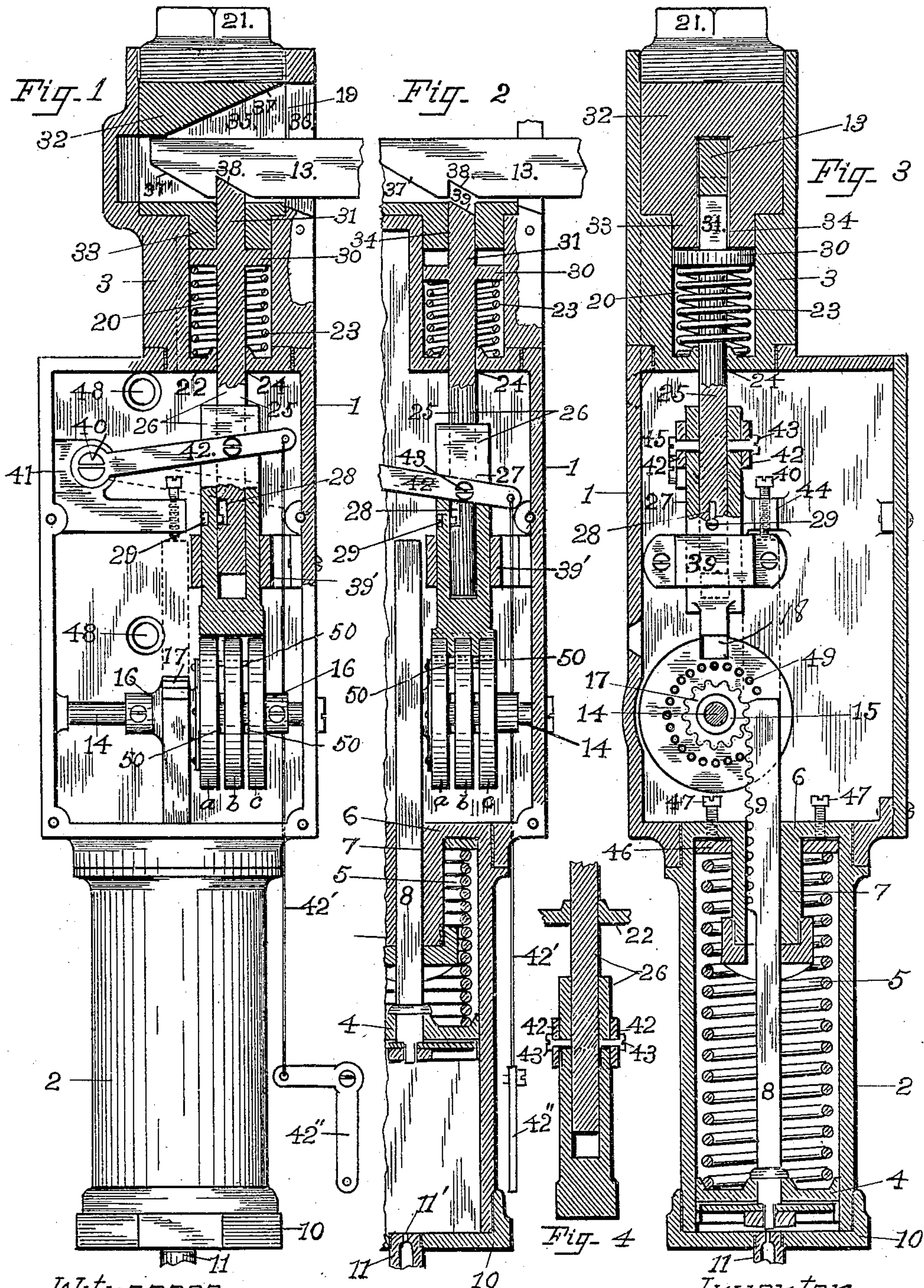


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FLUID PRESSURE COMBINATION LOCK.
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Patented Nov. 2, 1909.



Witnesses.

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FLUID-PRESSURE COMBINATION-LOCK.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, WILLIAM J. HOFSTATTER, a citizen of the United States, residing at Toledo, in the county of Lucas and State of Ohio, have invented a new and useful Improvement in Fluid-Pressure Combination-Locks, of which the following is a specification.

My invention relates to a fluid-pressure combination lock.

In Patent No. 787,575 dated April 18, 1905, I have shown and described a lock adapted to be unlocked by a predetermined combination of fluid pressures.

My present invention has for its object to provide a simplified lock of the kind that is adapted to automatically lock a closure for an opening in position closing the opening, and which requires for its unlocking the application of a definite and predetermined sequence of fluid pressures of different units of pressure.

A further object is to provide a lock of the kind that is adapted to automatically lock a closure for an opening when the closure is in position closing the opening, and that is adjustable to be only opened by a predetermined fluctuation of fluid pressure applied thereto.

I accomplish these objects by the construction and combination of parts, as hereinafter described and illustrated in the drawings, in which—

Figure 1 is a side elevation of a lock constructed in accordance with my invention, with the closure plate of the casing removed, and with the latch socket and the portion of the lock bolt within the socket shown in longitudinal section, and engaging the latch in locked position. Fig. 2 is a broken away portion of a longitudinal section of the same, showing the bolt in unlocked position, and also showing the piston in raised position. Fig. 3 is a longitudinal section of the same at a right angle to the closure plate of the casing, showing the parts in locked position, and Fig. 4 is a broken away longitudinal section of the lock bolt.

In the drawings 1 designates an elongated, rectangular casing, having a threaded orifice at one end into which is threaded one end of a pressure cylinder 2, and at the opposite end is provided with a threaded orifice into which is threaded a reduced and threaded end portion of a cylindrical extension 3 of the casing, forming a latch socket casing.

The pressure cylinder 2 is bored for the most of its length to receive a piston 4 and for the remainder of its length to form an annular seat for a helical spring 5, and leave an integral end portion 6 having an axial guide portion 7 extending a suitable distance into the cylinder. The guide portion 7 is provided with a longitudinal opening through which the stem 8 of the piston extends into the casing 1. The portion 9 of the stem within the casing is formed as a rack. The free end portion of the cylinder 2 is threaded, and is provided with a closure cap 10. The cap 10 is provided with a central threaded orifice, into which is threaded the end nozzle 11 of a supply pipe (not shown) that is connected to a main source of compressed air, which for the purpose of a description of the operation of my lock is assumed to be the main line of a train air brake system, and it will be further understood that the supply pipe is provided with any suitable form of stop and waste valve, whereby, when the valve is opened, air is admitted from the train line through the supply pipe to the cylinder 2, and when closed the air in the cylinder escapes through a reduced outlet to the atmosphere. It is also assumed that my improved lock is secured to a side post of a doorway of a freight car, in position to receive a lock latch 13, projecting beyond the edge of a sliding door, and that the latch is pivoted by one end to the inner side of the door, and movable through a very limited arc.

Within the casing is provided an arbor 14, which is fixedly secured to the sides of the casing transversely thereof, and upon the arbor are revolubly mounted a series of tumbler disks *a*, *b*, and *c*, separated by the washers 15, and prevented from lateral movement on the arbor by the collars 16 mounted on the arbor. The tumbler disk *a* is provided with a pinion 17, which is secured as a hub projecting axially from one side of the tumbler, and in position, on the arbor intermeshing with the rack 9 of the piston stem. Each tumbler is provided with a peripheral lock incut 18, and with adjustable means of inter-engagement as hereinafter described to automatically communicate movement of the tumbler *a* to the tumblers *b* and *c*, to aline or disaline the lock incuts 18.

The latch socket extension 3 of the casing 1 is provided with a longitudinal bore 19 and

with a reduced eccentric extension 20 of the bore 19. The outer end portion of the bore 19 is threaded to receive a closure plug 21. The bore 20 does not extend entirely through the extension 3, an end portion 22 being left as a seat for a helical spring 23, inserted in the bore, and through the seat 22 axial to the bore 20 is formed a guide orifice 24, through which extends into the casing 1, one member 25 of a locking bolt 26.

The portion of the member 25 extending through the spring 23, the guide orifice 24, and within the casing 1, is cylindrical, and within the casing 1 there is telescopically mounted thereon the other member 27 of the locking bolts 26, the member 27 being provided with a longitudinal central bore to receive the member 25, which is provided near its inner end with an incut 28, forming square shoulders adapted to operate as stops to limit the distance of telescopic movement of the members 25 and 27 in and on the other respectively, the member 27 being provided with a stop pin 29 extending into the incut, which engages the shoulders formed on the member 25 by the incut.

The portion of the member 25 within the bore 20 is provided with an annular flange 30 which moves as a piston in the bore and engages the spring 23, and beyond the disk flange 30 the member 25 has a squared end portion 31, which projects normally a short distance into the bore 19, in which is inserted a cylindrical plug 32 having an eccentric cylindrical extension 33, of reduced diameter, adapting it to enter the bore 20. The extension 33 is provided with a squared guide opening 34 into and through which extends the squared end portion 31 of the locking bolt. The guide opening 34 intersects a latch socket 35 formed in the plug 32 and which registers with an opening 36 in the extension 3, when the plug is in position in the extension 3 with the extension 33 of the plug in the bore 20, and it is manifest that when the plug is in such position with the closure plug 21 run in thereon that the plug 32 is secured against turning or displacement. The latch socket 35, at the top is provided with a downward and inward incline 37 which is adapted to direct the latch 13 downward against the tendency of the lock bolt to raise it as the latch engages the bolt. The latch 13 at its free end portion is provided with an incline 37', and a triangular incut 38 adjacent to the incline, adapted to receive the beveled end 39 of the squared end portion 31 of the lock bolt. As the incline 37 of the latch engages the bevel 39 of the lock bolt, the bolt is moved downward depressing the spring 23, until the incut 38 is directly above the bolt, when the spring raises the end of the bolt into the incut, and locks the latch in the socket.

The member 27 of the lock bolt 26 is

movable through a guide 39 secured to a side of the casing 1, and its lower end is broadened and flattened to transversely engage the three tumblers *a*, *b* and *c* and to adapt it to enter the incuts 18 when they are brought into alinement by the movement of the tumblers.

When the lock bolt 26 is in its normal position as established by the spring 23, which yielding holds the flange 30 of the bolt up against the extension 33 of the plug 32, the lower shoulder of the incut 28, of the member 25, engages the stop pin 29 of the member 27, and holds the member 27 raised slightly above the rims of the tumblers, as shown in Figs. 1 and 3. When the tumbler incuts 18 are alined, the member 27 may be moved down into the incuts, as shown in Fig. 2, and in so moving it the latch 13 is unlocked. To so move the member 27 to unlock the bolt 26, there is provided an arbor 40 mounted in a bearing 41 in the casing 1, and upon the arbor are fixedly mounted within the casing, the rock arms 42, which engage pins 43 extending oppositely from the sides of the member 27 of the lock bolt. The outer end of one of the arms 42 is connected by a wire or cable 42' to a bell crank 42'', one arm of which is on the outside of the car at any suitable and convenient position to throw the bolt.

Above and in line with the rack 9 of the piston stem, there is provided a lug 44 having a stop screw 45, by which an adjustable limit is provided to the distance of movement of the piston 4 in the pressure cylinder 2. There is also preferably interposed between the seat 6 and the spring 5 of the cylinder 2 an annular plate 46, and in the seat the adjusting screws 47, engaging the plate, by which the resistance of the spring to the piston may be adjusted.

The casing 1 is provided with screw holes 48, by which it may be attached to the door frame in position to receive the latch of a door to be locked.

The tumblers *a*, *b*, and *c* are each provided with a series of holes 49 to receive the contact pins 50 of the tumblers. In the inner face of tumbler *a* is fixed one pin 50, and in the adjacent face of the tumbler *b* two pins 50, one of which is adapted to be engaged by the pin of tumbler *a* when the tumbler *a* is revolved in one direction, and the other to be engaged thereby when the tumbler *a* is revolved in the opposite direction, and the adjacent faces of the tumblers *b* and *c* are likewise equipped with pins 50.

The rack 9 and the pinion 17 have the same number of teeth, and the maximum stroke of the piston 4 produces one revolution of tumbler *a*, and pins 50 of the tumblers *b* and *c* are so adjusted that when a maximum movement of the piston 4 has been made, the tumbler *c* will have been revolved

to bring its incut 18 in position to receive the lock bolt 26. Thus constructed and adjusted the other contact pin 50 of the tumbler *b* is then adjusted to turn back the tumbler *b* and bring its incut 18 in line with the incut of tumbler *c*, when the piston 4 reaches a certain point (arbitrarily selected) in its return stroke, and in such relation to the incut of tumbler *a*, that when the piston is raised from such point to another selected point above, but less than the maximum stroke of the piston, the incut 18 of tumbler *a* will also be in line with the incuts of tumblers *b* and *c*.

The pressure required to move the piston 4 to engagement of the rack of its stem with the stop 45 being known, and the pressure at each of the points above referred to being ascertained, the maximum, minimum and intermediate pressures necessary to bring the piston successively in their order to such points, constitutes the combination selected for opening the lock, and the combination is worked by admitting air to the cylinder when the source of pressure is at or above the maximum pressure of the combination, then reducing the pressure of the source to the minimum pressure of the combination, then raising the pressure of the source to the intermediate or final pressure of the combination, at which point the incuts of the tumblers will be alined and the latch of the door may be unlocked by moving the arms 42 of the arbor by the lever 43'' to throw the lock bolt 26 into engagement with the tumblers in the incuts 18. When the door has been opened, upon the release of the lever 43'', the spring 23 will raise the lock bolt to its normal position and withdraw it from the incuts of the tumblers. The valve of the supply pipe being then closed, the air in the cylinder will pass out through the waste duct, and the spring 5 will return the piston to its normal position, and in so returning, the tumblers will be operated to throw the incuts 18 out of alinement. When the door is again closed the latch 13 will automatically depress the member 25 of the lock bolt 26 in the member 27, which is prevented by the tumblers from downward movement, such depression being permitted by the incut 28 in the member 25, and when the door is fully closed the lock notch of the latch will permit the spring 23 to return the member 25 of the lock bolt to its normal locking position, in engagement with the notch of the latch.

It will thus be seen that when my lock is applied to a car, and connected to the main air brake line of a train in which the car is connected, the door of the car may be readily unlocked by the engineer after the valve of the supply pipe is opened, by first reducing the train line pressure to the minimum pressure of the combination and then raising it

to the intermediate pressure selected for the combination, and leaving the source at that pressure until the door is unlocked and opened and the valve of the supply pipe is closed, and that where a number of the cars composing a train are equipped with my locks, each operating by a different combination of pressures, any one of the cars may be unlocked without unlocking the others.

My lock is especially adapted for use on freight cars to prevent opening and robbing of cars en route to their destination. It is also adapted for use in warehouses, freight houses, factories, jails and the like, for unlocking from one position, distant doors all simultaneously, where the locks have the same combination, or separately where each lock has a distinct combination.

By providing the nozzle 11 of the supply pipe with a reduced inlet 11' (which is also the outlet) when the valve of the supply pipe is opened, the pressure in the cylinder 2 is gradually raised, and sudden impulse to the piston and through the piston to the tumblers is avoided, and the lock is made sensitive to accurate operation of the tumblers by high pressures.

What I claim to be new is—

1. In a fluid pressure combination lock, the combination with a lock bolt, of an arbor, a series of disk tumblers independently rotatable on the arbor in the path of the movement of the lock bolt, said tumblers each having an incut adapted when brought into alinement with the incuts of the other tumblers to jointly receive and permit the release of the lock bolt, and said tumblers being adapted when the incuts are disalined to prevent movement and release of the bolt, means of inter-engagement between the tumblers, arranged and adapted by predetermined forward and backward partial revolutions of one of the tumblers, to bring the incuts of all of the tumblers into alinement to receive the bolt, and means to actuate the actuating tumbler forward and backward, said means being adapted to be actuated by fluctuating fluid pressure.

2. In a fluid pressure combination lock, the combination with a lock bolt, of an arbor, a series of disk tumblers independently rotatable on the arbor in the path of the movement of the lock bolt, said tumblers each having an incut adapted when brought into alinement with the incuts of the other tumblers to jointly receive and permit the release of the lock bolt, and said tumblers being adapted when the incuts are disalined to prevent movement and release of the bolt, adjustable means of inter-engagement between the tumblers, arranged and adapted by predetermined forward and backward partial revolutions of one of the tumblers, to bring the incuts of all of the tumblers into alinement to receive the bolt, and means to

actuate the actuating tumbler forward and backward, said means being adapted to be actuated by fluctuating fluid pressure.

3. In a fluid pressure combination lock, a
5 lock bolt, an arbor, a series of disk tumblers independently rotatable on the arbor in the path of the lock bolt, and each having an incut adapted when brought into alinement with the incuts of the other tumblers to
10 jointly receive and release the lock bolt, said tumblers being adapted when the incuts are out of alinement to prevent the unlocking of the lock bolt, means of inter-engagement between the tumblers arranged and adapted to
15 bring the incuts of all the tumblers into alinement by predetermined forward and backward part revolutions of one of the tumblers, and means comprising a cylinder adapted to be connected to a source of fluid
20 under controllable pressure, a piston in the cylinder, adapted to be actuated in one direction by the pressure of the fluid, a spring in the cylinder adapted to produce graduated resistances to the piston, means connecting
25 the piston and the actuating tumbler, adapted to produce forward and backward revolution of the actuating tumbler, according as the pressure of the fluid is raised and lowered in the cylinder, substantially as set
30 forth.

4. In a combination fluid pressure lock, a lock bolt, an arbor, a series of disk tumblers independently rotatable on the arbor in the path of the lock bolt, and each having
35 an incut adapted when brought into alinement with the incuts of the other tumblers to jointly receive and release the lock bolt, said tumblers being adapted when the incuts are out of alinement to prevent the
40 unlocking of the lock bolt, adjustable means of inter-engagement between the tumblers arranged and adapted to bring the incuts of all the tumblers into alinement by predetermined forward and backward part revolutions of one of the tumblers, and means comprising a cylinder adapted to be connected to a source of fluid under controllable pressure, a piston in the cylinder, adapted to be actuated in one direction by the pressure of
50 the fluid, a spring in the cylinder adapted to produce graduated resistances to the piston, means connecting the piston and the actuating tumbler, adapted to produce forward and backward revolution of the actuating
55 tumbler, according as the pressure of the fluid is raised and lowered in the cylinder, substantially as set forth.

5. In a fluid pressure combination lock, the combination of a lock bolt comprising
60 telescopic members, one of the members

movable inward of the other to permit the unlocking of the bolt, a spring adapted to yieldingly hold the bolt in normally locked position, means to withdraw the bolt from
65 locked position by the movement of the other member, independently rotatable tumblers adapted to prevent the unlocking of the bolt, said tumblers having incuts normally disaligned, and adapted when in alinement to permit the unlocking of the bolt, and means
70 to operate the tumblers to bring the incuts into alinement, and adapted to be actuated thereto by alternating higher and lower fluid pressures.

6. In a fluid pressure combination lock, a
75 lock bolt, an arbor, a series of disk tumblers independently rotatable on the arbor in the path of the lock bolt, and each having an incut adapted when brought into alinement with the incuts of the other tumblers to
80 jointly receive and release the lock bolt, said tumblers being adapted when the incuts are out of alinement to prevent the unlocking of the lock bolt, means of inter-engagement between the tumblers arranged and adapted
85 to bring the incuts of all the tumblers into alinement by predetermined forward and backward part revolutions of one of the tumblers, and means comprising a cylinder adapted to be connected to a source of fluid
90 under controllable pressure, a piston in the cylinder, adapted to be actuated in one direction by the pressure of the fluid, a spring in the cylinder adapted to produce graduated resistances to the piston, a pinion
95 mounted on the arbor and secured to the actuating tumbler, and a stem for the piston having a portion formed as a rack and engaging the pinion, substantially as set forth.

7. In combination in a fluid pressure combination lock, a lock bolt, a series of tumblers controlling the unlocking of the bolt, a cylinder, a piston in the cylinder, a spring in the cylinder resisting the piston, means
100 operatively connecting the piston with the tumblers, and a connection from the cylinder adapted to connect it with a source of fluid under controllable pressure, and having a restricted opening into the cylinder adapted to slowly admit fluid under pressure to the
110 cylinder, and retard its escape therefrom, substantially as and for the purpose set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing
115 witnesses, this 16th day of June, 1909.

WILLIAM J. HOFSTATTER.

In presence of—

MARK WINCHESTER,
M. S. SMITH.