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Salzman et al.

[11] **3,879,970**

[45] **Apr. 29, 1975**

[54] **FLUID OPERATED LOCK**

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[22] Filed: **Apr. 19, 1974**

[21] Appl. No.: **462,343**

Related U.S. Application Data

[60] Division of Ser. No. 281,649, Aug. 18, 1972, Pat. No. 3,822,368, which is a continuation-in-part of Ser. No. 244,678, April 17, 1972, Pat. No. 3,805,121, which is a continuation-in-part of Ser. No. 199,883, Nov. 18, 1971, Pat. No. 3,782,148.

[52] **U.S. Cl.** **70/275**; 70/339; 137/552.5; 137/613

[51] **Int. Cl.**..... **E05b 47/04**; E05b 31/02

[58] **Field of Search** 137/552.5; 70/275, 278

[56] **References Cited**

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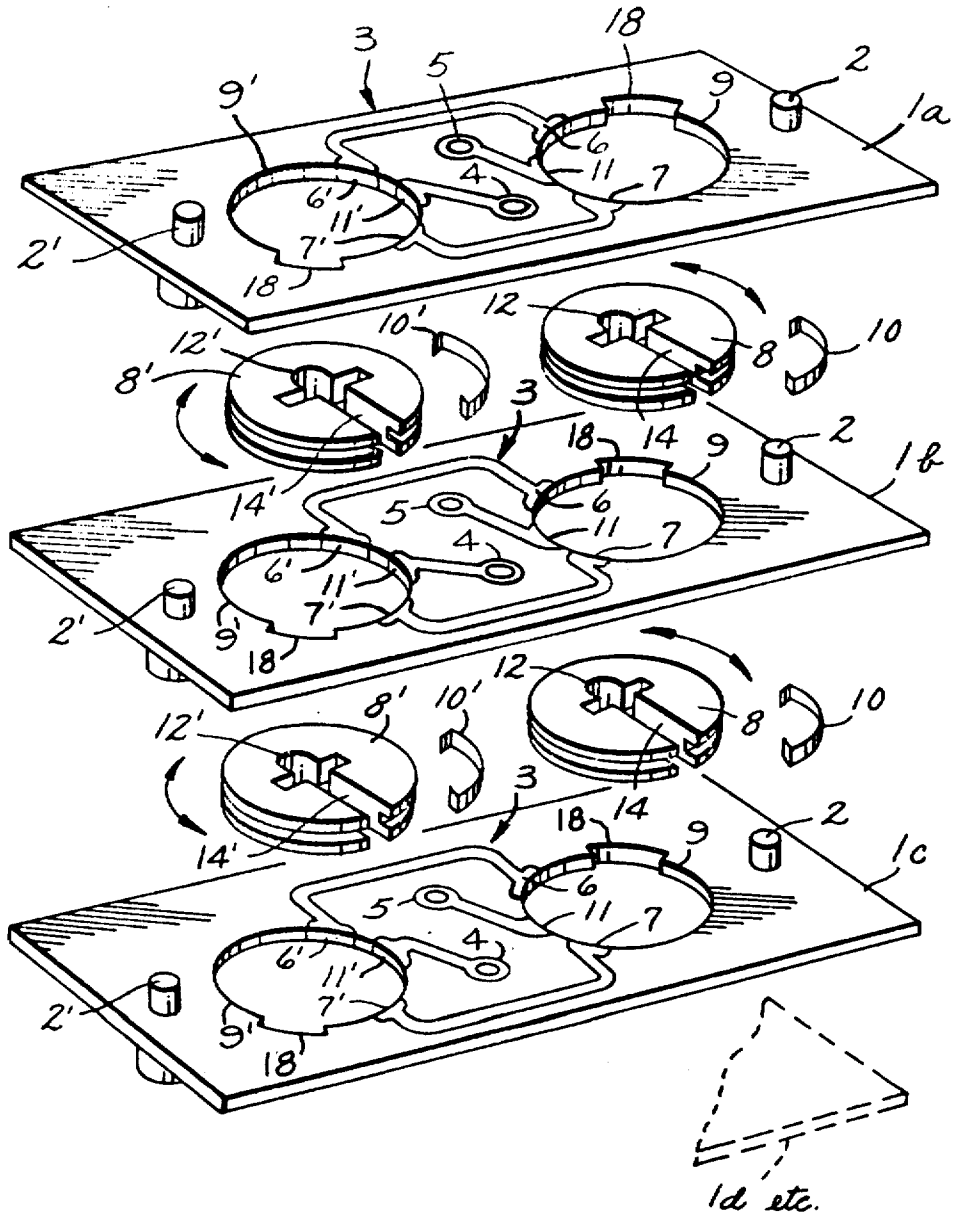
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Primary Examiner—Henry T. Klinksiek

[57] **ABSTRACT**

A lock construction comprising a plurality of circuit boards. The circuit boards are ganged together to form a connective circuit path. When a key is inserted and turned in the keyway of the lock, the connective path is altered. Only the correct key will allow entry. The circuit of the lock may either be an electrical circuit, or an analogous fluid circuit.

15 Claims, 9 Drawing Figures



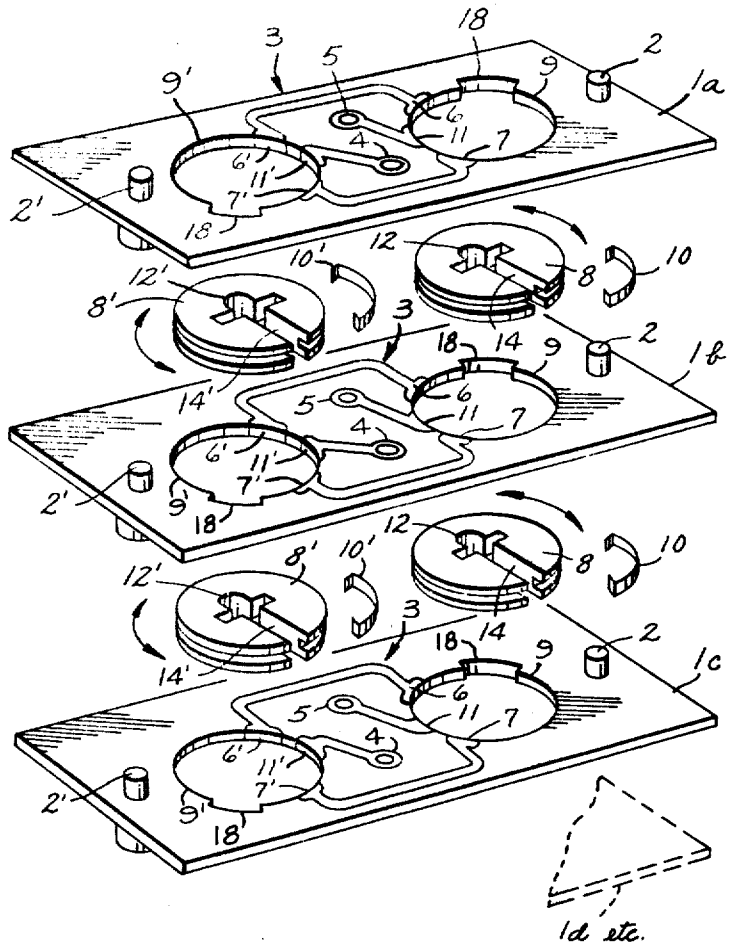


FIG. 1.

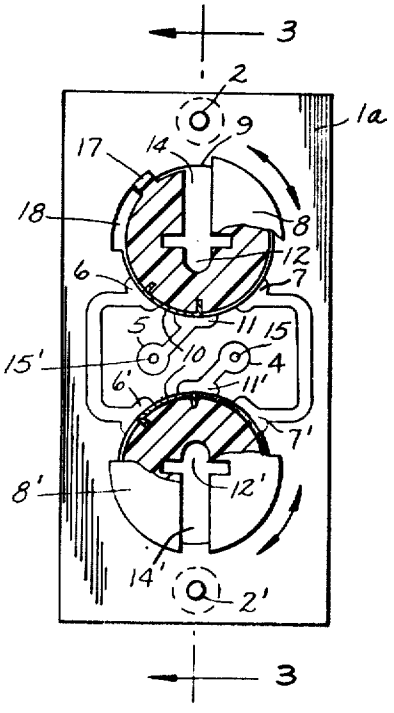


FIG. 2.

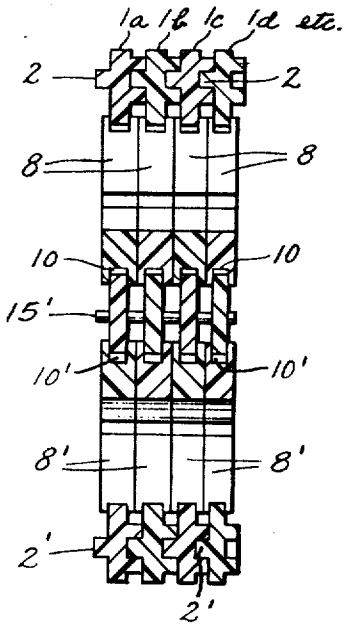


FIG. 3.

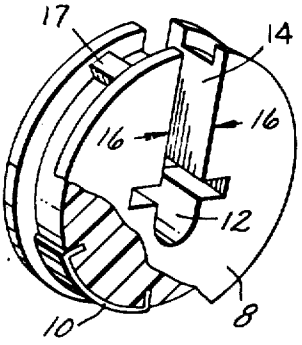


FIG. 4.

FIG. 5.

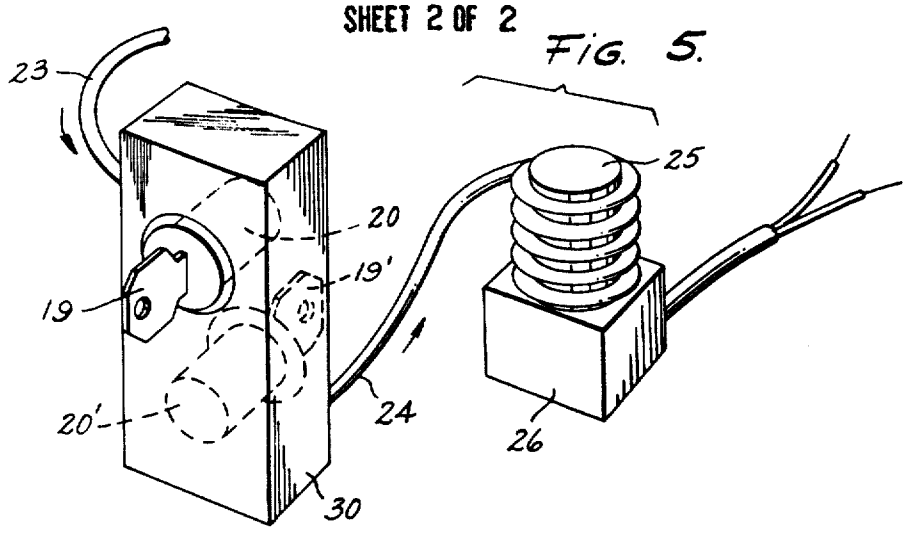


FIG. 6.

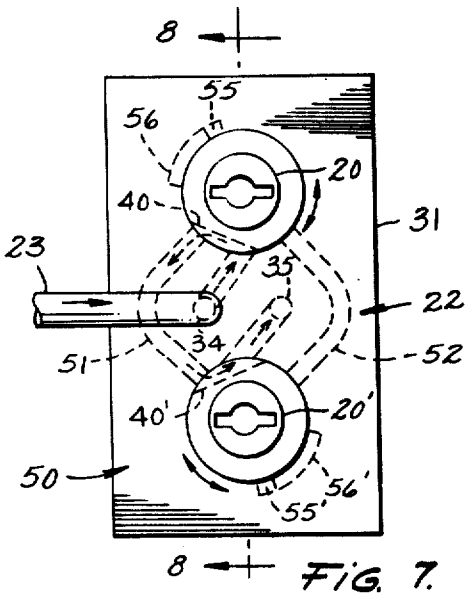


FIG. 8.

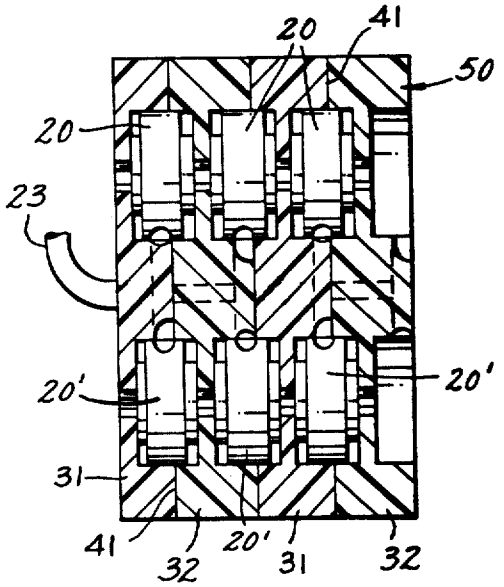


FIG. 7.

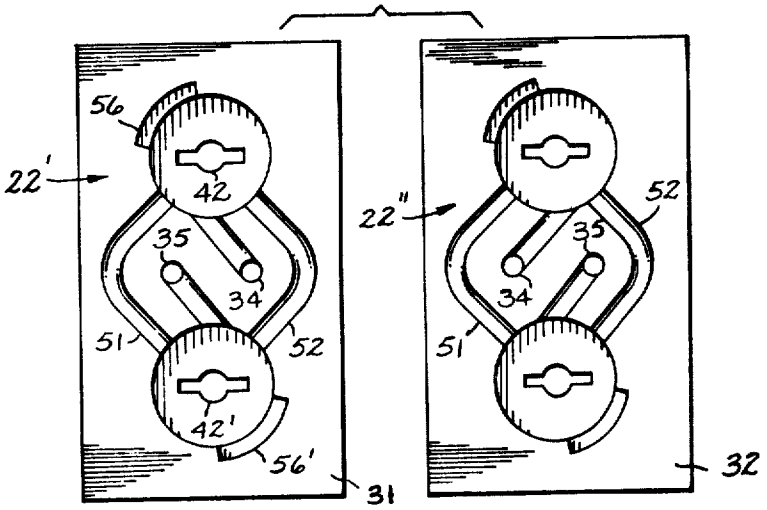
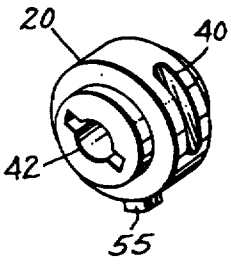


FIG. 9.



FLUID OPERATED LOCK

RELATED APPLICATIONS:

This application is a divisional of parent application Ser. No. 281,649, filed Aug. 18, 1972, now U.S. Pat. No. 3,822,368, which is a continuation-in-part of the pending application Ser. No. 244,678, filed Apr. 17, 1972, now U.S. Pat. 3,805,121, which is a continuation-in-part of the previously filed copending application for an "Electronic Anti-theft Locking System," Ser. No. 199,883, filed Nov. 18, 1971, now U.S. Pat. 3,782,148.

The present invention concerns itself with the construction of a lock as generally disclosed in the above cited applications, and with a further modification of a fluid analogue system based upon the electrical circuitry of said applications.

The electric lock of the previous applications is constructed according to this invention as a plurality of ganged circuit boards. Each circuit board represents the pairing of two single pole double throw switches. When the circuit boards are connected together, each pair of switches is connected so as to form the connective electrical path of the prior applications. The switches in the circuit board are formed by rotative members containing a conducting strip that is caused to move between two electrical positions. The rotative members contain a keyway for the insertion of a key. If the key contains a tooth at a particular rotative member position, then the rotative member will turn when the key is inserted and turned. If no tooth is present at a particular rotative member position, then the rotative member will not turn when the key is inserted and turned.

In an analogous system, a fluid path is created which is identical with the electrical path. The fluid lock is constructed of a plurality of ganged circuit boards similar to the electrical construction. The fluid circuit boards are cemented and sealed together to create a fluid tight circuit path. Rotative members alter the flow path of the fluid through the lock circuit.

Both the electrical and fluid locks work on the double key principle as set forth in the aforementioned wherein: One key is inserted in an inaccessible part of the lock to set a combination,, and the other key is inserted in an accessible part of the lock to set a combination. When the combinations match, as when the keys are complementary, the lock will be released.

It is an object of this invention to provide improvements in a lock construction;

It is another object of this invention to provide a novel fluid lock system and construction;

It is yet another object of this invention to provide an easily assembled, low cost lock construction;

These and other objects of the invention will become more apparent and will be better understood with reference to the following drawings in which:

FIG. 1 is an exploded isometric view of a first embodiment of the inventive lock construction;

FIG. 2 is a partially cutaway frontal view of the lock construction of FIG. 1;

FIG. 3 is a sectional view of the lock construction of FIG. 2 taken along lines 3—3;

FIG. 4 is an enlarged isometric view of a rotative member of the lock construction of FIGS. 1 through 3;

FIG. 5 is a schematic perspective view of a second embodiment of the inventive lock showing a fluid system;

FIG. 6 is a frontal view of the lock construction for the fluid system of FIG. 5;

FIG. 7 is a frontal view of the alternating circuit paths of the lock construction of FIG. 6;

FIG. 8 is a sectional view of the lock construction of FIG. 6 taken along lines 8—8; and

FIG. 9 is a perspective view of the rotative member of the lock construction of FIG. 6 through 8.

Generally speaking, the invention is for a lock construction comprising a plurality of ganged board-like elements, each respectively containing a portion of a circuit. Each of the elements are ganged together to form a connective circuit path in and between the elements. Means are supported by the elements for altering the continuity of the connective circuit path.

Now referring to FIG. 1, an exploded isometric view of the first embodiment of the inventive lock construction is shown. The lock construction comprises a plurality (generally more than the three boards shown here) of ganged circuit boards, 1*a*, 1*b*, 1*c*, ... etc. Each of the boards mechanically fastened to neighboring boards by means of snaps 2 and 2', respectively. Each board element has a circuit portion denoted generally by arrow 3. Terminals 4 of each circuit are connected to all the other terminals 4 of the circuits in boards 1*a*, 1*b*, 1*c*, ... etc. Terminals 5 of each circuit are connected to all other terminals 5 of the circuits in boards 1*a*, 1*b*. 1*c*, . . . etc. This connective construction will produce an electric path of the kind shown in FIGS. 7 and 8 of the previous filed application, Ser. No. 244,678, filed Apr. 17, 1972.

If on the other hand, terminals 4 and 5 are connected in sequential pairs, the connective circuit path of FIGS. 2 through 4 of the previous filed application will be produced. For example, terminal 4 of board 1*a* will connect with terminal 5 of board 1*b*, terminal 4 of board 1*b* will connect with terminal 5 of board 1*c*, terminal 4 of board 1*c* will connect with terminal 5 of board 1*d* (not shown), etc. This series circuit path is best accomplished by use of alternating circuit boards as will be better described with reference to FIG. 7 hereinafter.

By far, the easier construction is the parallel circuit (circuit of FIGS. 7 and 8 of application Ser. No. 244,678) because all the terminals connect in parallel with each other as aforementioned. In order to accomplish this construction, a wire is passed through all the terminals 4 and another wire is passed through all the terminals 5. Wire 15' through terminals 5 is shown in FIG. 3. A similar wire 15 is connected through terminals 4 (FIG. 2).

The series circuit construction requires individual pairing between the boards, rather than passing a connective wire through the terminals. In addition, the series circuit is more susceptible to compromise by "shorting" all the terminals, since it is a closed circuit path. The "open" circuit of the parallel circuit does not have this drawback.

Circuits 3 represent pairs of single pole double throw switches, which are alternately reversed by means of rotative members 8 and 8', respectively. Members 8 and 8' fit within circular slots 9 and 9', respectively. Rotative members 8 and 8' each contain a conducting strip 10 and 10', respectively. The conducting strips

form a conducting path between the middle terminals 11 and 11', respectively, and either of the end contacts 6 and 7, or 6' and 7', as the case may be. In other words, depending upon the positions of the rotative members, different switching paths are formed. The rotative members move between the end terminals by means of an inserted key that is turned (provided that there is a tooth at that particular rotative member position). Similar rotative positions will cause a conducting path between terminals 4 and 5. Dissimilar rotative positions will result in an open path between terminals 4 and 5. Rotative members 8 and 8', respectively, have a keyway slot 12 and 12', respectively (FIGS. 1 and 4). The rotative members have elongated slots 14 and 14', respectively. These slots serve to aid in assembling the rotative members into the circular slots 9 and 9', respectively. The rotative members are made to have resiliency, and are slightly over-sized for circular slots 9 and 9'. Elongated slots 14 and 14' make it possible to compress the resilient rotative members 8 and 8' as shown by arrows 16 in FIG. 4. The compressed rotative members are pressed into the slots 9 and 9', respectively, and then allowed to decompress. The result is that the rotative members are then snugly positioned within the circular slots. Another objective of the decompression is that the conducting strips 10 and 10' are biased into snug conductive engagement with the contact members 6, 7 and 11, or 6', 7' and 11', respectively.

The rotative members 8 and 8' are each prevented from rotating beyond the limits of the contacts 6 and 7, and contacts 6' and 7', as the case may be. This is accomplished by tab 17 (FIG. 2) which rides in slot 18 of the circuit board. The slot 18 has just enough width so that the strip 10 cannot over-shoot the end contacts. Rotative member 8' has a tab 17' riding in slot 18'.

Now referring to FIG. 5, a schematic view of a fluid lock system is shown. The fluid lock is an analogue system of the electrical lock of FIGS. 1–3. Instead of an electrical path, a fluid path is created between rotative elements 20 and 20'. The fluid path may be either a series fluid path or a parallel fluid path, the same as the electrical circuits of the electrical lock construction.

Fluid is introduced to the fluid lock 30 through line 23. Fluid exits through line 24 and travels to a bellows element 25. Independent of the fluid circuitry (series or parallel), fluid may be supplied to the bellows 25. The electric switch 26 is activated by the expansion of the bellows element 25, when it receives fluid from line 24. The switch 26 may be employed to close or open an electrical circuit.

As with the electrical lock, the fluid lock has an inaccessible cylinder 20', which may be disposed within a firewall of a car, or behind an automobile dash partition. Key 19' is inserted in cylinder 20' at the time of manufacture of the automobile.

Hydraulic pressure is created in the hydraulic system of an automobile, when it is started. Fluid from the hydraulic system is supplied to line 23, and hence to lock 30 at that time. The car occupant then puts key 19 into cylinder 20. If keys 19 and 19' are a match, then the switch 26 may be actuated to throw a solenoid, freeing the steering and/or transmission of the automobile. The switch 26 may also be used to control other systems of the automobile as well.

The novel feature of a fluid lock system, is that in order for an intruder to compromise the system, he must perform a plumbing operation. This would be so time consuming, that the theft of the automobile would become extremely risky for the thief.

In addition, the fluid lock system has the same high security and pickproof features of the electrical system. The fluid lock has the advantage over the electrical lock in that it can be used where electrical power is prohibitive or dangerous, such as in explosive manufacturing areas.

Referring to FIGS. 6 through 9, the internal construction of the fluid lock 30 of FIG. 5 is shown. FIG. 6 is a frontal view of the lock 30 showing the fluid entering through line 23. The lock 30 is constructed of board-like elements generally shown by arrows 50 in FIG. 8. The board-like elements 50 are glued and sealed along edges 41, so as to create a fluid seal for the fluid circuit shown generally by arrow 22 in FIG. 6.

Similar to the lock construction of FIGS. 1–4, the fluid lock has rotative members 20 and 20' analogous to members 8 and 8'. Rotative members 20 and 20', respectively alter the path that the fluid may take, analogous to the changing of the electrical path. Rotative members 20 and 20' contain a fluid slot 40 and 40', respectively (FIGS. 6 and 9). These fluid slots are analogous to electrical conducting strips 10 and 10'.

FIG. 6 shows by sequential arrows one possible fluid path for the flowing fluid in the circuit 22. Fluid entering the lock through line 23 is introduced to the circuit 22 through terminal opening 34. Terminal 34 is analogous to terminal 4 of the electrical system. From there, the fluid enters the slot 40 and is directed into fluid path 51. Had the rotative member 20 been in the alternative position, the fluid would have been directed through path 52.

From path 51, the fluid enters the other slot 40' of rotative member 20'. Since the rotative member 20' is in a complementary position with rotative member 20, the fluid is passed to terminal opening 35, which is analogous to terminal 5 of the electrical system.

From terminal opening 35 the fluid is passed on to the subsequent board-like element 50. The fluid flow path is then repeated for this board, then for the next board, and so on. The fluid finally exits the lock through terminal 35 of the last board-like element into line 24 (FIG. 5)

In a series circuit, it is advantageous to reverse the terminals 34 and 35 every odd board, i.e., boards 1*b*, 1*d*, 1*f*, ... etc. This arrangement also applies to the electrical lock construction, whereby terminals 4 and 5 are reversed every other board. The alternating board construction provides a direct coupling fluid path (or electrical path) between neighboring board-like elements.

For the fluid circuit 22, the reversal of the terminals 34 and 35 are shown in circuits 22' and 22'', of circuit boards 31 and 32, respectively. In constructing the lock, board-like elements 50 are alternated between board 31 and board 32 so as to yield the sequence: 31, 32, 31, 32, 31, 32, . . . etc. (FIG. 8).

Rotative members 20 and 20', respectively are free to move, but are fluid sealed in the board-like elements. The rotative member 20 has a keyway 42, while rotative member 20' has a keyway 42'. The rotative members have an appurtenance 55 which rides in slot 56 in the board, which limits their rotation similar to the electrical elements 17 and 18.

The electrical construction was shown with a preferred parallel connective circuit, and the fluid circuit was shown with a preferred series construction. Either fluid or electrical construction can have a parallel or series circuit, or they may have a hybrid circuit which consists of a combination of the two.

These and other modifications which will naturally be apparent to the skilled practitioner in this art, are deemed to lie within those limits, scope and spirit of the invention as presented by the appended claims.

What we claim is:

1. A fluid lock construction, comprising a plurality of ganged board-like elements, each respectively containing a portion of a fluid circuit, said elements forming with the other elements in said ganged construction a connective fluid circuit path, means supported by said elements for altering the continuity of said connective fluid circuit path, and locking means operatively connected to said fluid circuit and responsive to the continuity of the fluid path.

2. The lock construction of claim **1**, wherein said connective path is a series circuit path.

3. The lock construction of claim **1**, wherein said connective path is a parallel circuit path.

4. The lock construction of claim **1**, wherein said means for altering said fluid circuit path are movable members responsively movable with respect to a position of an inserted key.

5. The lock construction of claim **4**, wherein each board-like element contains at least one movable member, and wherein each of said members is movably responsive to an individual tooth on said key.

6. The lock construction of claim **4**, wherein said movable members each contain a portion of the fluid circuit path, and the movement of said members alters the fluid circuit path within each board-like element, and consequently changes the fluid circuit path for the entire lock construction.

7. The lock construction of claim **5**, wherein said movable members are rotatively movable in response to insertion and turning of said key and the presence of an individual tooth of said key being at an insertable position within said member.

8. The lock construction of claim **5**, wherein said movable members are ganged with other of said members by virtue of being disposed upon said board-like elements, each of said movable members having an insert portion for a key, and being thus ganged said insert portions form with the other insert portions a keyway for said key.

9. The lock construction of claim **8**, wherein there are two movable members for each board-like element.

10. A fluid lock, comprising:

A. structural means defining a fluid path;

B. means for supplying fluid to said fluid path;

C. means supported by the structural means for altering the continuity of said fluid path; and

D. locking means operatively connected to said structural means and being operatively responsive to the continuity of said fluid path.

11. The fluid lock of claim **10**, wherein said means for altering the continuity of said fluid path comprises a plurality of ganged elements having a keyway aperture for receiving a key.

12. The fluid lock of claim **10**, wherein said means for altering the fluid path comprises a plurality of paired rotative switching members, each disposed within, and forming part of said fluid path.

13. A fluid lock construction, comprising:

a first plurality of ganged switches being ganged back-to-back so as to form a keyway for receiving a first insertable key-like element, said first key-like element actuating at least one of said first plurality of switches when inserted therein;

a second plurality of ganged switches being ganged back-to-back so as to form a keyway for receiving a second insertable key-like element, said second key-like element actuating at least one of said second plurality of switches when inserted therein; and

interconnecting fluid circuit means for interconnecting said first and second plurality of switches to form a fluid circuit path whose continuity is dependent upon the actuation of certain of said first and second switches.

14. The fluid lock construction of claim **13**, wherein said fluid circuit is a series circuit.

15. The fluid lock construction of claim **13**, wherein said fluid circuit is a parallel circuit.

* * * * *