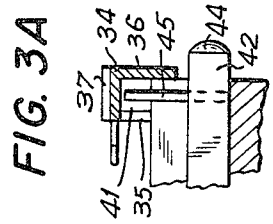
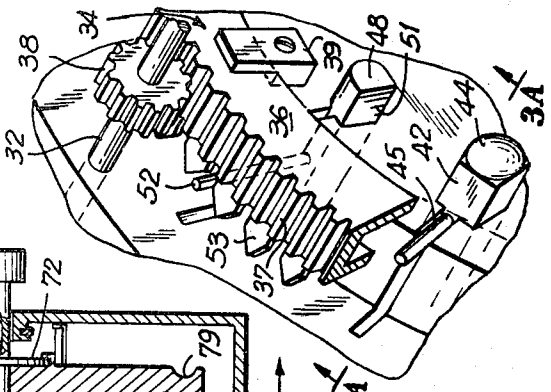
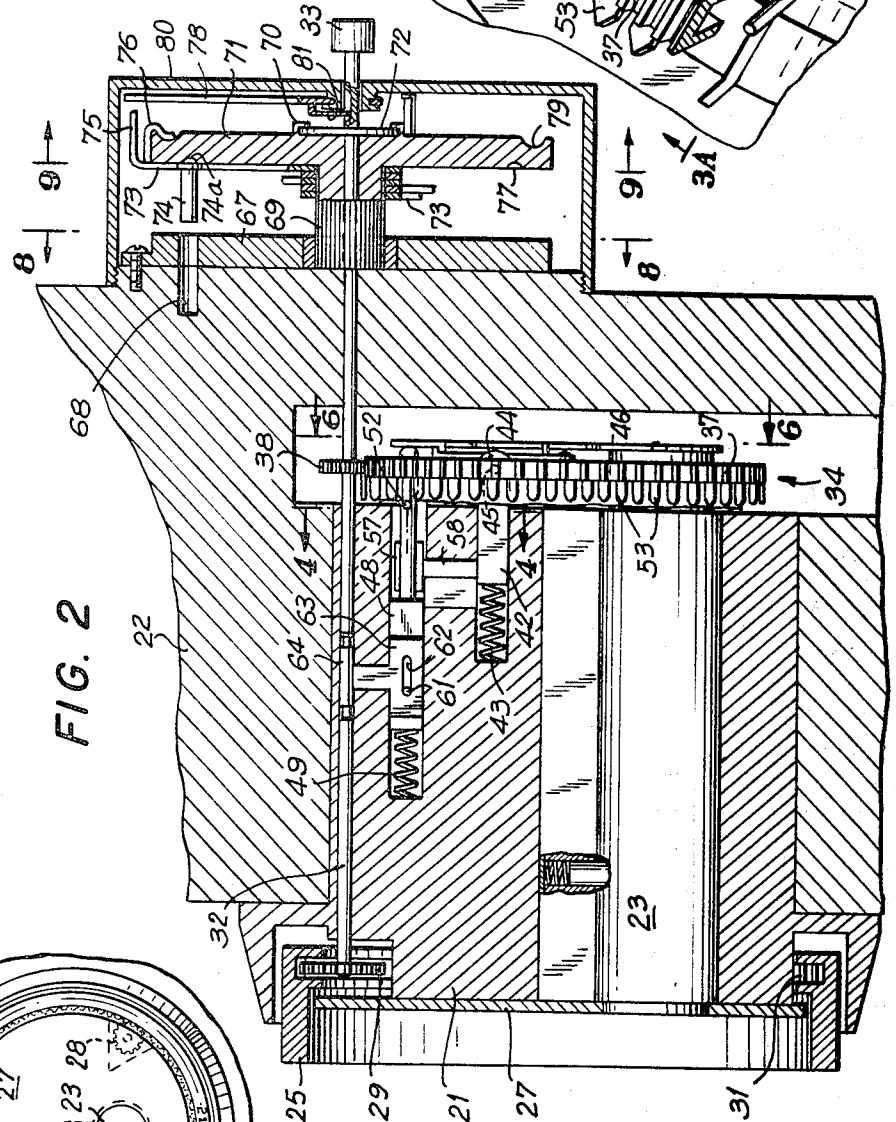
Nov. 5, 1968 SAM SHIAO-MING HSU 3,408,841

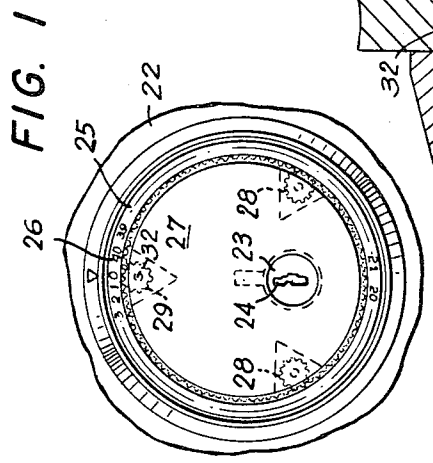
SAFETY LOCK MECHANISM

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SAFETY LOCK MECHANISM

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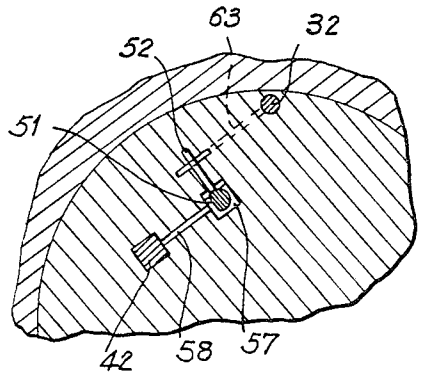
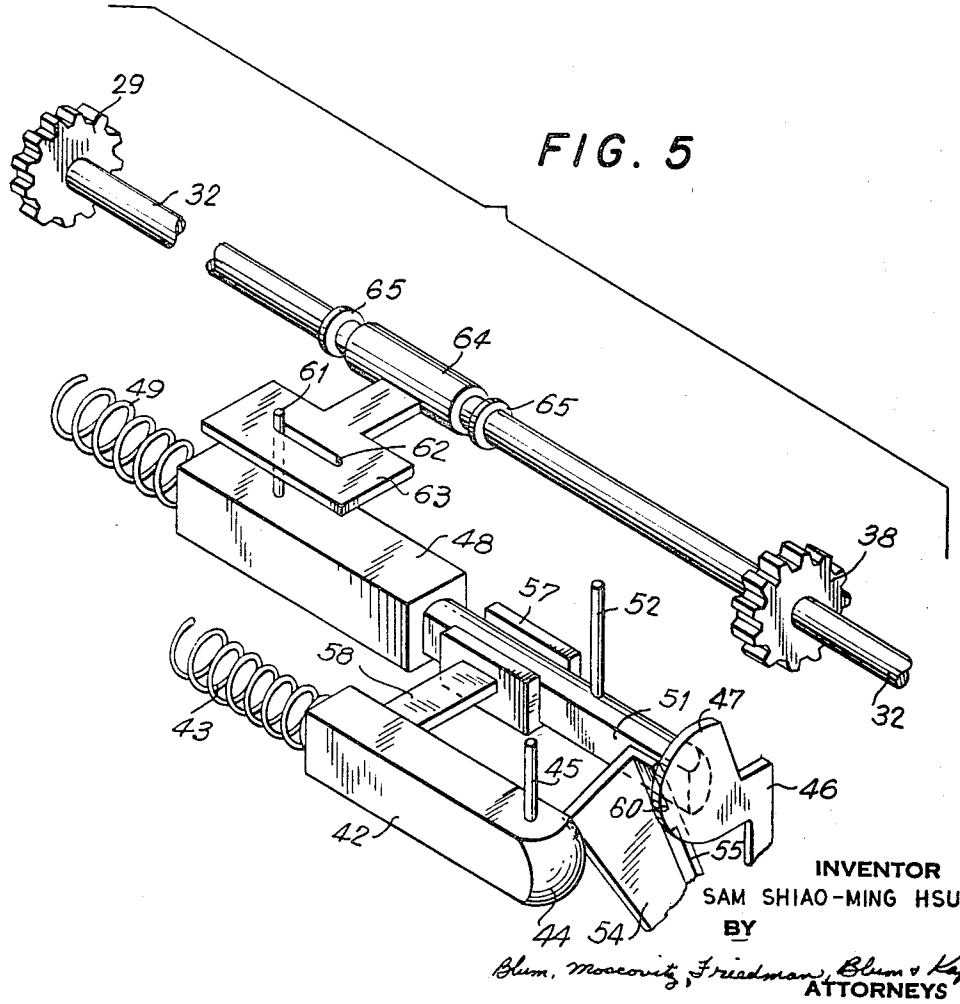


FIG. 4

FIG. 5



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FIG. 6

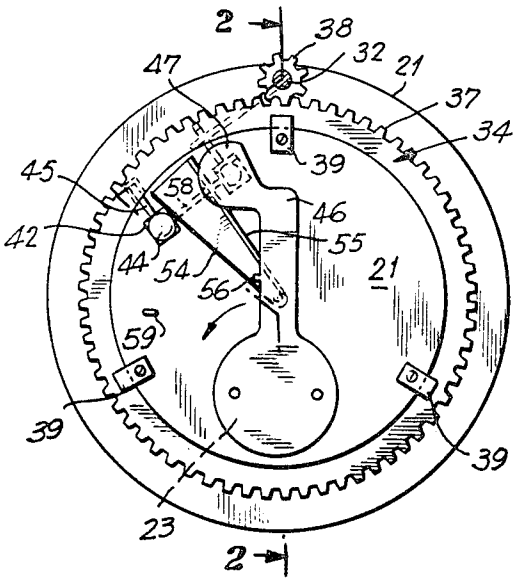
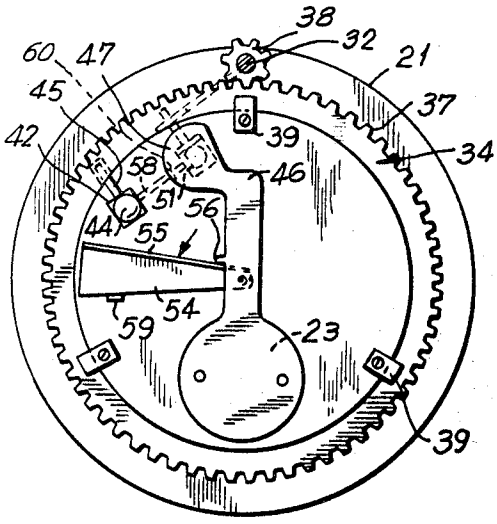


FIG. 7



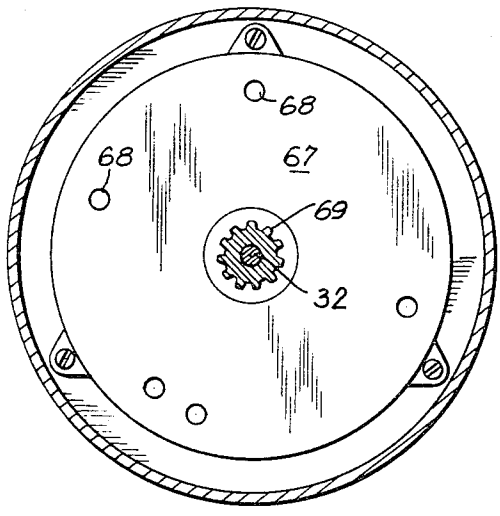


FIG. 8

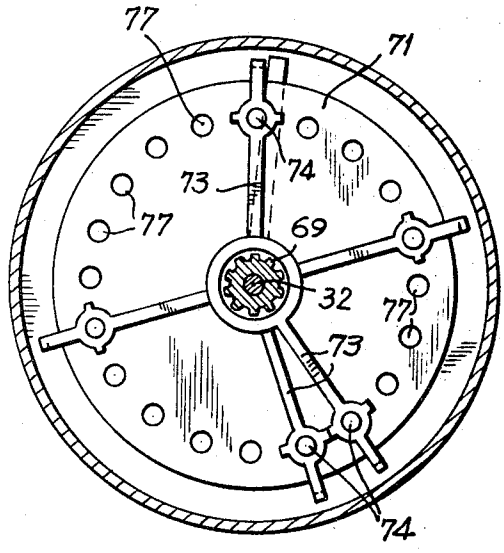


FIG. 9

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FIG. 10

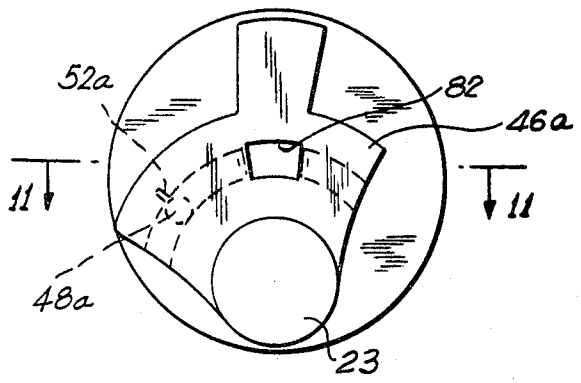


FIG. 11

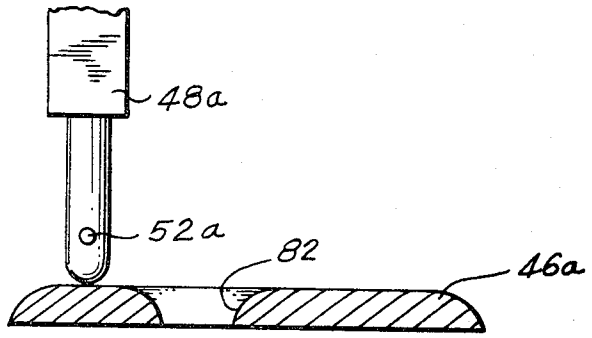
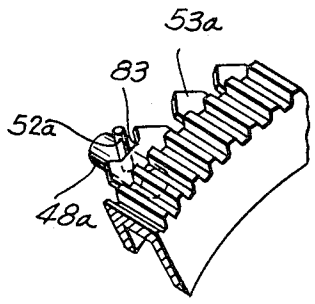


FIG. 12



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SAFETY LOCK MECHANISM

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Filed Mar. 8, 1966, Ser. No. 532,677
10 Claims. (Cl. 70—390)

ABSTRACT OF THE DISCLOSURE

A safety mechanism in combination with the usual lock which prevents unauthorized opening of the lock even by one possessed with the proper key by the provision of a mechanism which must be preset in order to permit the lock to be opened. If the safety mechanism is not properly preset, one possessed with the proper key, for example, could only partially open the lock and the key would thereupon become trapped in the lock.

This invention relates generally to door locks and more particularly to a safety lock mechanism for making locks secure against unauthorized entry.

While locks are ordinarily adequate to prevent entry by one without a key, pass keys are too often available to unauthorized persons.

Accordingly, it is a primary object of the invention to make a lock secure despite the possession of a proper key by an unauthorized person. A further object of the invention is to provide means whereby it becomes apparent that an attempt has been made to effect unauthorized passage.

Still other objects and advantages of the invention will in part be obvious and will in part be apparent from the specification.

Generally speaking, the invention embodies means that can be added to a lock mechanism for accomplishing the desired objectives. A lock constructed in accordance with the invention includes a dial with numbers on its face. The dial is mounted for rotation about the key plug, a preselected setting of the dial being required to permit the lock to be unlocked by its key. When the dial is set at the opening number, the lock may be unlocked or locked in the usual manner by use of the proper key. However, if the dial is set on any other number, and the proper key is inserted into the key plug, the key may be turned only slightly whereupon the door remains locked and the key is trapped in the partially turned portion. The key may be removed only when the dial is manipulated to set the proper release combination. The preselected opening number may be reset, as desired.

In a preferred construction, a tumbler and cylinder lock has an elongated plate secured to the back of the cylinder so that the plate is generally vertical when the tumblers are locking the cylinder. The lower end of the plate is fixed to the cylinder and, in the vertical position, the plate depresses a spring loaded pin. When the plate is turned with the cylinder in the opening direction, the pin springs out and exposes a flat side to the plate, thus preventing the plate from being turned back to the vertical position. It may only return to the vertical by completing a full revolution wherein means operated by the plate effect depression of the pin as the plate approaches the vertical.

During the initial turning, as the plate approaches a quarter revolution, it meets a second pin which, if the opening number has been set, is depressed by the plate. If the opening number was not set, the second pin cannot be depressed and rotation of the plate is arrested by both pins, thus preventing the key from being withdrawn. When the first pin is biased outwardly, the dial is locked to prevent a further attempted selection of the appropriate opening number.

A rod is mounted above the tumblers and is connected to the first pin in such a way that, as the rod is pulled back, the pin is depressed to permit release of the trapped key.

The invention comprises the features of construction, combination of elements, and arrangement of parts which will be exemplified in the constructions hereinafter set forth, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the invention, reference is had to the following description taken in connection with the accompanying drawings, in which:

FIG. 1 is a front elevational view of a lock constructed in accordance with the invention;

FIG. 2 is a partial sectional view taken along line 2—2 of FIG. 6;

FIG. 3 is a partial perspective view of the pin assembly;

FIG. 3A is a partial sectional view taken along line 3A—3A of FIG. 3;

FIG. 4 is a partial sectional view taken along line 4—4 of FIG. 2;

FIG. 5 is a partial perspective view of the preferred trapping mechanism;

FIG. 6 is a sectional view taken along line 6—6 of FIG. 2, with the parts being shown in the locked position;

FIG. 7 is a view similar to FIG. 6, with the parts being shown in the unlocked position;

FIG. 8 is a sectional view taken along line 8—8 of FIG. 2;

FIG. 9 is a sectional view taken along line 9—9 of FIG. 2;

FIG. 10 is a rear elevational view of a modified form of trapping mechanism;

FIG. 11 is a partial sectional view taken along line 11—11 of FIG. 10; and

FIG. 12 is a partial perspective view of the modified trapping mechanism of FIG. 10.

Referring now to the drawings and especially FIGS. 1 and 2, a lock cylinder **21** is mounted in the usual door **22** and includes a known type of cylinder barrel **23** having a key receiving slot **24**. A dial **25** inscribed with indicia **26** is rotatably mounted about cylinder **21** at the front face thereof. A plate **27** may be provided for limiting the outward movement of dial **25**. Two idler gears **28** and the gear **29** are rotatably and slidably mounted in the cylinder and cooperate with a ring gear **31** forming a portion of the inner surface of dial **25**. Gears **28** and **29** aid in rotatably mounting dial **25** about cylinder **21**. Gear **29** is fixed on a shaft **32** rotatably and axially slidably mounted in cylinder **21** with shaft **32** extending through the rear of lock cylinder **21** and being of sufficient length to extend well beyond the inside of the door, as shown in FIG. 2. The opposite end of shaft **32** is provided with a knob **33**.

A trapping ring **34** (FIGS. 3 and 3A) has a U-shaped cross section with an inner leg **35** riding on the periphery of lock cylinder **21** and an outer leg **36** in engagement with the rear face of the lock cylinder. The outer surface of trapping ring **34** is provided with a plurality of teeth **37** adapted to engage a gear **38** fixed to shaft **32**. The gearing is so selected that a single rotation of dial **25** effects a single rotation of trapping ring **34**. Clips **39** may be suitably provided to hold trapping ring **34** in the assembled position with respect to the lock cylinder without interfering with the rotation thereof. Inner leg **35** is provided with a slot **41** whose use will be hereafter described.

Referring now to FIGS. 2 through 6, a pin **42** is slidably mounted in lock cylinder **21** and is biased outwardly by means of a spring **43**. An inner portion of pin **42** may have a generally rectangular or other suitable cross-section to prevent axial rotation of the pin within the cylinder lock. The pin is provided with a rounded outer end **44** whose use will be hereafter described. Referring especially to FIG. 3A, pin **45** normally is positioned between the legs of trapping ring **34** but, when aligned with slot **41**, permits pin **42** to be depressed against the action of spring **43**.

As seen in FIG. 6, a plate **46** is mounted for rotation with cylinder barrel **23** and the outer end **47** normally depresses a pin **48**, also slidably mounted in cylinder **21** and biased outwardly by a spring **49**. The outer portion of pin **48** is provided with a flat **51** and a rod **52** extends perpendicularly from pin **48**. A plurality of teeth **53** extend inwardly toward rod **52** from the periphery of trapping ring **34** with a tooth being provided for each tooth on the trapping ring.

When the proper key is inserted in the cylinder barrel and the barrel is rotated (in the counterclockwise direction as shown in FIG. 6) outer end **47** rotates and releases the holding pressure on pin **48** whereby it is biased outwardly to move rod **52** into engagement with one of teeth **53** to prevent rotation of trapping ring during the opening cycle. If the proper opening indicia has been set, pin **45** is aligned with slot **41** and outer end **47** cams over rounded end **44** to depress pin **42**. On the other hand, if the proper opening number has not been set, depression of pin **42** will be prevented by cooperation between rod **45** and the legs of the trapping ring. On such attempted unauthorized entry, the cylinder barrel can not be rotated in the reverse direction to its original position as such is prevented by flat **51** which has been interposed in a blocking position with respect to plate **46** upon the outward movement of pin **48**. Thus the lock is effectively jammed in a partially turned position and the key may thereby not be withdrawn. Likewise, further selection of the proper opening number by rotation of dial **25** is prevented by the engagement of rod **52** between adjacent teeth **53**.

On authorized entry, when the proper opening indicia has been set, plate **46** rotates in a counterclockwise direction (FIG. 6) and, as it approaches a full circle, outer end **47** moves toward pin **48** which is in a blocking position. Pin **48** may have a cam shaped outer end permitting end **47** to ride thereover. Pin **48** may also be depressed through use of a plate **54** which is pivoted to lock cylinder **21** and has an upstanding flange **55** which is caused to move into contact with and cam over rounded end **44**. Such movement is effected by means of a projection **56** on plate **46** in engagement with flange **55**. As plate **54** cams over rounded end **44**, pin **42** is caused to retract. A channel **57** (FIG. 5) connected to pin **42** through an arm **58** effects withdrawal of pin **48** in order that plate **46** may take up a position holding pin **48** depressed. When the lock has been opened, plate **54** attains the position shown in FIG. 7, its movement being limited by a stop **59**.

On reverse rotation, a projection **60** on outer end **47** likewise carries plate **54** over rounded end **44** to again depress pin **42** and move pin **48** inwardly to permit plate **46** to return to the rest position.

Turning again to the situation wherein the key has been trapped by advancement of rod **52** between adjacent teeth **53**, means are provided for returning the lock to the normal lock position by an authorized person so that the key may be removed. Such means are best described in connection with FIGS. 2, 5, 8 and 9.

As heretofore stated, shaft **32** is slidable within cylinder **21** but is normally fixed when the parts are in the usual position. When pin **48** moves outwardly, a rod **61** extending therefrom slides forwardly in a slot **62** cut in a plate **63** which is secured to shaft **32**.

When pin **48** moves outwardly, rod **61** slides forwardly to the limit of slot **62** thereby permitting shaft **32** to move forwardly with dial **25** on depression of the dial. The forward movement of shaft **32** moves gear **38** out of engagement with the teeth on trapping ring **34** to thereby permit free rotation of dial **25** and shaft **32**. Note that plate **63** is mounted on shaft **32** by means of a collar **64** which permits relative rotation between the collar and shaft **32** with collars **65** being mounted fast on shaft **32** to prevent relative axial movement between collar **64** and shaft **32**. In this free position of shaft **32**, rotation of the shaft can be effected either through dial **25** or knob **33** on the inside of the door.

To the inside of the door is secured a plate **67** having a plurality of blind holes **68** therethrough. A spline **69** extends outwardly from the center of plate **67** and has slideably mounted thereon a plate **71**. Collar **72** fast on shaft **32** effects axial movement of plate **71** through clip **70** with the shaft but splines **69** prevent rotational movement of plate **71**.

Rotatably mounted about spline **69** are a plurality of fingers **73** each carrying a pin **74** having a head **74A**, a projection **75** and a clip **76**. Heads **74A** are received in depressions **77** in plate **71** so as to provide for indexing of fingers **73** on rotation thereof with clips **76** riding in a groove **79** to urge the heads into the depressions. An arm **78** is rotatably mounted on cover plate **80** and is keyed, through arm **81** for rotation with shaft **32**.

The normal position of dial **25** is as shown in FIG. 1 and, as heretofore described, outward movement of pin **61** in slot **62** permits inward movement of dial **25**. Outward movement of the dial is normally prevented by engagement of pins **74** with the surface of plate **67**. However, if each pin **74** is aligned with a cooperating hole **68**, outward movement of dial **25** is possible.

When a key has been jammed due to attempted unauthorized entry, it is necessary to withdraw rod **32** to pull back on pins **42** and **48**. An authorized person has knowledge of the location of holes **68** which are spaced about a circle which is keyed with the indicia on the face of dial **25**. When the lock is jammed, dial **25** is moved inwardly to free shaft **32** for rotation. The inward movement also moves plate **71** toward arm **78** and, with arm **78** in engagement with a projection **75**, rotation of the dial causes an associated finger **73** to be indexed to the proper position. The "feel" is accomplished through cooperation between head **74A** and depressions **77**. When a finger **73** has been properly aligned, dial **25** is slightly withdrawn to permit arm **78** to clear the aligned finger and dial **25** is rotated and then moved inwardly so that the next associated finger can be properly aligned. When each of the fingers has been properly aligned to align each pin **74** with an associated hole **68**, dial **25** may be pulled out past the normal position whereby the limit of slot **62** through rod **61** effects withdrawal of pin **48** so that plate **46** may be returned to the normal position.

Thus, not only is unauthorized opening of a lock prevented by one having the correct key, but release of the jammed mechanism can only be accomplished by one knowing the correct locations of holes **68**. Since fingers **73** are indexed with pins **74** out of contact with plate **67**, the proper setting of the fingers can not be accomplished

through "feel" and thus the lock can not be picked even for the purpose of withdrawing the key.

Resetting the correct opening number can be easily accomplished. Dial **25** is set at the correct opening number and cylinder barrel **23** is partially turned. This allows pin **48** to move outwardly to thereby permit depression of dial **25** to move gear **38** out of engagement with the teeth on trapping ring **34**. Dial **25** is freely rotated to a newly selected number and the dial is moved axially outwardly to its original, normal position. This has not changed the correct position of trapping ring **34** and thus the lock may be fully opened and the new number is set.

A modified form of the invention is shown in FIGS. 10 through 12, wherein the second pin, pin **42**, may be eliminated. In this embodiment, pin **48A** has a rounded end and is provided with an upstanding rod **52A** which performs the locking operation heretofore described. Plate **46A** is modified to have an elongated configuration with cam-shaped edges as shown in section in FIG. 11. A central aperture **82** is also formed with cam-shaped walls and teeth **53A** are modified to provide a flat **83** at the position corresponding to the correct opening number. The mechanism is otherwise constructed as heretofore described. With the embodiment shown in FIGS. 10 through 12, rotation of plate **46A** will be accomplished by rotation of cylinder barrel **23** with the key. If the correct opening number has been selected, pin **48A** will advance only partially into aperture **82**, further advance being prevented by cooperation between rod **52A** and flat **83**. This prevents pin **48A** from becoming jammed in plate **46A** and the rounded end of the pin cams over the cam-shaped aperture **82** to permit continued rotation of plate **46A**.

On the other hand, if the correct opening number has not been selected, rod **52A** engages in the deep cut between adjacent teeth **53A** thereby advancing pin **48A** fully into aperture **82** to lock plate **46A** against further movement. The mechanism for releasing the jammed pin would be as heretofore described.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above constructions without departing from the spirit and scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

What is claimed is:

1. A safety lock mechanism in combination with a lock cylinder having a rotatable cylinder barrel comprising a dial rotatable with respect to said lock cylinder and having indicia on the face thereof, a plate mounted for movement with said cylinder barrel, pin means slidable in said lock cylinder and positionable in the path of movement of said plate, said pin means engaging said plate only after said cylinder barrel has been partially rotated from locked position thereof, trapping means for selectively permitting or preventing blocking engagement between said pin means and said plate, and motion transmitting means interconnecting said dial and said trapping means for moving said trapping means to a position to permit non-blocking engagement between said pin means and said plate when said dial is rotated to a preselected setting of said indicia so that said cylinder barrel can be rotated to an unlocked position.

2. A safety lock mechanism as claimed in claim **1** wherein said trapping means includes a trapping ring rotatable with respect to said lock cylinder and having a plurality of axially extending teeth, said pin means being provided with a rod extending therefrom adapted to engage between said teeth for locking of said trapping ring, said plate being positionable over said pin means to hold said pin means depressed and being movable out of engagement therewith to permit release of said pin means whereby said rod engages between said teeth.

3. A safety lock mechanism as claimed in claim **2** wherein said motion transmitting means includes a rotatable shaft extending between said dial and said trapping ring, said shaft carrying gears in mesh with teeth on surfaces of said dial and trapping ring to effect rotation of said ring through said dial.

4. A safety lock mechanism as claimed in claim **2** wherein said plate is provided with an aperture for fully receiving said pin means when said dial is rotated to other than a preselected setting of said indicia.

5. A safety lock mechanism as claimed in claim **1**, wherein said trapping means includes a tapping ring rotatable with respect to said lock cylinder and having a channel-shaped cross-sectional configuration and a slot in one leg thereof, said pin means having a rounded end adapted for engagement by said plate, said pin means having a rod extending therefrom and normally disposed between the legs of said channel-shaped trapping ring, said pin means adapted to be depressed when said rod is disposed opposite said slot in said one leg of said trapping ring, depression being accomplished by the camming action of said plate thereover, depression being prevented by said one leg of said trapping ring when said slot is not in the required preselected position to thereby prevent further movement of said plate.

6. A safety lock mechanism as claimed in claim **5** wherein a second pin is slideable in said lock cylinder and includes a second rod extending from said second pin, said trapping ring being provided with a plurality of circumferentially spaced teeth extending toward said second rod, said second pin being normally depressed by engagement with said plate and being adapted to advance to move said second rod into blocking engagement between a pair of said teeth to thereby prevent rotation of said trapping ring when said plate is out of engagement with said second pin.

7. A safety lock mechanism as claimed in claim **6** and including channel means extending from said pin means and slideably receiving said second pin.

8. A safety lock mechanism as claimed in claim **7** and including a second plate pivoted to said lock cylinder and adapted for depression of said pin means on engagement between said second plate and the outer end of said pin means, said first plate including means for cooperating with said second plate for effecting rotation of said second plate during a preselected portion of the cycle of rotation of said first plate.

9. A safety lock mechanism in combination with a locking device comprising a dial rotatable with respect to said locking device and having indicia on the face thereof, pin means slidable with respect to said locking device and adapted for selectively blocking said locking device for preventing movement of said locking device from a locked position to an unlocked position while permitting limited movement of said locking device from said locked position into an intermediate position wherein further movement of said locking device is prevented, said pin means including means for preventing return movement of said locking device from means intermediate position to said locked position, release means cooperating with said pin means for releasing said locking device so that said locking device can be moved from said intermediate position, trapping means cooperating with said pin means for selectively permitting or preventing blocking of said locking device by said pin means, and motion transmitting means interconnecting said dial and said trapping means for moving said trapping means to permit said pin means to be located in a non-blocking position

when said dial is rotated to a preselected setting of said indicia so that said locking device can be moved to said unlocked position.

10. A safety lock mechanism as claimed in claim **9**, and including means for moving said dial with respect to said trapping means comprising a plurality of rotatable fingers each having a finger pin projecting therefrom, means defining a surface for abutment by said finger pins for preventing movement of said dial with respect to said trapping means, and a plurality of bores in said surface defining means for receiving said finger pins on rotation of said fingers to preselected positions whereby to permit advancement of said fingers and said surface defining means toward one another to thereby permit movement of said dial relative to said trapping means to permit unblocking of said locking device.

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