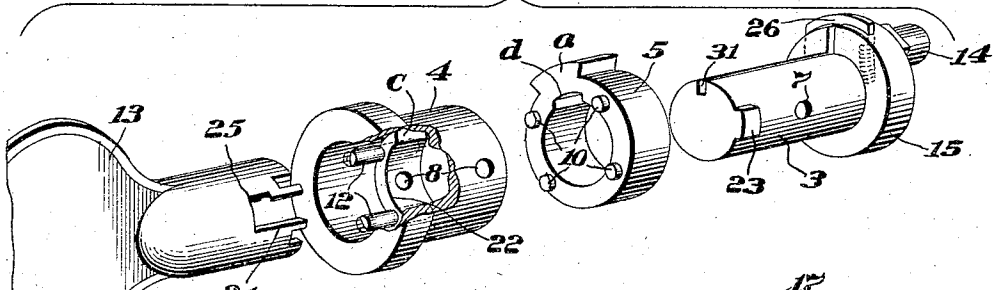
Dec. 13, 1932. M. FALK 1,891,214

LOCK

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Fig. 1



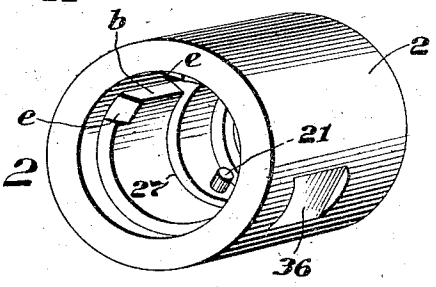


Fig. 2

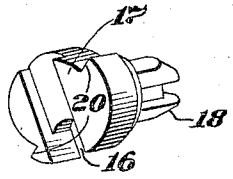


Fig. 3

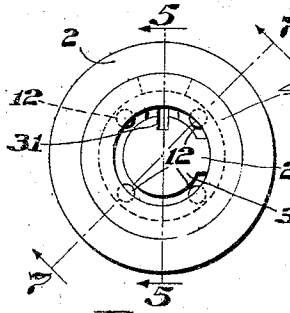


Fig. 4

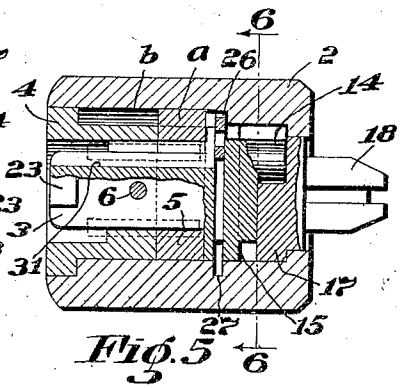


Fig. 5

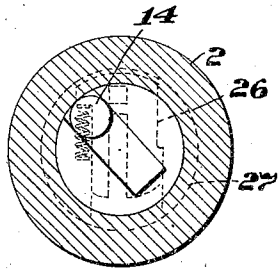


Fig. 6

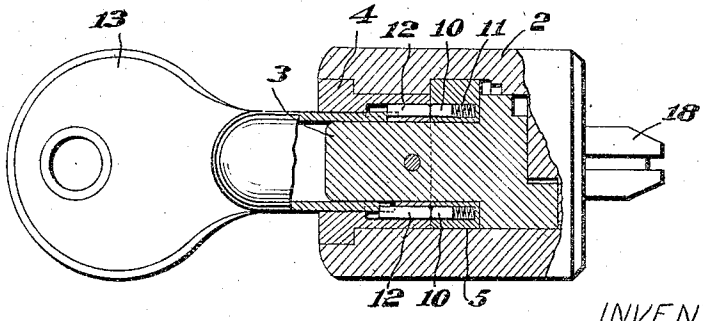


Fig. 7

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LOCK

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Fig. 8

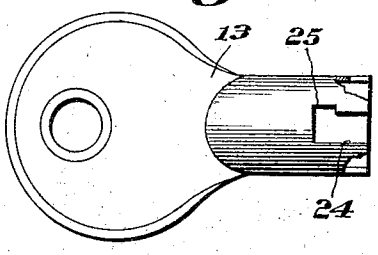
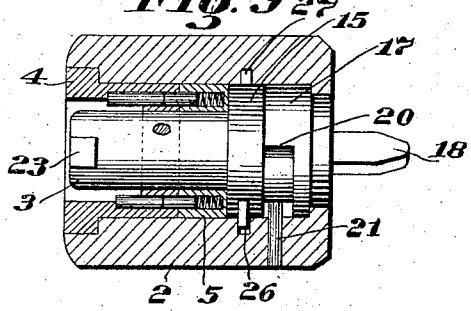


Fig. 9



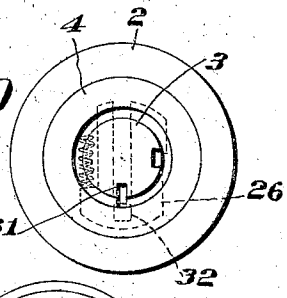


Fig. 10

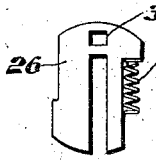


Fig. 11

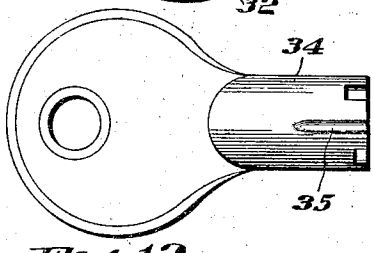


Fig. 12

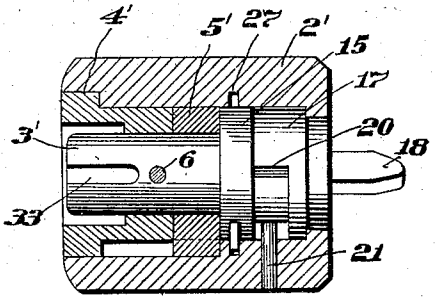


Fig. 13

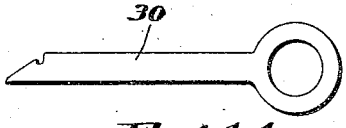


Fig. 14

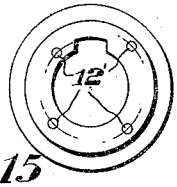


Fig. 15

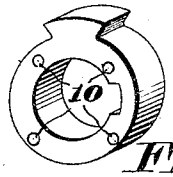


Fig. 16

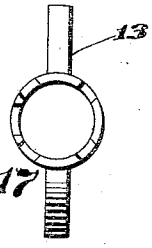


Fig. 17

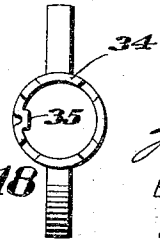


Fig. 18

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Patented Dec. 13, 1932 1,891,214

UNITED STATES PATENT OFFICE

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LOCK

Application filed December 5, 1931. Serial No. 579,165.

This invention relates to locks and is more especially concerned with locks of the pin tumbler type, although some features of the invention also are useful in other types of locks.

For many years the pin tumbler type of lock has been preferred for general use because of the relatively high degree of security which it affords. More recently, however, this type of lock has been displaced to a considerable extent by the disk tumbler type because of the fact that a lock of the latter type occupies less space and is more easily installed. This is particularly true of locks used in automobiles. This change, however, has been made at the sacrifice of a considerable degree of security since the disk tumbler lock can be picked far more easily than a pin tumbler lock.

The present invention aims to combine the advantages of the two types of locks. Stated more specifically, the invention aims to devise a pin tumbler lock which can be made in substantially as small dimensions as the disk tumbler type of lock. It is also an object of the invention to devise a pin tumbler lock which will be even more secure against picking than common locks of this type.

The nature of the invention will be readily understood from the following description when read in connection with the accompanying drawings, and the novel features will be particularly pointed out in the appended claims. In the drawings,

Figure 1 is a perspective exploded view of the parts of the locking unit of a lock mechanism constructed in accordance with this invention, and illustrates also a key for operating such a lock;

Fig. 2 is a perspective view of a shell in which the locking unit is mounted;

Fig. 3 is a similar view of an end member which may conveniently be used with the locking unit;

Fig. 4 is a front elevation of the assembled lock;

Fig. 5 is a vertical, longitudinal, sectional view of the complete lock;

Figs. 6 and 7 are sectional views approximately on the lines 6—6, Fig. 5, and 7—7, Fig. 4, respectively;

Fig. 8 is a side elevation, partly broken away, of a key for operating the pins of the lock shown in Fig. 9;

Fig. 9 is a view similar to Fig. 6 but showing the parts in a different relationship;

Fig. 10 is a front elevation of the lock assembly illustrating the relationship of the plug and the latch which holds the locking unit in the shell;

Fig. 11 is a plan view of the latch and the spring for operating it;

Fig. 12 is a side view of another form of key which may be used;

Fig. 13 is a vertical, longitudinal, sectional view of a modified embodiment of the invention;

Fig. 14 is a side view of a special tool designed for use in operating the latch shown in Fig. 11;

Fig. 15 is a rear elevation of a pin cylinder designed for use in a modified embodiment of the invention;

Fig. 16 is a perspective view of the pin block for use with the cylinder shown in Fig. 15; and

Figs. 17 and 18 are end views of the keys shown, respectively, in Figs. 8 and 12.

Referring first to Figs. 1 to 7, inclusive, the lock construction there shown comprises an outer shell or casing 2 which may conveniently consist of a hollow cylinder provided with bevelled ends. Removably mounted in this shell is a locking unit comprising a plug 3, a pin cylinder or sleeve 4, and a second pin cylinder or block 5. The plug 3 and cylinder 4 are secured rigidly together for rotation in unison by means of a pin 6, Fig. 5, this pin passing through the holes 7 and 8, Fig. 1. When the parts are in their operative positions in the shell 2, the pin block 5 is held in a stationary, or at least in a non-rotary, position by means of a lug *a* which projects radially therefrom and lies in a groove *b* formed for it in the shell 2. This block carries a series of locking pins 10, Figs. 1 and 7, each pin being backed up by a spring 11. The cylinder or sleeve 4 carries a corresponding number of combination pins 12.

In the particular construction shown in Figs. 1 to 7 four locking pins and four combination pins are used, the pins in each set being spaced apart at equal distances in the circumference of a circle struck about the axis of the plug 3, and all of the pins being located parallel to said axis. In other words, all of the pins are located at the same radial distance from said axis and each locking pin can be registered with any one of the combination pins providing the plug is allowed to make a complete revolution.

Both sets of pins 10 and 12 slide freely in the holes provided for them in their respective supporting members 5 and 4. They are all of substantially the same diameter. Consequently, the spring pressed locking pins 10 normally force the combination pins 12 forwardly, or toward the front of the lock, and thus lock the cylinder 4 to the pin block 5. Since the latter block is stationary in the shell 2 and since the plug 3 is secured to the cylinder 4, the plug normally is locked against rotation relatively to the shell. When, however, the combination pins are forced backwardly by means of a tubular key, such as that shown at 13, so that the ends of both sets of pins lie flush with the abutting end surfaces of the parts 4 and 5, these members then are unlocked from each other and the pin cylinder 4 and plug 3 may be rotated within the shell.

This rotary movement of the plug may be utilized to operate any suitable kind of a member at the back of the lock. As shown, the plug is provided with a pin 14 extending rearwardly from the enlarged disk portion 15 of the plug, and this pin enters a groove 16, Fig. 3, in a member 17 such as those used heretofore in locks designed to control the operation of ignition switches in motor vehicles, this member 17 being provided with a short blade 18 to operate the switch. Various other devices may, however, be substituted for the part 17. In some cases, for example, this part 17 instead of being provided with a blade 18 will be connected by means of a bar or rod with the bolt mechanism of a lock such as those used for fastening doors, drawers, and various other devices.

An ignition switch is designed simply to be turned on and off and the lock shown, therefore, is made to be given a half turn only, the part 17 having shoulders 20—20 separated by an angular distance of 180° to engage a pin 21, Figs. 2 and 9, on the shell to limit the range of rotation of the part 17. The construction of this portion of the locking mechanism necessarily will be varied in accordance with the nature of individual uses.

It will be clear from an inspection of Fig. 1 that the cylinder 4 does not have a cylindrical form in the strict sense of that term, although it is here called a cylinder because of its general shape and the nature of the functions which it performs. The bore of this member, however, is reduced approximately midway of its length, a shoulder 22, Fig. 1, being formed at the junction of the two portions of the bore, and the holes for the combination pins 12 extend inwardly from the rearward end of this cylinder into the larger portion of the bore. The plug 3 fits snugly within the reduced part of the bore and an annular space or aperture thus is provided at the forward end portion of the lock between the plug and the cylinder to receive the tubular portion of the key 13, the combination pins lying partially within this annular aperture or recess. In order to compel the insertion of the key in a definite relationship to the pins, the plug 3 is provided with a radially extending lug 23 and the key has a slot 24 to receive the lug. There is some tendency for the spring pressed locking pins to force the key out of the lock and it usually is preferable, therefore, to undercut the slot 24, as shown at 25, so that the shoulder at the junction of the undercut with the main portion of the slot will slide behind the lug 23 as soon as the key has been turned slightly and thus prevent any substantial outward movement of the key while it holds the pins in their unlocking positions.

It should be noted that the plug 3, pin block 5 and cylinder 4 with the pins form the essential elements of the lock and the assembly consisting of these parts therefore may aptly be termed "a locking unit." In practice these parts are assembled independently of the shell. The member 17 and pin 21 are located in the shell, and any shell then later is assembled with a locking unit, any unit fitting in any shell.

In assembling the locking unit the pin block 5 and the cylinder 4 are slipped over the forward portion of the plug 3, the parts 4 and 5 having grooves *c* and *d*, respectively, Fig. 1, to permit the passage therethrough of the lug 23, and the pin 6 later is driven through the holes 7 and 8 to secure the plug and the cylinder together, the pin block being held between the end of the cylinder and the enlargement 15 of the plug.

For the purpose of securing the locking unit removably in the shell, a spring pressed latch 26, Figs. 1, 10 and 11, is mounted to slide radially in the part 15. This latch runs in an annular groove 27, Figs. 6 and 9, in the shell 2, and it is normally held in its projected position by a spring 28, Fig. 11. The latch is wider or of greater angular extent than the lug *a*, Fig. 1, and usually lies directly behind it. When the locking unit is being forced into the shell the latch 26 is forced backwardly by its engagement with the bevelled surfaces *e*, Fig. 2, at opposite sides of the groove *b* and it snaps into the groove 27 as soon as the locking unit is fully inserted.

Normally this latch is inaccessible. If,

however, it is desired to remove the locking unit for any reason due, for example, to breakage of some part, the latch can be withdrawn by unlocking the lock and inserting the tool 30 in the groove 31, Figs. 1, 4 and 5, which runs from the forward end of the plug through to the slot in which the latch works. The bevelled end of the tool 30 can thus be inserted in the hole 32, Figs. 10 and 11, of the latch 26, whereupon by forcing the tool inwardly, the latch will be moved toward the axis of the lock far enough to withdraw it completely from the groove 27, thus permitting the entire locking unit to be pulled out of the shell 2. A new unit may then be snapped into place and the lock thus restored to its operative condition. Access to the latch 26, even in the manner above described, can be obtained only when the parts are in their unlocked positions since at this time only is the groove 31 in alinement with the grooves *c* and *d*, Fig. 1, through which also the tool 30 must be moved in order for it to operate the latch. So long as the grooves *c* and *d* are out of register with each other the tool cannot be inserted, and the latch, therefore, cannot be released.

In some cases it is desirable, as, for example, when the lock is to be used in connection with a combination ignition and lamp switch, to have the switch locked in any one of three or four positions. This result can be accomplished in the construction above described by making the key without the undercut 25 or by so shaping this undercut that a slight forward movement of the pins can occur when the key is in the lock. With such an arrangement, if the key is inserted and the plug is turned slightly and inward pressure on the key then relieved, while still continuing to turn the plug, the pins will snap into their locked positions as soon as the plug has made a quarter turn. If these operations are again repeated the plug can be given another quarter turn when it will again be locked. In the same manner it may be locked in any one of four positions, all 90° apart.

In other cases it is desirable to have the plug make a single revolution and then lock. This is conveniently accomplished by locating the pins at different radial distances from the axis of the lock, and such a construction is illustrated in Figs. 15 and 16, the former showing the combination pins 12′ while the latter shows a similar location of the holes 10′ for the locking pins. In such a construction the plug may be provided with a groove 33, Fig. 13, and a key such as that shown at 34, Figs. 12 and 18, may be employed, this key having a fin or spline 35 pressed into it to fit in the groove 33 so that they key can only be inserted in the lock in a definite relationship to the pins. If alternate pins in the arrangement shown in Figs. 15 and 16 are arranged at different radial distances while the diametrically opposed pins are located at the same radial distances from the axis of the lock, then the plug can be locked after making a half turn and again in the full turn position.

The invention thus provides a lock of the pin tumbler type which occupies no more space than a lock of the disk tumbler type while being far more difficult to pick. In fact, it is much more difficult to pick this lock than it is to pick the ordinary pin tumbler lock. At the same time the lock can be manufactured very economically, the plug, pin block, pin cylinder, shell, and the member 17 all being made, if desired, by the die casting method. The assembling operations are very simple. By using combination pins of different lengths a great number of combinations may be made when four combination pins are used in each lock. Obviously, however, this number can be increased or decreased, as desired. The small size and the added security are both important practical advantages.

The shell may be mounted in its operative position by methods similar to those used in prior types of locks. Because of its cylindrical shape it is simply necessary to bore a round hole to receive it. The flattened surface 36, Fig. 2, is designed to receive the end of the screw which usually is provided to secure it in place. A further advantage of this construction which frequently is very important is the fact that the key can be removed from the lock in any position of the plug and entirely regardless of whether or not the locking and combination pins are in alinement.

While I have herein shown and described a typical embodiment of my invention, it will be evident that the invention may be embodied in a considerable variety of other forms without departing from the spirit or scope thereof. For example, in the construction shown in Figs. 1 to 9, the block or cylinder 5 is held stationary and the cylinder 4 which carries the combination pins is mounted to rotate with the plug. A reversal of this arrangement could, however, be used in which the cylinder 4 is secured against rotation and the block 5 is arranged to rotate with the plug 3. In fact, the lock shown in Fig. 13 could be made to operate in exactly this manner with no other change except that the sides of the slots in the end of the key shown in Fig. 12 would be bevelled so that the key would be forced forwardly by the pins during the rotation of the plug until the plug reached a locking position.

Having thus described my invention, what I desire to claim as new is:

1. A lock of the pin tumbler type including an outer shell; a locking unit removably mounted in said shell and having a set of

combination pins and a set of locking pins cooperating with them, said pins extending parallel to the axis of said lock; and means for releasably securing said unit in said shell, said lock being constructed to prevent the operation of said means when the lock is in its locked condition but permitting such operation when the lock is unlocked.

2. A lock of the pin tumbler type including an outer shell; a locking unit removably mounted in said shell and having a set of combination pins and a set of locking pins cooperating with them, said pins extending parallel to the axis of said lock; a latch for releasably securing said unit in said shell, said lock being constructed to prevent the operation of said latch when the lock is in its locked condition but permitting such operation of said latch from the front end of the lock by means of a special tool when the lock is unlocked.

3. A lock of the pin tumbler type including an outer shell adapted to be secured in a stationary position; a locking unit removably mounted in said shell and including two relatively movable pin supporting members and cooperating sets of pins carried, respectively, by said members and both lying parallel to the axis of the lock; and means for releasably securing said unit in said shell, said means being normally inaccessible when the lock is mounted in its operative position.

4. A lock of the pin tumbler type including an outer shell adapted to be secured in a stationary position; a locking unit removably mounted in said shell and including two relatively movable pin supporting members and cooperating sets of pins carried, respectively, by said members and both lying parallel to the axis of the lock; and means for releasably securing said unit in said shell, said means requiring a special tool for its operation to release said unit.

5. A lock of the pin tumbler type including an outer shell adapted to be secured in a stationary position; a locking unit removably mounted in said shell and including two relatively movable pin supporting members and cooperating sets of pins carried, respectively, by said members and both lying parallel to the axis of the lock; and means under the control of said lock for releasably securing said unit in said shell.

6. A lock of the pin tumbler type including an outer shell adapted to be secured in a stationary position; a locking unit removably mounted in said shell and including two relatively movable pin supporting members and cooperating sets of pins carried, respectively, by said members and both lying parallel to the axis of the lock; and means for releasably securing said unit in said shell, said means requiring the operation of said lock to permit the release of said unit.

7. A lock of the pin tumbler type including an outer shell adapted to be secured in a stationary position; a locking unit removably mounted in said shell and including two relatively movable pin supporting members and cooperating sets of pins carried, respectively, by said members and both lying parallel to the axis of the lock; and means for releasably securing said unit in said shell, said lock being operable to protect said means against operation to release said unit and also being operable to permit such operation.

8. A lock of the pin tumbler type including an outer shell adapted to be secured in a stationary position; a locking unit removably mounted in said shell and including two relatively movable pin supporting members and cooperating sets of pins carried, respectively, by said members and both lying parallel to the axis of the lock, and a normally inaccessible latch for releasably securing said unit in said shell.

9. A lock of the pin tumbler type including an outer shell adapted to be secured in a stationary position; a locking unit removably mounted in said shell and including a pin cylinder, a set of combination pins mounted in said cylinder and lying parallel to the axis of said cylinder, and a set of locking pins cooperating with said combination pins to lock said cylinder against rotation relatively to said shell; and normally inaccessible means for releasably securing said unit in said shell.

10. A lock of the pin tumbler type including an outer shell adapted to be secured in a stationary position; a locking unit removably mounted in said shell and including a pin cylinder, a set of combination pins mounted in said cylinder and lying parallel to the axis of said cylinder, and a set of locking pins cooperating with said combination pins to lock said cylinder against rotation relatively to said shell; and a spring pressed latch mounted in a relatively inaccessible position in the lock for releasably securing said unit in said shell.

11. In a lock of the pin tumbler type, the combination of a plug mounted to rotate about an axis within the plug, a pin cylinder fastened to said plug to rotate therewith, a set of combination pins in said cylinder, said pins lying approximately parallel to said axis, a pin block at the end of said cylinder, a set of locking pins in said block for locking said cylinder to the block, said plug, cylinder and block being associated to form a locking unit, and a shell in which said unit is removably supported with said pin block held against rotary movement, said locking pins being arranged to cooperate with said combination pins and said lock having an aperture to receive a key for operating said combination pins.

12. In a lock of the pin tumbler type, the combination with a relatively stationary shell; of a locking unit removably mounted

in said shell and comprising a plug mounted for rotary movement in said shell about an axis within the plug, mechanism for locking said plug to the shell comprising a set of spring pressed locking pins lying parallel to said axis and spaced circumferentially around said axis, said pins being mounted in a relatively stationary part of the lock, and means for unlocking said plug to permit it to rotate relatively to said shell comprising a set of combination pins mounted to rotate with the plug and arranged to operate said locking pins, said lock being adapted to receive a key for operating said combination pins; a latch for releasably securing said unit in said shell, said lock being constructed to prevent access to said latch when the lock is in its locked condition but permitting the operation of said latch from the front end of the lock by means of a special tool when the lock is unlocked.

13. A lock of the pin tumbler type including an outer shell; a locking unit removably mounted in said shell and having a set of combination pins and a set of locking pins cooperating with them, said pins extending parallel to the axis of said lock; and normally inaccessible means for releasably securing said unit in said shell.

14. A removable locking unit for a lock of the pin tumbler type comprising a pin cylinder, a pin block, two sets of pins carried, respectively, by said cylinder and block and both lying parallel to the axis of said cylinder, springs cooperating with one set of said pins to cause them to lock said cylinder and block together, means for holding said cylinder and block in end to end relationship with said pins of one set in cooperative relationship to those of the other set, said means including a plug extending through said cylinder and block and provided with an enlargement on its inner end, said block being located between said enlargement and said cylinder.

15. A removable locking unit for a lock of the pin tumbler type comprising a pin cylinder, a pin block, two sets of pins carried, respectively, by said cylinder and block and both lying parallel to the axis of said cylinder, springs cooperating with one set of said pins to cause them to lock said cylinder and block together, means for holding said cylinder and block in end to end relationship with said pins of one set in cooperative relationship to those of the other set, and locking means carried by said unit for releasably securing said unit in a shell.

16. A removable locking unit for a lock of the pin tumbler type comprising a pin cylinder, a pin block, two sets of pins carried, respectively, by said cylinder and block and both lying parallel to the axis of said cylinder, springs cooperating with one set of said pins to cause them to lock said cylinder and block together, means for holding said cylinder and block in end to end relationship with said pins of one set in cooperative relationship to those of the other set, said means including a plug extending through said cylinder and block, and a spring pressed latch mounted on said plug for movement transversely to the axis of said cylinder.

17. A lock of the pin tumbler type including an outer shell; a locking unit removably mounted in said shell and having a set of combination pins and a set of locking pins cooperating with them, said pins extending parallel to the axis of said lock; and locking means requiring a special tool for its operation and operative to releasably secure said locking unit in said shell.

18. A lock of the pin tumbler type including an outer shell; a locking unit removably mounted in said shell and having a set of combination pins and a set of locking pins cooperating with them, said pins extending parallel to the axis of said lock; and locking means for releasably securing said locking unit in said shell, said locking means requiring a special tool for its operation and said lock being constructed to prevent the operation of said locking means by said tool except in connection with the operation of said lock by its key.

19. In a lock of the pin tumbler type, the combination of an outer shell; a locking unit removably mounted in said shell and including a rotary plug and a complete set of pins for locking said plug against rotation, said pins extending parallel to the axis of the plug; means carried by said shell and arranged to be operated by the rotation of said plug, and a latch for securing said locking unit removably in said shell.

20. In a lock of the pin tumbler type, the combination of an outer shell; a locking unit removably mounted in said shell and including a rotary plug and a complete set of pins for locking said plug against rotation, said pins extending parallel to the axis of the plug; and locking means for releasably securing said unit in said shell, said plug having a groove therein extending longitudinally thereof to receive a special tool for operating said latch to release said locking unit and said lock being constructed to prevent the operation of said latch by said tool except in connection with the operation of said lock by its key.

MORRIS FALK.