Sept. 7, 1965 P. NEMSKY 3,204,436

LOCKABLE CLOSURE WITH COMBINATION LOCKING MECHANISM SELF-CONTAINED IN THE LID THEREOF

Filed Nov. 29, 1963 2 Sheets-Sheet 1

FIG-1

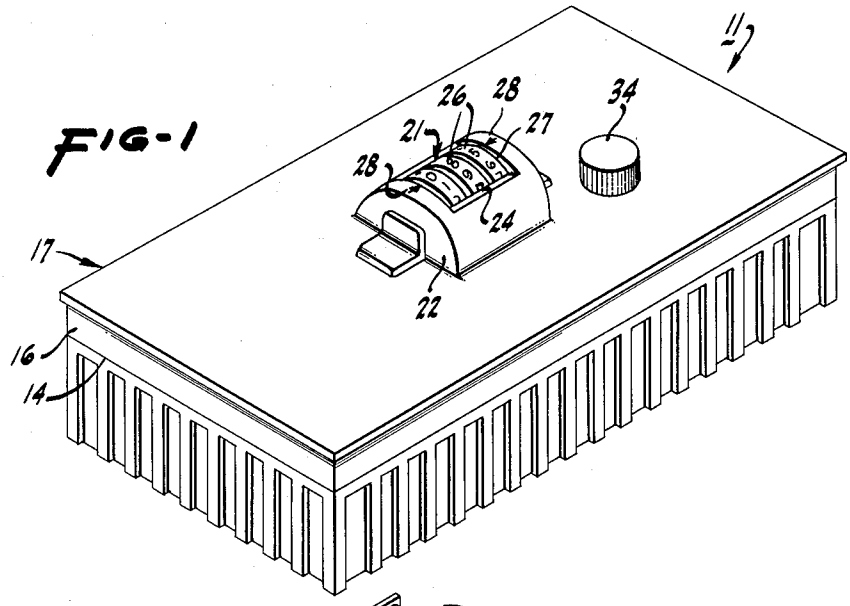
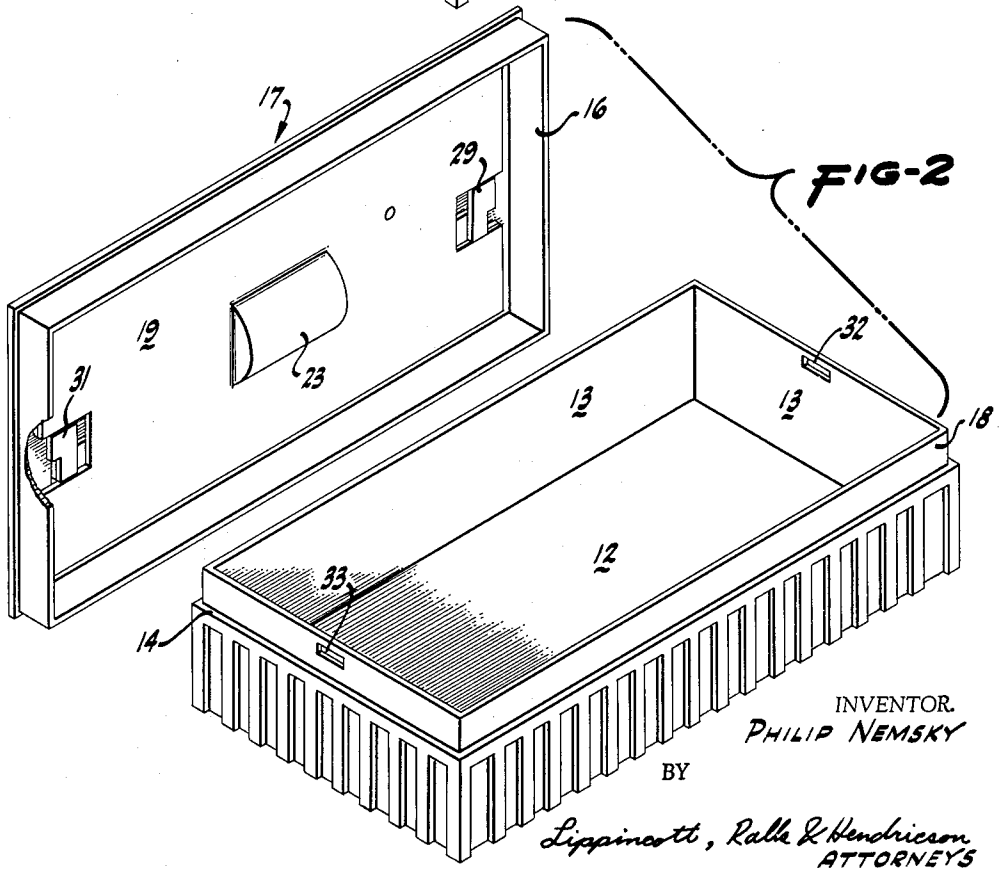


FIG-2



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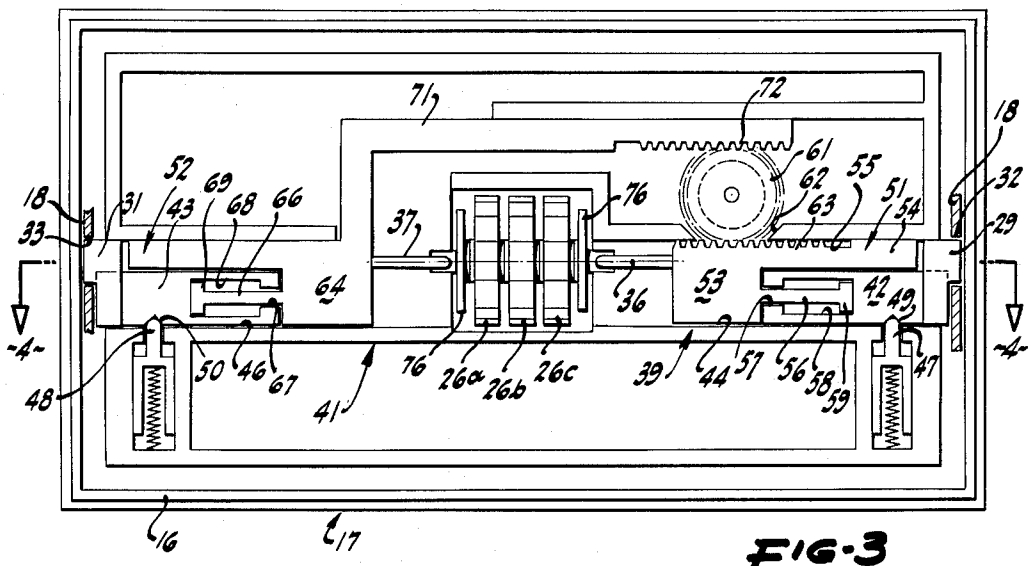


FIG-3

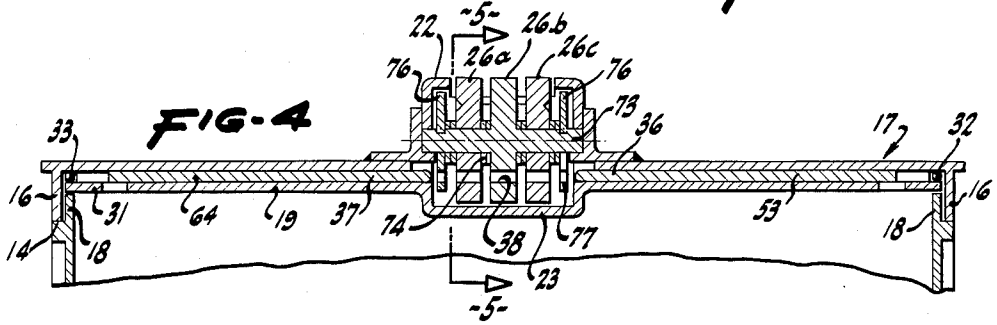


FIG-4

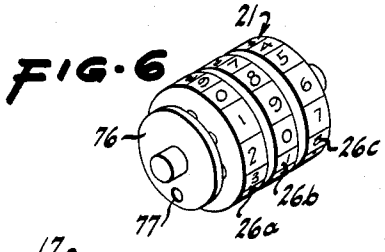


FIG-6

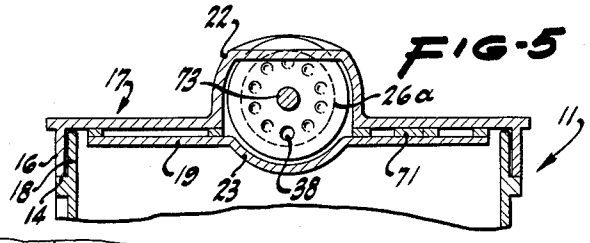


FIG-5

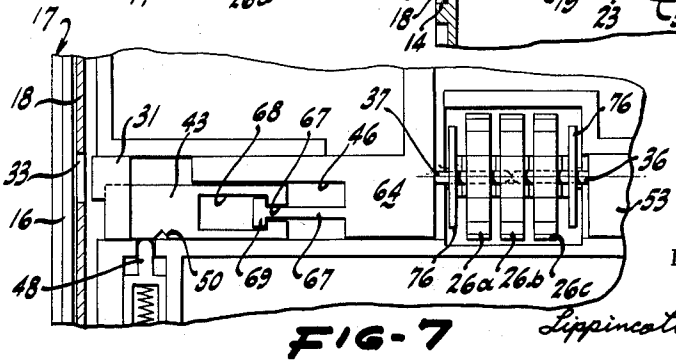


FIG-7

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3,204,436

Patented Sept. 7, 1965

3,204,436

LOCKABLE CLOSURE WITH COMBINATION LOCKING MECHANISM SELF-CONTAINED IN THE LID THEREOF

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Filed Nov. 29, 1963, Ser. No. 326,861

7 Claims. (Cl. 70—63)

This invention relates to lockable closures in general, and is particularly directed to a box for storing and safeguarding valuables, which is characterized by a lid having a self-contained combination locking mechanism therein.

Jewels and other valuables are usually stored in an enclosure, such as a box, when not in use. It is the usual practice to provide these boxes, etc., with means for locking a lid or cover thereto to afford some degree of safeguard over the valuable contents. The locking means should be sufficiently secure to prevent children or other individuals from gaining unauthorized access to the box interior. However, the locking means generally employed are of the simple key lock variety. Key locking mechanisms are not particularly secure in that one need only find the key in order to open same. In fact, frequently the key locking mechanisms employed are so simple that they may be readily opened without the key by tampering with a hair pin, or the like. Combination locking means, of course, may afford a greater degree of security since the valid combination may be retainind in the mind and is, hence, not available to unauthorized individuals. In this regard, a high degree of security may be obtained, provided the combination locking means is sufficiently complex that a large number of combinations are possible. The probability of one arriving at the valid combination without prior knowledge thereof is then extremely low.

Despite the apparent advantages accruing from the employment of combination locking means in jewel boxes or equivalent lockable closures, such employment has not been widespread. This is apparently due to the complexity of the mechanism and prohibitive cost of previous combination locking means capable of providing a large number of possible combinations and which are suited to employment in a jewel box or equivalent closure.

It is an object of the present invention to provide a lockable closure for jewels and other valuables having a combination locking mechanism self-contained in the lid thereof which is of relatively simple construction and yet possesses a high degree of combination complexity.

Another object of the invention is the provision of a lockable closure with a combination locking mechanism constructed of easily assembled components which may be manufactured with relative imprecision from plastic by conventional mass production techniques, thereby resulting in a locking mechanism of extremely low cost.

Still another object of the invention is to provide a self-contained combination locking mechanism in the lid of a box which features a novel arrangement of tumbler wheels and pins movable through bores in the wheels, the wheels permitting a maximum pin movement determinative of an open latch condition when their bores are aligned.

It is a further object of the invention to provide a combination locking mechanism of the type described wherein dummy recesses are provided in the faces of the outermost tumbler wheels in addition to the bores therethrough to permit partial pin movement when these wheels have invalid orientations so as to obscure the valid orientations thereof which might otherwise be detected by such partial pin movement.

Other objects and advantages of the invention will become apparent upon consideration of the following detailed description of the invention taken in conjunction with the accompanying drawings wherein:

FIGURE 1 is a perspective view of a lockable jewel box, or the like, embodying the combination locking mechanism of the present invention;

FIGURE 2 is an exploded perspective view of the box;

FIGURE 3 is a bottom plan view of the lid of the box with a protective base plate thereof removed to illustrate the structural details of the self-contained combination locking mechanism, the mechanism being depicted in locked condition;

FIGURE 4 is a fragmentary sectional view taken at line 4—4 of FIGURE 3, illustrating particularly the pin and tumbler wheel arrangement of the locking mechanism;

FIGURE 5 is a sectional view taken at line 5—5 of FIGURE 4;

FIGURE 6 is a detail perspective view of the tumbler wheel assembly of the locking mechanism; and

FIGURE 7 is a fragmentary plan view similar to FIGURE 3, but with the locking mechanism in open condition.

Referring now to the drawings and FIGURES 1 and 2 in particular, there will be seen to be provided a lockable closure, in the illustrated case a box **11** for jewels or other valuables. The box **11** is of generally rectangular configuration including a rectangular base **12** with marginal sidewalls **13** extending vertically upward therefrom. An outwardly projecting lip **14** extends about the periphery of the sidewalls **13** at a position in downwardly spaced adjacent relation to the top edges thereof. The lip **14** serves to support a depending skirt portion **16** of a lid **17** that is adapted to be removably positioned in closing relation to the open top of the box. More particularly, the skirt portion **16** circumscribes an upstanding rim **18** of the box defined between the lip **14** and upper edge of the sidewalls thereof when the lower edge of the skirt portion engages the lip. In accordance with the particularly salient aspects of the present invention, a combination locking mechanism is self-contained within the lid **17** to facilitate locked securance thereof to the box. In this regard, the combination locking mechanism is disposed between a base plate **19** disposed interiorly of the lid in close spaced parallel relation to the top wall thereof. The locking mechanism includes a tumbler wheel assembly **21** enclosed within a generally cylindrical housing defined by complementary semi-cylindrical housing portions **22** and **23** respectively provided on the top wall of the lid and the base plate **19**. The housing portion **22** includes a window **24** which affords access to the tumbler wheels **26** of the assembly **21**. The tumbler wheels may thus be selectively rotated so as to position a variety of combinations of numerals provided on their peripheries, as indicated at **27**, in alignment with indexing marks, such as arrows **28**, provided on the housing portion **22** adjacent the window. When the one predetermined valid combination of numbers is aligned with the arrows, the locking mechanism is condition for movement of latch members **29** and **31** thereof out of engagement with slots **32** and **33** provided in the opposite ends of the rim **18** of the box. In this regard, an actuating knob **34** positioned on the top of the box is operatively associated with the locking mechanism in such a manner that when the tumbler wheels **26** are positioned, as just described, the knob **34** may be rotated to effect movement of the latch members **29** and **31** out of, or into engagement with the slots **32** and **33**. When the tumbler wheels **26** are oriented in any but the valid combination in alignment with the indexing arrows **28**, the latch members cannot be moved relative to the slots in response to rotation of the actuating knob **34**.

Considering now in greater detail the combination locking mechanism self-contained within the lid **17** and referring to FIGURES 3 to 7, in particular, it is to be noted that movement of the latch members **29** and **31** is gov-

erned by movement of pins 36 and 37 in association therewith through bores 38 provided longitudinally of the tumbler wheels 26 at predetermined angular positions with respect to the numerals 27 whereon. Movement of the latch members 29 and 31 out of engagement with the slots 32 and 33 is only permitted upon a full excursion of the pins 36 and 37 into tip-to-tip contact with each other, and this movement of the pins through bores 38 can only occur when all of the bores are aligned. When the bores 38 of the tumbler wheels are not all aligned, partial movement of the pins 36 and 37 may be effected under some circumstances; however, the bolt assemblies 39 and 41 which couple the pins to the latch members 29 and 31 are so arranged that partial movement of the pins has no affect on movement of the latch members, movement of the latch members being only effected in response to a complete excursion of the pins. To the foregoing ends, the bolt assemblies 39 and 41 respectively include flat elongated rectangular bolts 42 and 43 which are slideable longitudinally of the lid along guides 44 and 46 provided on the interior surface of the top wall thereof. The guides extend from substantially the opposite ends of the skirt 16 to the opposite ends of the cylindrical housing portion 22. The latch members 29 and 31 are secured to the outer ends of the bolts 42 and 43, and consequently movement of the latches into or out of the slots 32 and 33 is effected upon translation of the bolts 42 and 43 along the guides 44 and 46. The bolts are normally retained in positions wherein the latches 29 and 31 engage the slots 32 and 33 and, hence, lock the lid to the box. Although various means may be provided to retain the bolts in such normal positions, such means preferably comprise spring-loaded detents 47 and 48 which engage notches 49 and 50 in side edges of the bolts when they are in their normal positions, as shown in FIGURE 3. Engagement of the detents with the notches prevents unintentional movement of the bolts 42 and 43. Movement of the bolts longitudinally inward to disengage the latches 29 and 31 from the slots 32 and 33 may be then only effected in response to the application of longitudinally inwardly directed forces thereon sufficient to depress the detents by movement of the notch edges thereover.

In order to apply translating forces to the bolts 42 and 43, the bolt assemblies 39 and 41 hereof include translating linkages 51 and 52 from which the pins 36 and 37 integrally project. Linkage 51 includes a head portion 53 which is slideable along one edge of the guide 44 and a trailing portion 54 slideable between a guide 55 and one side edge of the bolt 42. A tongue 56 extends from the head 53 of the linkage 52 through an end opening 57 in the bolt 42, terminating in an enlarged rectangular aperture 58 therein. The end of the tongue 56 is provided with an enlarged flange portion 59 which is slideable within the aperture 58 between the limits defined by the opposite ends thereof. The translating linkage 52 may, thus, be moved through a distance determined by the opposite ends of the aperture 58 without imparting a translating force to the bolt 42. Movement of the linkage beyond these limits, however, engages the enlarged flange portion 59 of the tongue 56 with one of the ends of the aperture 58. Movement of the linkage 52 longitudinally inward through a distance greater than that between the opposite ends of the aperture 58 engages the enlarged flange portion 59 of the tongue 56 with the innermost end of the aperture to thereby pull the bolt longitudinally inward and disengage the latch 29 from the slot 32. Longitudinal movement of the translating linkage 52 is effected in response to rotation of the actuating knob 34 as by means of a rack and pinion drive. In this regard, the knob 34 is a shaft connected to a pinion gear 61 provided at the interior surface of the top wall of the lid. The gear periphery extends through an opening 62 in the wall of the guide 55 and engages a rack 63 extending along the adjacent edge of the head portion 53 of the translating linkage 52. Thus, in response to rotation of the actuating knob 34, the gear 61 is rotated to in turn translate the rack 63, and therefore the linkage 52 in integral association therewith.

The translating linkage 52 is generally similar to the linkage 51, described above. More particularly, linkage 52 includes a head portion 64 which is longitudinally slideable along the guide 46. A tongue 66, projecting from the head 64, extends through an opening 67 in the inner end of the bolt 43 into an enlarged rectangular aperture 68. The end of the tongue 66 is provided with an enlarged flange portion 69 which is slideable within the aperture 68, and thus the linkage 52 may be moved longitudinally within the limits defined by the opposite ends of the aperture 68 without effecting translation of the bolt 43. Movement of the tongue beyond these limits effects translation of the bolt 43 in an analogous manner to that previously described with respect to bolt 42 and translating linkage 51. Translation of the linkage 52 is effected simultaneously with translation of the linkage 51 in response to rotation of the actuating rod 34. Translation of the linkage 52, however, is opposed to that of linkage 51 and is effected as by means of an L-shaped arm 71 which extends from the head 64 around the base of housing portion 22 into adjacent relation to the pinion gear 61. A rack 72 is formed along a side edge of the longitudinal portion of the arm and engages the pinion gear 61 at a position of diametric opposition to that engaged by the rack 63. Thus, rotation of the actuating knob 34 effects movement of the translating linkages 51 and 52 in opposite longitudinal directions. Moreover, by appropriate indexing of the racks 63 and 72 relative to the gear 61, the respective movements of the linkages 51 and 52 may be made exactly complementary. The pins 36 and 37 projecting from the heads of the respective linkages will touch substantially tip-to-tip at the transverse median plane through the housing portion 22 in response to a full excursion of movement of the linkages.

Considering now the tumbler wheel assembly 21 in greater detail, it is to be noted that same preferably includes three tumbler wheels 26*a*, 26*b*, and 26*c*. The central wheel 26*b* is fixedly secured to a shaft 73 of the assembly which is journaled at the opposite ends of the housing portion 22. The wheels 26*a* and 26*c* on opposite sides of the central wheel 26*b* are rotatably disposed upon the shaft 73, spacing of the wheels 26*a* and 26*c* from the central wheel 26*b* being facilitated as by means of spacer rings 74 respectively disposed therebetween. In addition, spacer rings 74 are provided between the outer end faces of the wheels 26*a* and 26*c* and retaining discs 76 respectively fixedly secured to the shaft 73 adjacent its opposite ends. Thus, the central wheel 26*b*, shaft 73, and retaining discs 76 rotate as a unit whereas the wheels 26*a* and 26*c* are independently rotatable about the shaft 73. The discs 76 are provided with longitudinal bores 77 which are aligned with the bore 38 through the central tumbler wheel 26*b*. Thus, the pins 36 and 37 may be longitudinally translated by the means previously described through the bores 77 in the retaining discs 76 when the central tumbler wheel 26*b* is appropriately oriented. The tips of the pins then abut the outer faces of the tumbler wheels 26*a* and 26*c* except when same are oriented in accordance with the valid combination and their bores 38 are aligned with the bore of wheel 26*b* and, therefore, with the bores 77 of the discs 76. The pins 36 and 37 may then be longitudinally translated into tip-to-tip engagement, thus permitting a full excursion of movement of the bolt assemblies 39 and 41 whereupon the translating linkages 51 and 52 effect translation of the bolts 42 and 43 longitudinally inward to disengage the latches 29 and 31 from the slots 32 and 33.

It will be appreciated that normally it would be an easy matter to determine the valid combination setting of the tumbler wheels 26 of combination locking mechanism of the general type just described. More particularly, torque could be continuously applied to the actuating knob 34 and the tumbler wheels rotated until the bores 77 of the

discs **76** were aligned with the pins **36** and **37** at which time the pins would enter the bores and the knob **34** would rotate through a small angle by virtue of the torque applied thereto. The tips of the pins **36** and **37** would then bear against the exterior faces of the tumbler wheels **26***a* and **26***c* and one could rotate these wheels on a trial and error basis until their bores were aligned with the pins and give way to the force thereon resulting from the continuously applied torque on the actuating knob. Such a trial and error determination of the valid combination is herein prevented by the provision of a plurality of circumferentially spaced recesses **78** in the outer faces of the wheels **26***a* and **26***c* at the same radius as the bores **38** therethrough. Consequently, with torque continuously applied to the actuating knob **34**, the pins enter the recesses or bores for each orientation of the wheels corresponding to a different numeral. The recesses cannot be distinguished from the bores and, thus, the valid combination cannot be determined in a trial and error manner.

Considering now the over-all operation of the combination locking mechanism self-contained in the lid **17** of the box **11**, assume that the lid is locked to the box with the latch members **29** and **31** engaging the slots **32** and **33** and the locking mechanism to be in the locked condition illustrated in FIGURE 3. To unlock the box, the tumbler wheels **26** are rotated to set the valid combination of their numerals in alignment with the indexing arrows **28**. At this time, the bores **38** of the respective tumbler wheels and the bores **77** of the discs **76** are in alignment with each other and with the pins **36** and **37**, as depicted in FIGURE 4. The actuating knob **34** may now be rotated to, in turn, translate the linkages **51** and **52** of the bolt assemblies **39** and **41** longitudinally inward towards each other, the pins **36** and **37** traversing the bores of the discs and tumbler wheels and coming into tip-to-tip contact, as shown in FIGURE 7. Such full excursion of pin movement permits the translating linkages **51** and **52** to undergo maximum inward longitudinal movement. The bolts **42** and **43** are consequently pulled longitudinally inward by the flanged end portions of the tongues **56** and **66** to positions wherein the latch members **29** and **31** are disengaged from the slots **32** and **33**, as also shown in FIGURE 7. The lid **17** may now be removed from the box **11** to afford access to its interior. To close the box and relock same, the lid is placed in closing relation to the open end of the box, and with the valid combination still set in alignment with the indexing arrows **28**, the actuating knob **34** is rotated in the reverse direction. The bolt assemblies **39** and **41** are responsively translated longitudinally outward to, in turn, re-engage the latch members **29** and **31** with the slots **32** and **33**. The tumbler wheels **26** are then rotated from the setting of the valid combination to thus lock the box. More particularly, for any but the valid combination, the pins **36** and **37** abut the face of at least one of the tumbler wheels and a full excursion of pin movement is thus not permitted. Consequently, the translating linkages **51** and **52** may only be moved within the limits of the apertures **58** and **68** of the bolts **42** and **43** without exerting translating forces thereon. The latch members **29** and **31**, hence, remain in engagement with the slots **32** and **33**, thereby maintaining the box in locked condition.

It is particularly important to note that all of the components of the combination locking mechanism described hereinbefore are of simple configurations and minimum complexity. Such components may be consequently readily fabricated from plastic, or the like, with relative imprecision on a mass production basis utilizing simple well known manufacturing methods. As a result, lockable closures, in accordance with the present invention, with combination locking mechanism self-contained in the lids thereof may be manufactured at extremely low cost.

Although the present invention has been described hereinbefore with respect to a single preferred embodiment, it will be appreciated that various modifications and changes may be made therein without departing from the true spirit and scope of the invention, and thus it is not intended to limit the invention except by the terms of the following claims.

What is claimed is:

1. A lockable closure comprising a base portion having an open end; a lid removably disposed in closing relation to said open end; and combination locking mechanism self-contained in said lid for locking same to said base portion; said combination locking mechanism including a pair of bolt assemblies mounted in said lid and respectively having latch members engageable with slots in said base portion to lock said lid thereto and pins movable in opposition to each other into tip-to-tip engagement, said bolt assemblies having translating means for moving said latch members to positions out of engagement with said slots only when said pins are in tip-to-tip engagement, actuating means carried by said lid for translating said pins between spaced-apart positions and positions in tip-to-tip engagement, and a tumbler wheel assembly mounted in said lid having a plurality of externally accessible rotatable tumbler wheels disposed between said pins in said spaced-apart positions thereof, said tumbler wheels each having a longitudinal bore therethrough, said bores being aligned with each other and with said pins in one predetermined combination of respective rotational orientations of said wheels, whereby said pins may be translated into tip-to-tip engagement only when said wheels are in said predetermined combination of rotational orientations.

2. A lockable closure according to claim **1**, further defined by said tumbler wheel assembly having a shaft with its opposite ends journaled in said lid, a central one of said tumbler wheels fixedly secured to said shaft, a pair of discs fixedly secured to said shaft adjacent its opposite ends and each having a bore in alignment with the bore of said central tumbler wheel, and at least one other of said tumbler wheels disposed between each of said discs and said central tumbler wheel and rotatable upon said shaft.

3. A lockable closure according to claim **2**, wherein the outer faces of the outermost ones of said tumbler wheels have a plurality of circumferentially spaced longitudinal recesses extending thereinto at the same radius as said bores therethrough.

4. A lockable closure comprising a box having an open end, a lid removably disposed in closing relation to said open end, a pair of opposed bolts mounted within said lid for movement longitudinally thereof, said bolts having openings in their opposed inner ends extending into enlarged rectangular apertures, latch members carried at the outer ends of said bolts engageable with slots in said box to lock said lid thereto, yieldable retention means carried by said lid and associated with said bolts to normally retain same in longitudinal positions wherein said latch members engage said slots, said retention means yieldable to longitudinal forces applied to said bolts, a pair of opposed translating linkages mounted within said lid for movement longitudinally thereof, said linkages respectively having tongues slideable within said apertures of said bolts, said linkages having opposed longitudinally aligned pins, said linkages movable between first positions wherein said pins are spaced apart and said tongues engage the outer ends of said apertures while said bolts are in said positions wherein said latch members engage said slots and second positions wherein said pins are in tip-to-tip engagement and said tongues engage the inner ends of said apertures while said bolts are in positions wherein said latch members are disengaged from said slots, externally accessible actuating means carried by said lid and associated with said translating linkages for effecting opposed longitudinal movement thereof between said first and second positions, and a tumbler wheel assembly mounted in said lid having a plurality of externally accessible rotatable tumbler wheels disposed in the space existing longitudinally between said pins when said translating linkages are in said first positions, said tumbler wheels each having

a longitudinal bore therethrough alignable with said pins in a predetermined rotational orientation of the wheel, whereby all of said wheels must be in their predetermined orientations to permit complete movement of said translating linkages between said first and second positions.

5. A lockable closure according to claim 4, further defined by said tumbler wheel assembly having a shaft with its opposite ends journaled in said lid, a central one of said tumbler wheels fixedly secured to said shaft, a pair of discs fixedly secured to said shaft adjacent its opposite ends and each having a bore in alignment with the bore of said central tumbler wheel, and at least one other of said tumbler wheels disposed between each of said discs and said central tumbler wheel and rotatable upon said shaft.

6. A lockable closure according to claim 5, further defined by the outer faces of the outermost ones of said tumbler wheels having a plurality of circumferentially spaced longitudinal recesses extending thereinto at the same radius as said bores therethrough.

7. A lockable closure comprising a rectangular box having an open end, said box having an outwardly projecting marginal lip and marginal rim extending from the lip to the open end of the box, said rim having opposed slots through the opposite ends thereof, a rectangular lid having a closure wall with a marginal skirt depending therefrom, said skirt engaging said lip and encompassing said rim, a pair of substantially flat rectangular bolts mounted at the interior surface of the closure wall of said lid for longitudinal movement adjacent the opposite ends thereof in inwardly spaced relation to said rim of said box, said bolts having openings in their opposed inner end edges terminating in enlarged rectangular apertures, latch members carried at the outer end edges of said bolts engageable with said slots to lock said lid to said box, yieldable retention means carried by said lid and associated with said bolts to normally retain same in longitudinal positions wherein said latch members engage said slots, said retention means yieldable to longitudinal forces applied to said bolts to thereby permit movement thereof to positions wherein said latch members are disengaged from said slots, a pair of opposed translating linkages mounted at the interior surface of the closure wall of said lid for movement longitudinally thereof, said linkages respectively including flat substantially rectangular head portions disposed longitudinally inwardly of the inner end edges of said bolts, said linkages including tongues extending longitudinally outward from said head portions through said openings in the inner end edges of said bolts and having enlarged ends slideable within said apertures, said linkages having opposed longitudinally aligned pins projecting from the head portions thereof, one of said linkages having a rack along a side edge of the head portion thereof, the other of said linkages having an arm

extending from the head portion thereof including a longitudinal portion with a second rack along a side edge thereof in transversely opposed spaced relation to said first rack, a gear rotatably mounted at the interior surface of the closure wall of said lid and having diametrically opposed portions engaging said first and second racks, an actuating knob at the exterior surface of the closure wall of said lid shaft connected to said gear to effect rotation thereof, said gear upon rotation translating said racks and associated linkages in longitudinal opposition between first positions wherein said pins are spaced apart and said enlarged ends of said tongues engage the outer ends of said apertures while said bolts are in said positions wherein said latch members engage said slots and second positions wherein said pins are in tip-to-tip engagement and said enlarged end portions of said tongues engage the inner ends of said apertures while said bolts are in said positions wherein said latch members are disengaged from said slots, a tumbler wheel housing including a semi-cylindrical portion projecting from the exterior surface of the closure wall of said lid and communicating with the lid interior in a region longitudinally intermediate said pins when said translating linkages are in said first positions, said semi-cylindrical housing portion having a window and an indexing mark longitudinally adjacent the window, a shaft within said housing journaled between the opposite ends thereof for rotation about a longitudinal axis, a central tumbler wheel fixedly secured to said shaft and accessible through said window, a pair of discs fixedly secured to said shaft adjacent its opposite ends, and a pair of outer tumbler wheels respectively rotatably mounted relative to said shaft between said central tumbler wheel and said discs and accessible through said window, said tumbler wheels having numerals at circumferentially spaced positions of their peripheries and longitudinal bores aligned with said pins when said wheels are rotatably oriented to align a predetermined combination of said numerals with said indexing mark, said discs having longitudinal bores aligned with the bore of said central tumbler wheel, said outer tumbler wheels having pluralities of circumferentially spaced longitudinal recesses extending into the outer faces thereof at the same radius as said bores therethrough.

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