Aug. 22, 1967 D. L. PARSONS 3,336,770

ELECTRICALLY ACTUATED LOCKING MECHANISM

Filed Jan. 15, 1965 2 Sheets-Sheet 1

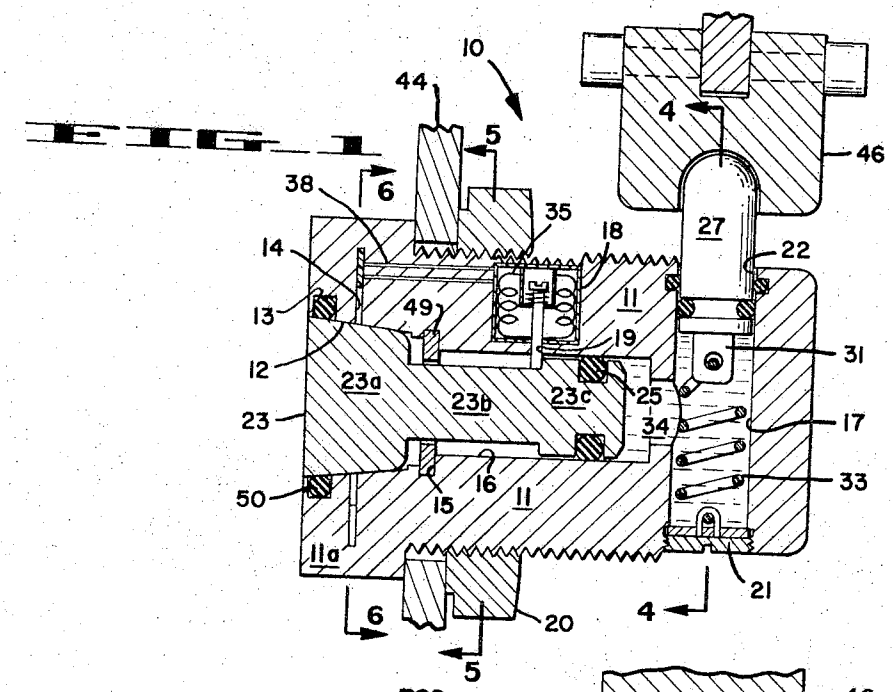


FIG. 2

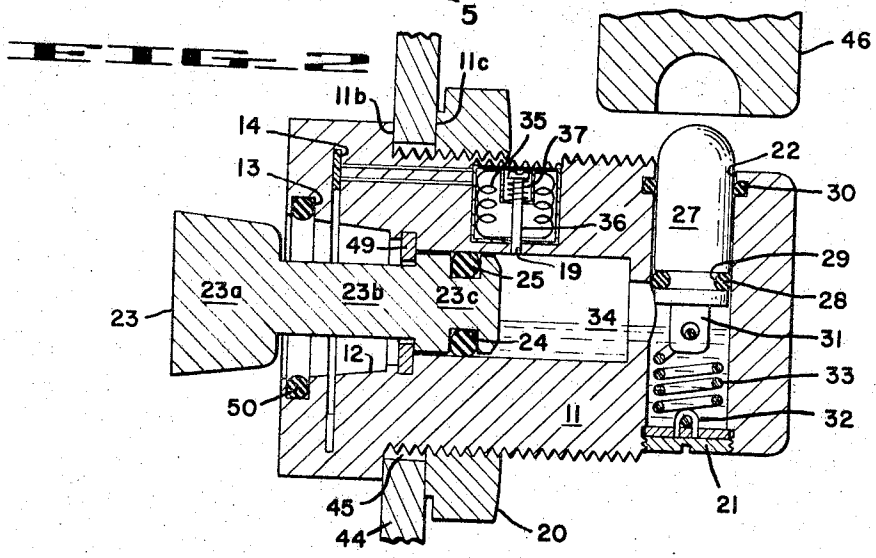
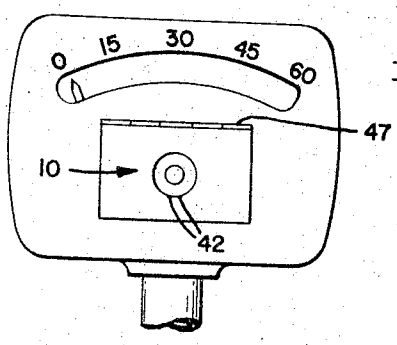


FIG. 3



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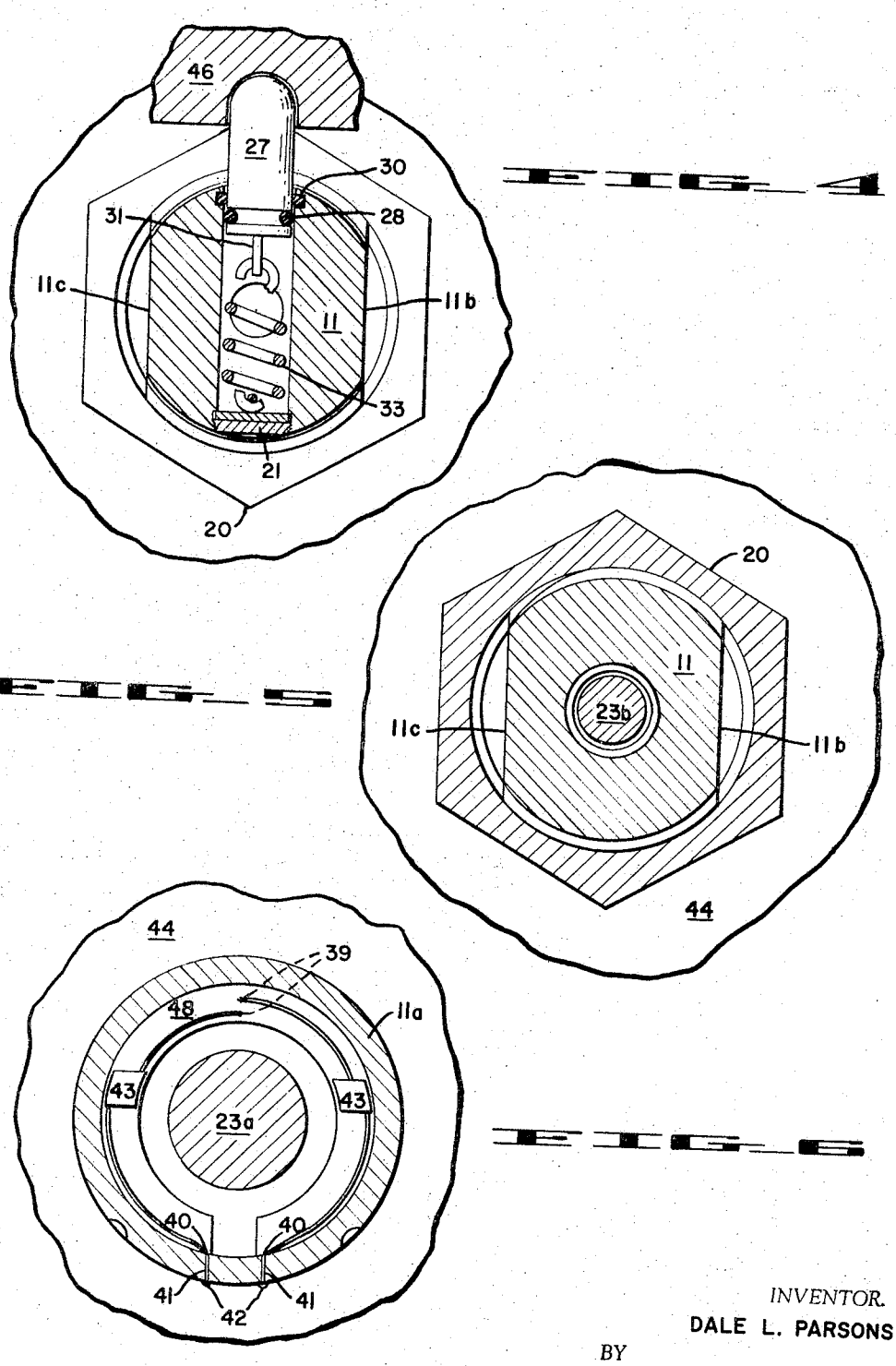

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United States Patent Office 3,336,770 Patented Aug. 22, 1967

3,336,770

ELECTRICALLY ACTUATED LOCKING MECHANISM

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Filed Jan. 15, 1965, Ser. No. 425,706
7 Claims. (Cl. 70—141)

This invention relates to an electrically actuated locking mechanism. More particularly it relates to a mechanism that is mechanically pick-proof. It discriminates among various current patterns and intensities and responds only to a selected current, which actuates a solenoid and unlocks the mechanism.

Today a great quantity of money is deposited in parking meters and the quantity is increasing as more municipalities resort to them for revenue. Because the parking meter is exposed without protection, it is an attractive source of money for street derelicts. It has been estimated that various larger cities in the United States lose roughly thirty to fifty thousand dollars annually to parking meter thieves, and it is common in some cities to have forged parking meter keys in circulation among street derelicts which eliminates the need for even picking the lock. It is therefore highly desirable to provide a mechanism for parking meters which is pick-proof and is actuated by a key that cannot be easily duplicated. The lock must be safe, quickly actuated by proper individuals, easily and quickly reset, and resistant to exposure to the elements.

Accordingly, it is an object of the present invention to provide an electrically actuated, mechanically pick-proof locking mechanism that discriminates among current patterns and intensities.

It is a further object to provide a lock that is easily and quickly disengaged or unlocked with the proper current pattern and easily reset or re-engaged.

It is another object to provide a lock which can be simply recalibrated with respect to its electrical discrimination and response.

It is a further object to provide a lock that is resistant to and not damaged by exposure to the elements.

The invention is best described with reference to the drawings wherein:

FIG. 1 is a sectional view taken on the longitudinal axis of the lock mechanism showing the lock in an engaged or locked position;

FIG. 2 is a sectional view corresponding to the view of FIG. 1 showing the lock in a disengaged or unlocked position;

FIG. 3 is a front view of a parking meter showing the mounting of the lock therein;

FIG. 4 is a sectional view taken on the line 4—4 of FIG. 1;

FIG. 5 is a sectional view taken on the line 5—5 of FIG. 1;

FIG. 6 is a sectional view taken on the line 6—6 of FIG. 1 and shows the discriminating printed circuit and its seating.

The invention will be hereinafter described with respect to utilization in a parking meter. It will be readily understood, however, that the invention may be used in a number of other environments. It may be used, for example, as a safe lock; a car, house or garage door lock; or a warehouse lock. Many other uses may be apparent to those skilled in the art.

A specific embodiment is shown in FIGS. 1–6 and the locking mechanism is referred to generally by the numeral **10**. It includes lock barrel **11** which defines conical entry cavity **12**, O-ring recess **13**, printed circuit recess **14**, retainer ring recess **15**, and cylinder **16**, which are all axially positioned. Lock barrel **11** also defines latch pin

cylinder **17**, which is positioned transverse to and communicates with cylinder **16**. Latch pin cylinder **17** extends the diameter of lock barrel **11**. Solenoid socket **18** is provided above cylinder **16** and communicates therewith through solenoid pin aperture **19**. Lock barrel **11** is threaded for engagement with hexagonal nut **20** which may be drawn toward head portion **11***a* for mounting. Plane faces **11***b* and **11***c* are provided to prevent axial rotation of lock barrel **11**.

Latch pin cylinder **17** is threaded at one end for engagement with latch pin spring retainer **21**. The opposite end defines latch pin cylinder recess **22**.

Lock piston **23** is designed with conical head **23***a*, neck portion **23***b*, and piston head **23***c*. Piston head **23***c* is machined for slidable movement in cylinder **16** and defines piston ring recess **24**. Piston ring **25** seated thereon establishes a slidable sealed contact with cylinder **16**.

Retainer ring **49** is seated in retainer ring recess **15** and extends inwardly of cylinder **16** substantially to neck portion **23***b*. Retainer ring **49** therefore limits the withdrawal of lock piston **23** to the position shown in FIG. 2 by preventing the passage therethrough of piston head **23***c*. Lock piston **23** is therefore slidable in cylinder **16** for a stroke which is apparent by comparing FIG. 1 with FIG. 2.

Entry cone ring **50** seals the joint between conical entry cavity **12** and conical head **23***a*, thereby preventing damage due, for example, to the entry of water and subsequent freezing or entry of dirt.

Latch pin piston **27** is machined for slidable movement in latch pin cylinder **17** and contains latch pin ring **28** seated in latch pin piston recess **29**. An efficient seal is therefore provided between latch pin piston **27** and its cylinder **17**. Latch pin cylinder ring **30**, seated in latch pin cylinder recess **22**, provides an additional seal but is not essential. Latch pin piston **27** contains spring connector arm **31**. Latch pin piston **27** is slidable in latch pin cylinder **17** for a stroke that is apparent by comparing FIG. 1 with FIG. 2.

Latch pin spring retainer **21** is threaded into latch pin cylinder **17** and contains latch pin spring connector arm **32**. Latch pin spring **33** extends from connector arm **31** to connector arm **32** and is under tension.

Cylinder **16** in communication with latch pin cylinder **17** and in conjunction with piston head **23***c*, latch pin piston **27** and latch pin spring retainer **21**, defines oil reservoir **34**. Oil reservoir **34** is completely filled with oil (S.A.E. 10, for example).

Solenoid **35** is seated in solenoid socket **18** with solenoid pin **36** extending through solenoid pin aperture **19**. Solenoid pin **36** has a stroke actuated by an electromotive force in the range of 6–128 volts. At the end of the downward stroke, which is actuated by solenoid spring **37**, solenoid pin **36** contacts the neck portion **23***b* to prevent withdrawal of lock piston **23** as shown in FIG. 1. At the end of its upward stroke, which is the response to electromagnetic force, solenoid pin **36** releases piston head **23***c* and allows the withdrawal of lock piston **23** as shown in FIG. 2.

Solenoid leads **38** extend from solenoid **35** to printed circuit output contacts **39** in printed circuit recess **14**. Printed circuit input contacts **40** are provided in recess **14** as shown in FIG. 6 and are connected by leads **41** to exposed contacts **42**. Thus, the proper current applied to exposed contacts **42** finds its way through printed circuit **43** to solenoid **35** to withdraw solenoid pin **36**.

Locking mechanism **10** is mounted in a door **44** through aperture **45** with the aid of hexagonal nut **20**. FIG. 3 shows the mounting of the locking mechanism **10** in a parking meter door.

Stationary latch socket **46** is rigidly secured in a position such that it accepts latch pin piston **27** when the

latter is at the upper limit of its stroke as shown in FIG. 1. At the lower limit of its stroke, as shown in FIG. 2, latch pin piston **27** is removed from socket **46**, and is slidable past socket **46**.

Having thus described the structure of the lock mechanism, its operation may be best understood with reference to FIG. 1, which shows the relative position of the various elements when the mechanism is locked or engaged, and to FIG. 2, which shows the relative position of the elements when the mechanism is unlocked or disengaged.

In the locked or engaged position latch pin piston **27** is engaged with latch socket **46** and movement of door **44** with respect to socket **46** is prevented. In other words, the meter is locked because door **44** is not pivotable about hinge **47**.

The meter is opened by contacting exposed contacts **42** with the leads from a source of current that will bridge printed circuit **43**. Solenoid **35** is then actuated and pin **36** is withdrawn as shown in FIG. 2. Lock piston **23** may then be withdrawn. The withdrawal is actuated by latch pin spring **33** which slides latch pin piston **27** out of engagement with socket **46**. Oil reservoir **34**, free to expand in cylinder **16**, shifts to make room for latch pin piston **27**. Thus, the elements assume the relative position shown in FIG. 2.

The locking mechanism may be simply and quickly reset by removing the current, closing the door, and then manually pressing lock piston **23** into cylinder **16**. Latch pin piston **27** is then forced upwardly and engages socket **46** and the meter is locked.

In the event it is not desired to use an oil reservoir as the means of linking lock piston **23** and latch pin piston **27**, a mechanical linkage could be employed. An oil reservoir is preferred, however, because it makes the position of latch pin piston **27** very flexible with respect to lock piston **23**. It also eliminates the need for intricate universal and other joints necessary in a mechanical linkage. It is readily recognized, however, that a mechanical linkage could be employed within the scope of the present invention.

The locking mechanism may be simply and quickly recalibrated by removing the printed circuit and replacing it with another one which responds to a different current pattern and intensity. Such circuits, referred to generally as "flip-flop" circuits, may be readily designed by those skilled in the art and employed in combination with the present invention. For convenience of replacement the printed circuit is mounted on a disc **47** which may be readily slipped into printed circuit recess **14** and removed therefrom.

Having thus described my invention, I claim:

1. A locking mechanism which comprises:

(A) a lock barrel defining

(1) a first cavity having a longitudinal axis,

(2) a second cavity transverse to said first cavity and in communication therewith, and

(3) a solenoid socket and pin aperture, said pin aperture communicating with said socket and first cavity;

(B) an exposed locking member axially slidable in said first cavity;

(C) a latch pin slidable beyond the surface of said lock barrel in said second cavity;

(D) means for linking said locking member and said latch pin such that sliding motion in one produces a corresponding sliding motion in the other;

(E) a solenoid in said solenoid socket having a pin extending through said pin aperture, said pin, when extended, engaging said locking member and preventing sliding movement thereof; and, when withdrawn, disengaging said locking member and allowing sliding movement thereof.

2. The locking mechanism of claim **1** wherein said lock barrel has exposed contacts and a discriminatory circuit linking said contacts and said solenoid.

3. A locking mechanism which comprises:

(A) a lock barrel defining

(1) a first cavity having a longitudinal axis,

(2) a second cavity transverse to said first cavity and in communication therewith, and

(3) a solenoid socket and pin aperture, said pin aperture communicating with said socket and first cavity;

(B) an exposed lock piston axially and sealingly slidable in said first cavity;

(C) a latch pin piston sealingly slidable beyond the surface of said lock barrel in said second cavity;

(D) an oil reservoir in said first and second cavities in contact with said lock piston and said latch pin piston;

(E) oil completely filling the reservoir;

(F) a solenoid in said solenoid socket having a pin extending through said pin aperture, said pin, when extended, engaging said lock piston and preventing sliding movement thereof; and, when withdrawn, disengaging said lock piston and allowing sliding movement thereof;

(G) means for urging the latch pin piston inwardly of the surface of the lock barrel;

(H) means for limiting the sliding movement of the exposed lock piston outwardly of the surface of the lock barrel; and

(I) keeper means adapted to be engaged with and disengaged from the latch pin piston as said latch pin piston slides relative to the lock barrel.

4. The locking mechanism of claim **3** wherein said lock barrel has exposed contacts and a discriminatory circuit linking said contacts and said solenoid.

5. A locking mechanism which comprises:

(A) a lock barrel defining

(1) a first cavity having a longitudinal axis,

(2) a second cavity transverse to said first cavity and in communication therewith, and

(3) a solenoid socket and pin aperture, said pin aperture communicating with said socket and first cavity;

(B) an exposed lock piston axially slidable in said first cavity;

(C) a latch pin piston slidable beyond the surface of said lock barrel in said second cavity;

(D) a hermetically sealed chamber defined by said lock piston, said first cavity, said second cavity and said latch pin piston;

(E) a fluid completely filling the chamber;

(F) a solenoid in said solenoid socket having a pin extending through said pin aperture, said pin when extended engaging said lock piston and preventing sliding movement thereof; and, when withdrawn, disengaging said lock piston and allowing sliding movement thereof;

(G) means for urging the latch pin piston inwardly of the surface of the lock barrel;

(H) means for limiting the sliding movement of the exposed lock piston outwardly of the surface of the lock barrel; and

(I) keeper means adapted to be engaged with and disengaged from the latch pin piston as said latch pin piston slides relative to the lock barrel.

6. The locking mechanism of claim **5** wherein oil is the fluid in said hermetically sealed chamber.

7. A locking mechanism which comprises:

(A) a lock barrel defining

(1) a first cylinder having a longitudinal axis,

(2) a second cylinder transverse to said first cylinder and in communication therewith, and

(3) a solenoid socket and pin aperture, said pin aperture communicating with said socket and said first cylinder;

(B) an exposed lock piston axially slidable in said first cylinder, said piston having a piston head and a neck portion;

(C) a latch pin piston slidable beyond the surface of said lock barrel in said second cylinder;

(D) a hermetically sealed chamber defined by said lock piston head, said first cylinder, said second cylinder, and said lock pin piston;

(E) oil completely filling said chamber in contact with said piston head and said latch pin piston;

(F) a solenoid in said solenoid socket having a pin extending through said pin aperture, said pin when extended, engaging said neck portion and preventing the sliding movement of said piston head in said first cylinder, and, when withdrawn, disengaging said neck portion and allowing sliding movement of said piston head in said first cylinder;

(G) means for urging the latch pin piston inwardly of the surface of the lock barrel;

(H) means for retaining said piston head in said first cylinder;

(I) exposed contacts on said lock barrel;

(J) a discriminatory circuit linking said contacts and said solenoid; and

(K) keeper means adapted to be engaged with and disengaged from the latch pin piston as said latch pin piston slides relative to the lock barrel.

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