desirable that the cooperating means 8, 8', 60, 60' are located close to the outer edges of the discs, even if a design resulting in a position closer to the centre of the discs is naturally conceivable. In the region where there are no teeth 50, the periphery of the first disc 500 comprises a first and a second position indicator 51, 51', with a spacing therebetween in the range of 80-180 degrees. Preferably, the position indicators 51, 51' are magnetic indicators, which are resilient and resistant to a harsh environment and do not get worn out. The position indicators 51, 51' inter-

act with a first and a second sensor 93, 93' comprised in the lock for detecting locked and unlocked position, respectively, of the lock 1.

[0029] As mentioned above, the second disc 600 has two grooves 60, 60' which are through-grooves and extend in the circumferential direction in the second disc 600 close to its outer edge K for rotationally symmetrical cooperation with the operating means 8, 8' in the first disc 500. Close to the outer edge means that the grooves 60, 60' are disposed in the radial direction outside at least half of the radius of the second disc 600, preferably at or outside $\frac{3}{4}$ of the radius, for achieving one or some of the objects of the invention. The grooves 60, 60' are diametrically positioned on the second disc 600 and have a length equal to or longer than a rotational distance of the operating means 8, 8' of the operating device 5 when unlocking and locking, respectively, the lock 1. In the described embodiment, each of the grooves 60, 60' has a length corresponding to a rotational angle of about 55 degrees, but the length can be longer or shorter depending on the length of stroke/locking distance which is required of the slide bar G. As is appreciated, the position of the grooves in the radial direction on the second disc 600 will influence the length of stroke/locking distance of the slide bar G. To avoid the risk of the espagnolette lock latching in one or both end positions for locking, the holder 71 for said actuating bars 7 should not pass beyond the movement axis R of the slide bars. When the two grooves 60, 60' and the holders 71 for the actuating bars 7 are disposed in the same radial direction as in the described example, it is appreciated that the grooves 60, 60' cannot be given a length corresponding to an angle above 90 degrees, since the slide bar G in such an embodiment would go beyond the maximum position in the X-direction or Y-direction in an imaginary Cartesian coordinate system where the movement axis R of the slide bar constitutes the ordinate and the origin coincides with the lock axis A. Therefore, the diameter of the second disc 600 in the locking device 6 should be adapted in proportion to the required length of stroke of the slide bar G, so that the length of the grooves 60, 60' corresponds to an angle smaller than 90 degrees. If it is no found to be a problem when the slide bar G goes beyond the maximum position in the X-direction or Y-direction, it is appreciated that the grooves 60, 60' can be given a length exceeding 90 degrees but, for obvious reasons, they cannot be larger than 180 degrees. In this context, it should also be mentioned that it is advantageous if the grooves are positioned relatively far out on the second disc 600 since this provides the longest torque lever and thus facilitates unlocking and locking of the lock, both in case of motor-operation and manual control. At the same time, it should be taken into consideration that it is desirable to keep down the size of the constituent parts for space reasons, which has enabled an optimum in size to be achieved with the dimensions given for the invention in connection with Figure 2. Another conceivable alternate embodiment is that the two grooves 60, 60' are disposed

radially inside the radius where the actuating bar 7 and its holder 71 are disposed, which then results in that the grooves 60, 60' can be given a longer length so that the rotational angle exceeds 180 degrees, which means that the slide bar G gets a longer length of stroke. In such an embodiment, it is appreciated that the holder 71 for the actuating bar 7 will go beyond the maximum position in the Y-direction, but an embodiment with shorter grooves can of course also be designed to allow the holder 71 of the actuating bar 7 to go beyond the maximum position. This can be used to prevent the slide bars G from falling back, which can occur in particularly shaky environments, for example on cargo doors on trucks, where there are constant small vibrations during driving. By allowing the holder 71 of the actuating bar 7 to go beyond the maximum position in the Y-direction, the locking end of the slide bar G is brought beyond its outermost position and is pulled back a short distance, typically a few millimetres, resulting in the slide bar being locked in that position. The small vibrations are not capable of shaking the slide bar G back over the maximum position, but a sort of threshold effect is achieved.

[0030] Another embodiment could be that grooves having a shorter length are disposed closer to the lock axis A than the holders 71 of the actuating bars 7, whereby a larger length of stroke can be obtained than if the grooves were positioned further out. It is appreciated that such an embodiment can be advantageous, since the second disc 600 has to transmit the force to the slide bars G, in that the second disc 600 thereby is kept as intact as possible.

[0031] The first and the second operating means 8, 8' on the first disc 500 cooperate with the first and the second groove 60, 60' on the second disc 600 in that the operating means 8, 8' are adapted to fit into the grooves 60, 60' and are allowed to move freely between the ends 60A, 60B, 60A', 60B' of the groove. In the shown embodiment, the grooves have one end for locking 60B, 60B', facing anti-clockwise, and one end for unlocking 60A, 60A', facing clockwise. In this context, the direction indication should not be construed as limiting for the invention, but should only be seen as a means for describing the function of the lock in connection with the figures shown. In this described case, the rotational distance is adapted so that the slide bars get a length of stroke/locking distance of about 4-5 cm in the direction of the movement axis R. It should be understood that the rotational distance can be both shorter and longer, which provides a shorter and longer, respectively, length of stroke/locking distance of the slide bars, which is adapted according to the application for which it is to be used.

[0032] As mentioned above, the locking device 6 according to the preferred embodiment shown here comprises two actuating bars 7. The respective actuating bar 7 is fixed by one of thereof to a slide bar G and by the other end thereof to a holder 71 on the second disc 600. The holder 71 is disposed at substantially the same radial distance from the lock axis A as the grooves 60, 60'. The

other end of the respective actuating bar 7 is fixed to its associated slide bar. When the lock 1 performs a locking/unlocking operation and the second disc 600 rotates, each holder 71 where the actuating bars are fixed performs a semi-circular rotational movement about the lock axis A. As a result of this rotational movement, the other end of the respective actuating bar 7 performs a linear movement along the movement axis R of the slide bar G. In this way, depending on the operation which is performed, the actuating bars 7 either pull in the respective slide bar G or push it out.

[0033] Manual control of the locking device 6 is enabled in that the operating means 8, 8' return to a neutral position after having performed a locking or unlocking operation. In connection with Figures 6A-6D, it is described in greater detail how the locking and unlocking operation is performed in motorized operation and how the neutral position enabling manual control of the lock is achieved. This is a great advantage, for example in case of power failure, when access is needed to material in the container. Thanks to the neutral position, there is no need of rotating the motor cooperating with the operating device 5, which, due to the large gear ratio, otherwise would require a force to be applied via the handle that is far greater than can be achieved manually. There is also a possibility to perform the locking and unlocking operation from inside the container, but then a handle is inserted into the forward profiled hole 61 in the second disc 600. Advantageously, a handle is always in place on the inside to eliminate the risk of somebody getting locked inside the container.

[0034] The motor is preferably made as small as possible for space reasons. The motor comprises twin gearboxes (not shown) in order to produce enough power to control the espagnolette lock, wherein the gear ratio amounts to 210:1 across the motor. The gear ratio between the motor 3 and the gear wheels 50, 30 at the locking device is 1:3. Thereby, enough force acting on the operating device 5 is obtained so that a sufficient torque being capable of pushing out and pulling in, respectively, the slide bars in the espagnolette lock is achieved.

[0035] An exploded diagram from the side of the constituent parts of the lock 1 is seen in Figure 2. In the same way as in Figure 1, the motor 3, the actuating bars 7 for the slide bars, the smaller gear wheel 30 actuated by the motor have been indicated substantially in their actual positions. The two discs 600, 500 in the locking device 5 and the operating device 6 are seen on the left in the figure and, consequently, parts at the back side of the lock, facing toward the inside of the container door, are located to the right in the figure.

[0036] The first disc 500 of the operating device 5 has a diameter D in the range of 30-200 mm, more preferably in the range of 50-120 mm. In the shown embodiment, the diameter D is 120 mm. The first disc 500 has a thickness T in the range of 2-20 mm, more preferably 5-10 mm if it is made of metal (steel), or other material of equiv-

alent strength, e.g. reinforced plastic. In the centre of the first disc 500, there is a circular through-hole H having a diameter d in the range of 10-50 mm, more preferably 20-40 mm.

[0037] Teeth 50 are disposed along half of the periphery of the first disc 500, which teeth 50 are adapted to cooperate with the motor 3 via a smaller gear wheel 30 with a gear ratio of at least 1:3 between the first disc 500 and the smaller gear wheel 30. The smaller gear wheel 30 has a diameter of the order of 30-50 mm, typically 42 mm, whereas the first disc 500 has a diameter of the order of 100-150 mm, typically 120 mm. For space reasons, it is desirable to keep the dimensions down, but for reasons indicated previously, the second disc 600 and indirectly also the first disc 500 need to have a certain size.

[0038] The second disc 600 of the locking device 6 has a diameter D' in the range of 30-200 mm, more preferably in the range of 50-120 mm. The second disc 600 has a thickness t in the range of 2-20 mm, more preferably 5-10 mm if it is made of metal (steel), or other material having an equivalent strength such as reinforced plastic. A first 64 and a second recess 64' are disposed in the edge K of the second disc with an angle in the range of 40-100 degrees therebetween. The cross-section of the recesses 64, 64' has the shape of a half-circle.

[0039] In addition to the operating device 5 and the locking device 6 described above, a number of plastic washers 52, 56 and a number of slide bearings 53, 54, 55 are seen, which have the task of providing stability when assembling the lock 1, so that no play arises between the different parts of the lock 1, as well as allowing relative rotation between certain parts. Furthermore, a mounting tube 4, which is rotationally symmetrically positioned with respect to the lock axis A, is seen. The mounting tube 4 has a narrower rearward portion 41 and wider forward portion 42' with a peripheral abutment surface 42 for a slide bearing 53. The forward portion 42' has a diameter adapted to the hole in the first disc 500 in order to be fitted into the hole H together with the slide bearing 53 when being assembled, so that the first disc 500 is positioned around the mounting tube 4 and allows rotation of the mounting tube 4 without the second disc 500 rotating. The mounting tube 4 comprises a centrally located, profiled rearward hole 43, here a square hole, positioned in line with said forward profiled hole 61 of the second disc 600 and having the same dimensions as this. The forward portion 42' of the mounting tube also comprises four holes 43', preferably threaded screw holes 43' (see Figure 1) intended for receiving fixing means 63, preferably screws 63. When assembling, the screws 63 are passed through the circular holes 62 in the locking device 6 and are threaded into the threaded screw holes 43' in the mounting tube 4. In this way, the forward profiled hole 61 and the rearward profiled hole 43 extend in line with each other along the lock axis A. Preferably, the two profiled holes 61, 43 are square holes, which are always accessible from the inside of the door.

On the outside of the door, a lock cylinder (not shown) is mounted in the opening, which cylinder first has to be removed before the rearward profiled hole 43 becomes accessible from the outside. When the lock cylinder has been removed, the profiled stem of a handle can be inserted into the lock 1 via the rearward profiled hole 43. In Figure 2, the mounting tube 4, the operating device 5, the locking device 6 and the slide bearing 53, the holes 62, H, 43' of the parts have been indicated to facilitate the understanding.

[0040] With reference to Figures 3 and 6A-6D, the function of a lock 1 in a preferred embodiment according to the invention which is mounted on a container door will be described. The skilled person will of course appreciate that the function is the same also on other doors/front doors/shutters which need to be locked.

[0041] The lock 1 in its housing is mounted on the inside of a container door and on the outside only a lock cylinder is visible, which cylinder is assembled to the lock 1 via an opening in the container door and through the mounting opening 22 in the mounting plate 2. In Figure 3, the lock 1 is seen in a locked neutral position (also seen in Figure 6 A). In order to actuate the lock 1 from the outside when the door is closed and locked, for example a tag being placed against a reading/actuator sensor (not shown) is used, and an initiation signal is transmitted to the motor 3 which starts. The driving force of the motor is transmitted via the smaller gear wheel 30, which in Figure 3 is concealed from view behind a protecting housing for the mechanical drives of the motor (see also Figure 4), and rotates the operating device 5 no more than slightly less than a quarter of a turn anti-clockwise. As the operating means 8, 8' on the operating device 5 in the neutral position abut against the end for opening 60A, 60A' of the grooves when the motor 3 starts for an opening operation, also the locking device 6 rotates a corresponding distance, i.e. no more than slightly less than a quarter of a turn, when the motor 3 rotates the operating device 5. When the operating device 5 has rotated slightly less than a quarter of a turn and the lock 1 is unlocked (see Figure 6 B), also the actuating bars 7 have been displaced during the rotation via their holder 71 in the second disc 600, which means that the actuating bars 7 have pulled in the slide bars (a so-called espagnolette locking system) in the direction of the movement axis R so that the container door can be opened. In the unlocked position, an operation of the motor 3 in the opposite direction is then performed immediately, so that the operating device 5 rotates back slightly less than a quarter of a turn clockwise to its initial starting position. When the operating device 5 has rotated back and once again has parked in its initial starting position, the operating device has assumed a neutral position (see Figure 6 C). In the neutral position, after having performed an unlocking operation, the operating means 8, 8' abut against the end for locking 60B, 60B' of the groove. When the container door is subsequently closed, a new signal is transmitted, preferably automatically, to the motor 3,

which now via the smaller gear wheel 30 rotates the operating device 5 no more than slightly less than a quarter of a turn clockwise and the actuating bars 7 push the slide bars upward and downward, respectively, in the direction of the movement axis R and lock the container door. As the operating means 8, 8' abut against the end for locking 60B, 60B' of the groove during the locking operation, also the locking device 6 rotates the corresponding distance, i.e. no more than slightly less than a quarter of a turn clockwise. After slightly less than a quarter of a turn of rotation in the clockwise direction, the lock 1 is locked and the motor 3 immediately rotates the operating device 5 back to the starting position so that operating device 5 once again ends up in the neutral position, but now with the operating means 8, 8' abutting against the end for opening 60A, 60A' of the groove, see Figure 6 A. Accordingly, the lock 1 performs an unlocking, alternatively a locking operation, immediately followed by the operating device 5 returning to the starting position after having performed the operation and thus assuming a neutral position. Thanks to the fact that the locking device 6 has been designed with grooves 60, 60' for cooperating with the operating means 8, 8', which grooves 60, 60' have been given a length adapted to the rotational distance, a neutral position is enabled where the operating device 5, and thus also the motor 3, are disengaged from the locking device 6.

[0042] Figure 3 shows the lock 1 according to the invention from the front. The lock 1 further comprises a printed circuit board 9 and terminals 90 for power supply. For the power supply any source suitable for the purpose can be used, for example a 24 V battery eliminator mounted inside the container (not shown). The printed circuit board 9 also comprises a microcomputer (not shown) that controls all functions such as unlocking and locking, respectively. Also additional functions, such as different safety measures, can be added. For instance, the computer can indicate if the slide bars are too slow to lock, e.g. if a stone is in the way. Furthermore, the computer can have a function for current measurement and detect if there is too much/too little voltage, which indicates that something is wrong somewhere and, in such a situation, the computer takes care of switching off the motor.

[0043] The printed circuit board 9 further comprises a limit position switch 91, preferably a microswitch 91, adapted to cooperate with the holder 71 on the second disc 600 for detecting an unlocked position of the slide bar. The microswitch comprises a spring 96 extending from the position of the limit position switch next to the second disc 600 and in over it and intersecting a rotational path of the holder 71. If the rotation during the unlocking operation were to go too far, the holder 71 is pushed against the spring 96 of the micro-switch and, as a safety measure, the current is interrupted. The printed circuit board 9 further comprises a first and a second sensor 93, 93', disposed in connection with the peripheral surface of the operating device 5, which are interacting with a respective position indicator 51, 51'. When the operat-

ing device 5 rotates in an unlocking operation, the first sensor 93 interacts with the first position indicator 51 for detecting an unlocked position and, in a locking operation, the second sensor 93' interacts with the second position indicator 51' for detecting a locked position.

[0044] In Figure 4, the lock 1 is seen in a view seen obliquely from below. For reasons of clarity, the actuating bars 7 to the two slide bars have been omitted. Here, it is evident how the motor 3 drives the smaller gear wheel 30 via the teeth 50 of the operating device. The second position indicator 51' on the peripheral surface of the second disc 500, and the second detector 93', are also clearly visible.

[0045] Figure 5 shows a close-up view of the limit position switch 91 and its position next to the second disc 600, and it is seen how the spring 96 extends from the limit position it switch 91 in over the second disc 600 and intersects the rotational path of the holder 71. Furthermore, a close-up view of a mechanical limit switch in the form of a spring-loaded ball 94 resting in the first recess 64 is seen. In the shown position, the lock is locked and when the lock 1 performs an unlocking operation, the second disc 600 is rotated anti-clockwise, and in that the distance between the first recess 64 and the second recess 64' is equal to the distance the second disc 600 rotates, the spring-loaded ball 94 will rest in the second recess 64'. In a corresponding way, the spring-loaded ball 94 will once again assume its position in the first recess 64 during a locking operation, when the locking device 6 has been rotated the same distance clockwise. The purpose of the spring-loaded ball 94 and the two recesses 64, 64' is to obtain an indication of locked/unlocked position during manual operation of the lock 1, which is achieved in that there is a clicking noise when the ball snaps down into a recess. It can also be sensed as a slight vibration in the handle, and, thanks to this, it is avoided that the locking device 6 is rotated too far. In addition to this click and snap indication of the two end positions, the lock in the preferred embodiment is designed so that there is a slightly less deep recess in the peripheral surface between the two recesses 64, 64'. The spring-loaded ball 94 is so disposed in the mechanical limit switch that it cannot be pushed back as far as required to rotate the second disc 600 beyond the two outer recesses and thereby allow the ball to roll up onto the peripheral surface having the slightly larger diameter dimension. Thereby, a mechanical stop function in locked and open position, respectively, is achieved.

[0046] Fig. 7 shows an exploded diagram of a lock 1 according to the invention in a view seen obliquely from above. The figure shows a clearer illustration of how the different parts are put together.

[0047] The invention is not limited by what has been described above, but can be varied within the scope of the following claims. For example, it is appreciated that the dimensions given can be varied, depending on where the lock is to be placed, without taking away from the function of the invention. Of course, the lock functions

well also on other objects than the container door described here, for instance, the lock can also be used on front doors of various kinds, diesel tanks, train transports, and trucks.

[0048] It is also very advantageous to connect the lock to an access control system, to make sure that only authorized staff is allowed to bypass the lock.

[0049] The skilled person will also appreciate that one groove and one slide bar could be sufficient, as well as that there could be a third fixing point for a third slide bar locking in the horizontal direction. In case a slide bar is used, it is probably most convenient to position the engagement of the slide bar with the door frame/case at the middle of the door, and that its movement axis R extends in the horizontal direction in case the door is a vertically suspended door, and vice versa.

[0050] In addition to the elements central to the invention which have been described, the lock comprises the required elements known to the skilled person, and components for installation, operation and maintenance of an electronically controllable lock.

[0051] The skilled person will also appreciate that, instead of gear wheels, the same function could have been achieved via, for example, rubber-covered slip-wheels, alternatively via a synchronous belt drive or a chain drive.

Claims

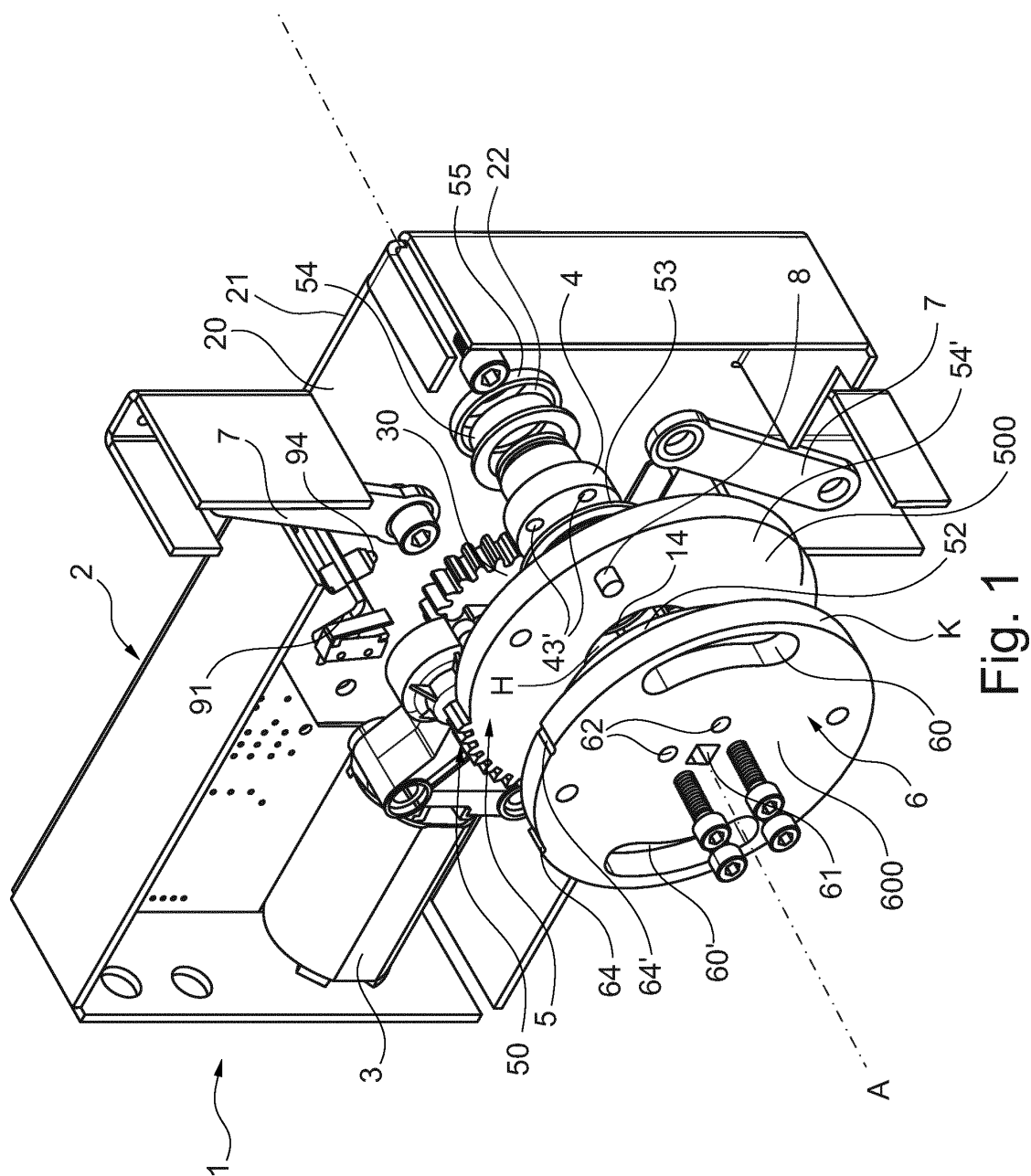
1. An espagnolette lock (1), comprising at least one slide bar (G) for manual locking/unlocking, further comprising a manually actuatable locking device (6) by means of which the slide bar (G) is actuated to perform a locking/unlocking operation, **characterized in that** said lock (1) also comprises a motor (3) and an operating device (5) being electronically actuatable via the motor, which device cooperates with said locking device (6) for electronically performing said locking/unlocking operation, whereupon the motor (3), after having performed the locking/unlocking operation, returns the operating device (5) to a neutral position where the operating device (5) is disengaged from the locking device (6), and that the manual locking/unlocking operation can be performed when the operating device (5) is disengaged from the locking device (6), that the operating device (5) comprises a first disc (500) and the locking device (6) comprises a second disc (600), which are concentrically disposed adjacent to each other on a lock axis (A), that said first disc (500) comprises a first operating means (8) on one side (54) of the disc, which operating means (8) cooperates with a first groove (60) in said second disc (600) and is adapted to fit into said first groove (60) and move freely between the ends (60A, 60B) of the groove.
2. The lock according to claim 1, **characterized in that** the operating device (5) comprises a first disc (500)

having teeth (50) along at least half of the periphery of the disc (500), which teeth (50) are adapted to cooperate with the motor (3) via a gear wheel (30) with a gear ratio of at least 1:3.

3. The lock according to claim 2, **characterized in that** said first disc (500) also comprises a second operating means (8'), which cooperates with a second groove (60') in said second disc (600).
4. The lock according to claim 3, **characterized in that** said second operating means (8') is adapted to fit into said second groove (60') and to move freely between the ends (60A', 60B') of the groove.
5. The lock according to claim 4, **characterized in that** the length of the groove (60, 60') is equal to or longer than the rotational distance of the locking device (6) for unlocking and locking the lock, respectively.
6. The lock according to claim 4 or 5, **characterized in that** the operating means (8, 8'), in the neutral position after unlocking, is located close to the end for locking (60B, 60B') of the groove, and that the operating means (8, 8'), in the neutral position after locking, is located close to the end for opening (60A, 60A') of the groove.
7. The lock according to claim 1, **characterized in that** said grooves (60, 60') are diametrically positioned on the second disc (600).
8. The lock according to any one of the preceding claims, **characterized in that** said operating device (5) further comprises at least one position indicator (51, 51'), preferably a magnetic indicator, for detecting locked and unlocked position, respectively, that said lock (1) further comprises at least one sensor (93, 93') intended for interacting with said position indicator (51, 51').
9. The lock according to claim 1, **characterized in that** said slide bar (G) is connected to the locking device (6) via an actuating bar (7) fixed to said second disc (600).
10. The lock according to claim 9, **characterized in that** the lock axis (A) is located at a point of intersection with a linear movement axis (R) of the slide bar (G) in the espagnolette lock.
11. The lock according to claim 3 and 9, **characterized in that** the locking device (6) comprises at least one actuating bar (7) for the slide bar and a holder (71) for said actuating bar (7) on said second disc (600), wherein said holder (71) and said grooves (60, 60') are located at substantially the same distance in the radial direction from the lock axis (A), preferably

close to the outer edge of the second disc (600).

12. The lock according to claim 3 and 9, **characterized in that** the locking device (6) comprises at least one actuating bar (7) for the slide bar and a holder (71) for said actuating bar (7) on said second disc (600), wherein said holder (71) and said grooves (60, 60') are located at different distances in the radial direction from the lock axis (A).
13. The lock according to claim 11, **characterized in that** the lock (1) further comprises a limit position switch (91), preferably a micro-switch, adapted to cooperate with said holder (71) for detecting an unlocked position of the slide bar, wherein the limit position switch (91) comprises a spring (96) extending from the position of the limit position switch next to the second disc (600) in over the second disc (600) and intersecting a rotational path of the holder (71).
14. The lock according to claim 6, **characterized in that** the lock (1) can be locked and unlocked, when the operating means (8,8') is in the neutral position, by means of handle actuating the locking device (6) via a first profiled hole (61) in the second disc (600), that said first profiled hole (61) is located in line with the lock axis (A) and is accessible to the handle both from the inside of the lock and from the outside thereof.
15. The lock according to claim 13, **characterized in that** the first profiled hole (61) does not becomes accessible from the outside until the lock cylinder has been removed.
16. The lock according to any one of the preceding claims, **characterized in that** the lock (1) further comprises a mounting tube (4) being rotationally symmetrically positioned with respect to the lock axis (A), which mounting tube (4) comprises a centrally located, profiled second hole (43) positioned in line with said first profiled hole (61) of said second disc (600), that said mounting tube (4) comprises a peripheral abutment surface (42) for a slide bearing (53), that said first disc (500) is positioned around the mounting tube (4) and the slide bearing (53) via a through-hole (H) in the first disc (500) so that a rotation of the mounting tube (4) can occur without the first disc (500) rotating.
17. The lock according to claim 1, **characterized in that** the motor (3) is a self-braking motor.



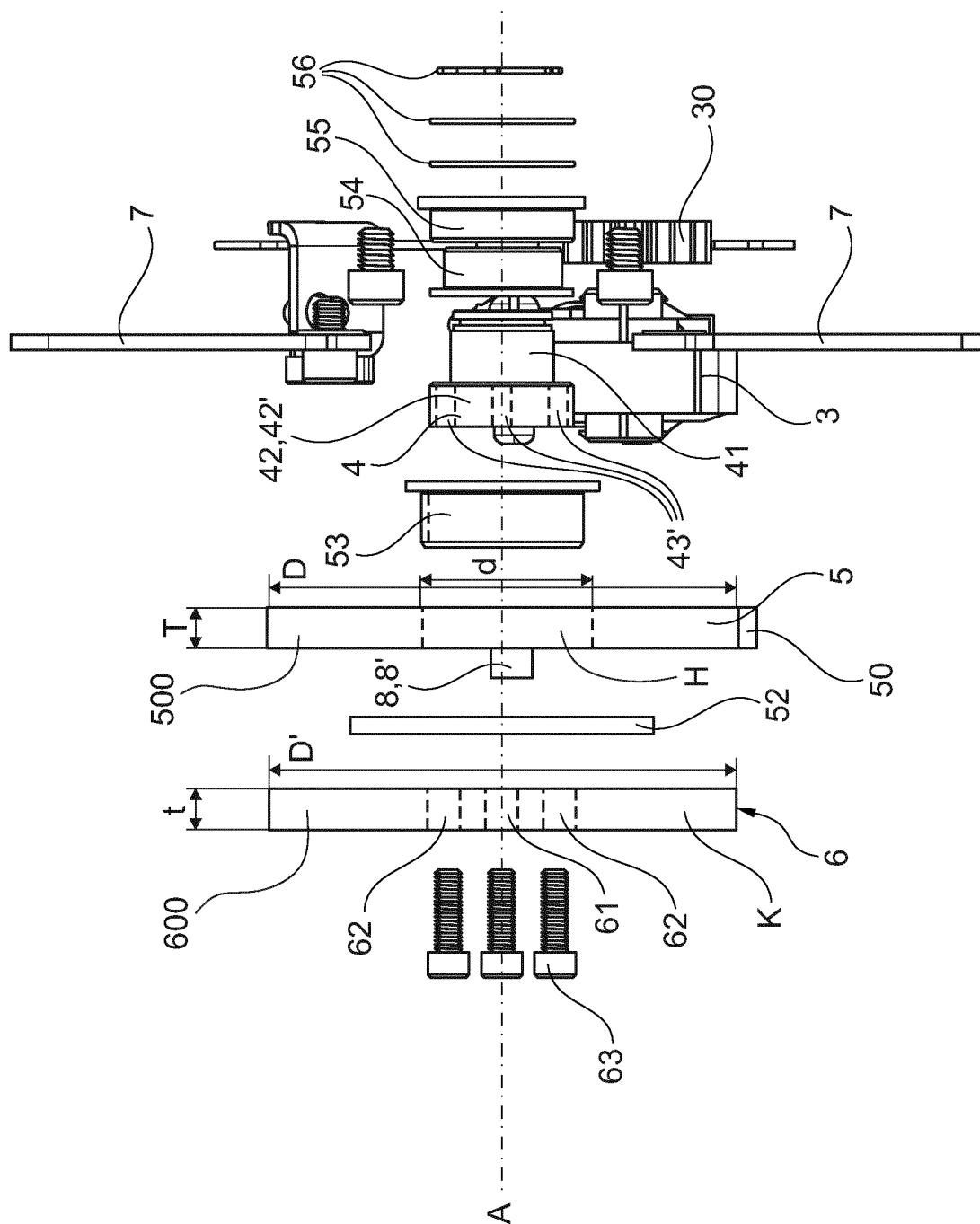


Fig. 2

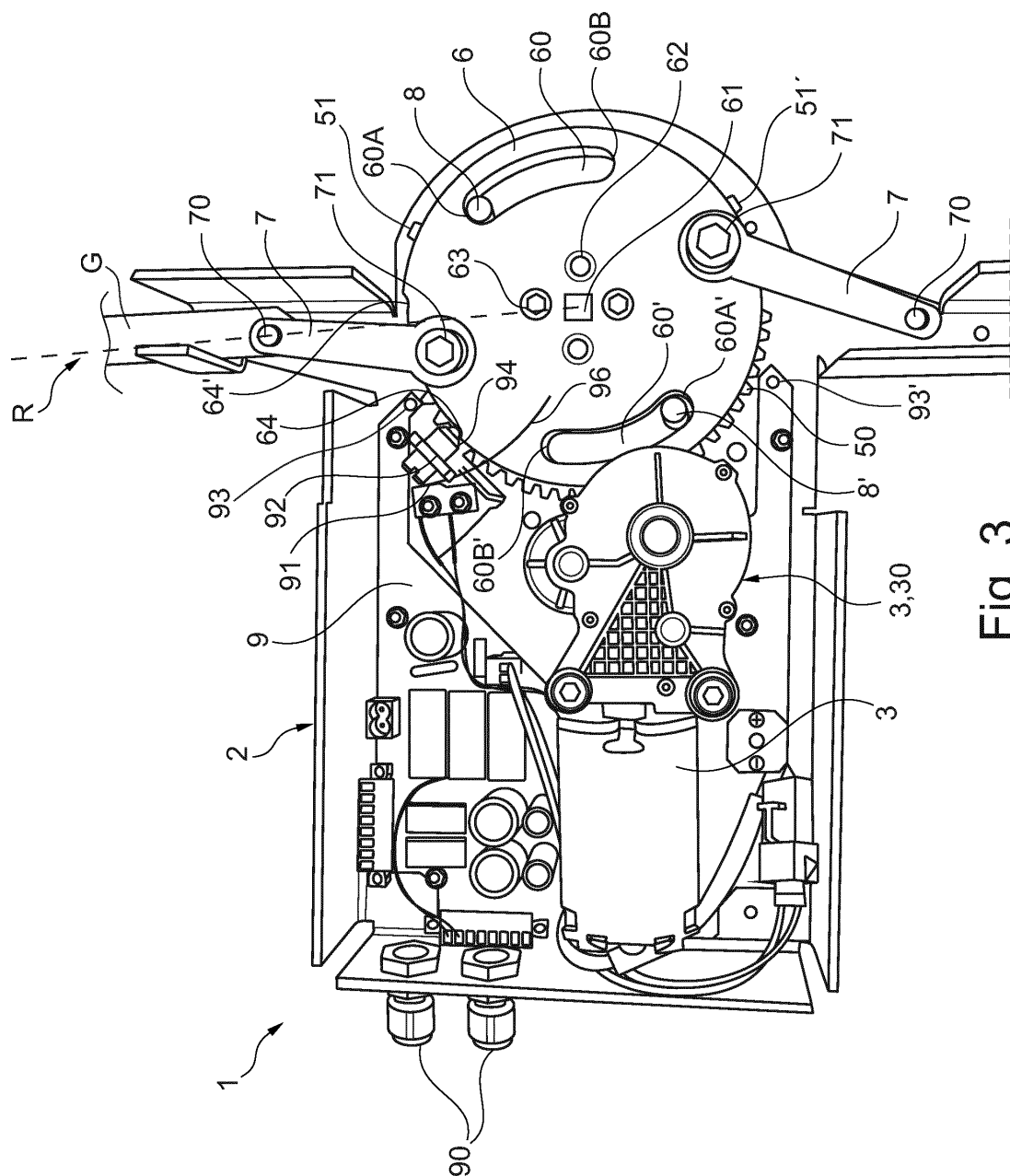
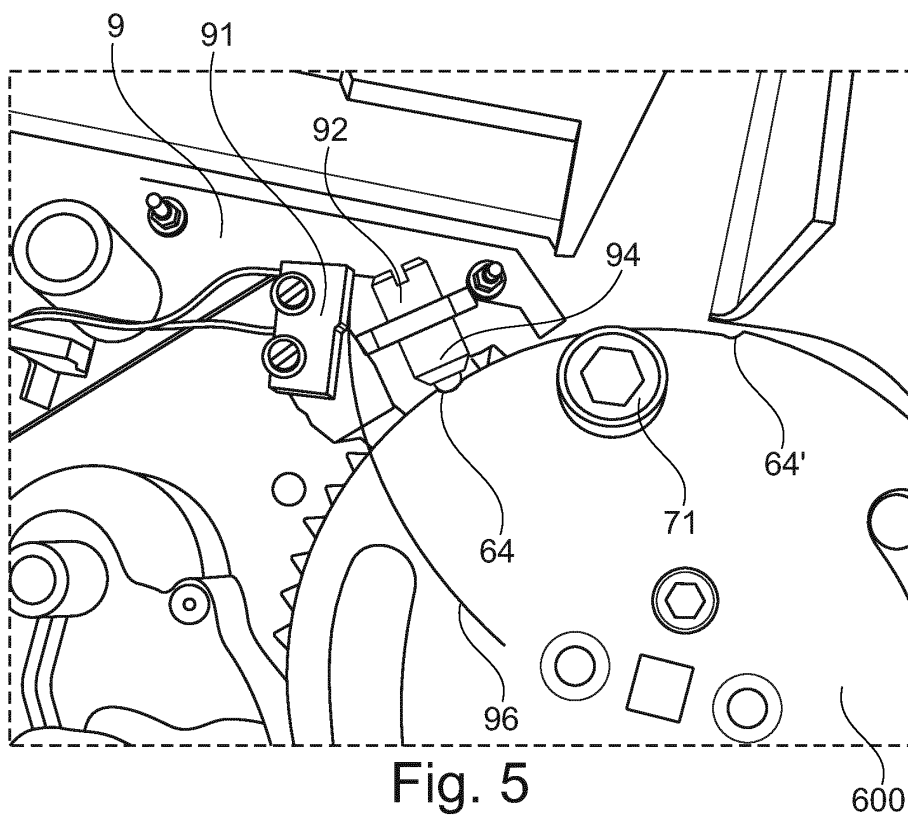
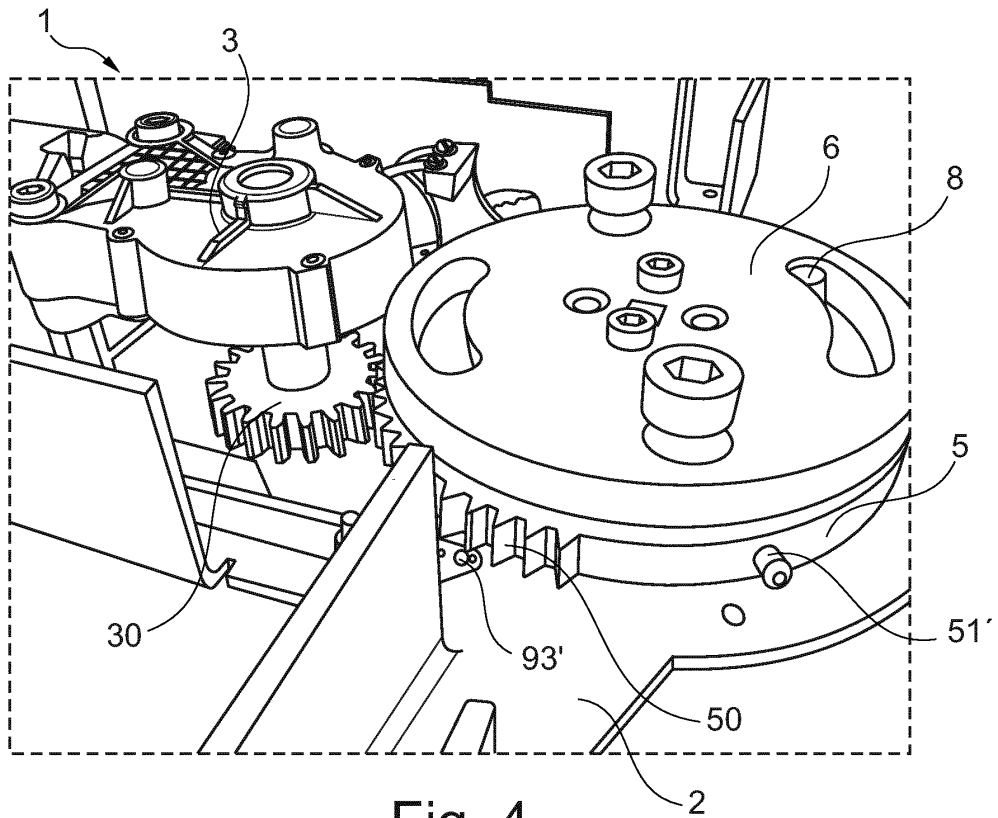
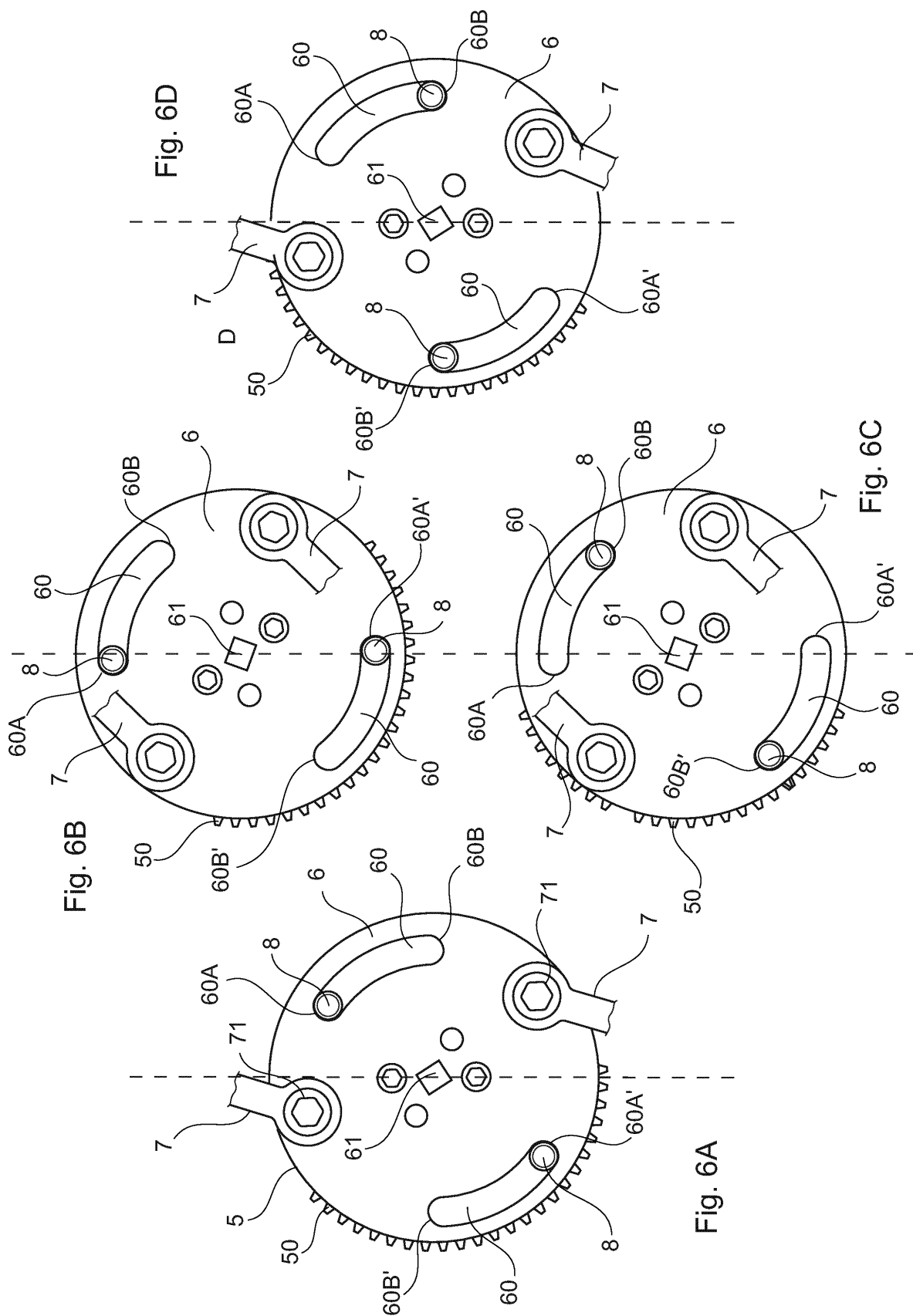
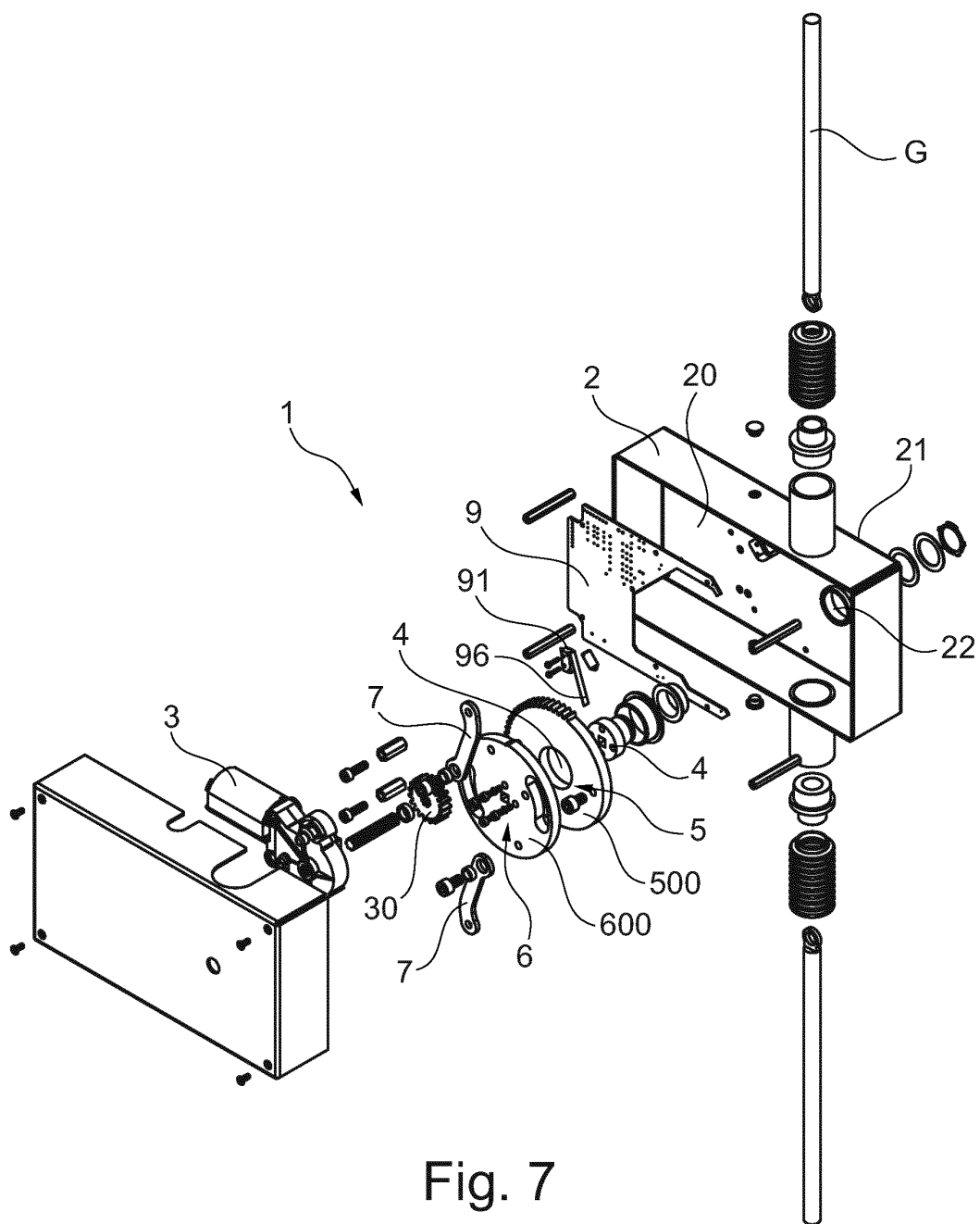


Fig. 3







REFERENCES CITED IN THE DESCRIPTION

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