United States Patent

Hanson

[15] **3,664,231**

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[54] LOCKING DEVICE

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[73] Assignee: **Pitney-Bowes, Inc.,** Stanford, Conn.

[22] Filed: **Dec. 17, 1970**

[21] Appl. No.: **98,999**

[52] **U.S. Cl.** **70/292,** 70/182, 70/304, 70/314, 70/315, 70/322, 70/326, 242/75

[51] **Int. Cl.** **E05b 37/16,** G05g 5/00

[58] **Field of Search** 70/286, 287, 288, 292, 293, 70/297, 298, 304, 308, 312, 315, 319, 314

[56] **References Cited**

UNITED STATES PATENTS

2,692,495	10/1954	Verdan	70/351
2,967,419	1/1961	Katona	70/288 X
3,034,329	5/1962	Pitney et al.	70/314
3,115,028	12/1963	Windle	70/288

FOREIGN PATENTS OR APPLICATIONS

602,134	5/1948	Great Britain	70/288

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[57] **ABSTRACT**

There is disclosed a combination lock which is actuated by two sets of numbered keys. Contained within the lock is a tape which is pre-punched with a succession of randomly generated codes. The lock can be actuated only when the keys punched by the user correspond with the code on the punched tape. Each actuation of the lock advances the tape to establish a new code.

22 Claims, 15 Drawing Figures

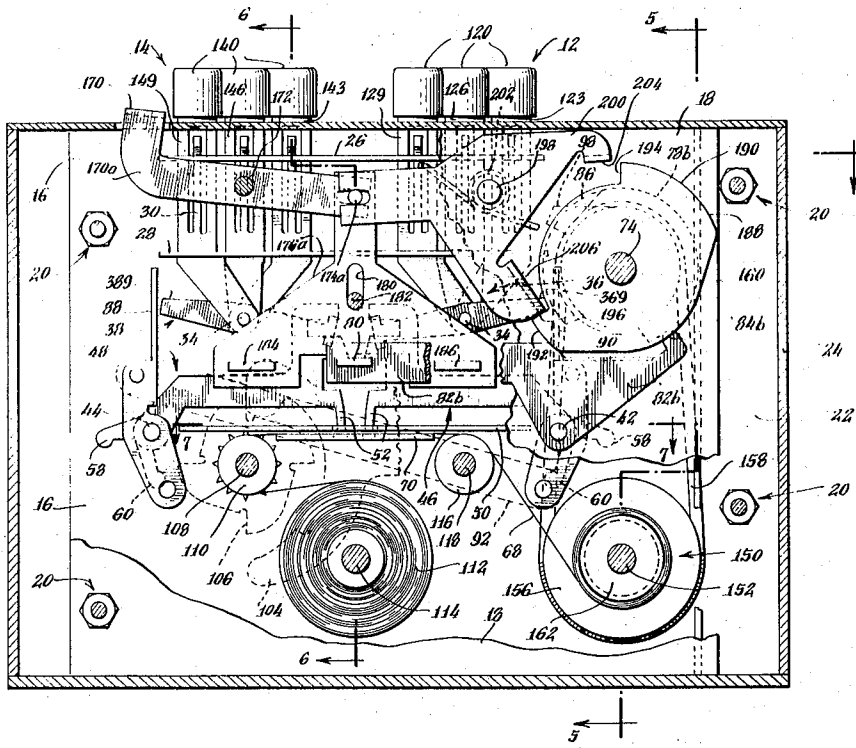


Fig. 1.

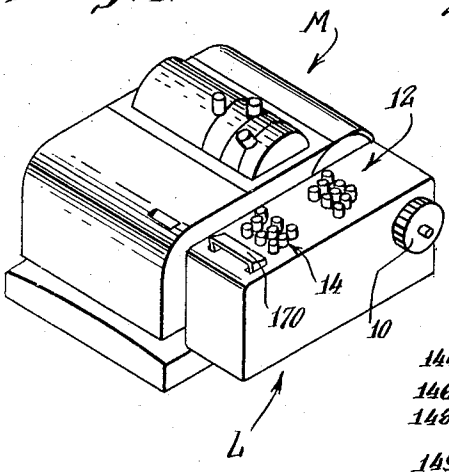


Fig. 6.

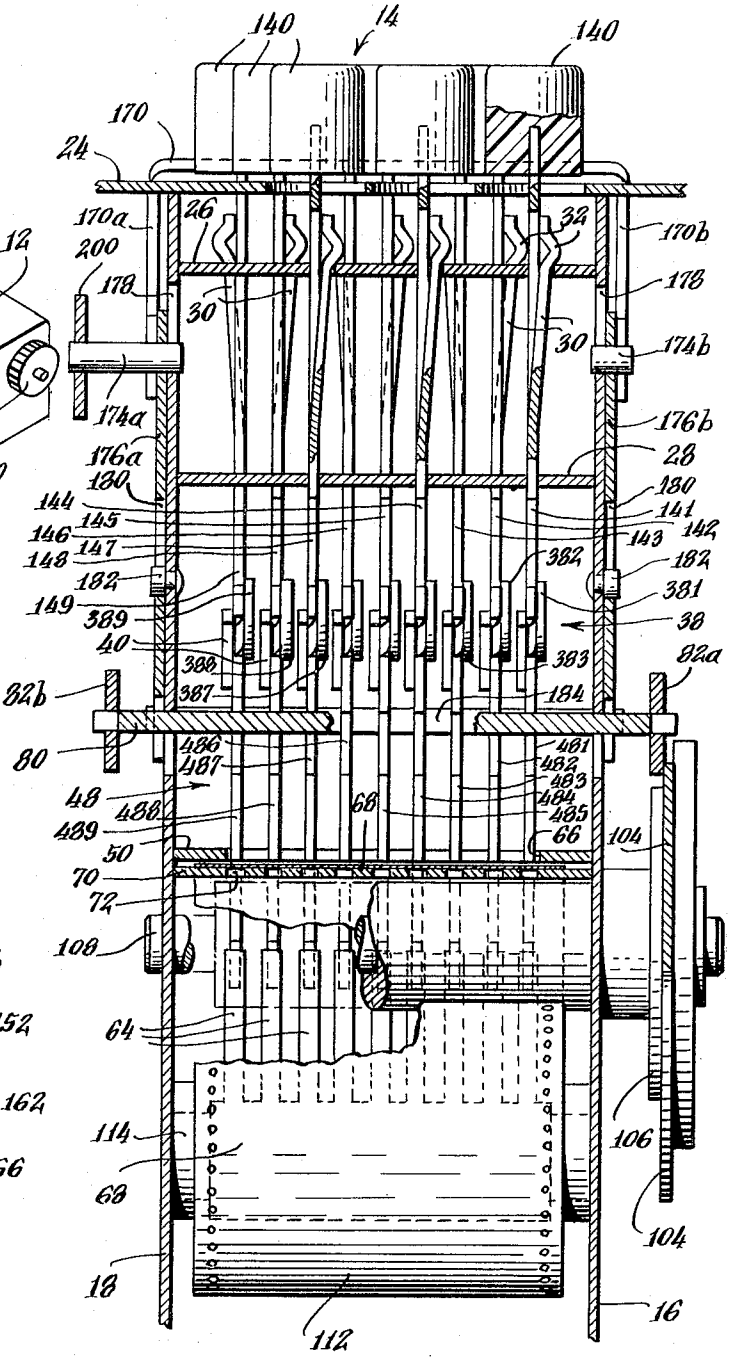
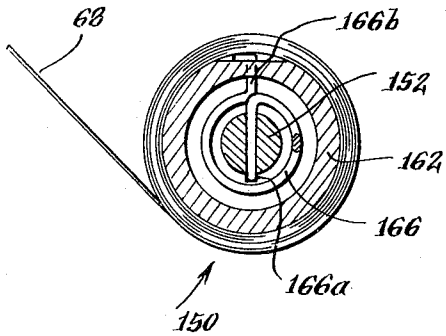


Fig. 11.



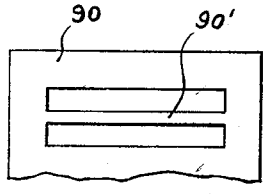


Fig. 15

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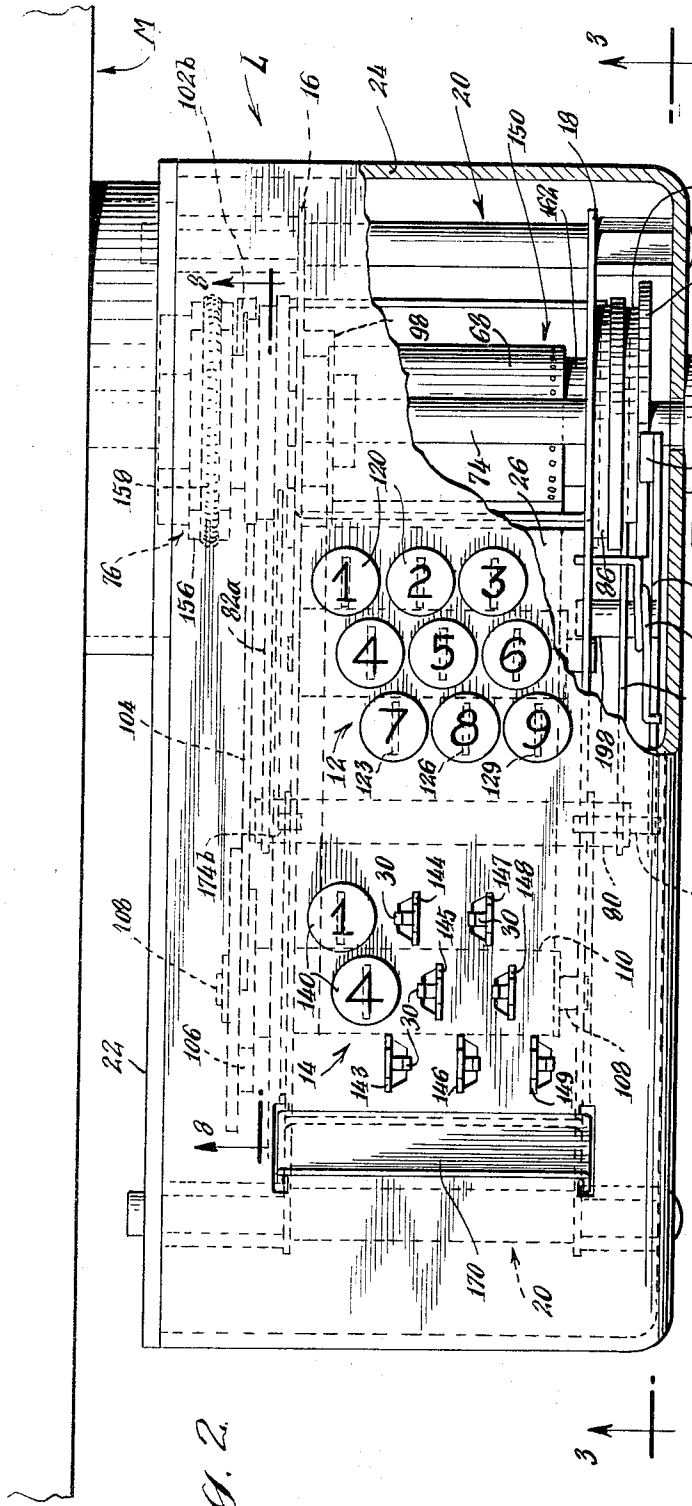


Fig. 2

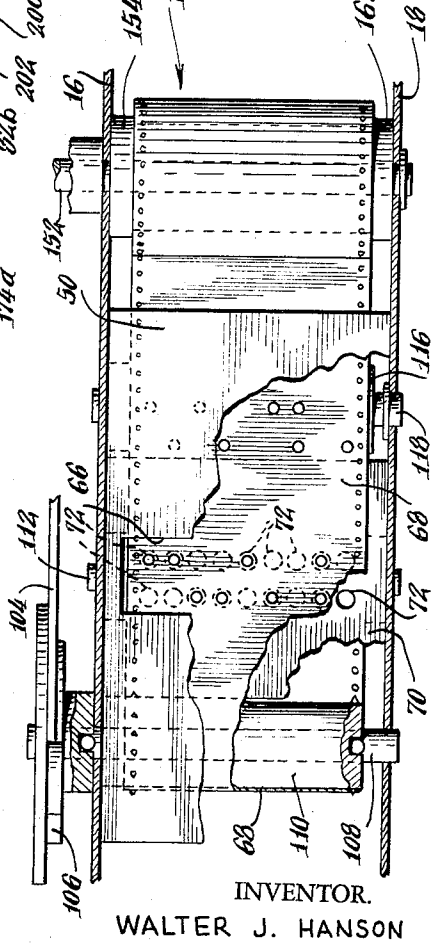


Fig. 7

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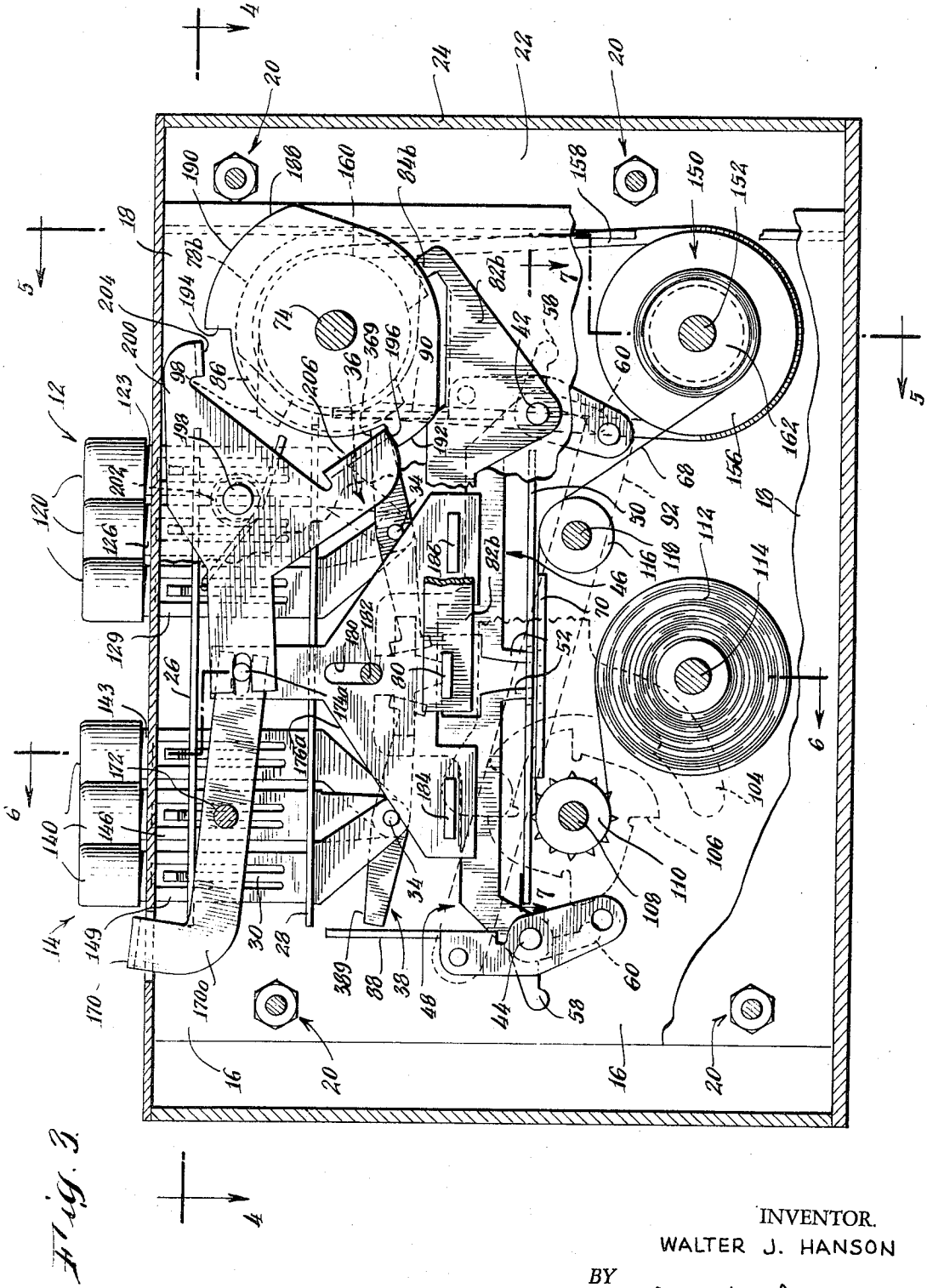


Fig. 2

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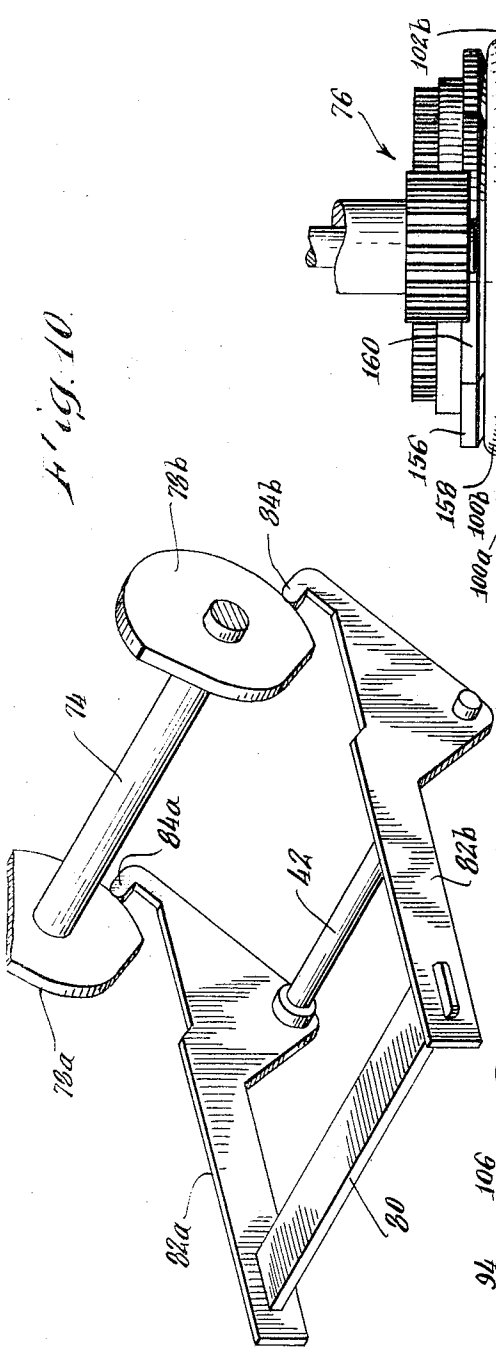


Fig. 10

Fig. 4

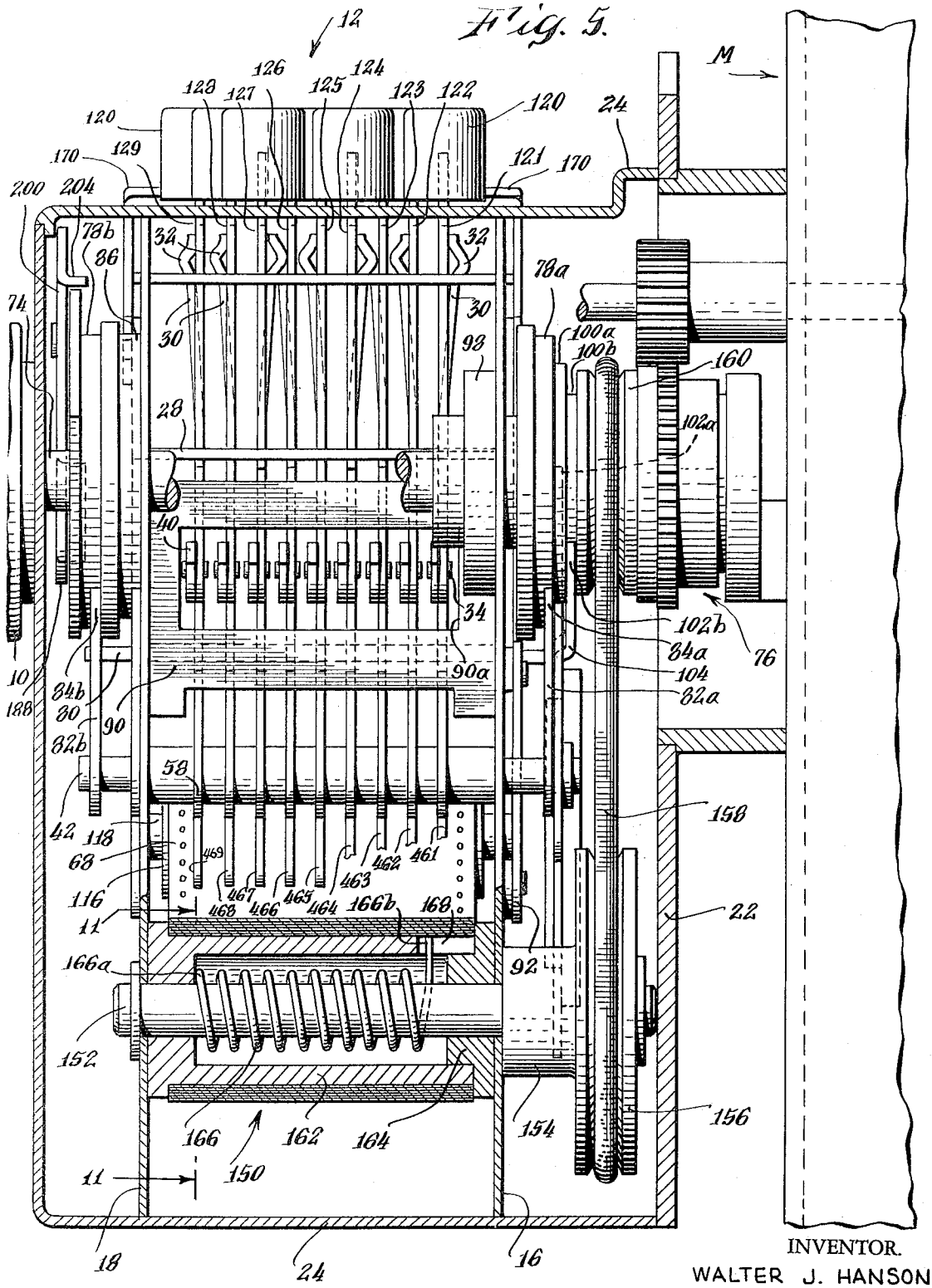
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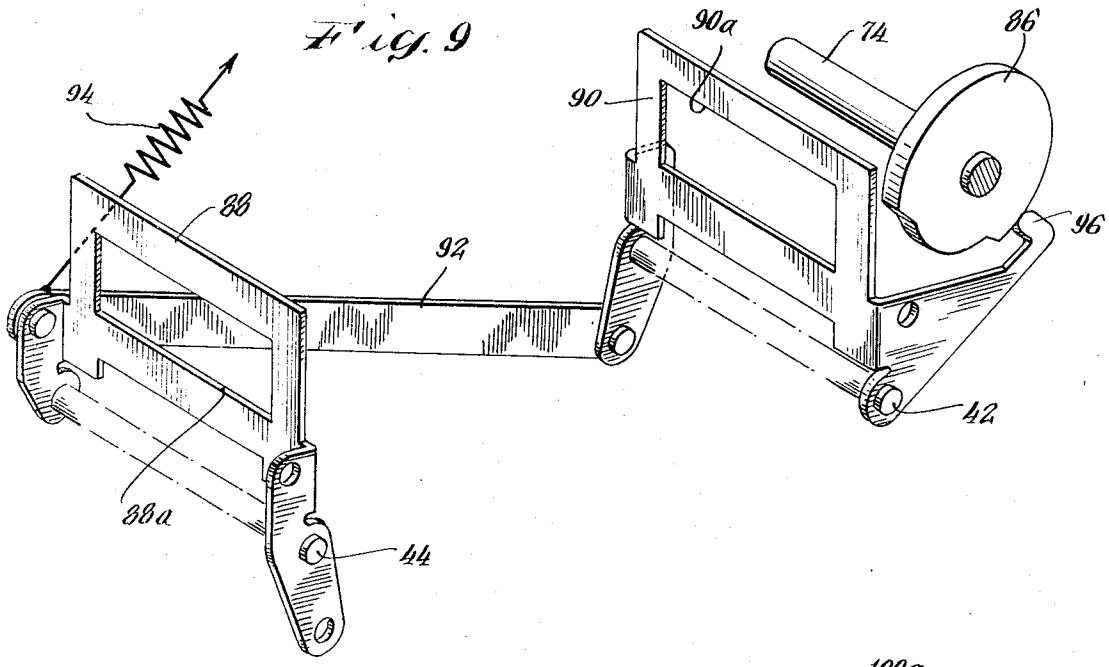
Fig. 5.



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Fig. 9



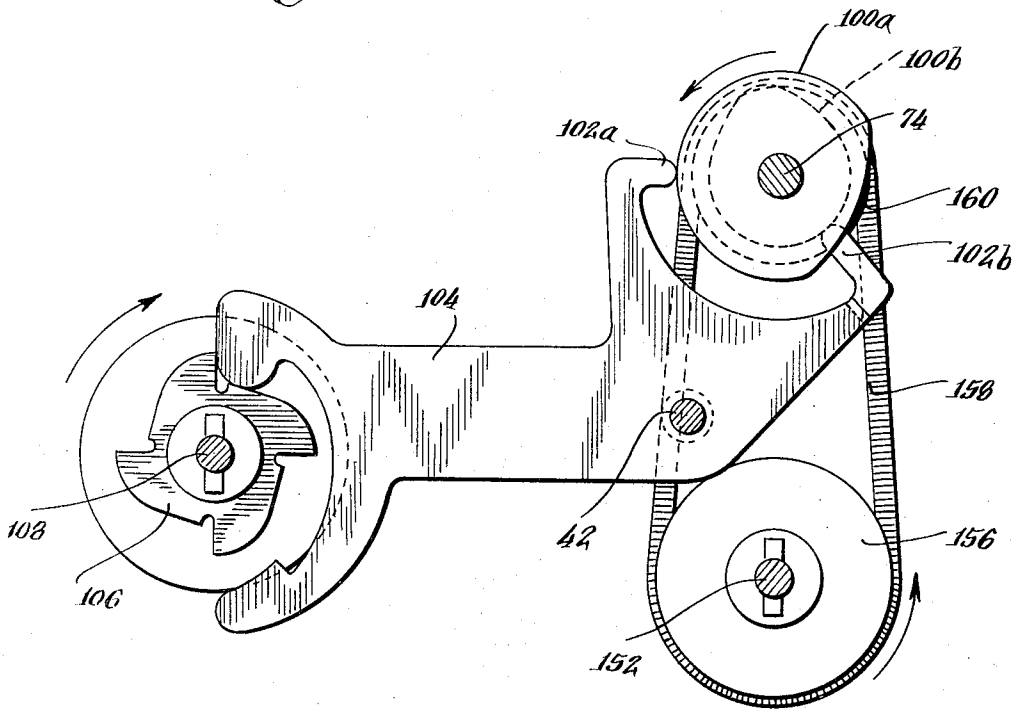


Fig. 8.

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Fig. 12.

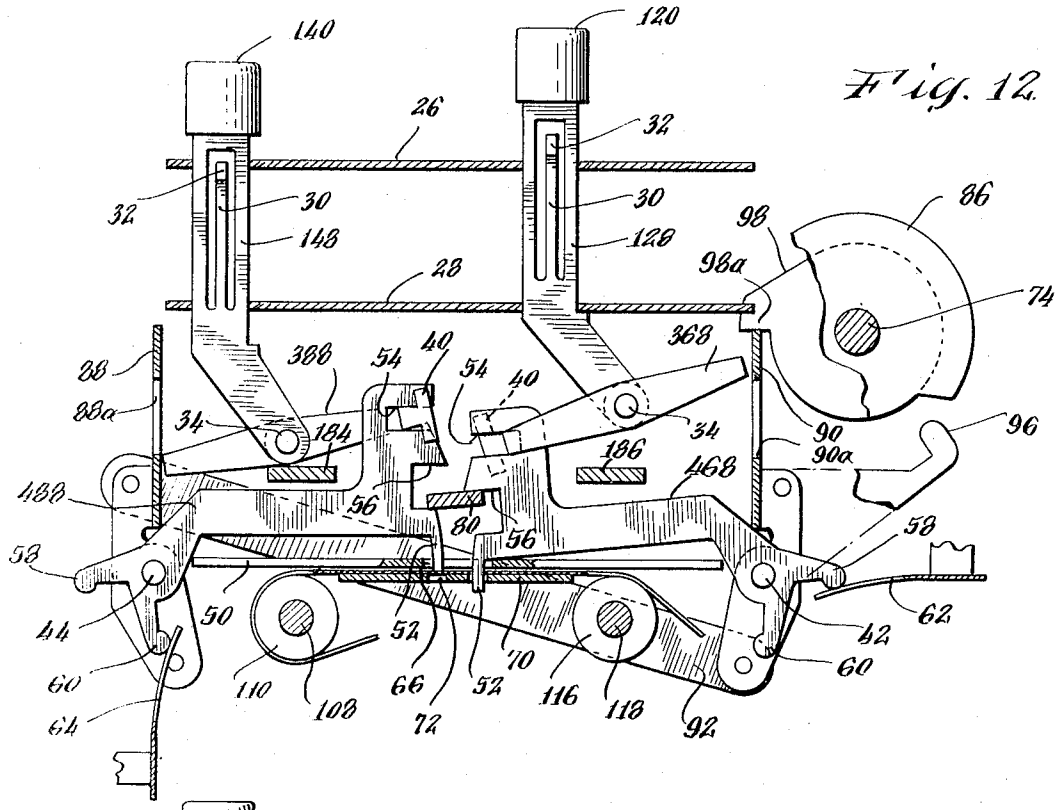
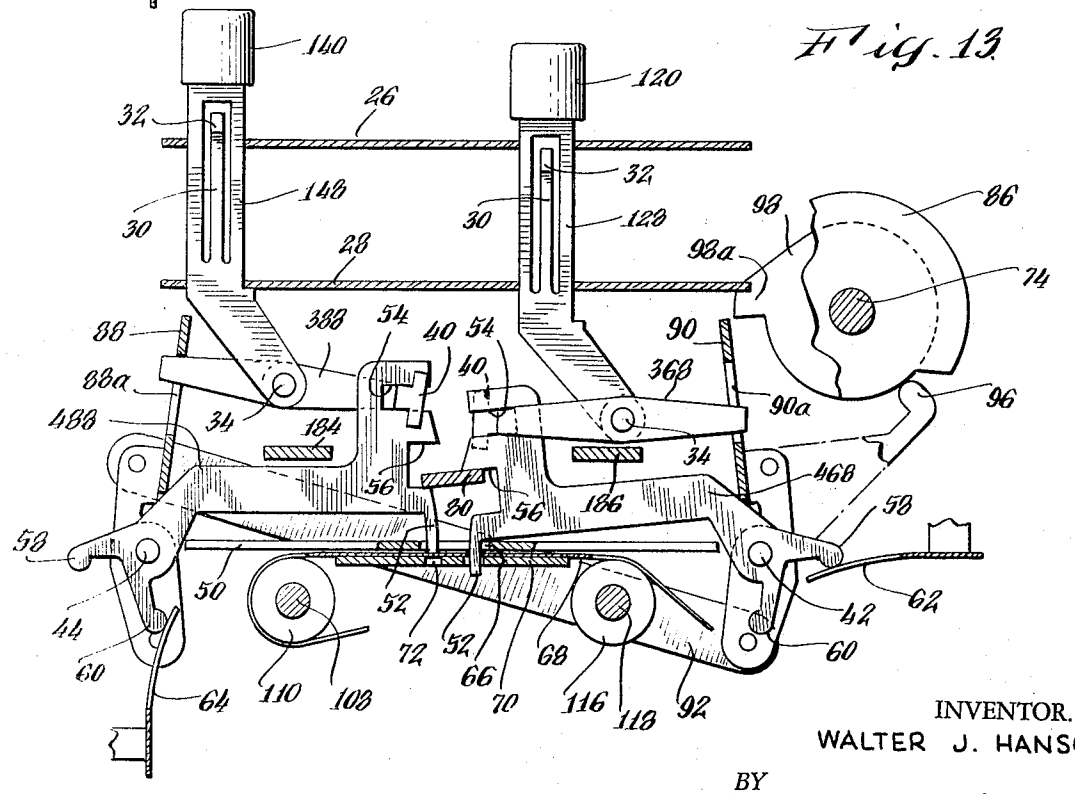


Fig. 13.



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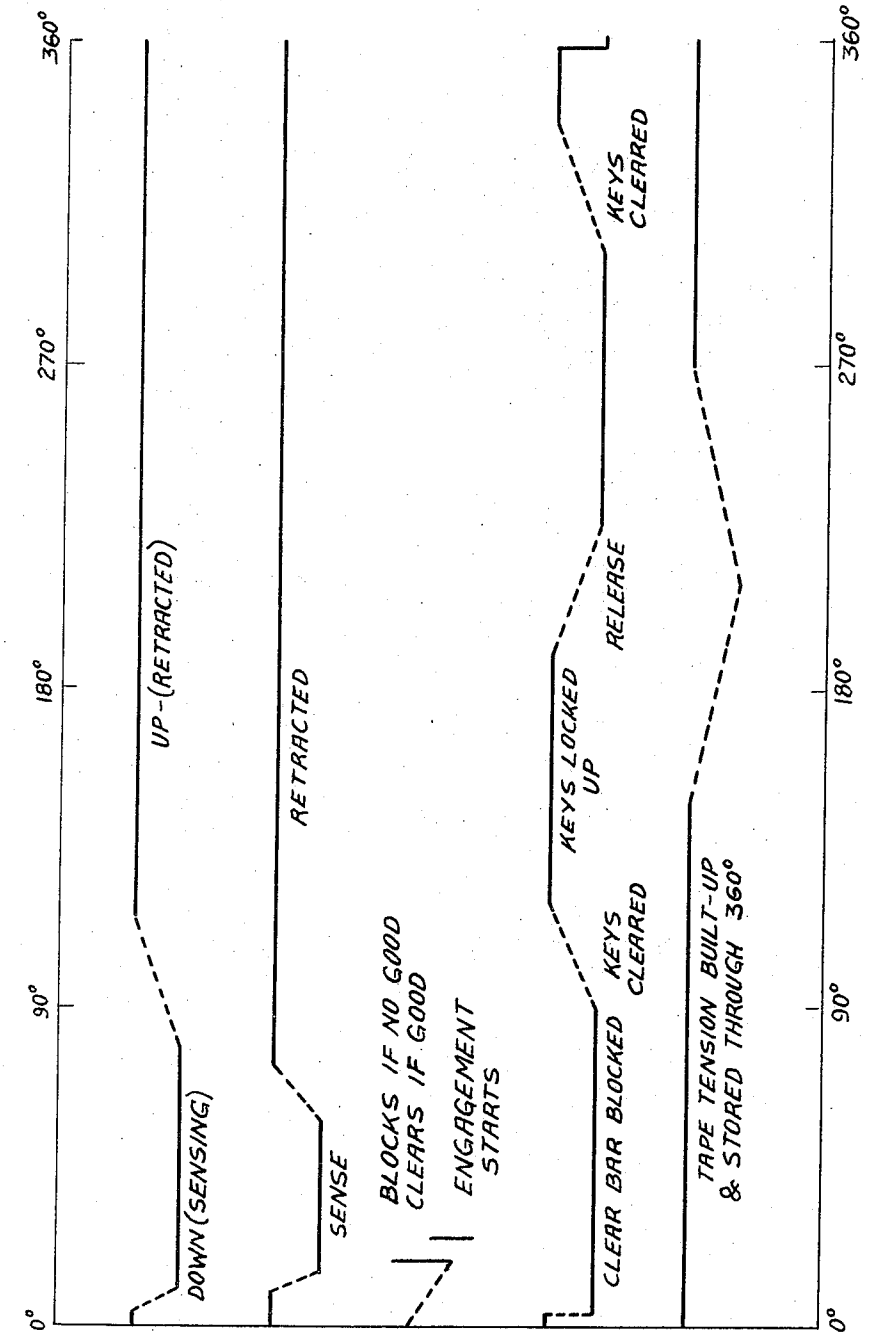


FIG. 14

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LOCKING DEVICE

BACKGROUND OF THE INVENTION

There are a number of applications in which it would be desirable to have a combination lock which would automatically change its combination upon each actuation. One such application is in postage meters. At the present time, when the postage value of a meter has been used, it is necessary to physically carry it to a post office where the meter is reset to the correct amount. This could be avoided if the postage meter included a combination lock whose combination changed upon each usage. This would make it possible, for example, to mail a check or otherwise provide for the proper credit and then obtain by telephone the combination required to actuate the lock and reset the meter by a predetermined amount. The combination would then change and the succeeding combination would be available only after another unit of postage has been paid for.

Locks with automatically changing combinations have been proposed in the past. One, for example, is disclosed in U.S. Pat. No. 3,034,329 which issued May 15, 1962 to R. C. Pitney et al. Locks of that nature, although important advances over the state of the art, retain certain disadvantages which it would be desirable to overcome. For example, the combination of such a lock is determined by the mechanical elements of the lock itself. This makes it difficult to alter the combination sequences. It also requires rather complex mechanical elements, causing the lock to be larger and more expensive than would be desirable.

Accordingly, it is an object of the present invention to provide an improved combination lock of simple construction which can be easily mass produced. Other objects are to provide such a lock wherein the sequence of combinations is established by punched tape which is easily replaced. Other objects, features, and advantages will become apparent from the following description and appended claims.

SUMMARY OF THE INVENTION

In accordance with the present invention there is provided a combination lock including an actuating member which can be unlocked upon entry of the correct combination therein. The lock includes combination determining means selectively positionable in the lock and defining apertures representing elements of a preselected combination. A plurality of sensing means are individually advanceable against the combination determining means and are positioned to enter any aperture which is aligned therewith. The lock includes a plurality of manual selection means, each of which corresponds to one of the sensing means and is independently movable to represent elements of a selected combination. A linkage interconnects each of the selection means and its corresponding sensing means and is adapted to assume a clearing position when an element of the selected combination corresponds to an element of the preselected combination and a blocking position in the absence of such correspondence. Means are provided for normally blocking the actuating member but releasing it when all of the linkage means are in their clearing positions.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view on a reduced scale of a postage meter incorporating a combination lock in accordance with this invention;

FIG. 2 is a plan view of the combination lock of this invention with a portion of the housing broken away to illustrate its internal construction;

FIG. 3 is a cross section taken substantially along line 3—3 of FIG. 2;

FIG. 4 is a cross section on an enlarged scale taken substantially along line 4—4 of FIG. 3;

FIG. 5 is a cross section on an enlarged scale taken substantially along line 5—5 of FIG. 3;

FIG. 6 is a cross section on an enlarged scale taken substantially along the line 6—6 of FIG. 3;

FIG. 7 is a cross section taken substantially along the line 7—7 of FIG. 3;

FIG. 8 illustrates a portion of the tape advance mechanism of the invention;

FIG. 9 is a perspective view of the sensing gate mechanism of the invention;

FIG. 10 is a perspective view of the release bar mechanism of the invention;

FIG. 11 is a cross section taken substantially along the line 11—11 of FIG. 5;

FIG. 12 is an illustration depicting the manner in which an improper combination keeps the lock in its locked position;

FIG. 13 illustrates the manner in which a proper combination unlocks the lock;

FIG. 14 is a timing chart illustrating the various steps in operation of the lock of the invention; and

FIG. 15 is an elevational view illustrating a modified version of the gate.

DESCRIPTION OF THE PREFERRED EMBODIMENT

There is illustrated in FIG. 1 a postage meter M to which is secured the combination lock L of this invention. Mounted on the side of lock L is an input knob **10**. This knob when rotated sets into the meter M a preselected amount of postage. The lock, however, permits turning of the knob only when a correct combination is selected. Positioned on the top of lock L are two sets **12, 14** of numbered buttons. The buttons of each set carry the digits 1–9 and the two sets may be differentiated by color. For example, buttons **12** may be white and buttons **14** red.

Referring now to FIGS. **2–5**, the lock will be seen to comprise an inner side frame **16** and an outer side frame **18** connected together in spaced parallel relationship by means of conventional bolt-nut-spacer assemblies **20**. Also mounted to these assemblies is back plate **22** and housing **24**. Extending between the side frames **16, 18** is a top plate **26** which is parallel to and spaced below the top of the housing. Parallel to, and spaced below, the top plate **26** is a guide plate **28**. The top plate **26** and guide plate **28** each defines a total of **18** slots. These slots are aligned to retain therein the key stems of the button sets **12, 14** as will now be described.

Button sets **12** and **14** are substantially identical. Each comprises a total of **9** key stems, **121–129** and **141–149**. Each key stem is topped by a suitable button **120, 140**. Only two types of key stems are required for all the eighteen keys. Those keys which form the center row of each set, namely, **122, 125, 128** and **142, 145, 148** are straight and their lower ends are positioned directly beneath the corresponding buttons as shown in FIG. 3. The key stems of those keys forming the outside rows of each set, namely, **121, 123, 124, 126, 127, 129, 1, 3, 4, 6, 7, 9** have their lower extremities cut at an angle in order that the bottom ends of all keys in each set are aligned as shown in FIG. 3. All the angled key stems are identical. Each key stem is stamped to form a central tongue **30** having a detent **32** therein (FIG. 6) which coacts with the top plate **26** to retain a key either in a raised or lowered position.

The lower end of each key stem carries a pivot **34**. Supported by the pivots **34** on the stems of key set **12** is a set **36** of tumbler levers. The individual tumbler levers **361–369** correspond respectively to the key stems **121–129**. A similar set **38** of tumbler levers are mounted on the pivots **34** of the stems of key set **14**. The individual tumbler levers **381–389** correspond respectively to the key stems **141–149**. The tumbler levers are identical although reversed in each set. Their construction is best seen in FIGS. **12** and **13**. They are elongated and pivoted at approximately their center points. At their inner ends, each lever is formed with an offset T head **40**.

A pair of shafts **42, 44** extend horizontally between the inner and outer side frames. Pivotally mounted on shaft **42** is a set **46** of sensing members **461–469**. A similar set **48** of sensing members **481–489** is mounted on shaft **44**. The sensing members override a plate **50** which is slotted to

restrain them to vertical movement only. The sensing members are identical although the two sets are reversed. The construction of the sensing members is most clearly illustrated in FIGS. **12** and **13** which portray members **468**, **488**. Each member includes an elongated inwardly extending body portion which terminates in a downwardly dependent sensing finger **52**. An upwardly extending portion of the member defines a horizontal slot **54** which loosely engages the offset T **40** of its corresponding tumbler lever. Below the slotted portion of each sensing member is a shoulder **56**. The opposite ends of the sensing members extend beyond the pivot and are provided with a horizontal lever arm **58** and a vertical lever arm **60**. Each of lever arms **58** of sensing member set **46** is engaged by a horizontal leaf spring **62**. Each vertical lever arm **60** of the sensing member set **48** is engaged by a vertical leaf spring **64**. These leaf springs bias the corresponding sensing members causing sensing fingers **52** to be urged downwardly through an opening **66** in plate **50**. Positioned directly below the opening **66** is a punched computer tape **68** supported by a tape support plate **70** defining two parallel rows of **9** holes **72** (FIG. **7**) aligned with sensing fingers **52**.

The knob **10** on the side of the lock is secured to the end of a combination drive and cam shaft **74**. The shaft **74** extends through the lock to actuate a meter input mechanism **76**. Mounted upon shaft **74** are a plurality of cams and other elements which will now be described.

Mounted on shaft **74** on the outside of side frames **16**, **18** are a pair of identical sense release cams **78***a*, *b*. These cams control the vertical position of a sense release bar **80** which extends through suitable openings in the side frames and lies below shoulders **56** of the sensing members forming sensing member sets **46** and **48**. As will be more apparent from FIG. **10**, the bar **80** is supported between parallel arms **82***a*, *b* which are pivoted on shaft **42** and include cam follower portions **84***a*, *b*. The cams **78***a*, **78***b* define circular raised portions extending approximately 203°, the remaining circumference of the cam being relieved. When the cam followers are contacting the raised portion of the cams, the sense release bar **80** is raised to the position shown in FIG. **3** thereby lifting the sensing members of sets **46**, **48**. When the cam is rotated until the relief portions are beneath the cam followers, the bar is lowered to the positions shown in FIGS. **12** and **13**.

Also mounted on shaft **74** is lock release cam **86** (FIG. **9**). The cam controls the movements of a pair of gates **88**, **90**, each defining a window **88***a*, **90***a* therein. The gates are respectively pivotable about shafts **44**, **42** and are joined by a cross link **92** connected above the pivot point of gate **88** and below the pivot point of gate **90**. A coil spring **94** biases the gates inwardly but they are retained in a normally upright position by means of a cam follower **96** which bears against the circular portion of cam **86**.

Also mounted on shaft **74** is a dead lock cam **98**. This cam is provided with a radial projection **98***a* which, as shown in FIG. **12**, engages gate **90** when rotated counterclockwise with the gate in its raised position. As shown in FIG. **13**, projection **98***a* clears the gate when the gate is rotated inwardly.

The tape drive is controlled by a pair of conjugate cams **100***a*, **100***b* mounted on shaft **74** (FIG. **8**). The cams are engaged by cam followers **102***a*, **102***b* on an escapement pawl **104** rotatably mounted on shaft **42**. The opposite end of the escapement pawl engages a four toothed ratchet **106**. This ratchet, in turn, is secured to a shaft **108** controlling a toothed feed roller **110**. In the illustrated embodiment, the teeth of feed roller **110** are at its ends and the tape **68** is of the type having sprocket holes along its two edges. This, however, is not a critical feature of the invention and a tape utilizing a single sprocket drive could be employed if desired. The tape **68** which passes over the feed roller is removed from a supply roll **112** (FIG. **3**) rotatably mounted on a shaft **114**. From the feed roller the tape passes through the spaces defined between plate **50** and support plate **70** and over an idler **116** rotatably mounted on shaft **118**. From idler **116** the tape **68** passes over a torque roller assembly **150** which maintains the tape under tension in a manner to be described.

The construction of the torque roller assembly will be most apparent from a consideration of FIGS. **5** and **11**. From these figures, it will be noted that a shaft **152** extends between side frames **16**, **18** and is secured at its right end (as viewed in FIG. **5**) to the hub **154** of a pulley **156**. Pulley **156** is driven via a coil spring drive belt **158** from a drive pulley **160** mounted on shaft **74**.

Rotatably mounted on shaft **152** between side frames **16**, **18** is a roller **162** and end cap **164**. These two elements form a take-up spool for the tape **68**. The space within the roller houses a torsion spring **166** which, in its relaxed state, has an internal diameter larger than the external diameter of shaft **152**. The left end **166***a* of the torsion spring is secured to shaft **152** by capturing it in a diametrical slot as shown in FIG. **11**. The right end **166***b* is engaged in a slot **168** in roller **162**.

The lock of this invention also includes a key reset mechanism which is best illustrated in FIGS. **3** and **6**. It includes a hand actuated reset bar **170** extending across the top surface of the lock and including a pair of spaced arms **170***a*, **170***b* which are pivoted to the side frames by stub shafts **172**. The inner ends of the arms are bifurcated and engage pins **174***a*, *b* mounted in identical Y-shaped side members **176***a*, *b*. The pins **174***a*, *b* also extend through guide slots **178** in the side frames and additional slots **180** in the side members are guided by fixed studs **182**. Extending between the side members **176***a*, *b* and across the width of the lock below the pivots **34** on the lower ends of the key stems are reset bars **184**, **186**. The lock of this invention is also designed to clear the keyboard automatically on completion of a cycle. For this purpose, there is mounted on the end of shaft **74**, as seen in FIG. **3**, a clearing cam **188**. This cam has opposed high lobe portions **190**, **192** terminating at radial shoulders **194**, **196**. A stub shaft **198** on side frame **18** rotatably supports a clearing lever **200**. The lever is biased in a counterclockwise direction by means of a coil spring **202**. The left end of the lever is bifurcated and engages pin **174***a*. At its right end the lever carries a pair of cam followers in the form of two offset ears **204**, **206** which are angularly separated by an amount slightly less than the angle between shoulders **194**, **196**.

OPERATION

The combination required to operate the lock of this invention is established by a prepunched paper tape **68**. Each combination comprises two series of four digits each. Preferably, these are randomly selected by a computer which punches the tape and stores the sequence of combinations in its memory. The lock can be operated only when the proper four keys in each bank are depressed. If an improper key is depressed, or if a key is not depressed when it should be, the lock cannot be operated. The means by which this result is achieved are shown in FIGS. **12** and **13** which illustrate only the "8" key in each bank. All other keys function in an identical manner.

In order to initiate sensing, the sense release bar **80** is lowered, thereby freeing sensing members **468**, **488** as well as all other sensing members. In the illustration the number "8" appears in the combination for the righthand set of keys, but not in the combination for the lefthand set of keys. FIG. **12** illustrates two improper key settings. Key **120**, which should be depressed, has not been and key **140**, which should not be depressed, has been. Each of these key positions establishes the vertical position of the corresponding pivot **34**. However, sensing finger **52** of sensing member **468** has passed through the opening in tape **68**, lowering the left end of tumbler lever **368**. The right end of tumbler lever **368** is therefore positioned above the window in gate **90**.

On the left side of the figure, it will be noted that, as no hole exists in the punched tape **68**, sensing finger **52** is in a raised position, as is the righthand end of tumbler lever **388**. This brings the lefthand end of tumbler lever **388** to a position below the window in gate **88**. The gates at this point have been released, as cam **86** has been moved away from cam follower **96**, and spring **94** (FIG. **9**) tends to bias the gates inwardly. However, they are unable to move substantially due to the im-

position of the tumbler levers. In this position, rotation of shaft **74** is stopped by virtue of deadlock cam **98** engaging the top of gate **90**. As the gates are interconnected by cross link **92**, only one key out of 18 needs to be improperly positioned to prevent operation of the lock.

FIG. **13** illustrates operation of the lock by proper adjustment of the keys. Here it will be noted that key **120** has been depressed, lowering pivot **34** and the righthand end of tumbler lever **368** so as to clear gate **90**. Similarly, the lefthand key **140** has not been depressed, leaving the pivot point **34** raised and allowing the left end of tumbler lever **388** to clear gate **88**. In this position, therefore, the gates are permitted to move inwardly as illustrated, clearing deadlock cam **98** and permitting rotation of shaft **74**.

The tape control system is best described by reference to FIGS. **5**, **7**, **8** and **11**. Drive pulley **160** on shaft **74** drives pulley **156** on shaft **152** through the action of the coil spring drive **158**. As shaft **152** is not secured to the roller **162** or its end cap **164**, it will wind down the torsion spring **166** against the pull of the tape until the inner diameter of the torsion spring is reduced to shaft size. Under this condition, it stores a fixed torque value. In actual practice, these elements are sized so that, with the roller fixed, approximately three turns are required to reach this condition. The torque which is delivered by the spring belt **158** must slightly exceed the stored spring torque. Thereafter, the belt **158** will slip in the pulleys. Referring now to FIG. **3**, it will be noted that the torque roller assembly **150** just described will exert a pull on tape **68**, keeping it under tension against the restraining force of the sprocketed feed roller **110**. Movement of the tape for changing from one combination to the succeeding combination upon each actuation of the lock is provided by the escapement mechanism shown in FIG. **8**. As the conjugate cams **100***a*, **100***b* are rotated, they cause the escapement pawl **104** to rock about shaft **42** in a clockwise direction. The upper lobe of the pawl releases the upper tooth of ratchet **106** causing it to rotate 45° in a clockwise direction under the tension of the tape. The 45° motion is a result of the righthand tooth of ratchet **106** contacting the lower lobe of the pawl. When the pawl then returns to the position illustrated in FIG. **8**, a full 90° rotation of ratchet **106** and feed roller **110** results. The tape is punched in such a manner that the twin rows of combination-defining holes are separated by distances equal to one-fourth the circumference of the feed roller so that they are properly aligned beneath the sensing fingers for the next operation of the lock. Each tape advance is immediately taken up by the stored torque in the roller assembly and the continuing torsional effort of the felt drive recharges the spring.

As the tape **68** accumulates on roller **162**, its diameter increases, resulting in decreasing tape tension due to the fact that the torque is relatively fixed. Accordingly, the percentage of slip of the belt **158** increases proportionately. For this reason, the torque values are established to provide a suitable range of tape tension safely below the tensile strength of the tape at start up but sufficient to assure reliable escapement function at minimum tension. These values, however, are easily ascertainable by one skilled in the art and need not be set forth in detail.

The overall operation of the lock of this invention can best be described by reference to the timing chart, FIG. **14**. The horizontal scale of this chart is one rotation of shaft **74** through 360°. It will be assumed that the combination has been correctly inserted by depressing the proper four keys in each set. Knob **10** on the side of the lock is then turned.

As rotation begins, the shoulder **194** of clearing cam **188** passes beneath the ear **204** of clearing lever **200** (FIG. **3**). This blocks manual operation of clearing bar **170** preventing the keys from being reset during the sensing portion of the cycle.

Next, cams **78***a*, *b* (FIG. **10**) release arms **82**, permitting the sense release bar **80** to drop. The eighteen sensing members then drop to a sensing position with their sensing fingers **52** either resting on the paper tape or passing through a hole therein. This causes all tumbler levers to be positioned to enter the respective windows of the movable gates as shown in FIG. **13**.

Next, cam **86** releases the cam follower **96** and the gates, under the influence of spring **94**, rotate inwardly, thereby clearing the deadlock cam **98** permitting continued rotation of shaft **74**. After a short sensing period of less than 90° of shaft rotation, cam **86** once more picks up cam follower **96** and retracts the gates to their initial positions.

Thereafter, at approximately 90°, two cams come into action. Cams **78***a*, *b* raise the sense release bar **80**, once more lifting all 18 of the sensing members. Also, high lobe portion **190** of the clearing cam **188** engages ear **206** of clearing lever **200**, raising the side members **176***a*, *b* and reset bars **184**, **186**. The reset bars engage the lower ends of the key stems, raising all keys until they detent into their raised positions.

Thereafter, at approximately 150° of rotation, the tape advance escapement of FIG. **8** is actuated, permitting the tape to advance and align the next combination in proper position.

Immediately after deadlock cam clears gate **90**, anti-reverse means (not shown) of any suitable type may be used to prevent reverse rotation of shaft **70**.

It is believed that the many advantages of this invention will now be apparent to those skilled in the art. For example, the lock is constructed primarily of stamped metal parts, many of which are duplicates. This results in a lock which is inexpensive and can be easily mass produced. Furthermore, since the combination is established by an easily changeable paper tape, all locks can be mechanically identical and still have different combinations and sequences of combinations.

It will also be apparent that a number of variations and modifications can be made in this invention without departing from its spirit and scope. The tape, for example, need not be of paper but may be of any suitable material. Furthermore, the tape may be of "chadless" type, defining depressions rather than holes. For this reason, the term "aperture" as used in the following claims is to be construed as defining such depressions and their equivalents. Also a modified construction for the gates **88** and **90** may be used as illustrated in FIG. **15** wherein the upper and lower portions of each gate window may be separated by integral horizontal bar **90'**.

The lock of this invention has been described primarily as an adjunct to a postage meter. However, it will be apparent that its applications are not so limited but extend to any usage wherein its unique characteristics would be of value.

For all these reasons, the foregoing description is to be construed as illustrative only, rather than limiting. This invention is limited only by the scope of the following claims.

I claim:

1. A combination lock adapted to be unlocked upon entry of the correct combination therein which comprises: an actuating member; combination determining means defining therein apertures representing elements of a preselected combination; a plurality of sensing means individually advanceable against said combination determining means and positioned to enter any aperture aligned therewith; a plurality of manual selection means, each corresponding to one of said sensing means and independently movable to represent elements of a selected combination; linkage means intermediate each of said selection means and its corresponding sensing means and adapted to assume a clearing position upon correspondence of an element of said selected combination to an element of said preselected combination and a blocking position in the absence of such correspondence; and means for normally blocking said actuating member but releasing said actuating member when all of said linkage means are in their clearing positions.

2. The lock of claim **1** wherein said combination determining means comprises a tape.

3. The lock of claim **2** wherein said tape defines therein a plurality of sets of apertures, each aperture set determining a different preselected combination.

4. The lock of claim **3** wherein said combination determining means comprises means for advancing said tape upon each

actuation of said actuating member to present a different aperture set to said sensing means.

5. The lock of claim 1 wherein said combination determining means comprises: a tape defining therein a plurality of sets of apertures, each determining a different preselected combination; means for tensioning said tape for advancement relative to said sensing means; and means for normally restraining such advancement but releasing said tape for an incremental advance upon each actuation of said actuating member to present a different aperture set to said sensing means.

6. The lock of claim 5 wherein said tensioning means comprises: a shaft; means for driving said shaft upon actuation of said actuating member; a roller secured to said tape and mounted on said shaft for rotation relative thereto; and resilient means interconnecting said roller and shaft for storing a selected torque value therebetween.

7. The lock of claim 6 wherein said resilient means comprises a coil spring surrounding said shaft having its first end connected to said shaft and its second end connected to said roller, the internal diameter of said spring in its relaxed condition being greater than the outside diameter of said shaft.

8. The lock of claim 6 wherein said driving means comprises a belt and pulley drive connected to slip when said selected torque value is stored.

9. The lock of claim 1 wherein each of said manual selection means comprises a key stem longitudinally movable between a first and a second position.

10. The lock of claim 1 wherein each of said linkage means comprises a tumbler lever having first and second ends, a first pivot point therebetween, and a second pivot point at said first end, one of said pivot points being movable by said manual selection means and the other of said pivot points being movable by said sensing means.

11. The lock of claim 10 wherein each of said manual selection means comprises a key stem connected to said first pivot point of a respective tumbler lever.

12. The lock of claim 1 wherein each of said sensing means comprises: a substantially planar member having thereon a sensing finger adapted to enter an aperture aligned therewith; and means for resiliently urging said finger into said aperture about an axis of rotation substantially perpendicular to the plane of said member and spaced from said finger.

13. The lock of claim 12 wherein said axis of rotation is common to a plurality of said members.

14. The lock of claim 12 wherein each of said linkage means comprises a tumbler lever having first and second ends, a first pivot point therebetween, and a second pivot point at said first end, one of said pivot points being movable by said manual selection means and the other of said pivot points being movable by said sensing means.

15. The lock of claim 14 wherein each of said manual selection means comprises a key stem connected to said first pivot point of a respective tumbler lever.

16. The lock of claim 10 wherein said actuating member is a rotatable shaft and said blocking means comprises: a gate movable between a locking position and an actuating position, said gate being retained in said locking position by any of said tumbler levers in a blocking position but movable to said actuating position when all of said tumbler levers are in their clearing position; and a deadlock cam secured to said shaft positioned to engage said gate in its locking position to prevent rotation of said shaft and to pass said gate in its actuating position to permit rotation of said shaft.

17. The lock of claim 16 wherein each of said manual selection means comprises a key stem connected to said first pivot point of a respective tumbler lever.

18. The lock of claim 17 wherein each of said sensing means comprises: a substantially planar member having thereon a sensing finger adapted to enter an aperture aligned therewith; and means for resiliently urging said finger into said aperture about an axis of rotation substantially perpendicular to the plane of said member and spaced from said finger.

19. A combination lock adapted to be unlocked upon entry of the correct combination therein which comprises: a tape defining therein a plurality of sets of apertures, each determining a different preselected combination; a plurality of sensing means individually advanceable against said tape and positioned to enter any aperture aligned therewith; means for tensioning said tape for advancement relative to said sensing means; a plurality of manual selection means, each corresponding to one of said sensing means and independently movable to represent elements of a selected combination; a plurality of tumbler levers, each having first and second ends, a first pivot point therebetween, and a second pivot point at said first end, one of said pivot points being movable by one of said manual selection means and the other of said pivot points being movable by one of said sensing means, each tumbler lever assuming a clearing position upon correspondence of an element of said selected combination to an element of said preselected combination and a blocking position in the absence of such correspondence; gate means movable between a locking position and an actuating position, said gate means being retained in said locking position by any of said tumbler levers in a blocking position but movable to said actuating position when all of said tumbler levers are in their clearing positions; an actuating member normally restrained by said gate means in a locking position but movable when said gate means is in an actuating position; and means for normally restraining advancement of said tape but releasing said tape for an incremental advance upon movement of said actuating member to present a different aperture set to said sensing means.

20. The lock of claim 19 wherein each of said manual selection means comprises a key stem connected to said first pivot point of a respective tumbler lever.

21. The lock of claim 20 wherein each of said sensing means comprises: a substantially planar member connected to said second pivot point of a respective tumbler lever; a sensing finger extending from said planar member and adapted to enter an aperture aligned therewith; and means for resiliently urging said finger into said aperture about an axis of rotation substantially perpendicular to the plane of said member and spaced from said finger.

22. The lock of claim 21 wherein: each set of apertures in said tape comprises two subsets formed on spaced, parallel lines; said sensing means are arranged in two sets corresponding, respectively, to said subsets, each set being rotatable about a different axis of rotation; said key stems are arranged in two sets corresponding, respectively, to said sets of sensing means; said tumbler levers are arranged in two opposed sets with the second ends of the levers of the two sets in reversed relationship; said gate means comprise first and second planar gates disposed adjacent the respective second ends of said lever sets, each of said gates defining a window therein, said gates being biased for complementary, reversed, inward movement toward the respective lever sets, said windows being aligned to receive the second ends of those tumbler levers in a clearing position.

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