This invention relates to locks and in particular to cylinder locks.

Cylinder locks, as at present commonly used, employ a plurality of spring pressed cylindrical tumblers to normally lock the cylinder to the case element of the lock. The tumblers are moved out of locking position against the pressure of the springs by a flat key serrated in conformity with the size and location of the cylindrical tumblers. The present day cylinder locks have numerous disadvantages both from a manufacturing and operating standpoint and considering their comparative simplicity are high in cost.

I have devised a cylinder lock which has all of the advantages of the present cylinder locks, but is simpler in construction, can be manufactured at much lower cost, is much less subject to wear in use and is for all practical purposes pick-proof.

It is the principal object of this invention to provide a cylinder lock in which one or more ball members are employed which are movable radially from locking to unlocking position and vice versa, solely by, or solely against, the force of gravity, said balls when in either of said positions being positively held against movement.

It is also an important object of this invention to provide a cylinder lock in which a ball is employed that is movable from locked position to unlocked position in a vertical radial path located above the center of the cylinder of the lock, said ball being normally held in locked position by a retractable member which substantially closes the keyhole to access by foreign bodies, whereby when the key displaces said retractable member and a hole therein is aligned with said ball said ball falls out of locked position to permit the cylinder of the lock to be rotated and when the key is retracted the ball is raised thereby into locked position to be held therein by said retractable member.

It is a further object of the invention to provide a cylinder lock in which a plurality of balls are employed movable from locked position to unlocked position in paths radially and longitudinally spaced about the cylindrical keyhole in the cylinder, one of said paths being vertical and above the center of said keyhole, said balls being normally positively held in locked position by a retractable member closely fitting within the keyhole and closing access thereto, whereby when the key is inserted in the keyhole to retract the retractable member and the holes in the key are aligned with said balls, the said ball movable in said vertical path will fall out of locked position to permit the key to rotate the cylinder to move the remainder of said balls from locked position to unlocked position and when the key is retracted said balls will be returned to locked position and held therein by said retractable member.

The further objects, features and advantages of my invention will be readily apparent from a consideration of the following description taken with the accompanying drawings in which:

Fig. 1 is a vertical section showing a lock embodying the features of my invention;
Fig. 2 is a plan view of a key for the lock;
Fig. 3 is a view similar to Fig. 1 showing the locking mechanism in position to be rotated by the key;
Fig. 4 is a sectional view taken along the line of Fig. 3; and
Fig. 5 is a rear view of the lock of Fig. 1.

The lock of the invention is of general utility and may be used in place of the present day cylinder locks to fasten doors and similar closures. While the lock, embodying features of my invention, is shown as positioned in the closure member itself, it is to be understood that the invention is not limited to this embodiment but that the lock is susceptible of being incorporated into the padlock and other forms. Also, while the lock of the drawings is not shown as associated with the lockbox usually employed with cylinder locks, it is to be understood that such a lockbox may be employed with the lock shown.

Referring to the drawings, the novel lock 10 is shown as mounted in position in a closure member, such as a door, in which a hole is provided to house the outer cylindrical case member 11. The annular flange 32, integral with case member 11, contacts one face of the closure member while a nut 12 threaded on screw threads 13 formed on the rear end of the case member 11 contacts the opposite face of the closure to keep the lock 10 fixed in position. The case member 11 is provided with a central bore 14a which houses the cylinder member 18. A cylindrical keyhole bore 18a is formed through the center portion of the cylinder member 18.
The cylinder member 18 includes an end which projects outwardly beyond the rear end of the case member 11 and upon which is mounted a latch member 21. The latch member 27 is maintained in fixed position by means of a set screw 28. The latch member 27 may be used to operate the components of the usual lockbox, not shown, or it may be the actual latching means.

The extending end of the cylinder member 18 has a screw threaded bore adapted to receive a similarly screw threaded plug 21. Plug 21 is provided with a central screw threaded hole which receives the threaded end 22 of the stem member 23. The stem member 23, at its keyhole end, is provided with an enlarged, generally hemispherical head 24 of a size to permit ready entrance of the hollow key 30. About the stem member 23 is a spring member 25. The coils and the diameter of the wire of which are such that spring 25 contacts the stem member 23 and the walls of the keyhole bore 18a with only sufficient clearance to provide for easy operation.

Between enlarged head 24 and spring 25 is a ball 26 constantly urged by the spring 25 toward the head 24 and having a bore therethrough to permit it to be placed on the stem member 23. The ball 26 is of a size to fit snugly in the keyhole bore 18a and to effectively seal the keyhole 18a against access by any of the instrumentalties commonly used for lock picking.

In line with the extreme outer position of the ball 26 are provided the bores 14 and 20 in the casing member 11 and the cylinder member 18, respectively. These bores are of a diameter to snugly house the ball 17 while providing for movement of said ball in directions radially of the center line of the keyhole 18a. The ball 17 is of such a diameter that it exceeds the thickness of the cylinder member 18 by an amount equal to the width of the annulus space between the wall of the keyhole 18a and the surface of the stem 25.

The plug 15 closes the upper end of the bore 14. The portion of the plug 14 presented to ball 17 has a depression 16 formed therein to accommodate a portion of ball 17. The depth of depression 16 is substantially equal to the distance between the wall of the keyhole 18a and the surface of the stem 23. Furthermore, the depth of depression 16 is so chosen that it does not exceed substantially one fourth the diameter of ball 17.

A plurality of balls, bores and plugs of the same nature as those just described are distributed along the length of the keyhole; these are not only longitudinally spaced but they are also radially spaced. The invention is not limited to any pattern of spacing but the pattern chosen will determine the character of the key and only a key conforming to the particular pattern will operate in the lock.

The key 30 includes the usual flat enlarged portion for manipulating it and a hollow cylindrical portion 29 adapted to be inserted into the keyhole over the enlarged head and along stem 23. The cylindrical portion 20 of the key 30 is provided with a plurality of holes 31 corresponding in number and spacing to the balls 17 and others of the key.

The key 30 is also provided with a projection 33 which is adapted to engage a similar shaped depression 34 in the cylinder 18 for rotating said cylinder to rotate latch member 21 to the locked or unlocked position, as the case may be. Depression 34 also serves to indicate the position of registry between the key 30 and the lock mechanism.

In assembling the lock, ball 26 and the spring 25 are first placed on the stem 23. The threaded end of the stem 23 is then threaded into plug 21 and the stem 23 is inserted into the keyhole from the rear. The plug 21 is then screwed into position. A screwdrive slot is cut into plug 21, as shown in Fig. 5, to facilitate this operation.

After this, the balls 17 are positioned in their respective bores and the cylinder 18 moved into the bore 11a until the shoulder 19 contacts the stem member 23. The latch piece 27 is then placed upon the extending end of cylinder 18 and fixed in position by tightening set screw 28. Fig. 1 shows the lock parts in the locked position. At this time the first ball 17 rests upon the ball 26 and contacts the depression 16 in the plug 15. The remainder of the balls are held against their respective plugs by means of the coils of spring 25. The pitch of spring 25 is such as to assure the result. When the parts are in this position, Fig. 1, it is not possible to rotate cylinder 27. It will also be noticed that when the parts are in this position, Fig. 1, it is not possible to enter the keyhole to move the balls out of the locked position as the balls are radially as well as longitudinally spaced so that while one or more balls may fall out by movement of ball 26, as by means of a flat strip of wire, others of the balls being below the center of the keyhole will remain in the locked position. Unless the location of the balls are accurately known, it is not possible to unlock the lock.

To rotate the parts of the lock 10 to the unlocked position, the key 30 is inserted in the keyhole 18a and projection 33 made to seat into depression 34. In doing this, ball 26 and spring 25 are retracted along the stem 23. When the holes 31 in the key 30 are in registry with their respective balls 17, the first ball will fall by gravity into contact with stem 23, Fig. 3. Any other ball 17 that is located above the center line of the keyhole will also fall into contact with stem 23. The balls below stem 22 will maintain the original position. Upon initial rotation of the key, the balls below the center of the keyhole will be raised out of contact with their respective plugs 15 and into contact with stem 23. To assure this result it is necessary, as pointed out heretofore, that the depth of depression 16 does not substantially exceed one fourth the diameter of ball 17. When the balls are in contact with the stem 23, the cylinder 18 and the latch member 27 rotate with the key 30 to permit the latch member 27 to unlatch the closure or the lockbox.

The key 30 cannot be retracted as long as latch 27 is out of the locked position as the balls 17, being in contact with the surface of bore 11a and the surface of the stem 23, will prevent it. When the key is rotated to again bring latch member 27 to the locked position, key 30 may be retracted as the balls may then be moved to their original position. The ball 24 and spring 25 facilitate the removal of key 30 from the keyhole and in fact, act to eject the same therefrom.

While the invention has been described with particular reference to specific embodiments, it is to be understood that it is not to be limited
thereto, but is to be construed broadly and restricted solely by the scope of the appended claims. What is claimed is:

1. In a lock, a case member having a bore therein, a cylinder member fitted for rotation in said bore and having a cylindrical keyhole therein, latch means on said cylinder member and movable therewith, a stem mounted centrally in said keyhole, said case member having a depression which communicates with said bore, said cylinder member having a radial hole extending from the outer surface thereof to said keyhole and being located to align with said depression in one position of said cylinder member relative to said case, a ball positioned in said depression and said radial hole, when in said one position, to lock said cylinder against rotation in said case member, a retractable member positioned adjacent said radial hole and normally preventing egress of said ball from said depression, and means enclosing said stem member and movable therealong into operating position, said means having a radial opening therein, said means in said movement displacing said retractable member away from said radial hole and positioning said radial opening in line with said radial hole to permit egress of said ball out of said depression toward said stem member so as to free said cylinder for rotation in said case member.

2. In a lock, a case member having a bore therein, a cylinder member fitted for rotation in said bore and having a cylindrical keyhole therein, latch means on said cylinder member and movable therewith, a stem mounted centrally in said keyhole, said case member having a depression which communicates with said bore, said cylinder member having a radial hole extending from the outer surface thereof to said keyhole and being located to align with said depression in one position of said cylinder member relative to said case, a ball positioned in said depression and said radial hole, when in said one position, to lock said cylinder against rotation in said case member, a retractable member positioned adjacent said radial hole and normally preventing egress of said ball from said depression, and a hollow cylindrical key insertable in said keyhole and movable along said stem into operating position, said key having a radial opening therein, said key in said movement displacing said retractable member away from said radial hole and positioning said radial opening in line with said radial hole to permit egress of said ball out of said depression toward said stem member so as to free said cylinder for rotation in said case member.

3. In a lock, as defined in claim 2, in which said key hole, whereby said ball member moves into contact with said stem member solely through the action of gravity, and when said key member is withdrawn from said keyhole the sides of the bore in said key member raise said ball into contact with the bottom of said depression and said retractable member in following said key member engages said ball as said key leaves it to maintain it in contact with the bottom of said depression.

4. In a lock, a case member, a cylinder member fitted for rotation in a bore in said case member and having a cylindrical keyhole therein, latch means mounted on said cylinder member for movement therewith, a cylindrical stem member mounted centrally in said keyhole, spring pressed retractable means around said stem member closely fitted for longitudinal movement in said keyhole and preventing access thereinto, a hollow cylindrical key member insertable in said keyhole over said stem member and adapted to push said retractable member ahead along said stem as said key is moved into lock operating position, said key including means engageable with said cylinder member for rotating said key and cylinder member as a unit, said lock having a radial bore therein comprising a depression in said case member and radial bores in said cylinder member and said key member, the depth of said depression being substantially equal to the distance between the peripheries of said stem member and said keyhole, and a ball in said bore of a diameter substantially equal to but not in excess of the thickness of said cylinder member plus the depth of said depression, whereby when said ball is in contact with said retractable means it contacts the bottom of said depression and rotation of said cylinder member is prevented.

5. In a lock, as defined in claim 5, in which said bore is vertically disposed so that said ball is of a diameter substantially equal to but not greater than the thickness of the wall of said cylinder member plus the depth of the said depression.

6. In a lock, as defined in claim 2, in which said cylinder member and said key are provided with means engageable whereby said key is in lock operating position to enable said key and cylinder member to be rotated as a unit.

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7. said keyhole said retractable member holds said balls out of said keyhole to lock said case member and cylinder member against relative movement, and when said key is in lock operating position said balls are in position to permit said key member and cylinder member to rotate relative to said case member.

8. In a lock, a case member, a cylinder member fitted for rotation in a bore in said case member and having a cylindrical keyhole therein, latch means mounted on said cylinder member for movement therewith, a cylindrical stem member mounted centrally in said cylinder member and said key member, the depth of said depression being substantially equal to the distance between the peripheries of said stem member and said keyhole, and a ball in each of said longitudinally spaced radial lock bores of a diameter substantially equal to but not in excess of the thickness of said cylinder member plus the depth of said depression, whereby when said key member is out of said keyhole said retractable member holds said balls out of said keyhole to lock said cylinder member against relative movement, and when said key member is in lock operating position said balls are in position to permit said key member and said cylinder to rotate relative to said case member.

9. In a lock, a case member, a cylinder member fitted for rotation in a bore in said case member and having a cylindrical keyhole therewith, a cylindrical stem member mounted centrally in said cylinder member, spring pressed retractable means around said stem member closely fitted for longitudinal movement in said keyhole and preventing access thereinto, a hollow cylindrical key member insertable in said keyhole over said cylinder member and said key member, the depth of said depression being substantially equal to the distance between the peripheries of said stem member and said keyhole, and a ball in each of said longitudinally spaced radial lock bores of a diameter substantially equal to but not in excess of the thickness of said cylinder member plus the depth of said depression, whereby when said key member is out of said keyhole said retractable member holds said balls out of said keyhole to lock said cylinder member against relative movement, and when said key member is in lock operating position said balls are in position to permit said key member and said cylinder to rotate relative to said case member.

10. In a lock, a case member, a cylinder member fitted for rotation in a bore in said case member and having a cylindrical keyhole therewith, a cylindrical stem member mounted centrally in said cylinder member, spring pressed retractable means around said stem member closely fitted for longitudinal movement in said keyhole and preventing access thereinto, a hollow cylindrical key member insertable in said keyhole over said cylinder member and said key member, the depth of said depression being substantially equal to the distance between the peripheries of said stem member and said keyhole, and a ball in each of said longitudinally spaced radial lock bores of a diameter substantially equal to but not in excess of the thickness of said cylinder member plus the depth of said depression, whereby when said key member is out of said keyhole said retractable member holds said balls out of said keyhole to lock said cylinder member against relative movement, and when said key member is in lock operating position said balls are in position to permit said key member and said cylinder to rotate relative to said case member.

11. In a lock, a case, a cylinder rotatable in a longitudinal bore in said case and provided with a keyhole, said case having a depression opening into said longitudinal bore, said cylinder having a transverse bore therein opening into said longitudinal bore and said keyhole adapted to be brought into registry with said depression to provide a lock-piece receiving chamber, a lock-piece adapted to be housed in said chamber to lock said cylinder and said case against relative rotative movement, and retractable means in said keyhole adapted in the extended position to obstruct the keyhole end of said transverse bore to maintain said lock-piece in locking position, retractable means adapted in retracted position to clear said transverse bore whereby said lock-piece may be moved out of said depression and into said keyhole to unlock said case and said cylinder for relative rotative movement.

12. In a lock, a case, a cylinder rotatable in a longitudinal bore in said case and provided with a keyhole, said case having a depression opening into said longitudinal bore, said cylinder having a transverse bore therein opening into said longitudinal bore and said keyhole adapted to be brought into registry with said depression to provide a lock-piece receiving chamber, a lock-piece adapted to be housed in said chamber to lock said cylinder and said case against relative rotative movement, and retractable means in said keyhole adapted in the extended position to obstruct the keyhole end of said transverse bore to maintain said lock-piece in locking position, retractable means adapted in retracted position to clear said transverse bore whereby said lock-piece may be moved out of said depression and into said keyhole to unlock said case and said cylinder for relative rotative movement.

13. In a lock, a case, a cylinder rotatable in a longitudinal bore in said case and provided with a keyhole, said case having a depression opening into said longitudinal bore, said cylinder having a transverse bore therein opening into said longitudinal bore and said keyhole adapted to be brought into registry with said depression to provide a lock-piece receiving chamber, a lock-piece adapted to be housed in said chamber to lock said cylinder and said case against relative rotative movement, and retractable means in said keyhole adapted in the extended position to obstruct the keyhole end of said transverse bore to maintain said lock-piece in locking position, retractable means adapted in retracted position to clear said transverse bore whereby said lock-piece may be moved out of said depression and into said keyhole to unlock said case and said cylinder for relative rotative movement.

14. In a lock, a case, a cylinder rotatable in a longitudinal bore in said case and provided with a keyhole, said case having a depression opening into said longitudinal bore, said cylinder having a transverse bore therein opening into said longitudinal bore and said keyhole adapted to be brought into registry with said depression to provide a lock-piece receiving chamber, a lock-piece adapted to be housed in said chamber to lock said cylinder and said case against relative rotative movement, retractable means in said keyhole adapted in the extended position to obstruct the
keyhole end of said transverse bore to maintain said lock-piece in locking position, said retractable means adapted in the retracted position to clear said transverse bore whereby said lock-piece may be moved out of said depression and into said keyhole to unlock said case and said cylinder for relative rotative movement, and a cylindrical key insertable in said keyhole to move said retractable member from the extended to the retracted position, said key having a transverse bore therein adapted to be brought into registry with said first mentioned transverse bore by rotation of said key relative to said cylinder to provide a passageway for said lock-piece in its movement out of said depression and into said keyhole.

GEORGE WINSLOW GARNISS.

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The following references are of record in the file of this patent:

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Certificate of Correction

GEORGE WINSLOW GARNISS

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 6, line 39, for the claim reference numeral "5" read 6;
and that the said Letters Patent should be read as corrected above, so that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 6th day of February, A. D. 1951.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.