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Wiczer

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[54] **DOOR MECHANISMS FOR SAFES**

[76] Inventor: **Max Wiczer,** c/o Wico Corporation, 6400 W. Gross Point, Niles, Ill. 60648

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[52] **U.S. Cl.** **70/92,** 70/149, 70/339, 292/37

[51] **Int. Cl.**... **E05b 65/10,** E05b 55/06, E05b 35/12

[58] **Field of Search** 70/149, 337, 389, 70/92; 292/37, 49; 109/59, 58, 58.5, 60

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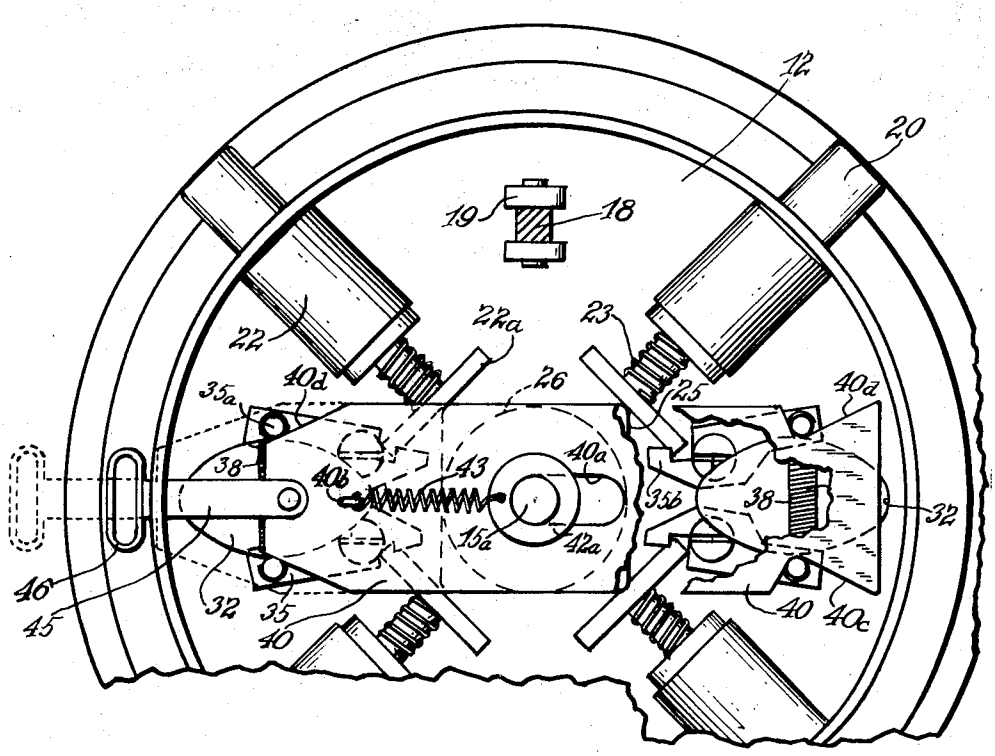
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Primary Examiner—Marvin A. Champion
Assistant Examiner—William F. Pate, III
Attorney—William E. Anderson et al.

[57] **ABSTRACT**

A door for a safe, the door carrying an outer medial knob extended with handles. On the inner side the door carries two laterally-arranged sets of bolts, all with inner ends urged toward the center by springs; and the knob carries a square cam on the inner side of the door effective to impinge on the said inner ends, this advancing the bolts — when the door is closed — into locking engagement with the safe. A key-lock on the door for each set of bolts operates a lever mechanism on the inner side of the door to check the return of the bolts from the advanced positions.

14 Claims, 6 Drawing Figures



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SHEET 1 OF 2

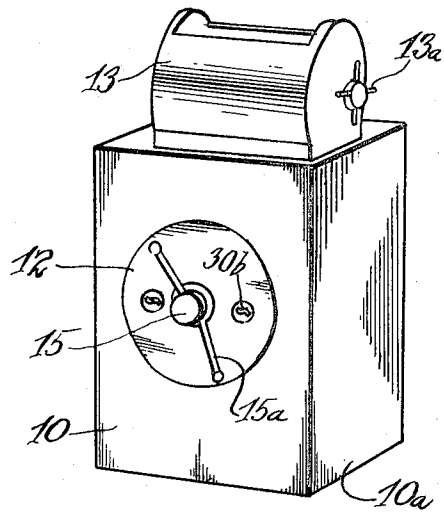


Fig. 1.

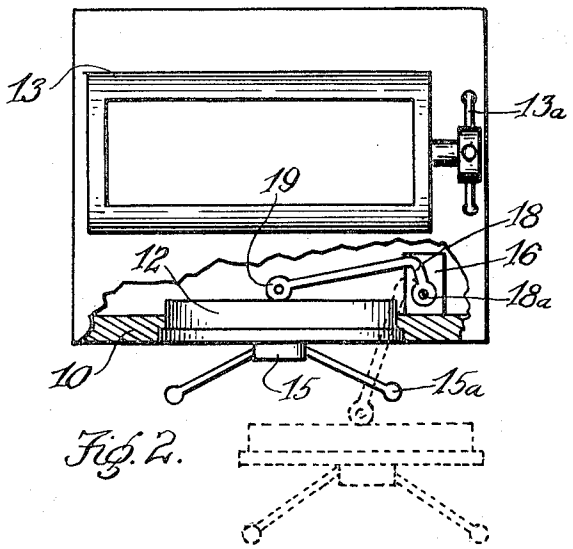


Fig. 2.

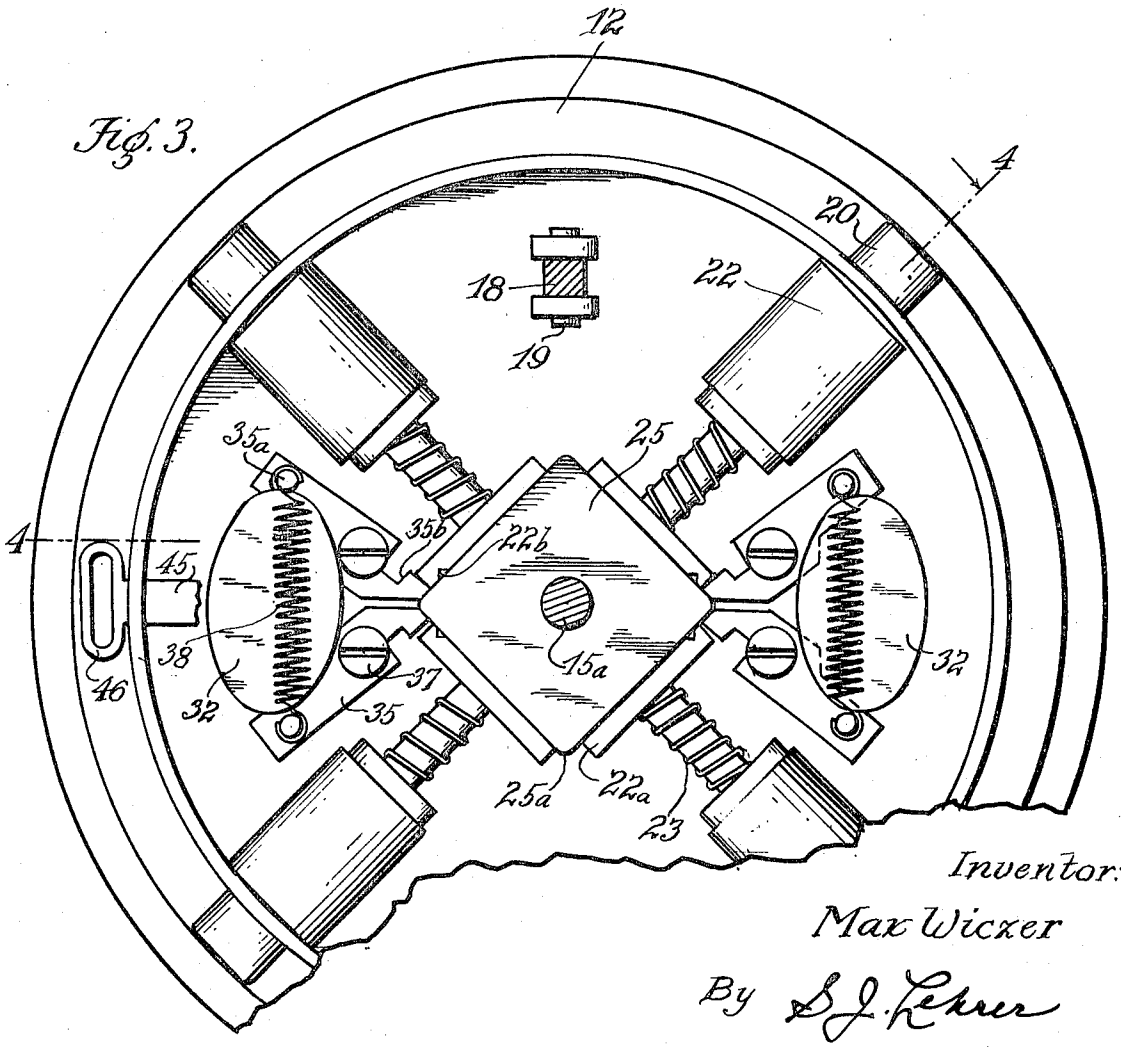


Fig. 3.

Inventor:
Max Wicker
By S. J. Lehrer
Attorney.

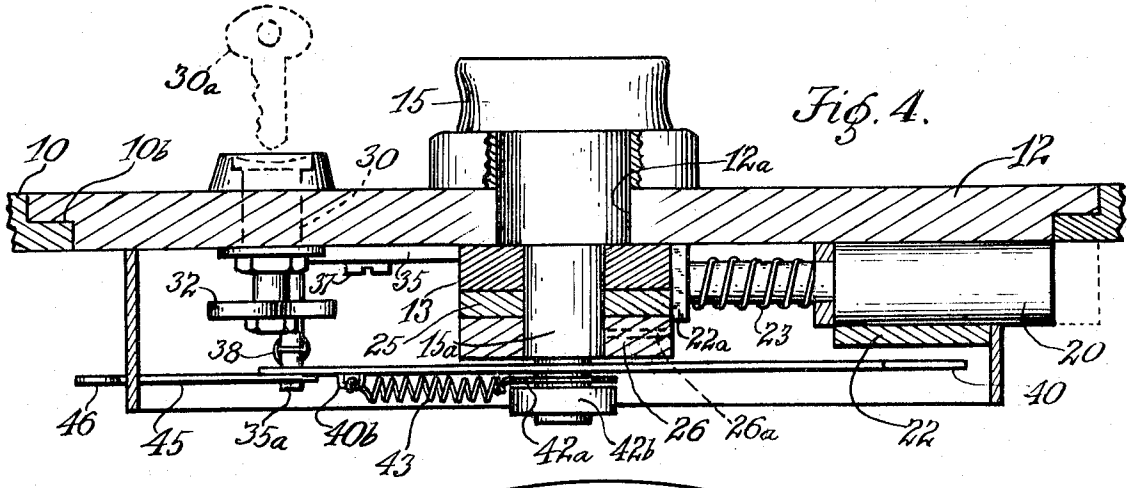
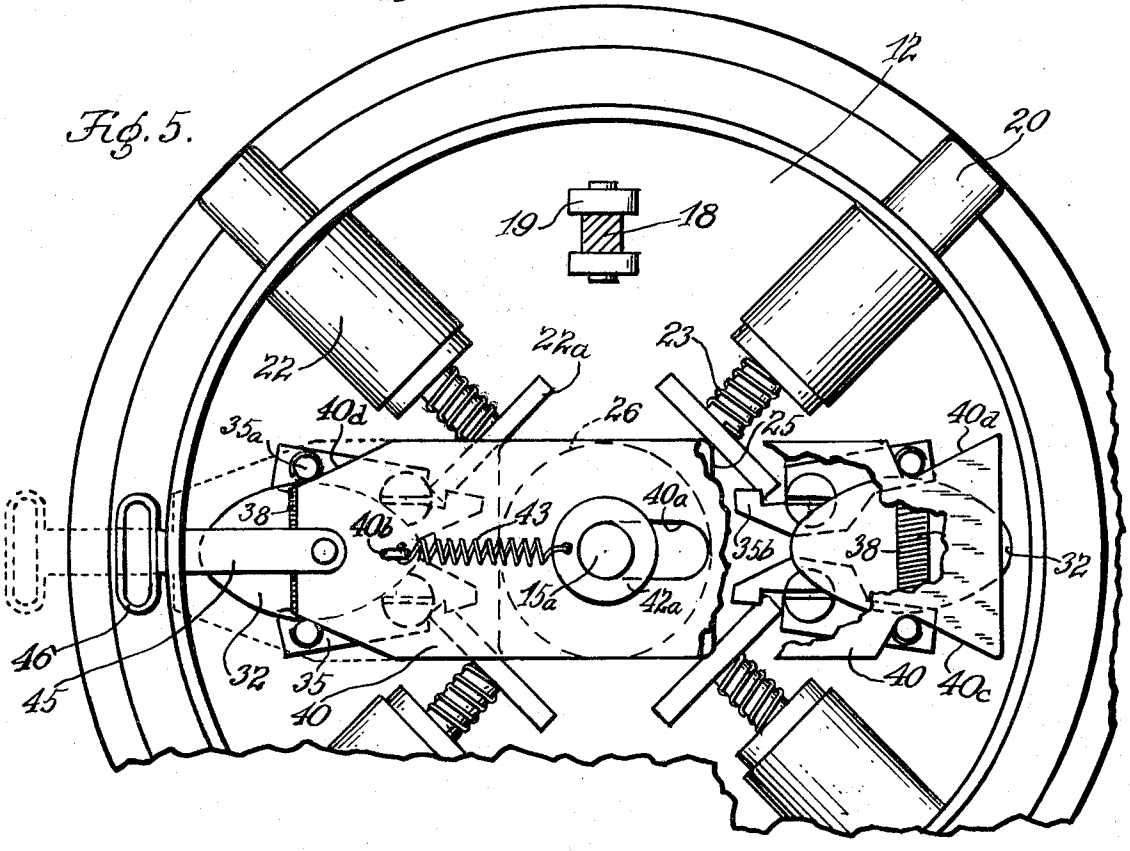


Fig. 4.

Fig. 5.



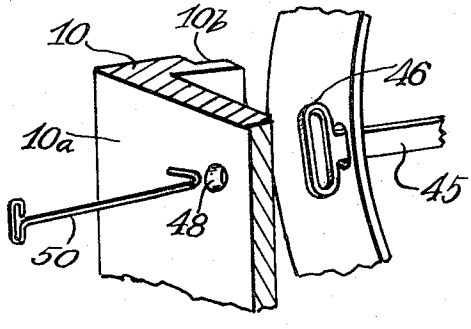


Fig. 6.

Inventor:
Max Wicker
By S. J. Rehrer
Attorney.

DOOR MECHANISMS FOR SAFES

My invention relates to safes located in stores or offices, or carried in delivery cars, for the storage of routine or daily money receipts. Safes of this type are usually desirable where there is increased risk of theft or robbery; and some forms of the safes are made with a deposit facility which does not require opening the safe door. In either case there is the risk that an intruder may produce or alter a key to fit the safe lock; or, where the safe is left alone for a considerable period of time or overnight, force could be used to break open the safe lock or knock off the conventional external hinges which carry the door and make it possible to open the same.

In view of the above hazards, it is one object of the present invention to provide a door mechanism which employs two key locks, so that the added time for an intruder to manipulate them will be a discouraging factor and increase chances of detection.

A further object is to include hinge means for the door which are entirely inside the safe, so that access to such means will be impossible as long as the safe is locked.

Another object is to provide a rotary control for the door which is free to be rotated in either direction at all times, which functions to advance a set of locking bolts inside the safe, and also serves as a handle to pull the door open when it is unlocked.

An additional object is to provide dual sets of locking bolts for the door, and key-operated controls to maintain the bolts in the locked positions.

Another object is to provide a door knob rotatable to advance the bolts to the door-locking positions, and means keeping the bolts clear and unaffected by the further or idle turning of the door knob.

A final object is to provide a set of key locks, and design the key-operated controls in a manner to allow the bolts to be unlocked only when the proper keys have been turned to a required extent in the key locks.

A better understanding of the invention may be gained by reference to the accompanying drawings, in which

FIG. 1 is a perspective view on a miniature scale incorporating the improved door mechanism, with a top-mounted deposit facility shown;

FIG. 2 is a horizontal section showing the hinge means when the door is closed, finely-dotted lines indicating the position of such means when the door has been opened;

FIG. 3 is a view of the door mechanism from the inside with one of its identical corners broken away, the door being shown unlocked and a fragment of an emergency releasing device illustrated at the left;

FIG. 4 is a section on the line 4—4 of FIG. 3;

FIG. 5 is a view similar to FIG. 3 of the door mechanism in the locked position, the emergency releasing device being shown by means of full and dotted lines; and

FIG. 6 is a fragmental detail in perspective of means to actuate the emergency release device.

Referring specifically to the drawings, **10** denotes the front wall and **10a** the side walls of the safe. As mentioned, the safe may also incorporate a top deposit facility **13** of rotary design which permits bags of money or batches of checks to be dropped into the safe while it is kept locked, without the need of opening the safe.

The door **12** is preferably of the circular form shown, and closes in an annular seat **10*b*** recessed in the front wall **10.** The door is of heavy steel plate; and it carries a center knob **15** with prominent handles **15*a*** for rotating the knob or pulling the safe door open. In this respect, FIG. **2** shows that the front wall of the safe carries brackets **16** for pivoting hinge arms **18** at **18*a***, such arms extending to make a pivotal connection **19** with the inner side of the door **12** as seen in FIG. **3.** Finely-dotted lines in FIG. **2** show the position of the hinge and the door when the latter is open.

The door **12** carries four identical bolt structures spaced equally apart in circular direction. FIG. **4** shows each bolt **20** in the retracted position when the door is open. When it is closed, the bolts may be advanced in radial directions to project them inside the front wall **10** as indicated by finely-dotted lines at the right-hand end of the same figure, locking the door.

The door carries bearings **22** for disposing the bolts **20** slidably. Each bolt has a base plate **22*a*** at its inner end and a coil spring **23** between the base plate and the bearing. The door knob **15** has an inward shaft **15*a*** which passes freely through a central opening **12*a*** in the door. FIG. **4** shows that the shaft **15a** first receives a washer **13** on the inside, then a cam **25** and a hub **26.** The latter is secured on the shaft by a set screw **26*a***, and is welded to the cam. The latter is square with rounded corners **25*a***. FIG. **3** shows that the bolt springs **23** keep the base plate **22*a*** in engagement with the flats of the cam. However, when the knob **15** is given a partial turn after the door is closed, the cam **25** urges the bases **22*a*** to advance the bolts and lock the door, as previously stated.

The door incorporates controls to lock the bolts **20** in their advanced positions. Such controls are dual in character, one relating to the two bolts left of the door center, and the other to those on the right. Each control has a cylinder **30** to which a key **30*a*** is applicable as shown in the lefthand portion of FIG. **4.** On the inner side of the door the cylinder carries an elliptical cam **32.** When the key is in the horizontal position the cam **32** corresponding to it is vertical, as shown in FIG. **3**; and a half-turn of the key in the counterclockwise direction turns the cam to the horizontal position indicated in FIG. **5.** Actually, the cam describes only a quarter-turn. Because some cylinder locks call for a half-turn of the key, only the second quarter of the key motion turns the cam. Each locking control also includes inclined companion levers **35** pivoted on screws **37** driven into the inner side of the door. The outer end-portions of the levers carry side pins **35*a*** drawn by a spring **38** to engage the periphery of the related cam **32** at the top and bottom. The inner end-portions of the levers are formed into divergent hooks **35*b*** which bear against the base plates of the related door bolts **20** when these are in the retracted positions, as shown in FIG. **3.** However, when the cam **32** has been turned to the horizontal position, and the bolts are advanced by a partial turn of the square cam **25,** the spring **38** draws on the levers **35** to deposit the end hooks **35*b*** into notches **22*b*** made in the under sides of the bolt base plates **22*a***. The springs **38** are stronger than the bolt springs **23,** and maintain the bolts in the advanced position, even after the base plates are no longer impinged by the square cam **25** after a further or random turn of the knob.

During the normal use of the safe in a business place or delivery car the door is locked. Also, if the safe has the top-loading facility **13**, bags of money, packets of checks or other items of value may be dropped into the loading device and its handle **13***a* turned to deposit the items in the safe. When the safe owner or a bank messenger desires to open the door for the removal of safe contents, the handles **15***a* of the knob **15** are first positioned vertically in order to allow a clear approach to the key-slots **30***b* of the key lock cylinders **30.** The vertical position of the handles **15***a* also places the square cam **25** inside the door in the position of FIG. **3** where it will not interfere with the retraction of the bolts **20.** The next step is to insert both keys **30***a* horizontally in the key slots and give each a half-turn (180°) in clockwise direction. This turns the oval cams **32** from the horizontal positions in FIG. **5** to the vertical ones of FIG. **3.** This action also gathers the hooks **35***b* of the levers **35** from the positions in FIG. **5** where they clear the bolt base plates **22***a*, so that the bolts will become automatically retracted by their springs **23.** The door is now free to be drawn open by pulling on the knob handles **15***a*.

When it is desired to lock the door, it should be recalled that the square cam is still in the position of FIG. **3.** The first step in the door-locking operation is to turn the keys in the counter-clockwise direction and remove them. This turning action rotates the oval cams **32** back to the horizontal positions. However, this will not affect the positions of the levers **35** because the bases **22***a* of the bolts **20** will bar the levers from being gathered by the springs **38.** The next step is to push the door to the fully-closed position. The final step is to give the knob **15** a quarter-turn in either direction. This will cause the square cam **25** to impinge on the bolt bases and advance the bolts from the positions of FIG. **3** to those of FIG. **5.** As the bolts advance, their bases clear the hooks **35***b* of the levers **35,** allowing these to gather from the pull of the springs **38** until the hooks seat in the base notches **22***b* as seen in FIG. **5.** As stated before, the force of the springs **38** maintains the bases and bolts in the advanced or door-locking positions.

It is now apparent that both keys must be available in order to operate the door lock. If a key has been lost or mislaid, the operation of the door lock will be delayed while a spare key is located or a new key obtained from the manufacturer of the safe. However, if one of the door locks does not function properly, and the safe must be opened, an emergency release device is included in the present door mechanism. According to FIGS. **4** and **5,** the main part of the emergency releasing device is a large, horizontal plate **40** spaced inwardly from the operative parts so far described. This plate is formed with a horizontal slot **40***a* for the passage of the center shaft **15***a* of the knob **15,** and is slidable between the cam hub **26** and a collar **42***b* carried by the outer end of the shaft. A loose washer **42***a* is carried on the shaft between the plate **40** and the collar **42***b*. A spring **43** from the washer **42***a* directed to a kePper **40***b* of the plate draws the latter to normally occupy the position shown in FIG. **5.** The plate has an arm **45** at the left, which terminates with an open handle **46.** The right-hand end of the plate is formed with companion inclined cams **40***c* and **40***d* engaging the lever side pins **35***a* at the bases of the cams. Therefore, when the handle **46** is drawn to the position indicated by dotted lines in the left-hand side of FIG. **5,** the travel of the plate **40** toward the left causes the cams **40***c* and **40***d* to separate the side pins, duplicating the function of the elliptical cams **32** to release the bolts for automatic retraction by the springs **23.** Since the handle **46** is contained in the locked safe, FIG. **6** shows that a hole **48** may be drilled at a secretly known point in the side wall **10***a* of the safe opposite the handle **46,** and a wire hook **50** inserted to engage the handle and draw the plate **40** as just described.

The advantages of the improved door mechanism will now be summarized. First, unlocking means which require the operation of two keys to unlock the door are provided. Thus, a double task faces an intruder attempting to pick the key locks or use spurious keys, with increased chances of failure or detection. Further, destruction of the key locks by drilling or prying will not retract the bolts, since these are still held advanced by the internal levers, and the lock cams can only be rotated by the operation of the correct keys in the key lock cylinders. Also, when the door has been locked, the square cam remains clear of the bolt group, so that the random rotation of the knob will be free and not affect or harm any other part of the mechanism. Further, the door hinges are fully inside the safe and therefore inaccessible with harmful intent. Finally, the mechanism is of a sturdy and balanced nature and composed of few parts.

I claim:

1. A door lock for safes and the like comprising companion sets of bolts carried by the door and extending in outward directions from a medial zone, means in the latter allowing the bolts to remain in the retracted positions, such means operable by a partial turn when the door is closed to advance the bolts into locking engagement with the safe, and key-operated controls to lock each set of bolts in the advanced position, said key-operated controls comprising companion key locks corresponding to said sets, each key lock operable by the turn of a key, said controls including levers free of the bolts before the related keys are turned, and said controls also including means effective after the bolts have been advanced and when the keys have been turned to move the levers into positions checking the return of the bolts.

2. The structure of claim **1,** and yieldable means maintaining the bolts in the retracted positions before and after said partial turn.

3. The structure of claim **1,** and backing springs maintaining the bolts in the retracted positions before and after said partial turn.

4. The structure of claim **1,** said bolts having widened inner end portions, and said means comprising a rotary knob on the outer side of the door, and a cam carried by the knob and having a circular series of points urging said end portions in outward directions during said partial turn.

5. The structure of claim **1,** said bolts having widened inner end portions, and said means comprising a rotary knob on the outer side of the door, and a square cam carried by the knob with corners urging said end portions in outward directions during said partial turn.

6. The structure of claim **1,** said bolts having inner end portions, each portion formed with a notch and said levers including end hooks, said end hooks being seated in said notches to check the return of the bolts after the bolts have been advanced and the keys have

been given said turn to move the levers into the checking positions.

7. The structure of claim 1, said levers being rotary levers and said contros also including cams carried by said key locks effective after the bolts have been dvanced and the keys have been given said turn to rotate the levers into the checking positions.

8. The structure of claim 7 further including yieldable means maintaining said levers in the rotated positions.

9. The structure of claim 7 wherein said cams are oval and are disposed to provide low profiles before said turn and high profiles after the bolts have been advanced and the keys have been given said turn, said high profiles being effective to turn the levers into the checking positions.

10. The structure of claim 9 wherein said rotary levers are disposed in pairs and further including springs connecting each pair of levers into contact with the profiles of the oval cams.

11. A safe having a door with a medial knob, key locks in the door spaced sidewise from the knob, two sets of bolts carried by the door on its inner side corresponding to the key locks and in advanced positions locking the door to the safe, controls on the inner side of the door maintaining the bolts in the advanced positions, said controls operative on the rotation of the key locks by means of keys to release the bolts for retraction, and means automatically retracting the bolts in such event to unlock the door from the safe.

12. The structure of claim 11, a square cam carried by the knob on the inner side of the door, said controls also maintaining the inner ends of the bolts clear of any rotary position of the square cam while 4he bolts are advanced, the bolts bearing with their inner ends when retracted on the flats of the square cam.

13. A safe having a door with a medial knob extended up and down with handles, key locks in the door spaced sidewise from the knob, two sets of bolts carried by the door on its inner side corresponding to the key locks and in retracted positions, a square cam carried by the knob on the inner side of the door and seating the inner ends of the bolts on the flats of the square cam, oval cams with high profiles carried by the key locks on the inner side of the door corresponding to the locking positions of the keys, companion levers bearing on said high profiles and engaging the bolts from the side, the turning of the keys to unlocking positions placing said profiles low, a turn of the handles causing the square cam to advance the bolts, and means maintaining said levers on the low profiles and in engagement with the ends of the bolts to check their return and maintain the door locked to the safe.

14. The structure of claim 1, said controls also being key-operated to allow each set of bolts to be retracted, and a manual device effective to operate the controls in the second-mentioned manner when key means are ineffective.

* * * * *