

[54] **LOCK WITH SECURITY COUNTER**

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[58] Field of Search **70/38 A, 51, 52, 431, 432,**
70/433, 434, 435, 436, 437; 235/115, 117

[56] **References Cited**

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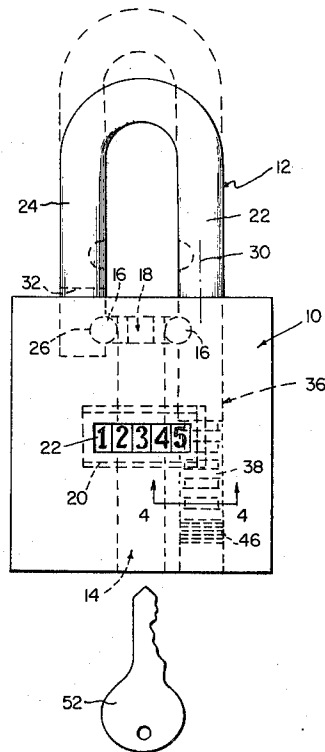
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[57] **ABSTRACT**

A lock such as a padlock in combination with a registering counter operated by the shackle of the lock for counting and registering the number of times the shackle is moved from unlocked to locked position, in which the actuating link between the shackle and the counter comprises rack and pinion means.

14 Claims, 5 Drawing Figures



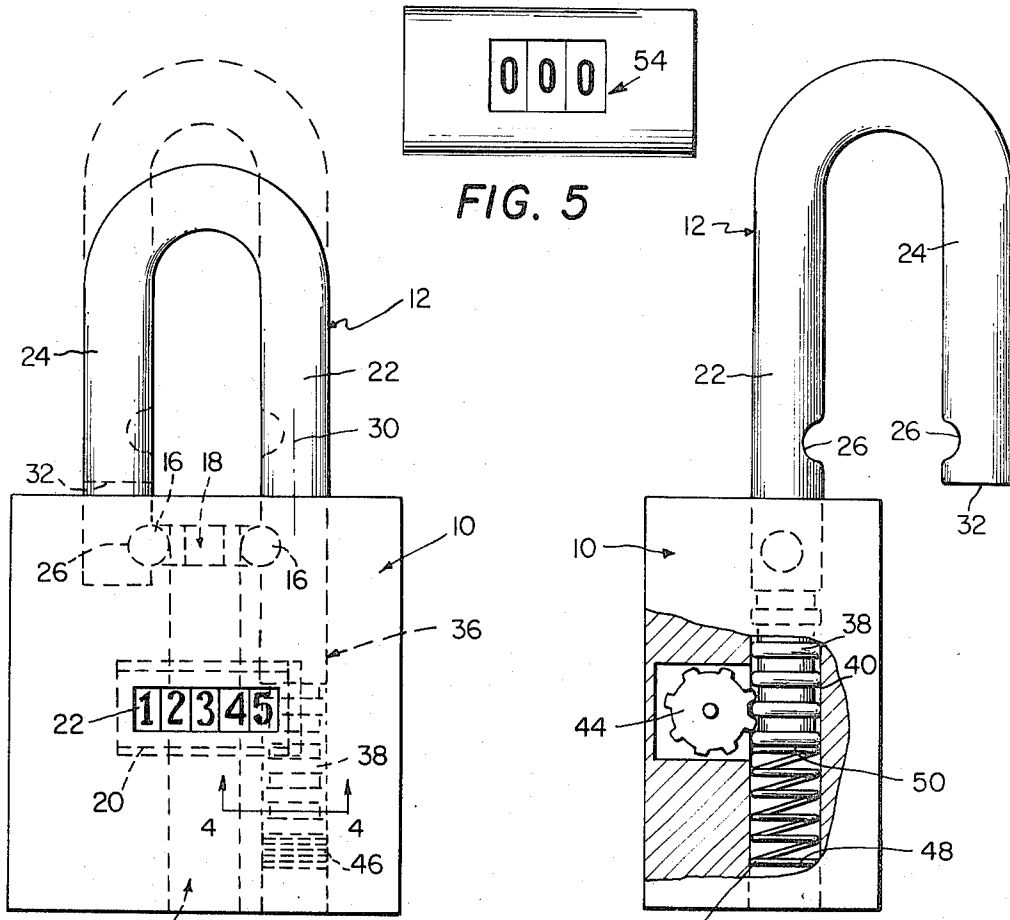


FIG. 5

FIG. 2

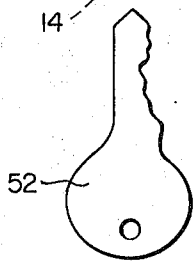


FIG. 1

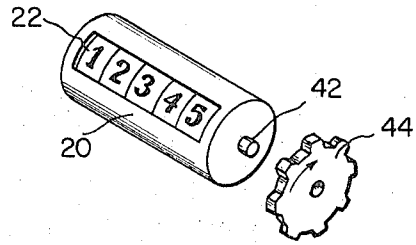


FIG. 3

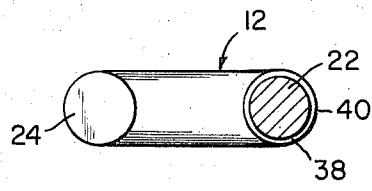


FIG. 4

LOCK WITH SECURITY COUNTER

BRIEF SUMMARY OF THE INVENTION

In certain applications where locks are used it is necessary to have an exact count of the number of times that access has been gained to the room or container which has been secured by locking. This becomes important in cases where security files or secret files are kept in a room or file container, and it is also important in cases where sensitive materials such as drugs are kept in a room, cabinet or container. There are many other applications where information concerning access to locked places is important.

One way of determining the control of access to locked places is to have an accurate count of the number of times the locked closure has been opened. Thus if it is determined that a door of a room, or a cabinet, has been opened three times whereas the records show officially authorized openings only twice, then it must be presumed that the third opening resulted from an unauthorized access to the secured area.

Various types of locks have been devised which incorporate a counter such as a registering counter from which one can determine the number of times the lock mechanism has been operated to unlock and lock the lock. The present invention falls within this class of device. The present invention has as an objective a positive connection between the lock and the counter.

It is a further object of the invention to provide such a positive connection with a minimum number of extraneous working parts and it is also an object of the invention to provide such a connection which will remain positive in its application while permitting the lock shackle to rotate freely without disturbing the action of the counting mechanism. Further objects and advantages will appear in the description hereinbelow.

DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

The invention is illustrated in the accompanying drawings in which:

FIG. 1 is a front elevation with parts in phantom;

FIG. 2 is a side elevation partly in section along the lines 2-2 of FIG. 1;

FIG. 3 is an exploded perspective of a registering counter and a pinion as incorporated in the invention;

FIG. 4 is a sectional view of the shackle of the invention only along the lines 4-4 as shown in FIG. 1; and

FIG. 5 is a bottom plan view of an alternate form of lock having combination operating means.

Similar numbers refer to similar parts throughout the several views of the drawings.

DETAILED DESCRIPTION

The lock has a main body portion 10. In the preferred embodiment the lock is in the form of a padlock and the lock body portion 10 may be either machined from solid stock, or from laminated construction, or it may be a casting of suitable durable material for security purposes. The usual materials for lock bodies are steel, brass and castings. The machining or casting should provide sufficient opening to allow the placement in, or connection with, the body portion 10 of a shackle 12, a locking mechanism comprising a cylinder 14, locking elements such as locking balls 16 and a retainer assembly 18. There should also be provision within the body portion for holding a registering counter 20 securely in

place in a position to be connected to the shackle 12, as will be hereinafter described. The manner of forming lock bodies 10 and providing for the inclusion of the machined parts is well known to the art.

The shackle 12 comprises a first leg 22 and a second leg 24. Both legs have detents 26 is opposed facing relationship so that they can hold the shackle 12 in a locked position by means of the locking balls 16 and retainer assembly 18, as is well known in the art. When in locked position, as shown in solid line in FIG. 1, the balls 16 are maintained within the detents 26. By operation of the retainer assembly 18 the balls 16 are permitted to be placed inwardly so that the shackle 12 can move from a locked position, as shown in solid line in FIG. 1, to an unlocked position, as shown in dotted line in FIG. 1, and vice versa. When shackle 12 is in unlocked position it may rotate around an axis designated by dotted line 30 so that the end 32 of leg 24 can be moved away from the body portion, as shown in FIG. 2, in order to facilitate insertion through a loop or locking hasp (not shown) during a locking operation. The registering counter 20 is provided with a visible read out such as the digital counter 22, and the body portion is provided with an observation opening 34 so that the visible read out of the counter 20 can be seen. First leg 22 of shackle 12 is provided with rack means 36. Rack means 36 is formed by a series of teeth 38 having curved outer edges such as curved ridges 40. In the preferred form of the invention the curved ridges 40, as well as the teeth 38, are formed completely around leg 22 to form annular shaped teeth 38.

The counter 20 is operated through a shaft 42 on which is mounted a pinion 44. The pinion 44 is in constant mesh with the teeth 40. When the shackle 12 is moved from a locked position to an unlocked position, the teeth 40 will move longitudinally with the shackle and cause the pinion 44 to rotate. The pinion 44 will also rotate for the same reason when the shackle 12 is moved from an unlocked to a locked position, however in a reverse direction of rotation.

It is desired in this invention to have the counter work in a forward direction only, so that the actual number of unlocked and locked figures will be recorded without any subtraction from the visible read out record. The counter 20 is therefore selected to be one which will actuate and register a count only when the pinion 44 is moved in a first direction and will not register the addition or subtraction of a count when the pinion is moved in a second or reversed direction. Thus, every time a lock is unlocked or locked the cycle will provide an unlocking and a locking movement of the shackle and will cause the read out on the counter 20 to move up one unit. Shaft operated counters such as counter 20 are well known in the art and the parameter of the rack and pinion can be adjusted to rotate the shaft 42 a sufficient distance in the selected direction to register the addition of one count for each complete locking cycle of the lock.

With the construction as described, the shackle 12 may be rotated on axis 30 when in open position without affecting the pinion 44. When leg 22 of the shackle 12 rotates, the teeth 40 will rotate with it. However, the movement of the teeth in the direction of rotation will be lateral to the pinion and will not move the pinion. It will nevertheless still be a positive connection between the shackle 12 and the counter 20 because of the annular construction of the teeth. In the preferred form

of the invention a shaft operated registering counter with a read out section is used which is actuated by a rotation of shaft 42 in the direction of the arrow in FIG. 3.

It has been found that a registering counter such as the mechanical totalizing counter types sold by the Veeder Root Corp. of Hartford, Connecticut, will register one higher unit of count for each cycle of the lock in accordance with the invention when attached to a pinion and rack arrangement as described hereinabove.

A spring 46 which is seated against a spring seat 48 in the body portion 10 and against the end 50 of the first leg 22 is provided to maintain the shackle 12 in unlocked position when the locking mechanism is operated to remove the balls 16 from the detents 26. The unlocking is accomplished by rotating the cylinder 14 which rotates the retainer assembly 18. Retainer assembly 18 can be rotated by removable key 52 in the usual manner or by a permutation type lock operating mechanism well known to the art. Such well-known combination operating means 54 are shown in FIG. 5 of the drawings. The combination operating means 54 shown in FIG. 5 are set at 000. It is to be understood, of course, that the combination setting may be fixed in any numeral known to the art by any other numerals or indicia.

In the construction shown in the preferred form of the invention the shackle 12 is placed off center, somewhat to the rear of the body portion 10, to provide room for the counter 20 to lie within the body portion, as shown in the figures of the drawings. This arrangement makes it possible for the shaft operated counter to be in offset perpendicular arrangement to at least one leg of the shackle to actuate the mechanism of the connection made by the rack and pinion arrangement. The invention as described shows a registering counter attached to a lock shackle by means of a single connecting part, namely the pinion.

While I have defined this invention in its preferred form, there are other forms that it may take without departing from the spirit and scope of the invention.

Wherefore I claim:

1. A lock comprising a main body portion; a shackle movable with relation to said main body portion from an unlocked position to a locked position, a locking mechanism for locking the shackle in said locked position, a registering counter operated by said shackle for counting and registering the number of times the shackle is moved from unlocked to locked position; wherein the shackle comprises a leg including rack means and the registering counter includes pinion means in meshed engagement with said rack means.

2. A lock as claimed in claim 1, in which the rack means comprises at least one tooth including a ridge,

with at least a portion of said ridge curved around a portion of the leg.

3. A lock as claimed in claim 2, in which the shackle leg is rotatably mounted to rotate on an axis with relation to the main body portion and the curved ridge of the rack tooth is substantially located in at least a portion of a circumference around said axis of said leg.

4. A lock as claimed in claim 1, in which the rack means comprises annular teeth.

5. A lock as claimed in claim 4, in which the registering counter is a digital counter actuated by movement of the pinion.

6. A lock as claimed in claim 4, in which the registering counter is included within the main body portion and the pinion means is positioned substantially perpendicular to said leg axis within said body portion.

7. A lock as claimed in claim 6, in which the body portion has observation means through which at least a portion of the registering counter is visible, and the registering counter has a visible read out.

8. A lock as claimed in claim 7, in which the shackle is U-shaped and is provided with a second leg shorter than said first leg, comprising an end positioned outside of the main body portion when the shackle is in unlocked position and within the main body portion when the shackle is moved to locked position.

9. A lock as claimed in claim 8, in which the first mentioned shackle leg is movably mounted within the main body portion against the action of spring means seated within said main body portion with said spring means positioned to urge said first mentioned leg towards the unlocked position.

10. A lock as claimed in claim 9, in which the locking mechanism comprises a pair of ball elements and the shackle legs are each formed with a ball receiving portion positioned so that the ball elements will enter said ball receiving portions when said shackle is moved to locked position, to maintain said shackle in locked position.

11. A lock as claimed in claim 10, in which the locking mechanism includes operating cylinder means to operate the ball elements.

12. A lock as claimed in claim 11, in which the operating cylinder means includes a removable key.

13. A lock as claimed in claim 11, in which the operating cylinder means is associated with combination operating means.

14. A lock as claimed in claim 11, in which the registering counter is connected to the pinion means by means of a shaft and the counter and its shaft are in offset perpendicular relation to the first mentioned shackle leg.

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