

June 1, 1965

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3,186,196

PLUNGER-TYPE LOCK

Filed Aug. 7, 1963

Fig. 1.

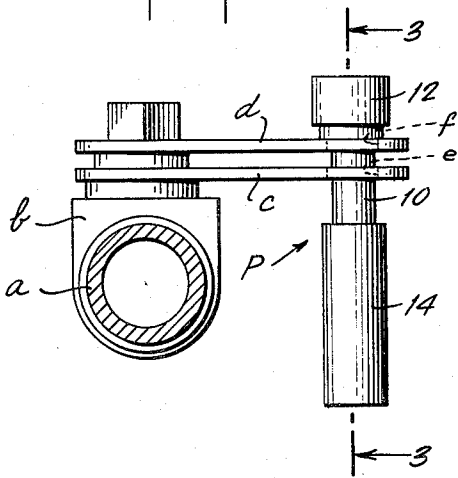


Fig. 2.

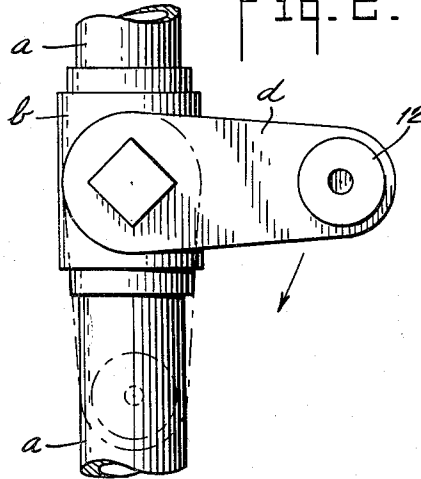


Fig. 3.

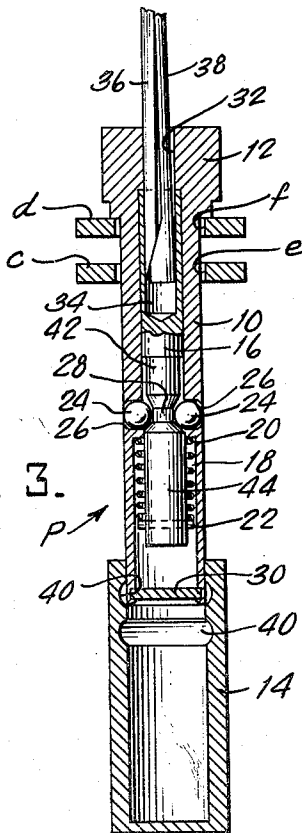
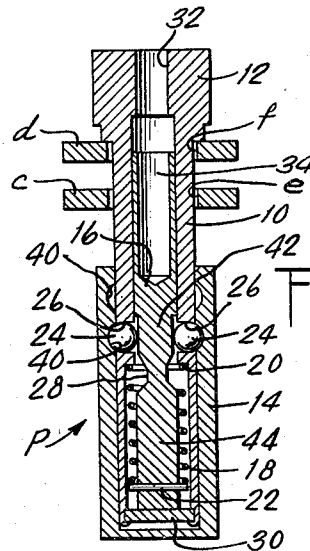


Fig. 4.



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3,186,196

PLUNGER-TYPE LOCK

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Filed Aug. 7, 1963, Ser. No. 300,459

1 Claim. (Cl. 70—34)

This invention relates to a plunger type of lock having a first enlarged head integral with or fixed on one end of a shank or plunger, and a second, separate, enlarged head which may be applied to the other end of the plunger and removed therefrom by means of a key.

Such a lock, as hitherto employed, is disclosed in United States Patent No. 3,033,016, the lock and its operation being best illustrated in FIGS. 5, 7 and 8 of the drawings of said patent. In the two latter figures and in FIG. 6 of said patent drawings is disclosed a key for opening such a lock. A similar or equivalent key is used in opening an improved lock according to the present invention.

It has been found that such prior locks, having cylindrical shank portions of diameters strictly limited by the dimensions of lockable equipment with which they are used, could quite easily be cracked open by an interloper using a hammer or equivalent means for carrying out his wrongful act. The nature of the operating parts within the shank portion of such a lock, together with the dimensional limitations imposed by the equipment with which such a lock is to be used, makes it impractical and probably impossible merely to increase the wall thickness of the shank to give it sufficient strength to withstand such acts of an interloper.

The principal object of this invention is to provide an improved plunger lock wherein a novel arrangement of operating parts within its cylindrical shank permits the latter to be made with a thicker wall than hitherto to enable the lock to withstand efforts to break it open.

A preferred embodiment of this invention is illustrated in the accompanying drawing, although those familiar with such locks will readily perceive that the inventive concept disclosed in said drawing may be utilized in various other ways.

In the drawing:

FIGURE 1 is an elevational view illustrating a lock, according to this invention, in locking association with an arm of a valve such as might be used, for example, in a gas-carrying pipeline.

FIG. 2 is an elevational view as seen from the top of FIG. 1.

FIG. 3 is an enlarged, central, longitudinal, sectional view of said lock with a completely separable, cup-shaped locking head thereof in an initial position in upward movement toward locking position on a shank portion of the lock.

FIG. 4 is a view, generally similar to FIG. 3, but showing the locking head in a final locked position from which it may be removed only by the use of a suitable key.

It should be understood that the illustrated lock and its principal parts are cylindrical or are circular in cross-section.

The pipe *a* in FIGS. 1 and 2 is provided with a shut-off valve *b* having a rigid, non-movable arm *c* projecting sidewise therefrom and an angularly movable arm or handle *d* by means of which the valve can be opened by moving the handle *d* to its broken-line position shown in FIG. 2 and can be closed by moving the handle to its full-line position. In closed position, the handle or arm *d* is in alignment with arm *c* and said handle can be locked in its closed position by a plunger lock P, extended within aligned holes *e* and *f* in the two arms *c* and *d* as shown in FIGS. 1, 3, and 4.

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Referring particularly to FIG. 3, the illustrated lock comprises a body element which includes a cylindrical shank 10 and an integral, enlarged head 12 formed at one end of said shank (the upper end as illustrated), a separable, cup-shaped locking head 14 adapted for locking application upon the lower end of the shank, and a locking plunger 16 slidable longitudinally with the shank.

The lock further includes a compression coil spring 18 disposed about the lower end of the locking plunger 16 and coacting with and between an annular internal shoulder 20 of the shank 10 and an abutment pin 22 extending transversely through the locking plunger toward the latter's lower end, to bias the plunger downwardly to its locking position as in FIG. 3.

Detent means, shown as at least one, but preferably a plurality of balls 24 are disposed within slightly larger holes 26 in the wall of the shank 10. When the locking plunger 16 is in its non-locking position, as in FIG. 4, the balls 24 may recede inwardly to non-locking position in the holes 26 and into an annular detent-releasing recess 28 in the plunger which recess is of such depth that the receded balls are entirely within the confines of the adjacent outer cylindrical surface of the plunger. The outer edges of the holes 26 are suitably beveled inwardly, to such an extent, as to retain the balls within the holes and against separation from the plunger while, nevertheless, permitting them to move outwardly in the holes to the extent indicated in FIG. 3, to locking position.

The lower end of the plunger 16 is closed by a suitable closure-disk 30, held in place by the rolled-in bottom edge portion of said plunger. Coaxial bores 32 and 34, provided respectively in the head 12 and the upper end of the plunger 16, permit the introduction into the lock of gripping fingers 36 and 38 of a key such as is shown in said prior patent (not otherwise shown herein), for internally gripping the plunger 16 and pulling the latter upwardly against the force of spring 18 from the plunger's locking position as in FIG. 3 to its non-locking position as in FIG. 4. The separable locking head 14 is formed with one or more internal, endless circular grooves 40, provided for locking purposes as hereinafter detailed.

In using the lock P disclosed herein, the shank 10, with the locking head 14 entirely separated therefrom, is inserted downwardly through holes *f* and *e* in the arms *d* and *c* when the latter are in aligned positions with the valve *b* closed.

The gripping fingers 36, 38 of a key, such as shown, for example, in said prior patent, are inserted into the lock through bores 32 and 34, and after said fingers are slid longitudinally in relation to each other to spread them into tight engagement with the surface of bore 34, the key is pulled upwardly relatively to the lock to cause the fingers to pull the plunger 16 upwardly to its non-locking position as in FIG. 4.

With the plunger held in its non-locking position by the key, the balls 24 are free to seat within the plunger's annular recess 28 and thus be entirely within the outer confines of the shank 10, thus permitting the locking head 14 to be slid upwardly onto the shank 10 to bring one or the other of grooves 40 into transverse alignment with the balls 24.

The key is then removed, first being suitably manipulated to cause the fingers 36, 38 to slide relatively to each other to contract and release their grip upon the plunger 16, whereupon the latter immediately moves downwardly under the force of spring 18 to bring a thicker, detent-holding portion 42 of the plunger into transverse alignment with balls 24 to hold the latter seated immovably within the related groove 40 of the locking head 14. The heads 12 and 14, of course, are larger than the holes *e* and *f* so that when the head 14 is securely

locked in place on the shank 10, the lock cannot be properly opened and the valve *b* operated except by the use of a proper key.

The lock may be opened by inserting the fingers 36, 38 of the key thereinto, then expanding them to grip the plunger 16, then lifting the plunger by the key to bring its recess 28 into alignment with the balls 24; whereupon the balls can move inwardly into said recess and out of groove 40 to free the locking head 14 for removal.

As far as manipulative operation is concerned, the presently disclosed lock is identical with the lock shown in said prior patent. Structurally, however, it is quite different, the differences residing in an ingenious rearrangement of operating parts so that, without increasing the diameter of the shank 10, it can be made of considerably greater wall thickness and thereby greatly strengthened and enabled to resist attempts to break the lock with hammer blows.

The principal difference giving rise to such increased strength resides in providing for relocation of the coil spring which holds the plunger in its locking position. In the mentioned patent structure, the lock's shank accommodates therewithin the coil spring which extends about a plunger portion having a bore within it for receiving the fingers of the key.

A very troublesome problem arises from the just-stated association of parts in the patent structure. One aspect of the problem is that the diameter of the lock's shank cannot be increased as it then could not be employed with many existing valves, etc. for which such locks are to be used. Another aspect is that the bore 34 must be of a size enabling the lock to be used with the many keys now in use which must serve for opening old locks as well as new ones; and the wall of the plunger defining that bore must be amply strong to withstand the described spreading of the key's fingers 36, 38 without becoming even slightly distorted.

For the above-indicated reasons, the wall of the patented lock's shank, immediately below the integral enlarged head, is necessarily quite thin, about .030 inch. Needed case hardening of the lock's cylindrical parts makes them somewhat brittle to a depth of about .005 inch, both inside and outside, so that the strength of the shank at the mentioned point is concentrated in about .020 inch of the metal. Experience has demonstrated that the shank of such a lock can be broken by a sharp blow of a hammer.

The problem has been solved by the present invention by changing the plunger to provide a lower-end extension 44 thereon, and disposing the spring about said extension instead of having it take up critical space adjacent to the bore 34. With this improvement, the lock operates the same as the patented lock. By thus relocating the spring, the wall of the shank may be made considerably thicker than in the patented lock at all points where a hammer blow might be directed by an interloper.

The wall of the shank of the present improved lock, at all points where exposed to such a blow, may have a thickness of about .080 inch, about .070 inch of which remains unaffected by case hardening. It may be seen that the thicker wall of the shank extends well into the head 14 when the latter is locked upon the shank and that any other wall portions of the shank are protectively enclosed within said head. It is also worthy of note that as the upper end of the plunger 16 is an accurate sliding fit within the immediately surrounding wall portion of the shank 10, the plunger gives substantial reinforcement to that wall portion of the shank. Thus, the lock is rugged and of ample strength to withstand any hammer blow to which it might be subjected by an interloper.

As a matter of convenience in describing and defining

this invention, certain expressions indicative of direction such as, for example, "downwardly" and "upwardly" or indicative of location such as, for example, "upper" and "lower," are employed in this specification and in the accompanying claim with reference to the position of the lock as shown in the accompanying drawing, irrespective of the position or attitude in which the lock may be disposed in actual use.

It will be recognized by those familiar with such locking devices that the present inventive concept may be utilized in various other ways without departing from the invention as set forth in the following claim.

I claim:

A plunger-type lock comprising:

a body element which includes;

a cylindrical shank and

a first enlarged head disposed at the upper end of said shank and formed with a first key-member-receiving coaxial bore extending completely therethrough;

a second enlarged head removably applicable to a lower-end portion of said shank to substantially enclose said lower-end portion;

detent means coacting between said shank and said second head for locking the latter upon said shank;

a plunger formed at its upper end with a cylindrical wall which is slidable in intimate relation to an inside cylindrical surface of said shank to support the plunger for sliding axially between a locking position in which a detent-holding portion of the plunger, located intermediate the plunger's ends, coacts with said detent means to effect the latter's locking of said second head upon said shank and a non-locking position in which a detent-releasing portion of the plunger, also located intermediate the latter's ends, coacts with said detent means to cause the latter to release said second head for removal from said shank,

said plunger being formed with an integral extension at its lower end,

said cylindrical wall defining therewithin a key-member-receiving second coaxial bore therein opening at the plunger's upper end in alignment with said first bore; and

a coil spring extending about said extension and within a lower-end portion of said shank and coacting with the latter and with an abutment on said plunger to urge the latter yieldably toward its said locking position,

said lower-end portion of the shank and said extension and spring being enclosed within the second head when the latter is locked upon the shank to protect said lower-end shank portion against damage, the thickness of the lock between the plunger surface defining said second bore and the outer surface of the shank being limited by the size of the key to be used with the lock and the diameter of an opening in a member with which the lock is to be used, and said thickness being made up solely of said cylindrical wall of the plunger and a wall portion of the shank within which said plunger wall is slidable, and the wall portion of the shank within which said cylindrical wall of the plunger is slidable being reinforced by its intimacy with said cylindrical wall.

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