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(71) Applicant: **VON DUPRIN, INC.**
Indianapolis, IN 46219 (US)

(72) Inventors:
- **Trent, Bradley W.**
  Indianapolis, Indiana 46250 (US)
- **Coleman, Michael D.**
  Noblesville, Indiana 46060 (US)

(74) Representative: **Feakins, Graham Allan et al**
RAWORTH, MOSS & COOK
RAWORTH HOUSE
36 Sydenham Road
Croydon, Surrey CRO 2EF (GB)

(54) Inertial blocking mechanism for use with an exit device

(57) An inertia operated blocking mechanism (40) for use with an exit device (10) which utilises a mass arm (50) on a rotatable link (41) to rotate, as a result of an impact loading on the non-device side of a door, the rotatable link into a confronting position with a pushbar (12) to prevent pushbar movement, relative to the exit device and door, caused by the impact loading, and therefore, prevent inadvertent device operation as a result of the impact loading.

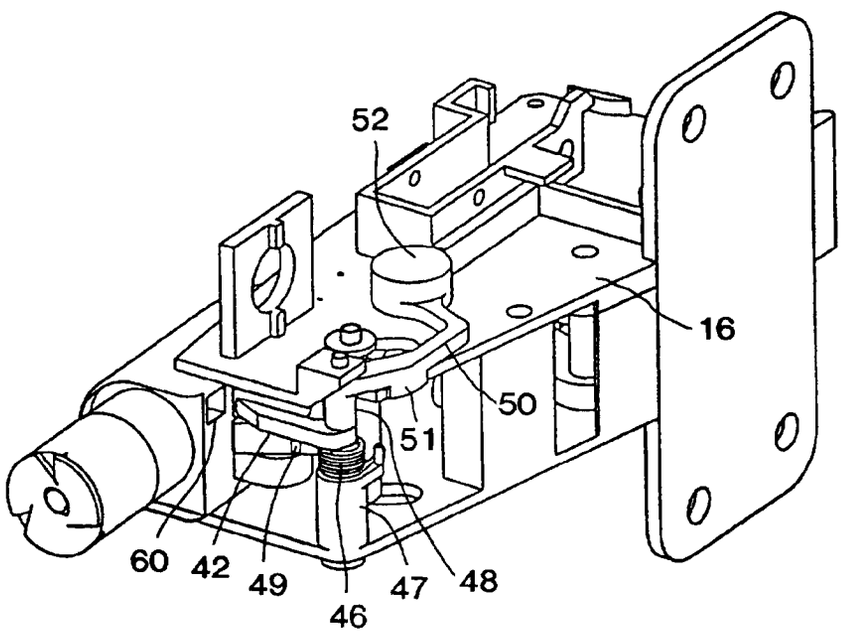

FIG. 2

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Description

[0001] This invention relates generally to exit devices and more particularly to an inertial blocking mechanism for use with an exit device.

[0002] The main purpose of an exit device is to keep a door securely locked to the outside, while providing fast and easy egress from the inside during an emergency situation. Most panic devices are designed with features that prevent tampering with the latch from either side of the door. This helps to ensure their functionality and reliability. It also helps to prevent access by any unauthorised persons, such as vandals or burglars. Many current exit device designs rely on a deadlocking feature to help provide these functions. Deadlocking of the latchbolt prevents tampering by only allowing the latchbolt to move if the motion is initiated by the device actuation member, i.e., the pushbar being depressed. Any other attempts to open the door without utilising the actuator, such as sliding a credit card through a crack in the door to force back the latchbolt, are pointless if the latch is deadlocked.

[0003] Although the deadlocking feature has proved satisfactory for some time, it has now been discovered that deadlocking alone may not be enough to keep unwanted persons out. While testing exit devices to see how they measure up against the newest hurricane building codes in Florida, it was found that a strong impact to the door from the outside, such as from a wind driven piece of lumber or large tree branch, may cause an exit device to unlatch and the door to swing open. Further investigation revealed that a heavy impact on the non-device side of the door may cause the pushbar to depress on its own, releasing the latchbolt from the deadlocking and allowing the door to open. This was determined to be caused by the considerable accelerations imparted to the device through the door. The flexing in the door allowed the relative accelerations between the pushbar and the rest of the device to release the deadlocking because the pushbar actually moved enough, relative to the device itself, to actuate it.

[0004] According to the present invention, there is provided an inertial blocking mechanism for use with an exit device mounted on a first side of a door, the other side of the door being the non-device side, the exit device having an actuating member moveable between a pre-operated position and an operated position, the inertial blocking mechanism being characterised by a blocking arm for blocking movement of the actuating member from the pre-operated position to the operated position and an inertial means for moving the blocking arm into a confronting position with the actuating member, blocking movement of the actuating member, when the non-device side of the door is subjected to an impact load.

[0005] The invention also extends to an exit device for mounting on a first side of a door, the other side of the door being the non-device side, the exit device comprising a latch mechanism and an actuating member operably connected to the latch mechanism and the actuating member being moveable between a pre-operated position and an operated position and being characterised by an inertial blocking mechanism essentially as just defined.

[0006] For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:-

Fig. 1 is a top view of an inertial blocking mechanism for use with an exit device;

Fig. 2 is a perspective view of the inertial blocking mechanism shown in Fig. 1;

Fig. 3 is a side view of the inertial blocking mechanism shown in Fig. 1;

Fig. 4 is a perspective view of the inertial blocking mechanism shown in Fig. 1, illustrating normal operation of the exit device pushbar;

Fig. 5 is a perspective view of the inertial blocking mechanism shown in Fig. 1, illustrating impact operation of the inertial blocking device;

Figs. 6A and 6B are schematic representations of the inertial blocking mechanism illustrating, respectively, the pre-operation position of the exit device and normal operation of the exit device; and

Figs. 7A and 7B are schematic representations of the inertial blocking mechanism illustrating the impact operated position of the inertial blocking mechanism and the exit device.

[0007] Figs. 1 to 3 show a portion of an exit device 10 incorporating an inertial blocking mechanism 40 for blocking actuation of the exit device 10 as a result of impacts on the non-device side of the door. The exit device 10 includes a pushbar 12 that is operably connected to a latchbolt 14. This inertial blocking mechanism 40 stops the motion of the pushbar 12 (only the end cap portion of the pushbar being shown in the drawings) in the event of a large impact from the outside, and, therefore, keeps the latchbolt 14 in the deadlocked state so the door does not open. The inertial blocking mechanism 40 is never engaged during ordinary operation of the exit device 10, but, when subjected to larger accelerations, the device 40 moves to a blocking state. The inertial blocking mechanism 40 can work with many types of exit devices, such as cross bars, or pushbars using scissors, bell cranks or hinge mechanisms.

[0008] Using a blocking mechanism that can be actuated only when an impact occurs to the non-device side of the door is ideal. If it were possible that the pushbar

motion could also be impeded due to an impact on the device side, it could impede egress from a building, which is not desired of an exit device. This impact resistance mechanism 40 cannot be affected by someone hitting the pushbar abnormally hard, or by any other impacts to the device side of the door, because of the fact that it is based on inertia. Acceleration from the device side will only act to hold the mechanism 40 firmer in its non-confronting position because it cannot rotate any farther in the counter-clockwise direction. By making the blocking motion depend on high acceleration from one particular direction only, i.e., the outside, the potential egress preventing problem is avoided.

[0009] The inertial blocking mechanism 40 is essentially made up of three fundamental parts, a rotatable link 41, a torsion spring 46 and a pin 43. The rotatable link 41 consists of a mass arm 50 with a mass 52 at its end located outside the exit device housing 16 that extends toward the door stile. The rotatable link 41 also has a blocking arm 42 that extends in a direction almost perpendicular to the pushbar 12. These two arms 50, 42 are located at opposite sides of a base cylinder 48 that rotates about the pin 43. The pin 43 is located below the pushbar 12 and extends all the way through both sides of the exit device housing 16. A large stepped boss 47 extending from inside the housing 16 supports the first half of the pin 43, and the rotatable link 41 is supported by the remainder of the pin 43. The torsion spring 46 is located around the smaller stepped end of the stepped boss 47 next to the rotatable link 41. The spring 46 pushes on a small boss 49 extending from the blocking arm 42 and is grounded on part of the stepped boss 47 next to the rotatable link 41.

[0010] Under normal conditions and during ordinary operation of exit device 10, the inertial blocking mechanism 40 is held in a fixed position that does not interfere whatsoever with the pushbar motion or any other parts of the exit device 10. Unless there is an impact from the non-device side of the door, it is as though the inertial blocking mechanism 40 is not even present in the exit device 10. The torsion spring 46 holds the rotatable link 41 such that the blocking arm 42 is in a non-confronting position with the pushbar 12. In one embodiment, shown in the drawings, this is accomplished by cutting a pocket or aperture 60 into the underside of the pushbar 12 end cap to allow the pushbar 12 to travel its full actuation distance 91 without contacting or confronting the tip of the blocking arm 42. The torsion spring 46 applies a constant counter-clockwise moment to the rotatable link 41, firmly holding the blocking arm 42 in its pre-load (non-confronting) position, and allowing the aperture 60 in the pushbar 12 to slide over it as the pushbar 12 is actuated (See Fig 6B). A small pad 51 extending from the mass arm 50 in toward the housing 16 controls the pre-load position of the rotatable link 41 because the torsion spring 46 acts to hold the pad 51 flush against the housing 12 edge. This flush position is maintained at all times under normal conditions, ensuring that there will be no interference with the normal operation of the exit device 10.

[0011] However, when an impact occurs to the outside or non-device side of the door, the rotatable link 41 rotates approximately nine degrees clockwise (in the direction of arrow 80) around the axis 70 of the pin 43. This moves the blocking arm 41 into the path of the pushbar 12 (or a confronting position) and does not allow the pushbar 12 to travel the minimum distance 92 to actuate the device (see Figs. 6A, 7A and 7B) This rotation occurs because of the relative accelerations that result from impact. The impact actually causes the door to move toward the device 10, while the pushbar 12 and mass 52 tend to stay where they are due to inertia. In a relative co-ordinate system, this can be looked at as the pushbar 12 and mass 52 moving toward the door and the door not moving at all, which is an easier way to think about it. The acceleration from the impact results in forces (F = ma) that act on the pushbar 12 and the rotatable link 41. These forces are applied at the respective centres of gravity. Since the centre of gravity of the rotatable link 41 is located near the end of the mass arm 50 (due to the mass 52 being located at the end of the mass arm 50), it creates a moment about the pin 43 that temporarily overcomes the torsion spring 46 and causes the blocking arm 42 to rotate clockwise into the pushbar 12 path. The timing of this rotation, with respect to the timing of the pushbar 12 movement, is extremely important, because it must occur before the pushbar 12 has moved far enough to trap the blocking arm 41 in the aperture 60. If the blocking arm 41 is late, it will not stop the pushbar 12 from actuating the exit device 10. The torsion spring 46 and mass arm 50 and mass 52 must be designed to ensure that this does not happen. Once the pushbar 12 has been blocked, then both pieces, pushbar 12 and rotatable link 41, are returned to their normal positions by their respective springs.

[0012] The most important advantage of the inertial blocking mechanism 40 is that, as a whole, it will provide improved security. The inertial blocking mechanism 40 will help keep the door securely fastened during a hurricane, when branches and other debris could be thrown against the door by high winds.

[0013] Another advantage of the inertial blocking mechanism 40 is that it is purely mechanical. It does not rely on electrical power being available in order to work properly, because it is actuated by the inertia of the parts in the design. This is a very important aspect of the design, as power failures are common during hurricanes so electricity may not be available.

[0014] Preferably, another advantage of this design is its small number of parts. The rotatable link 41 incorporates the mass arm 50 and the blocking arm 41 together into one rigid body. This ensures that the blocking arm 41 rotates into position instantaneously when the inertia of the mass 52 initiates movement. This rigid connection removes the possibility that any slack or free play that

may exist in a connection between parts could hinder the proper functioning of the mechanism. There is no delay in moving the blocking arm 41 into position to confront and stop the pushbar 12, so it will always be there in time.

[0015] In addition to those mentioned above, another preferred aspect of this inertial blocking mechanism 41 is the fact that the complete device blocking only happens for a very short time after impact. There is no switch that the owner must reset to put the exit device back in its ordinary state of operation. The rotatable link 41 is automatically returned to its stationary (or non-confronting) position by the torsion spring 46 after blocking movement of the pushbar 12. This avoids potential egress prevention issues if the owner did not know his device had been subjected to an impact and it did not reset. The inertia-based mechanism does not rely on the owner in order to function properly.

Claims

1. An inertial blocking mechanism (40) for use with an exit device (10) mounted on a first side of a door, the other side of the door being the non-device side, the exit device having an actuating member (12) moveable between a pre-operated position and an operated position, the inertial blocking mechanism being characterised by a blocking arm (42) for blocking movement of the actuating member (12) from the pre-operated position to the operated position and an inertial means (41) for moving the blocking arm (42) into a confronting position with the actuating member, blocking movement of the actuating member, when the non-device side of the door is subjected to an impact load.

2. A mechanism according to claim 1, wherein the inertial means comprises a rotatable member (41) having the blocking arm (42) at an end thereof.

3. A mechanism according to claim 2, wherein the rotatable member rotates about a vertical axis.

4. A mechanism according to claim 2 or 3, wherein the rotatable member (41) has a mass arm (150) at another end thereof.

5. A mechanism according to claim 4, wherein the centre of gravity of the rotatable member (41) is proximate the mass arm (50) of the rotatable member.

6. A mechanism according to claim 5, wherein the blocking arm (42), the rotatable member (41) and the mass arm (50) form a rigid member.

7. A mechanism according to any one of the preceding claims, wherein the inertial mechanism further includes a biasing means (46) for biasing the blocking arm (42) into a non-confronting position with the actuating member (12).

8. An exit device (10) for mounting on a first side of a door, the other side of the door being the non-device side, the exit device comprising a latch mechanism and an actuating member (12) operably connected to the latch mechanism and the actuating member being moveable between a pre-operated position and an operated position; characterised by an inertial blocking mechanism (40) according to any one of the preceding claims.

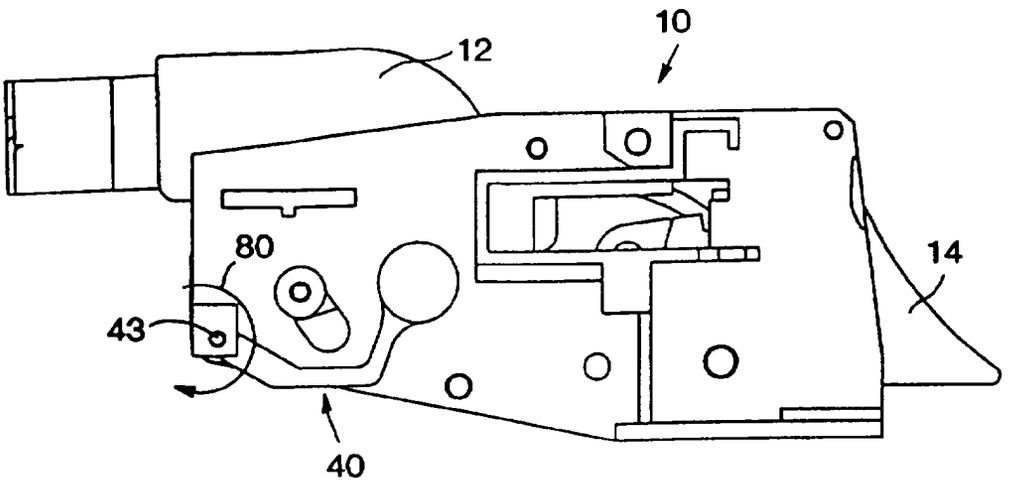

FIG. 1

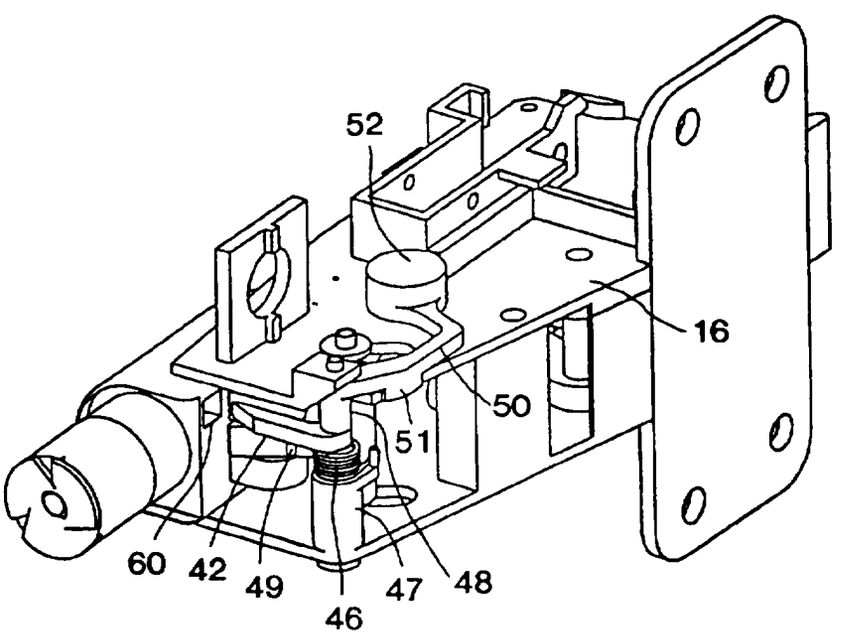

FIG. 2

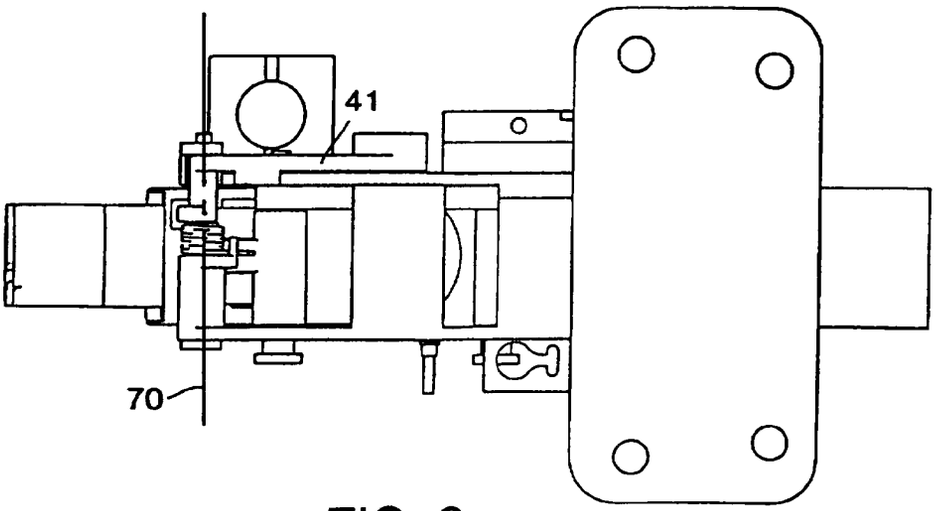

FIG. 3

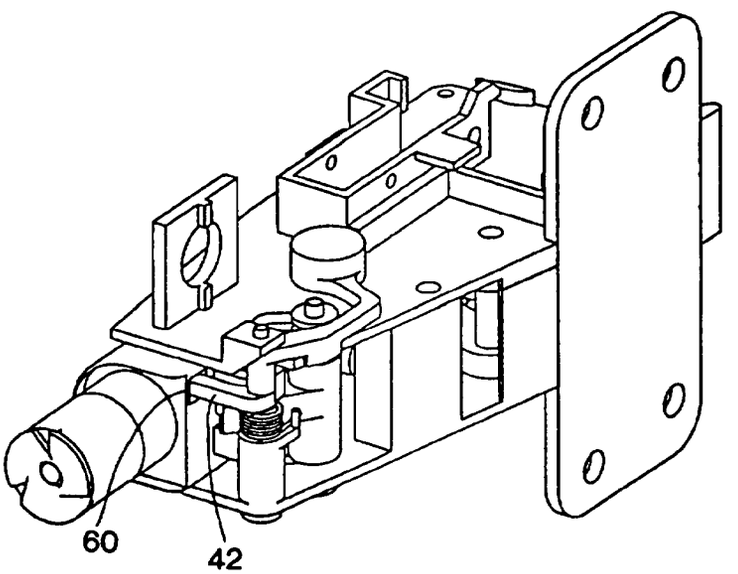

FIG. 4

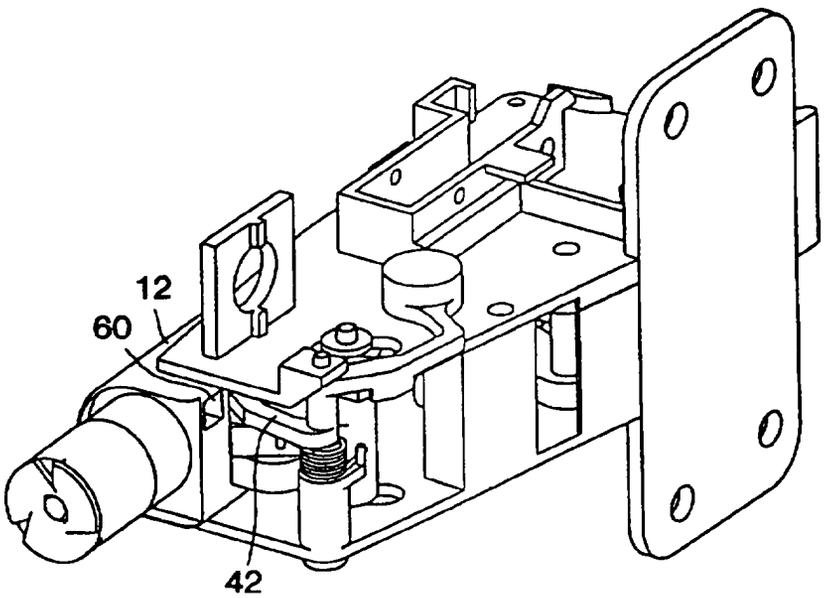

FIG. 5

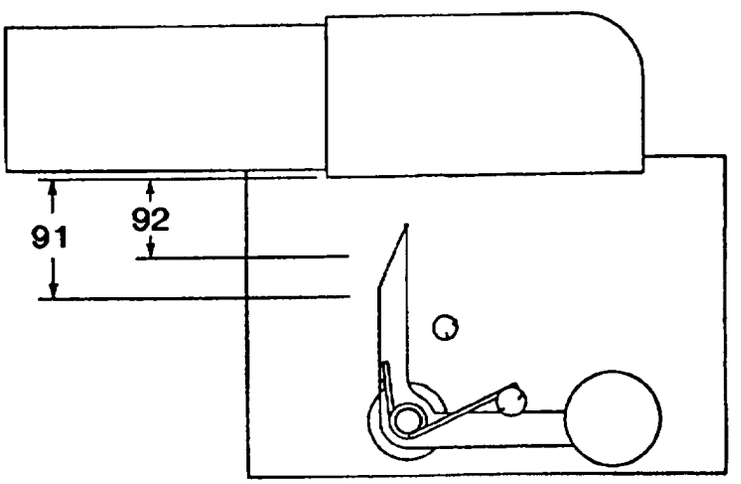

FIG. 6A

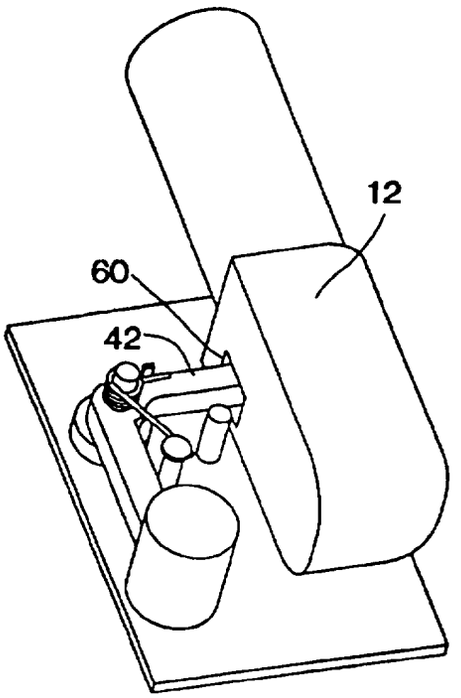

FIG. 6B

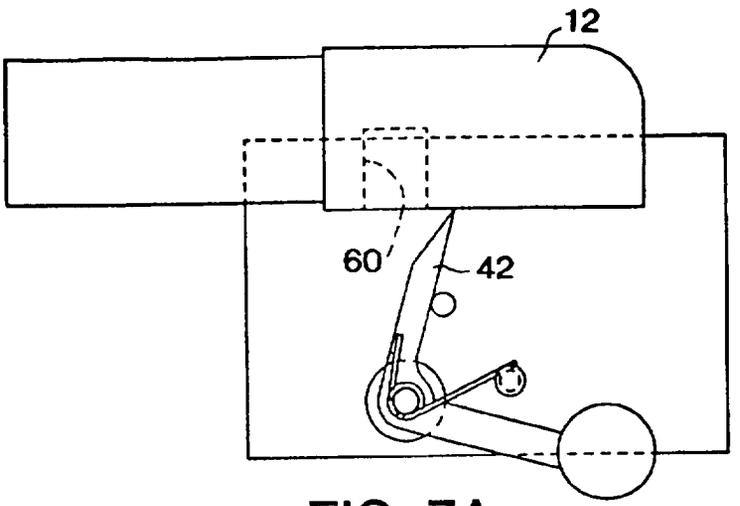

FIG. 7A

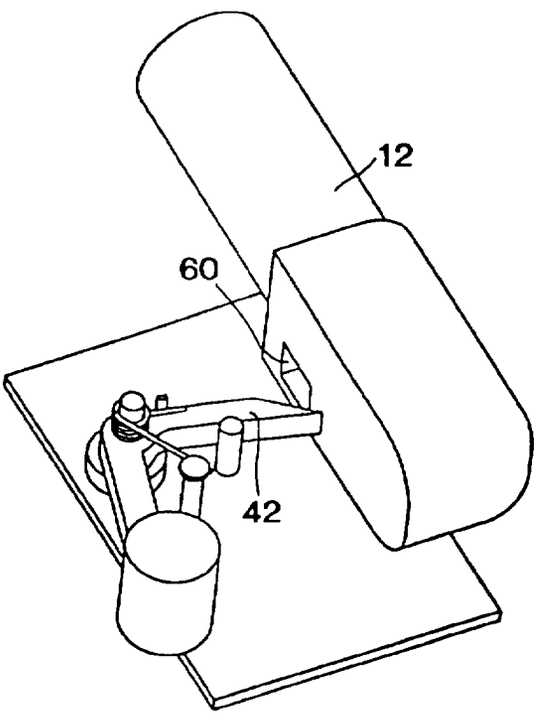

FIG. 7B

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 30 4539

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

E05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	31 October 2000	Friedrich, A

CATEGORY OF CITED DOCUMENTS

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