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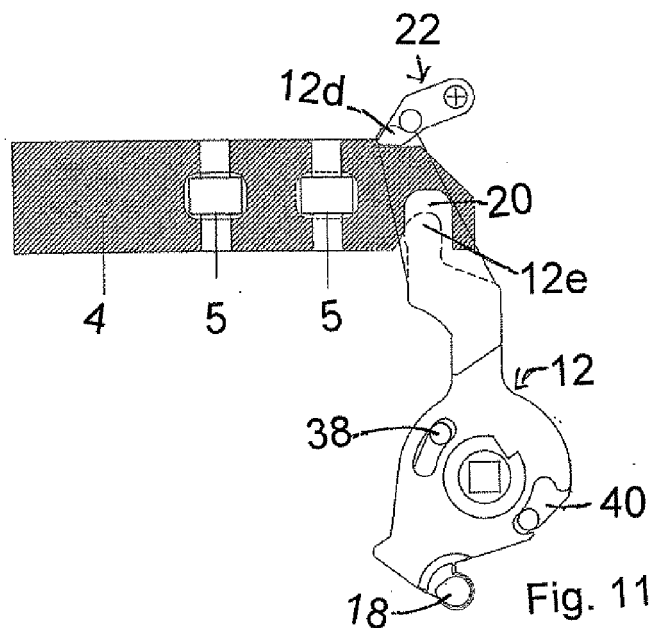
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(54) **Locking mechanism**

(57) Locking mechanism 2 with a deadlock latch 4 in which a rotary cam 12 has means 12e to move the latch 4 between retracted and throw positions. The cam 12 is a modular arrangement with at least two inserting cams 12, 14, one of which 12 is driven by a panic release, the

other of which 14 is driven by an actuator which is selectively locked by a deadlock. In one embodiment the latch 4 is provided with an anti-thrust mechanism 22, 28 to prevent the lock being forced into the retracted position whilst the cam also has means 12d to disengage the anti-thrust 22 prior to the cam 12 moving the latch 4.



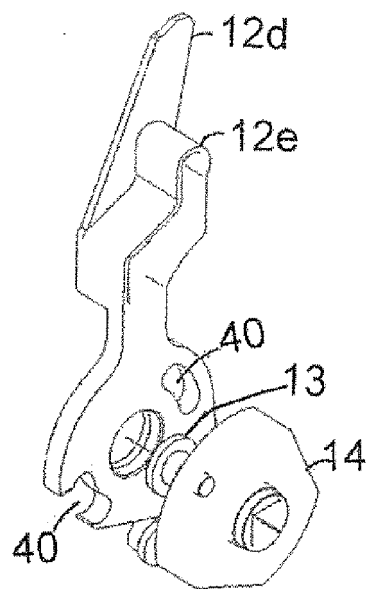


Fig. 16

Description

[0001] The present invention relates to a locking mechanism with a deadlock latch arranged to move between throw and retracted positions by a key actuator, and particular, but not exclusively a locking mechanism with a panic override.

[0002] Emergency exits are locked by a latch or bolt which is not accessible from one side of the exit, normally the outside, in order to prevent unauthorised access. The other side or the inside of the exit is equipped with a quick release mechanism which can move the latch into the retracted position enabling the exit to be opened and thereby enabling escape there through. The quick release mechanisms include apparatus such as push plates, push pads, push bars, thumb turn mechanisms etc. It is desirable to increase the functionality of the locking mechanism for emergency exits by providing a key activated lock on the outside which enables authorised retraction of the latch from the outside. One drawback of providing a lock on the outside is that in certain positions of the lock, the latch may be blocked from retracting, thus blocking the action of the panic function.

[0003] In a typical lock the drive pin of the panic release travels on a linear trajectory and it is necessary to rotate the drive handle of the panic release by 90°. This determines the length of throw of the latch, typically 16 to 20mm. This in turn, determines the strength of the lock, whether it can be forced from its mounting in the locked position. To increase the throw it is necessary to provide a longer rotation of the handle to move the drive pin further, which makes the lock harder to open in an emergency.

[0004] Locking systems are known which rely on electrical power to move the latch, however, such locks do not work in the event of a power failure. Traditionally a locking mechanism is designed for a particular use, for example, attachment of a particular drive/ key actuator and cannot be adapted to connect a different means of actuator, e.g. change from handle to push plate. Also the lock has a specific locking function deadlock being provided on one or both sides of the lock, it not being possible to change between the two. This means that a specific lock has to be manufactured and selected for a specific purpose and cannot be changed in situ without replacement of the entire lock, a time consuming and skilled task. It also means that a large number of locks need to be manufactured with consequential tooling costs, material costs etc.

[0005] It is an object of the present invention to provide a locking mechanism which overcomes or alleviates the above described disadvantages.

[0006] In accordance with the present invention there is provided a locking mechanism comprising a deadlock latch, a rotary cam arrangement to move the latch between a retracted and throw condition and an anti-thrust mechanism engaging the latch to prevent the latch being forced into its retracted condition, wherein the cam ar-

range ment has means to disengage the anti-thrust mechanism prior to it moving the latch.

[0007] The means to disengage may comprise an arm extending from a cam body of the cam arrangement. The means to move the latch may comprise a second arm extending from the cam body. The first and second arms may have different lengths and may be in the form of a unitary arm.

[0008] The latch may be provided with an aperture for retaining the end of the second arm located remotely of the cam body therein. The aperture may be larger than the end of the second arm retained therein. The aperture may be located in an edge of the latch facing the cam.

[0009] The anti-thrust mechanism may be in the form of a spring loaded latch engageable in an aperture provided on the opposite edge of the latch. The first arm may extend beyond the latch to engage the anti-thrust mechanism.

[0010] The latch may have bearings to facilitate its movement between the throw and retracted positions thereof.

[0011] In accordance with a second aspect of the present invention there is provided a modular cam arrangement for moving a latch between a retracted and throw condition, the cam arrangement comprising at least two interacting cams, one of which is rotatably driven by a panic release, the other of which is driven by an actuator, which actuator is selectively locked by a deadlock.

[0012] The cam driven by the panic release may also be lockable by the deadlock. The locking of the panic release driven cam may be by engagement with the actuator driven cam. The two cams may be interlocked for simultaneous rotation.

[0013] The two cams may be interlocked for simultaneous rotation only when the deadlock is disengaged.

[0014] The panic release driven cam may be adapted to rotate when the actuator is locked by the deadlock.

[0015] A spigot may be provided on one cam which extends into a cam guide track on the other cam to interlock the cams and to enable a rotary movement of the panic release cam when the actuator driven cam is locked by the deadlock. The cam arrangement may be adapted such that engagement of the spigot with the end of the track enables the actuator driven cam to drive the panic release drive cam when the deadlock is disengaged.

[0016] The panic release driven cam may be provided with at least two connection points for selective connection of different panic release actuators. One connection point may enable the connection of a drive pin of a panic release mechanism, the other connection point may enable the connection of a rotational drive spigot of a panic release. One of the connection points may be provided on a further cam mounted to the panic release driven cam for driving the panic release cam in a rotary motion.

[0017] A shield may be provided between the panic release driven cam and the actuator driven cam to prevent unauthorised access to the panic release.

[0018] The cams of the modular cam arrangement may

be separable to enable replacement of at least one cam therein.

[0019] At least one of the cams is spring loaded.

[0020] When a drive pin connection is provided the locking means may be provided with a rotary guide track for a drive pin of a panic release.

[0021] In accordance with a third aspect of the present invention, there is provided a method of operating a locking mechanism, the locking mechanism comprising a deadlock latch, an anti-thrust mechanism engaging the latch to prevent the latch being forced into a retracted position and cam arrangement engaging the latch and engageable with the anti-thrust latch, the method comprises the steps of rotating the cam to remove the anti-thrust out of engagement with the latch and continuing to rotate the cam to move the latch, wherein the latch is only moved after the anti-thrust has been disengaged.

[0022] By way of example only specific embodiments of the invention will now be described with reference to the accompanying drawings, in which:-

Fig. 1 is a perspective view of a housing of the locking mechanism constructed in accordance with a first embodiment of the invention;

Fig. 2 is a detail view of a cam mechanism mounted in the housing of the locking mechanism with an anti-thrust and latch of the locking mechanism;

Fig. 3 is a perspective view of the cam mechanism of Fig. 2;

Fig. 4 is an exploded view of the cam mechanism of Fig. 3 to illustrate the three separate interacting cams;

Fig. 5 is a front view of the cam mechanism;

Fig. 6 is a longitudinal sectional view along the line A-A of Fig. 4;

Fig. 7 is an opposite side view of the cam mechanism;

Fig. 8 is a longitudinal sectional view of the housing to illustrate the position of the cam mechanism with respect to the latch and anti-thrust;

Fig. 9 is a schematic view of an alternative form of the cam 12;

Fig. 10 is a view similar to Fig. 7 showing a further embodiment of a cam arrangement and a modification to the latch;

Fig. 11 is a view similar to Fig. 2 of the embodiment of Fig. 10;

Fig. 12 is a front view of the cam arrangement of Fig. 10;

Fig. 13 is a side view of the cam arrangement of Fig. 10;

Fig. 14 is a rear view of the cam arrangement of Fig. 10

Fig. 15 is a section along B-B of Fig. 12; and

Fig. 16 is an exploded view of the cam arrangement of Fig. 10.

[0023] As illustrated in Fig. 1 the locking mechanism comprises a housing 2, a bolt or latch 4 which is selectively, reciprocally, mounted in the housing 2, to enable the latch 4 to move between a throw and retracted position. In the throw position, the latch 4 is adapted to protrude outwardly of the housing 2 to facilitate a locked condition of the locking mechanism. In the retracted position the latch 4 is substantially retracted into the housing to facilitate an unlocked condition of the housing mechanism.

[0024] The housing 2 is provided with an opening 6 to enable connection of a lock release mechanism (not illustrated) to an internal linkage mechanism 8 provided within the housing 2, the linkage mechanism to be described further herein under. The lock release may be in the form of, for example, a lever handle, push plate, push pad or actuator. The lock release is operably connected to a deadlocking device (not illustrated). A further aperture 7 is provided in the housing 2 for connection of the deadlocking device to the lock release. The interaction of the deadlocking device and lock release is standard and will not be described further, it only be necessary to state that, the lock release will not activate the internal linkage mechanism until the deadlocking device is disengaged.

[0025] The deadlock may be disengaged either by power or manually. On the opposite side of the housing 2, to that illustrated, is provided a further aperture 9 for the connection to the internal linkage mechanism of a panic release mechanism.

[0026] The internal mechanical linkage is operable by the panic release mechanism to quickly move the latch 4 into the retracted position, enabling the exit to be opened.

[0027] The internal mechanical linkage 8 between the panic release or lock release and the latch 4 is best illustrated in Figs. 3 and 4 and is in the form of a cam mechanism which has three cams 10, 12, 14 which are interconnected to provide a plurality of rotational movement combinations.

[0028] The cams 10, 12, 14 comprises two outer cams 10, 14 and an inner cam 12.

[0029] The inner cam 12 comprises a substantially annular main body 12a with two oppositely disposed arms

12b, 12c extending outwardly from the periphery thereof. A first of the arms 12b carries two apertures 16, 18, located remotely of the main body 12a. A first of the apertures 16 is adapted to receive a drive pin (not illustrated) of a panic release mechanism mounted to the housing 2. The drive pin is adapted to rotate the middle cam 12 anticlockwise when the panic release is operated. The second aperture 18 connects a return spring (not illustrated) to the cam 12 which is adapted to return this cam 12 to its start position.

[0030] The second arm 12c depends from the opposite peripheral edge of the main body 12a to that of the first arm 12b. This second arm 12c comprises two prongs 12d, 12e a first of which 12d is longer than the other prong 12e, as best illustrated in Figs. 6 and 8. The shorter of the two prongs 12e, as best illustrated in Figs. 2 and 8 sits in an engagement aperture 20 provided in an outer surface of the latch 4 which faces the cam 12. The engagement of the prong 12e in the engagement aperture 20 of the latch 4 enables selected liner reciprocal movement of the latch 4 between the throw and retracted positions; in that rotation of the cam 12, by the drive pin of the panic release mechanism, in the anticlockwise direction X, drives arm 12 c anticlockwise pulling the latch 4 into the housing 2 into its retracted position. This is via the pushing action of prong 12e in the aperture 20 of the latch 4. Whereas the action of the return spring moves the cam 12 clockwise, consequently moving the arm 12c clockwise whereby its prong 12e drives the latch 4, via its engagement in the aperture 20, out of the housing 2 back into the throw position thereof.

[0031] The longer of the prongs 12d, extends beyond the latch 4 to moveably engage an anti-thrust lever 22 for the latch 4. This provides an anti-thrust mechanism for the latch 4 to prevent the external forcing of the latch 4 into its retracted position. The anti-thrust lever 22 is pivotally mounted via a pin or fulcrum 24. One end of the anti-thrust lever 22 extending one side of the pin 24 has a pointed end or tongue 26 which realisably engages in an aperture 28 provided in the outer surface of the latch and is the end of the lever engaged by the prong 12d. The opposite end of the anti-thrust lever 22, at the opposite side of the pivot point 24 is provided with an aperture 30 which connects a return spring not illustrated.

[0032] In use the anti-clockwise rotation of the cam 12 by the drive pin of the panic release drives the longer prong 12d anticlockwise, which pushes the tongue 26 of the anti-thrust lever 22 out of the engagement within the anti-thrust aperture 28 of latch 4, which then enables the movement of the latch 4 by the other shorter prong 12e.

[0033] The latch 4 is not able to be moved until the anti-thrust mechanism 22, 28 has enabled release of the latch 4.

[0034] The aperture 20 in the latch 4 (as best illustrated in Fig. 2) in which prong 12e engaged, is wider than the shorter prong 12e. Thus when the cam 12 starts to rotate the prong 12e does not immediately drive the latch 4, until it rotates sufficiently far enough to engage the wall

of the aperture 20. This provides a degree of play, enabling the safe release of the anti-thrust mechanism by the longer prong 12d, before the latch begins to move. This prevents long term use damage to the anti-thrust mechanism.

[0035] In a modification to the latch, as best illustrated in Figs. 10 and 11, the latch 4 is modified to include a pair of rollers 5 mounted within its body extending to the outer surface thereof. One roller 5 extends through one face, the other through the opposite face of the latch 4. The rollers are offset to spread the load.

[0036] These rollers 5 provide bearings enabling the smoother movement of the latch 4 when it is fired into receiver 3 provided in lock housing 2 and when it fires out of the housing 2 when opening the lock. This enables the lock to be opened with a lighter force to the panic release and thereby a further reduction in the length of the movement of the panic release required to release the exit in an emergency.

[0037] The presence of the cam 12 enables the mounting of the drive pin of the panic release on a curved trajectory (not illustrated). This throws the cam more quickly and together with the length of the cam arm 12c, more specifically cam prong 12e, which engages in the latch 4, enables a longer throw for the latch with minimum rotation of a, for example, drive handle.

[0038] In one example, the longitudinal length of the cam including arms is 107cm. Cam prong 12e extends 50cm from the rotational centre of cam 12. The aperture 16 for drive pin is 22cm from a plane passing through the rotational centre and offset relative to the rotational centre. This arrangement enables a throw of 37mm with a minimal handle rotation of 30°. This enables an increased security, the additional length further reducing the possibility of the latch being jimmied from its mounting when locking an exit, which provides an easier operation of the handle or push pad actuator.

[0039] As mentioned above, cam 12 is rotatably mounted within two other cams 10, 14.

[0040] Cam 10 is provided in the internal aperture 32 of the annular main body 12a of cam 12. The outer peripheral surface of the cam 10 is profiled and adapted to fit into a similarly profiled surface on the inner periphery of the aperture 32 of cam 12. Thus rotational movement of cam 10 drives a corresponding rotational movement in cam 12. By this means a rotational drive spigot (not illustrated) of a panic release mechanism, inserted into spigot receiving aperture 34 provided in cam 10, which spigot demonstrates a rotational movement when the panic mechanism is operated can rotate cam 12 via cam 10.

[0041] By this means cam 12 is operable by a slider of a panic release via a drive pin thereof in engagement within aperture 16 of the arm 12b of cam 12 to rotate the cam 12. Or by the rotational movement of the spigot which drives cam 10. This enables different types of panic release mechanisms to be connected to the same locking mechanism, with the associate form of operating the cam

(linkage) mechanism, slider or rotational to be connected to the cam to enable the operation of cam 12 and release of the locking mechanism. Or by both if panic release is equipped with both means for activating the locking device.

[0042] During operation of the panic release function described above, the final cam, cam 14 does not rotate. Cam 14 is designed to rotate cam 12 only when the deadlock is disengaged. Cam 14 has a substantially annular main body 14a with a central annular shoulder 36 extending outwardly therefrom. The shoulder 36 fits into an annular channel 37 provided in the opposite side of cam 10 to the spigot aperture 34. The cam 14 thus is retained for a free rotational movement within the channel 37 of cam 10 mounted within aperture 32 of the cam 12. Thus when cams 12 and 10 rotate they do not move deadlock cam 14.

[0043] Cam 14 is additionally provided on one side with a pair of diagonally disposed spigot 38, which face the cam 12. Within the main body 12a of cam 12 is provided a corresponding pair of curved slots 40 into which a respective spigot 38 extends. The opposite side of cam 14 is provided with a spigot receiving aperture 42 for receipt of a spigot of a lock release (not illustrated), which as mentioned previously is operably connected to a deadlocking device. Once the deadlocking device has been deactivated the lock release is able to be activated which then rotates cam 14. The spigots 38 by this means rotate within their respective slots 40 and once they engage with the end of their slot 40, the cam 12 rotates along with the cam 14 enabling prongs 12d to initially disengage the anti-thrust 22 and then prong 12c to retract the latch 4. By this means it is possible to enter the emergency exit by unlocking the locking mechanism from the opposite side of the exit to that of the panic release mechanism. The cam 14 is equipped with a spring return (not illustrated) enabling the return of the cam 14 to its initial locked position.

[0044] The three cam arrangement enables the connection of a plurality of different lock release means with disengagement of the anti-thrust prior to the movement of the latch. This enables a simplification of the manufacturing process, in that a single locking mechanism can be easily adapted on site during fitting by selection of the appropriate connection on the locking mechanism to drive the locking mechanism, enabling the connection of a variety of different release mechanisms, thereby obviating the need for a specific locking device with means to connect to a specific release mechanism.

[0045] The locking mechanism of the above described embodiment can be used to lock, for example, an emergency exit from a building. Unauthorised entrance to the building is prevented by the deadlock, whilst escape from the building is simply achieved by a single action activation of the panic release to unlock the exit.

[0046] In a second embodiment of the locking mechanism, the mechanism is modified to provide a locking mechanism in which the panic release can be locked by

the deadlock and it is then necessary to deactivate the deadlock to enable activation of the panic release. This arrangement increases the security of the locking mechanism by also preventing unauthorised opening of the emergency exit from the inside of the building. To this end a simple modification to the internal mechanical linkage is rendered to alter the size of the slots 40 in cam 12. This is illustrated in Fig. 9 in which the shorter slots are indicated by the numeral 40'. There is no other alteration or modification to the cam 12. The slots 40' enable spigots 38 of cam 14 to snugly fit therein to effectively lock the three cams 10, 12, 14 together for simultaneous rotation. As in the previous embodiment cam 12 is locked, that is prevented from rotating, until the deadlock has been released. By this means cams 12 and 10 are also locked by their engagement with cam 12 until the deadlock is deactivated enabling rotation of cam 12. To this end deadlock release means is accessible from the inside. Once the deadlock is deactivated, activation of the panic release is then able to rotate cams 10 and 12 as per the previous embodiment to remove the anti-thrust from the latch and then retract the latch 4. The deadlock release could be connected to an alarm system to indicate deactivation.

[0047] The modular arrangement of the three cams simplifies the manufacture of the lock. It simply being necessary to replace cam 12. This can be done at the time of manufacture, or in situ if the type of locking release is to be altered, from deadlock to a single action release, or visa versa, of the panic release. Since only the size of the slots in cam 12 have been altered and all other elements of its locking action remain the same, then no other alteration to the locking mechanism is required. This locking mechanism can thereby serve several functions. As mentioned previously, different types of activation means can be connected to drive the locking mechanism, which can be selected when fitted on site, or even altered when a different activation means is required. Also adjustment of the locking function is achieved by simply changing cam 12. Whilst complete replacement of cam 12 has been described, it is to be understood that the slots in cam 12 could simply be adjusted in size using, for example, an insert to achieve the same change in function.

[0048] Although cams 10 and 12 have been described as separate items, it is to be understood that these cams could be formed as a unitary item as illustrated in Figs. 10 to 16. In this embodiment instead of cam 10 being provided as an insert in the internal aperture 32 of the main body 12a of cam 12, cam 12 is instead cast to provide an integral protuberance 10. The protuberance 10 provides an equivalent function to cam 10 enabling connection of a panic release mechanism via spigot receiving aperture 34, thus allowing rotation of the cam 12.

[0049] In this embodiment a hardened metallic insert or plug 13 is located in aperture 32 of the main cam body 12a. This shields the release mechanism provided by the panic release from attack from drilling from the exterior of the exit.

[0050] Cam 14 fits into the aperture 32 as described above but with plug 14 providing a suitable recess for receipt thereof.

[0051] Whilst the cam 14 has only been described as having a spigot receiving connection for enabling its rotation, a pivotal connection, similar to apertures 16, 18 of cam 12 could also be provided.

[0052] It is of course to be understood that the invention is not intended to be restricted to the details of the above described embodiments which are described by way of example only.

Claims

1. A modular cam arrangement (12,14) for moving a latch (4) between a retracted and throw condition, the cam arrangement (12,14) comprising at least two interacting cams (12,14), one of which (12) is rotatably driven by a panic release, the other of which (14) is driven by an actuator, which actuator is selectively locked by a deadlock.
2. A modular cam arrangement according to claim 1, wherein the cam (12) driven by the panic release is lockable by the deadlock by engagement with the actuator driven cam (14).
3. A modular cam arrangement according to claim 1 or 2, wherein the two cams (12,14) are selectively interlocked for simultaneous rotation when the deadlock is disengaged.
4. A modular cam arrangement according to any of claims 1 or 3, wherein the panic release driven cam (12) is adapted to rotate when the actuator is locked by the deadlock.
5. A modular cam arrangement according to any one of claims 1 to 4, wherein a spigot (38) is provided on one cam (12,14) which extends into a cam guide track (40,40') on the other cam (14,12) to interlock the cams and to enable a rotary movement of the panic release cam (12) when the actuator driven cam (14) is locked by the deadlock, and wherein the cam arrangement (12,14) is adapted such that the engagement of the spigot (38) with the end of the track (40) enables the actuator driven cam (14) to drive the panic release driven cam (12) when the deadlock is disengaged.
6. A modular cam arrangement according to any one of the preceding claims, wherein the panic release driven cam (12) is provided with at least two connection points for selective connection of different panic release actuators.
7. A modular cam arrangement according to claim 6,
8. A modular cam arrangement according to claims 6 or 7, wherein one of the connection points is provided on a further cam (10) mounted to the panic release driven cam (12) for driving the panic release cam (12) in a rotary motion.
9. A modular cam arrangement according to any one of the preceding claims, wherein the cams (10,12,14) of the modular cam arrangement are separable to enable replacement of at least one cam therein.
10. An arrangement according to any one of the preceding claims, wherein at least one of the cams is spring loaded.
11. A modular cam arrangement according to anyone of the preceding claims, wherein a shield (13) is provided between the cams (12,14) to prevent unauthorised access to the panic release.
12. A modular cam arrangement as described in any one of the preceding claims, in which the cam arrangement is located in a locking mechanism comprising a deadlock latch (4) and an anti-thrust mechanism (22) engaging the latch (4) to prevent the latch (4) being forced into its retracted condition, wherein the cam arrangement (12,14) has means to disengage the anti-thrust mechanism (22) prior to it moving the latch (4).
13. A modular cam arrangement according to claim 12, wherein the means to disengage comprises an arm (12d) extending from panic release driven cam (12) of the cam arrangement (12,14), and the cam arrangement has means to move the latch (4) comprising a second arm (12e) extending from the panic release driven cam (12).
14. A modular cam arrangement according to claim 12 or 13, wherein the latch (4) is provided with an aperture (20) for retaining the end of the second arm (12e) located remotely of the cam body (20) therein, which aperture is larger than the end of the second arm (12e) retained therein.
15. A modular cam arrangement according to claim 12, 13 or 14, wherein the anti-thrust mechanism is in the form of a spring loaded latch engageable in an aperture (28) provided on the opposite edge of the latch (4).

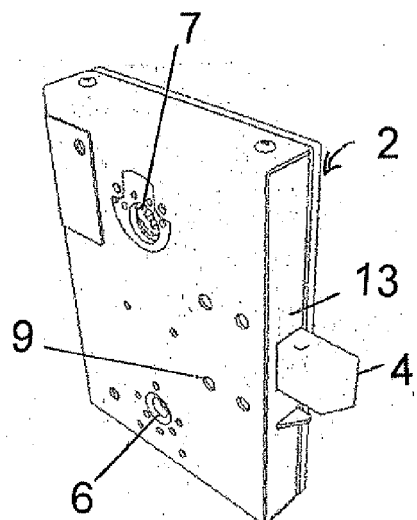


Fig. 1

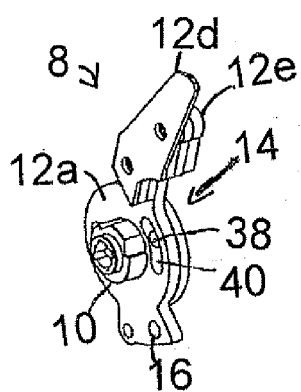


Fig. 3

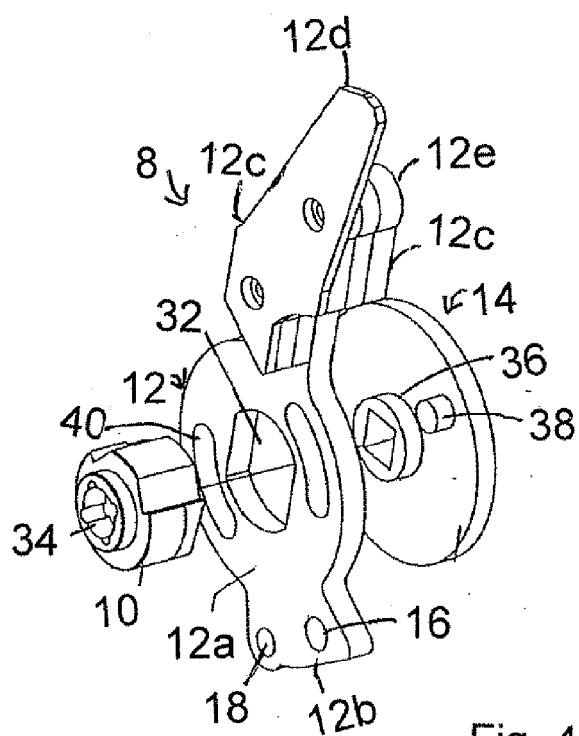


Fig. 4

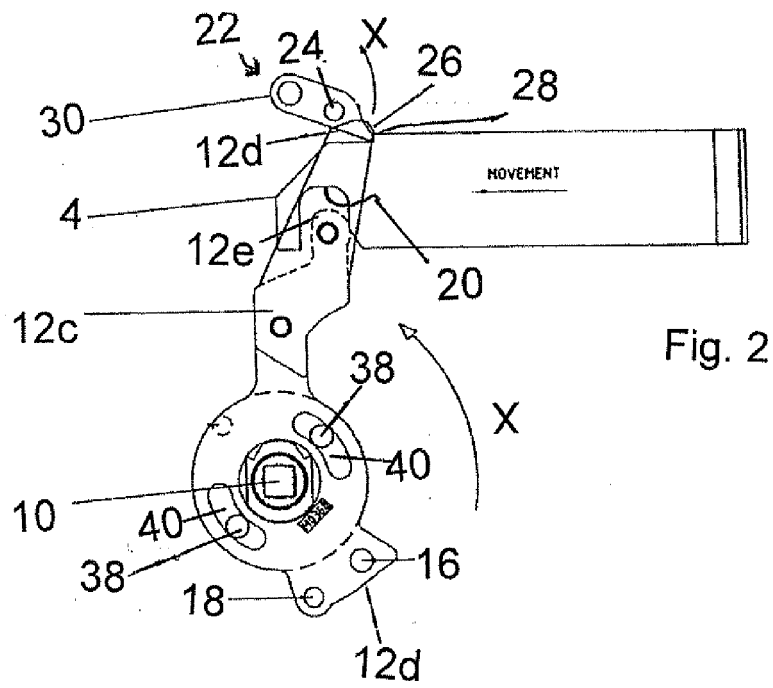


Fig. 2

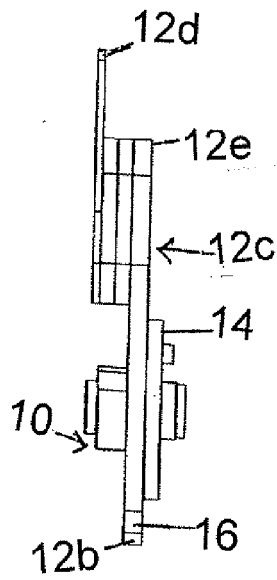


Fig. 7

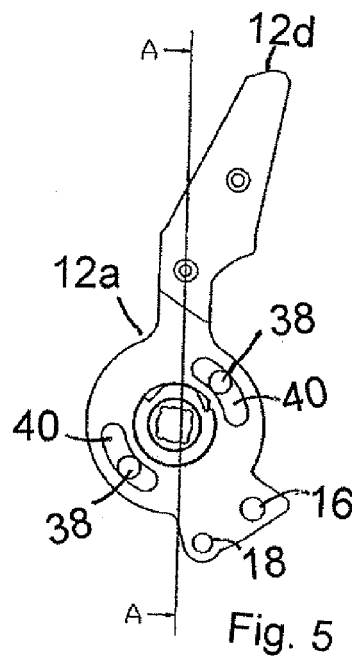


Fig. 5

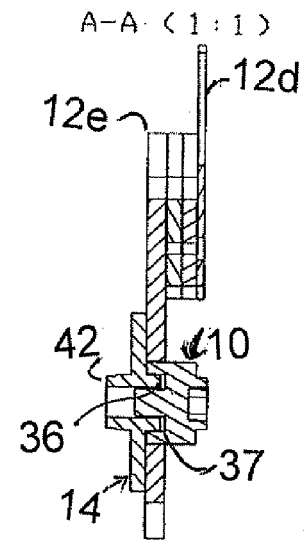


Fig. 6

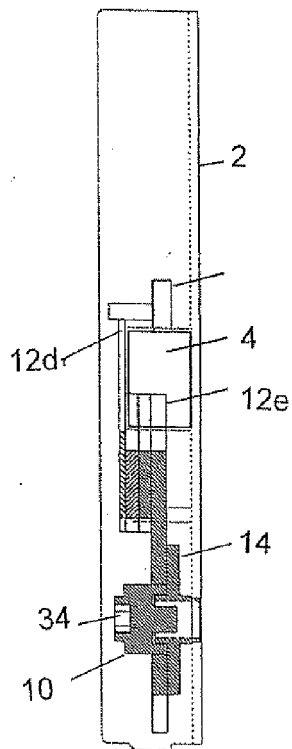


Fig. 8

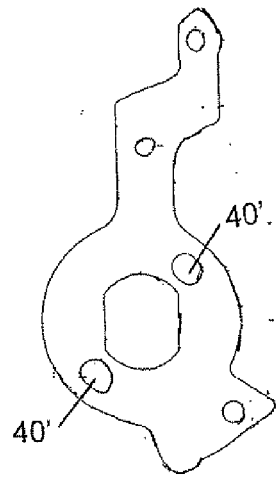


Fig. 9

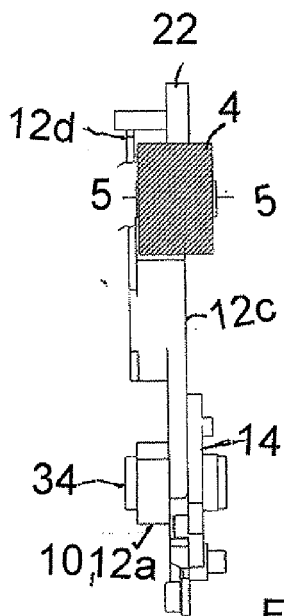


Fig. 10

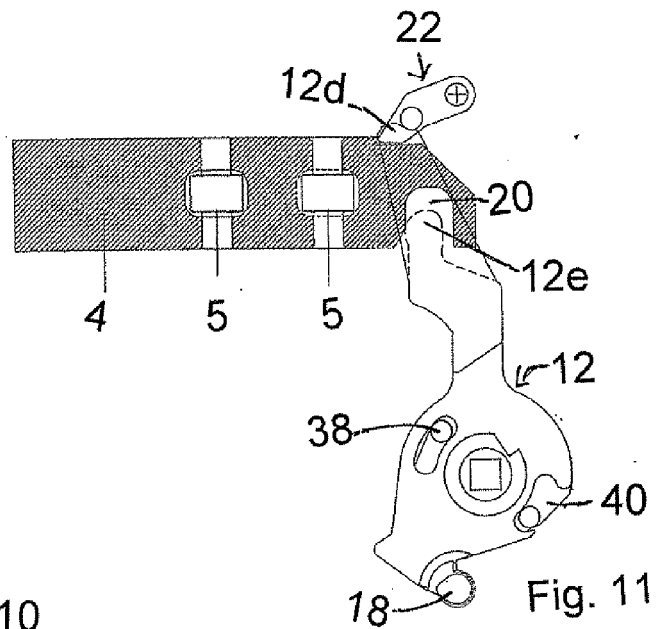


Fig. 11

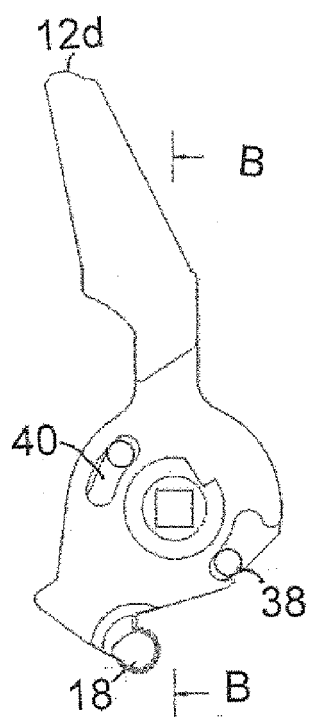


Fig. 12

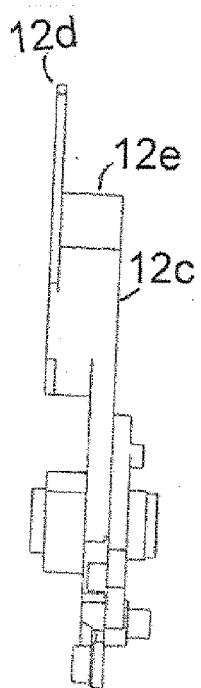


Fig. 13

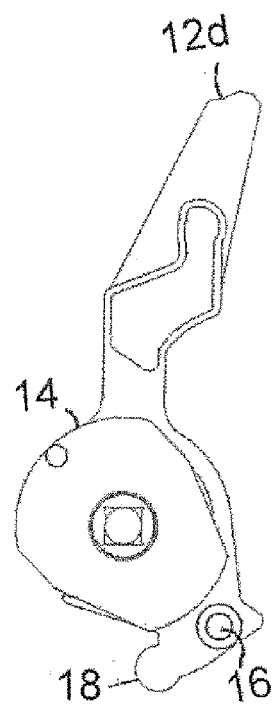


Fig. 14

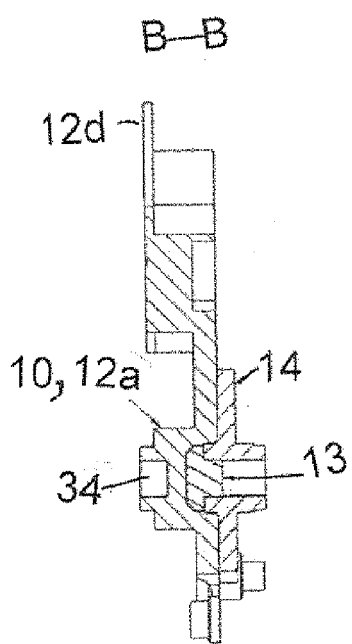


Fig. 15

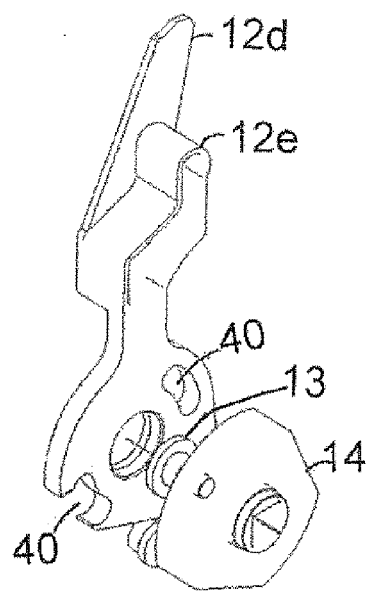


Fig. 16