T. J. HERON.

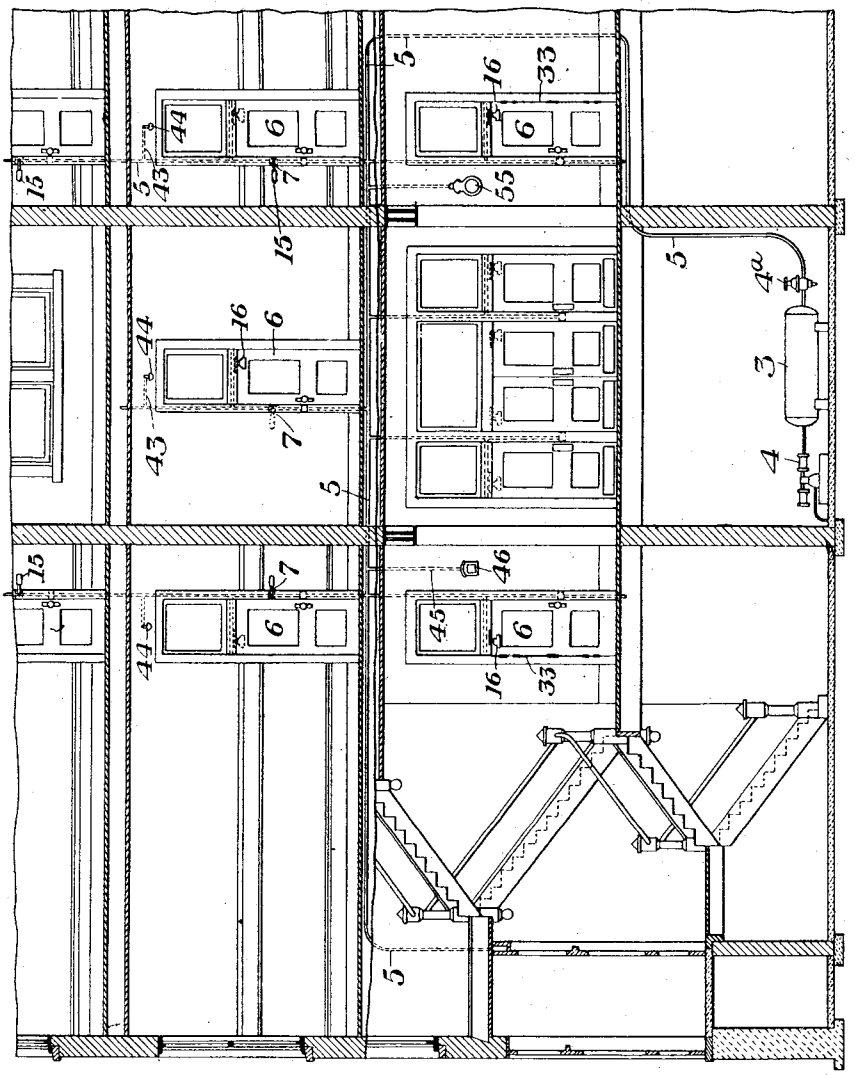
DOOR OPERATING MECHANISM.

APPLICATION FILED NOV. 16, 1909. RENEWED AUG. 18, 1910.

1,039,393. Patented Sept. 24, 1912.

4 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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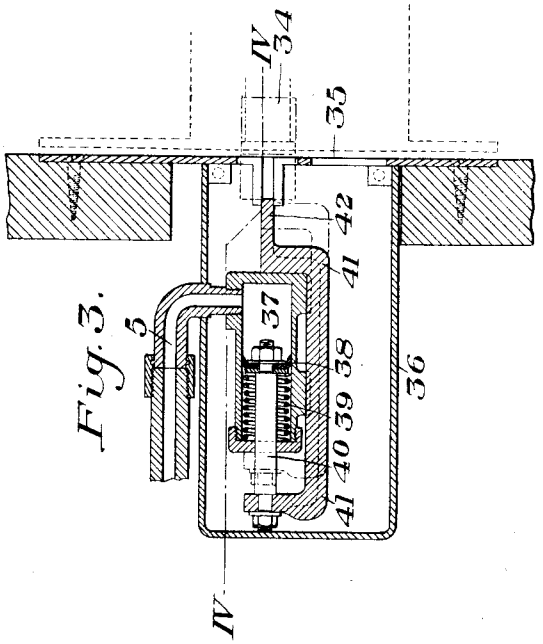

Fig. 3.

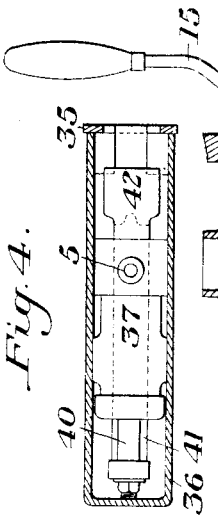

Fig. 4.

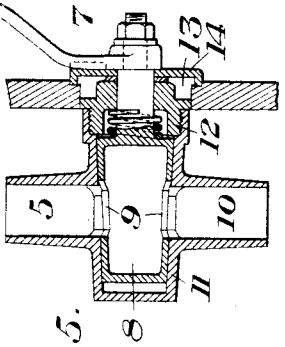

Fig. 5.

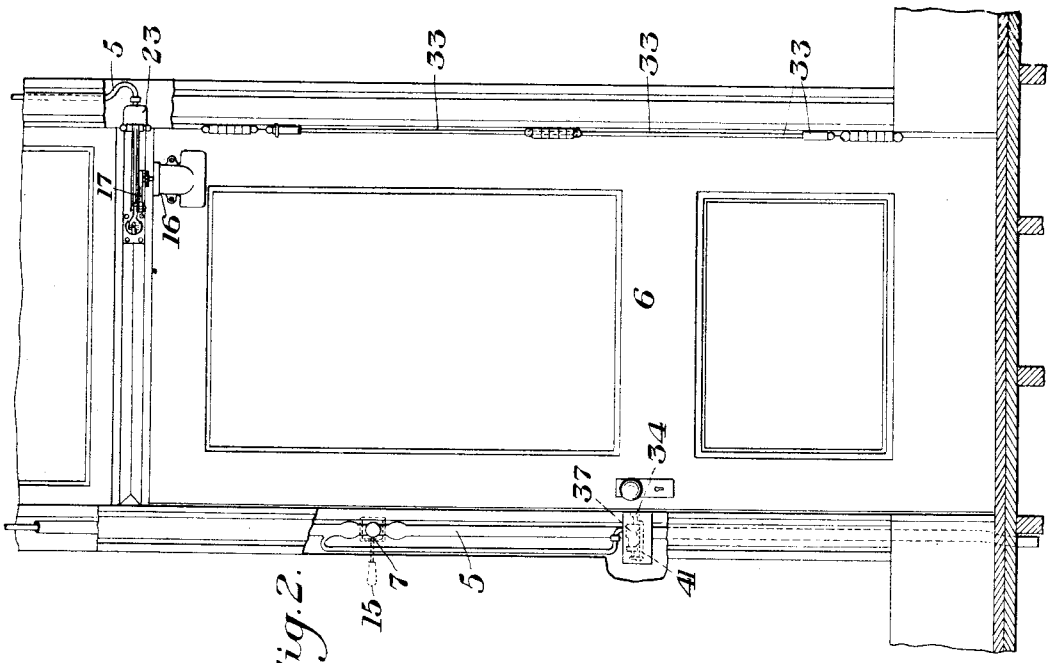

Fig. 2.

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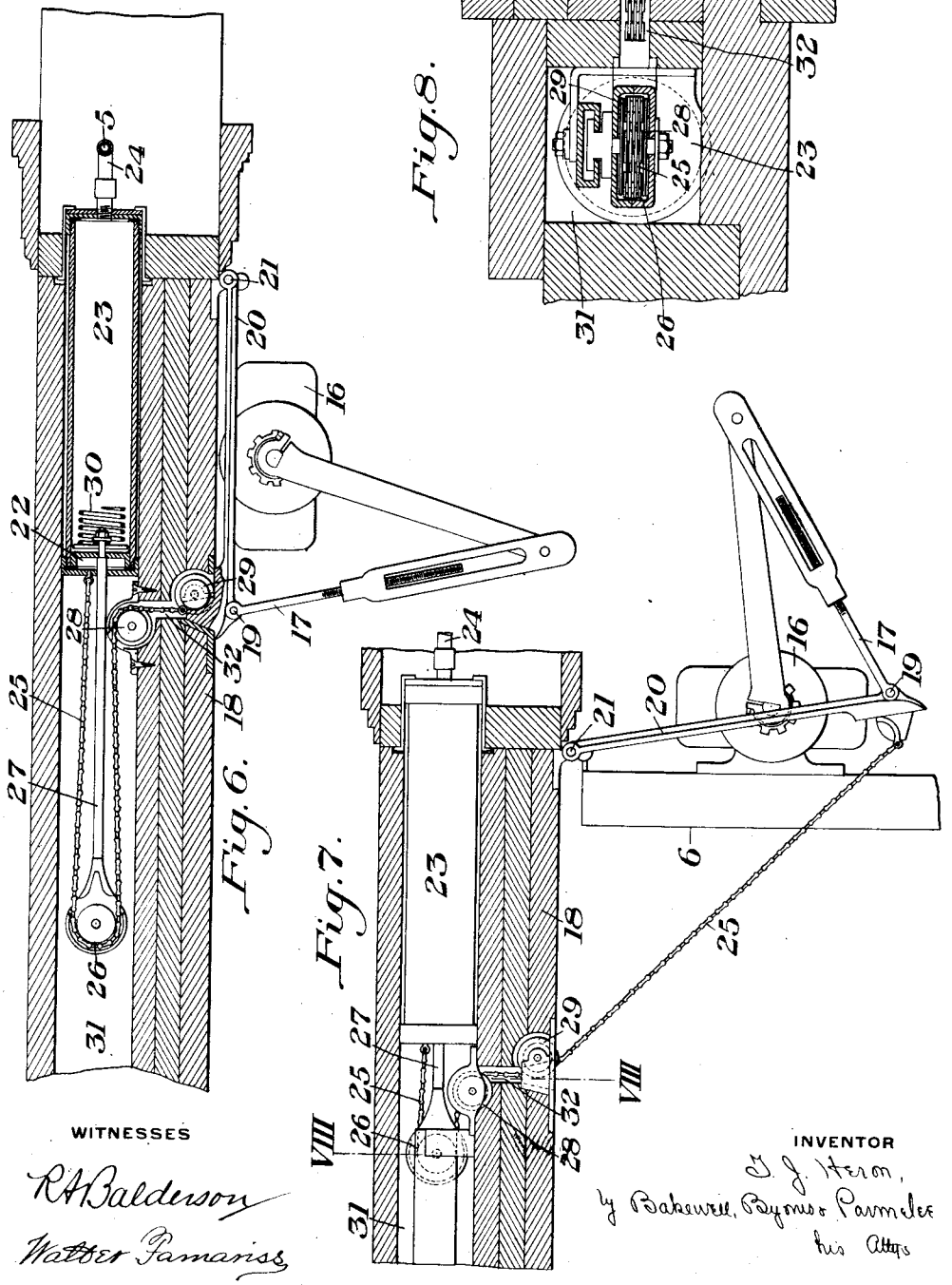

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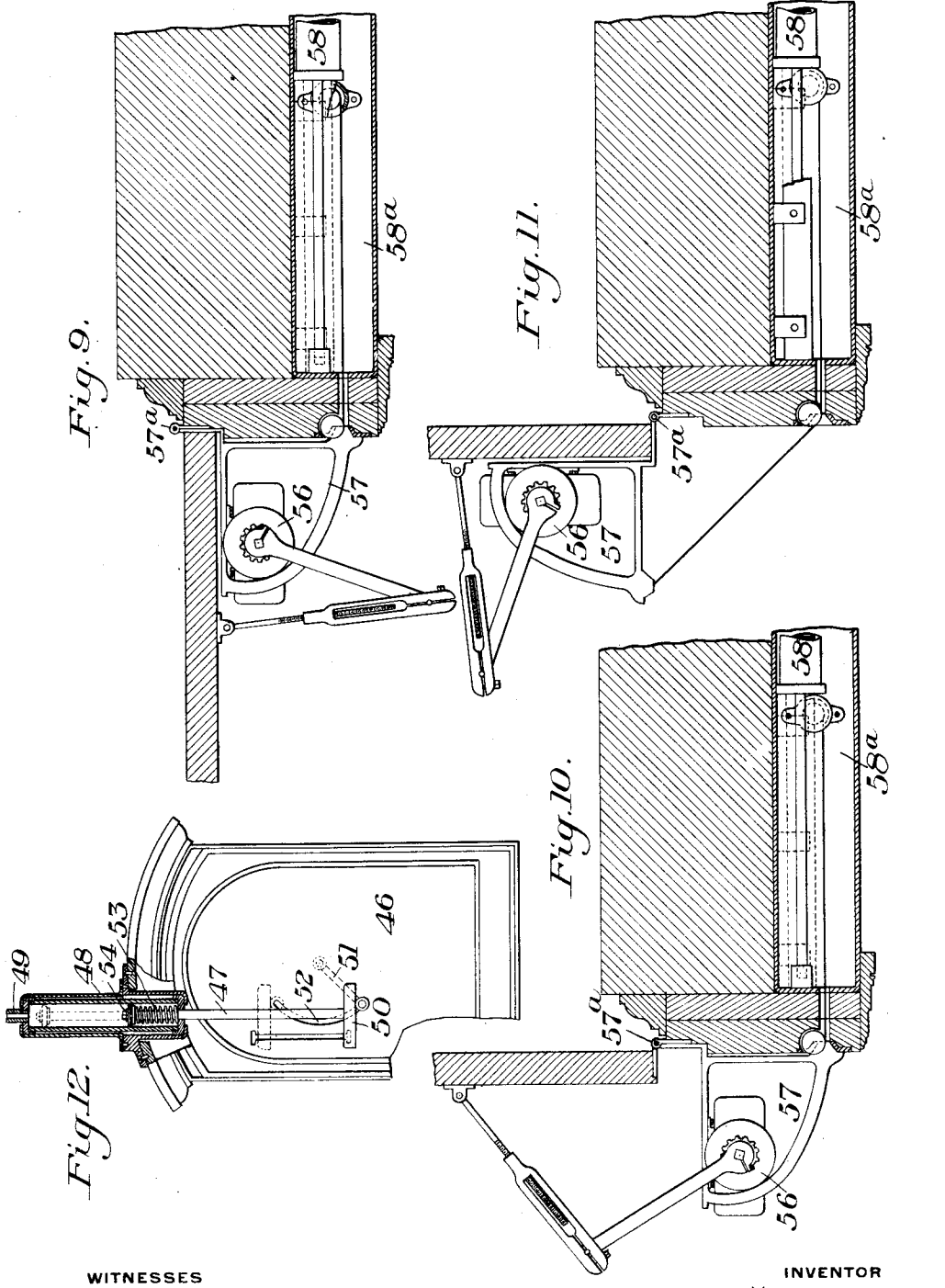

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UNITED STATES PATENT OFFICE.

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DOOR-OPERATING MECHANISM.

1,039,393. Specification of Letters Patent. Patented Sept. 24, 1912.

Application filed November 16, 1909, Serial No. 528,360. Renewed August 18, 1910. Serial No. 577,881.

To all whom it may concern:

Be it known that I, THOMAS J. HERON, of Pittsburgh, county of Allegheny, and State of Pennsylvania, have invented a new and useful Door-Operating Mechanism, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a sectional elevation illustrating the application of my invention to a building; Fig. 2 is a front elevation of a door with a portion of the door frame broken away; Fig. 3 is a detail sectional view showing one form of bolt-releasing mechanism; Fig. 4 is a section on the line IV—IV of Fig. 3; Fig. 5 is a detail sectional view of one of the release valves; Figs. 6 and 7 are horizontal sectional views through the upper portion of a door frame showing the mechanism therein contained; Fig. 6 showing the door in closed position and Fig. 7 showing the door open; Fig. 8 is a section on the line VIII—VIII of Fig. 7; Figs. 9, 10, and 11 are detail sectional views showing a modified arrangement of the door closing device, the parts being shown in different positions in the different views; and Fig. 12 is a detail view showing a portion of one form of fire alarm box which may be employed in connection with my invention.

My invention has relation to door operating mechanism, and is designed to provide means of simple and reliable character by means of which all the doors of public buildings, such as schools, fire doors, shutters and other similar devices, may be simultaneously opened from any one of any desired number of different points throughout the building.

The invention is also designed to provide mechanism of this character which will not interfere with the opening and closing of the doors in the ordinary way; also to provide mechanism of this character in which the doors having once been opened by the operation of the mechanism cannot be again closed until the mechanism has been restored to its normal condition; and also to provide mechanism of this character which can be applied to a building at a relatively low cost, and which is not likely to get out of order but can be depended upon to operate at all times.

The nature of my invention will be best understood by reference to the accompanying drawings, in which I have shown my preferred embodiment thereof, and which will now be described, it being premised, however, that various changes can be made in the details of construction and arrangement of the parts without departing from the spirit and scope of the invention as defined in the appended claims.

In accordance with my invention I provide the building which is equipped therewith with a storage reservoir 3 for compressed air or other suitable fluid, this reservoir being supplied by any suitable pump or compressor such as indicated at 4 having its outlet pipe provided with a suitable regulating valve 4^a. From this reservoir 3 I extend a system of pipes 5 leading throughout the building to the desired points, with branches extending into the frames or jambs of the doors 6 to be controlled. The system of pipes is provided with any desired number of release valves 7, any one of which when opened being arranged to permit the air to escape from the pipes and thereby reduce the pressure in the system. One of these valves is preferably provided at each door, and as many more located at different points throughout the building, may be used as may be desirable or necessary in any particular case. One of these valves 7 is shown in detail in Fig. 5. As there shown, it consists of a turning plug 8 having a port 9 extending diametrically therethrough and arranged to connect one of the branches of the pipe 5 with an escape or exhaust connection 10. The valve plug is removably secured in a containing case or chamber 11 by means of a screw-plug 12 inserted through an opening 13 in the door frame or jamb, said opening being normally closed by the cap plate 14.

15 is the operating handle or lever for the valve. It will be seen from Fig. 1 that this operating handle or lever is the only part of the valve which is exposed to view, the other parts being concealed within the frame or jamb of the door; while at the same time the cap 14 and plug 12 can be readily removed to permit access to the valve and its removal if necessary.

Each of the doors is provided with a door-closing device 16, which may be of any known or suitable character, except that the lever arm 17 instead of being connected to

the top jamb 18 of the door frame, or to the transom bar, is preferably connected at 19 to a lever arm 20 pivoted to the door jamb at 21. This lever arm 20 is normally held in the fixed position shown in Fig. 6 by being connected with the piston 22 of a cylinder 23, which is connected at 24 to the pipe system 5. I have shown the connection between the piston and the lever 20 formed by a chain or other flexible connection 25 passing over a pulley 26 at the end of a piston rod 27, and thence over the idle or guide pulleys 28 and 29.

30 is a spring for cushioning the reverse movement of the piston 22.

The cylinder 23, the piston rod 27 and the chain 25, are all placed in a suitable space or opening 31 in top jamb 18 of the door frame, or in the transom bar or any other convenient place, such as shown in Fig. 9, the end of the chain extending out through the opening 32 for connection with the free end of the lever 20.

For the purpose of throwing the doors open in case of emergency, each door is provided with a motive device, which preferably consists of torsion spring 33. This spring is put under the necessary degree of tension and normally tends to throw the door open, this tendency being, however, normally restrained by the door-closing device 16 which is sufficiently strong to overcome the action of the spring 33.

In order that the doors may be thrown open by the springs 33, it is necessary to release the action of the door-closing device 16 in the manner hereinafter described, and for latched doors it is also necessary to release the usual latch or bolt 34 of each door. For this purpose I provide in the side jamb of each door frame, adjacent to the keeper 35 for the latch or bolt 34, the device now to be described. This consists of a casing 36 having therein a cylinder 37. In this cylinder is a piston 38, which is normally held in the position shown in Fig. 3, against the action of a spring 39, by the pressure in the pipe system 5, a branch of that system being connected to each cylinder 37. Connected to the piston rod 40 of each of these cylinders is a yoke 41 having a nose portion 42 which is adapted to be projected into the keeper 35 and thereby push back the bolt or latch 34. The system may be operated without the use of this bolt or latch operating device just described, by eliminating the bolt or latch entirely and using the door-closing device 16 to normally hold the door closed. In this case, the opening of any one of the valves 7 or the melting of any one of the fusible plugs 44 produces a reduction of pressure in the piping system 5, which through cylinders 23 and their pistons 22, etc., releases levers 20, thus permitting the doors to open and sending in a fire alarm. This would make a more economical installation.

43 in Fig. 1 designates branches of the pipe system 5, each of which is closed at its outer end by a fusible cap or plug 44, adapted to melt at a low temperature.

The operation is as follows:—In case of fire or other emergency, which makes it advisable to throw open the doors and thus provide for the escape of the occupants as rapidly as possible, the operation of any one of the valve levers 15 opens an exhaust for the pipe system 5. As soon as sufficient air has been exhausted from the pipe system so that the pressure acting against the pistons 38 no longer counterbalances the springs 39 the latter moves the pistons 38 and yokes 41 and thereby releases the latches or bolts 34 of all the doors. Simultaneously therewith the pressure in the cylinders 23 is released and the flexible connection 25 is slackened. When this occurs, the door closing devices 16 can no longer exert any closing effect upon the doors, since there is now no longer a fixed connection or support for the aforesaid door closing devices, due to the release of levers 20 by the flexible connectors 25; consequently the levers 20 are free to be moved by the door closing devices to the position shown in Fig. 7, and torsion springs 33 now act to open the doors, as also shown in Fig. 7. After the system has once been operated in the manner described, the doors cannot again be closed to remain closed until the valve or valves 7 which were opened, have been closed and the pressure in the pipe system has been restored, since until this is done, the torsion springs 33 continue to hold the doors open, and the latch releasing device remains in position to prevent the door bolts or latches from engaging the keepers. It is therefore insured that the doors when open will remain open until all of the occupants of the building have had an opportunity to escape and the necessity which gave rise to the operation has so far passed that the release valve or valves 7 can be again closed.

The fusible caps or plugs 44 provide automatic means for effecting the opening of the doors in case of fire, since the melting of any one of these caps or plugs will effect the necessary reduction of pressure in the pipe system to open all the doors.

I may also provide the pipe system 5 with a branch 45, to which is connected any suitable device 46, which will operate upon reduction of pressure to close an electric circuit and send in a fire alarm. Thus, in Fig. 12, 46 indicates an ordinary fire alarm box, having an actuating rod 47 extending into a cylinder 48 which is connected at 49 with the pipe system 5. The rod 47 is connected to a piston 54 in cylinder 48, said piston being normally held by the pressure

in the cylinder against the tension of compression spring 53, in the position shown in Fig. 12, thereby holding the alarm box in "wound up" condition. The rod 47 carries a cross-head 50 which engages the end of operating lever 51, which is pivotally mounted inside of the casing and whose free end projects through a slot 52 into position to be engaged by said cross-head and held in the position shown. When the pressure in the system is reduced as described, the spring 53 lifts the piston 54 and rod 47, thereby allowing the lever 51 to move upwardly to sound the alarm, the operation being the same as that of an ordinary fire alarm signal or telegraph call box. 55 indicates a suitable gong or alarm, which may also be connected to the pipe system 5 so as to be operated upon the reduction of pressure therein by means similar to the means shown for actuating the fire alarm box.

In some cases, as in connection with outside doors, it is desirable to place the door closing devices upon the inner side of the door so that they are protected from the weather. In such cases, I may employ the construction and arrangement shown in Figs. 9, 10 and 11. In these figures, the door closing devices 56 (of any usual character) is attached to an arm or bracket 57 which is hinged to the door at 57^a concentric with the door hinges. The arm or bracket 57 is normally held in the fixed position shown in Figs. 9 and 10 by connection with a cylinder 58. The cylinder 58 is similar in its action to the cylinders 23 before described, except that it is shown as placed in the wall 58^a at one side of the door instead of above the door. As shown in Fig. 10, the door can ordinarily be opened in the usual manner, and the door-closing device will operate to close it. When, however, the pressure in the cylinder 58 is released in the manner before described, the door-closing device is free to move with the door, which is thrown open by the torsion spring, and the parts assume the positions shown in Fig. 11.

My invention provides a simple and effective means whereby in cases of emergency all the doors of a building may be simultaneously opened from any one of a number of different points to provide free escape to the occupants and thereby avoid the disastrous results to life or limb which have occurred on numerous occasions due to the fact that the exit openings of a building have been closed at a time when escape has been necessary.

The equipment of a building with my invention in no way interferes with the ordinary opening and closing of the doors, since until such time as one or more of the release valves is operated the door-closing devices operate in their usual manner and overcome the action of the door-opening torsion springs or other door opening motive devices. An important feature of the system lies in the fact that the system must be in working condition in order for the doors to remain closed; that is, if pressure in the piping system is not kept up, the doors immediately open, giving notice that the pressure is released.

The equipment of a building with the invention can be done at a comparatively low cost, and the cost of maintenance is also very low, due to the fact that there is very little loss of power, except such as occurs from slight leakages and from occasional tests of the system.

It will be obvious that the invention is susceptible of many modifications in details of construction and arrangement. Thus, the releasing devices for the door, door latches or bolts may be of different form; any suitable character and arrangement of the release valves may be provided; and different means may be employed, actuated by reduction of pressure in the system, for throwing the door-closing devices out of operation.

What I claim is:

1. Door mechanism of the character described, comprising a system of pressure pipes or conduits having branches extending to the different doors to be opened, means for normally supplying pressure to said pipes or conduits, means for effecting a reduction of said pressure from any one of a number of different points, and door opening devices rendered operative by such reduction of pressure; substantially as described.

2. Door opening mechanism of the character described, comprising a system of pressure pipes or conduits extending to the different doors to be opened, means for normally maintaining pressure in such system, a plurality of pressure releasing devices located at different points, latch releasing devices, and door opening devices rendered operative by a reduction of pressure in such system; substantially as described.

3. In door operating mechanism of the character described, a device for opening each of the doors, a door closing device for each door normally overcoming the action of the opening device, a fluid pressure system for controlling the operation of the closing device, and means for effecting a reduction of pressure in said system to throw the closing device out of operation; substantially as described.

4. In door opening mechanism of the character described, a device for opening each of the doors, a device for closing each of the doors and normally overcoming the action of the opening device, a fluid pres-

sure system for controlling the operation of the door closing devices, and means operated by reduction of pressure in said system and whereby the door closing devices of all the doors can be thrown out of operation; substantially as described.

5. In door opening mechanism of the character described a device for opening each of the doors, a device for closing each of the doors and normally overcoming the action of the opening device, a pneumatic system for controlling the operation of the door closing devices, and means operated by a reduction of pressure in such system and whereby the door closing devices of all the doors can be thrown out of operation from any one of a number of different points, substantially as described.

6. In door opening mechanism of the character described, a system of pipes having connections leading to the doors to be opened, means for normally maintaining pressure in such system, a plurality of release valves connected to the pipes at different points, means for opening the doors, a door closing device for closing each of the doors and normally overcoming the action of the opening device, devices for releasing the door bolts or latches, and other devices for throwing the door closing devices being out of operation, said devices all operated by reduction of pressure in said system; substantially as described.

7. In an automatic door opening system, the combination of a door, a pressure cylinder connected to a suitable source of pressure and arranged to hold the door closed, means arranged to open the door when the pressure is released from said cylinder, and mechanism for releasing the door bolt or latch comprising a cylinder normally connected with the said source of pressure, a piston in said cylinder, a spring acting on said piston in opposition to the pressure, and a pushing device connected to said piston and arranged to act on the door latch or bolt to release the same from its keeper; substantially as described.

8. In apparatus of the character described, the combination of a door, a door closing device for closing the door, a movable member to which the closing device is connected, a cylinder, a source of pressure to which the cylinder is connected, a piston in said cylinder, and a connection between the piston and the movable member to which the door closing device is connected, whereby the pressure holds said movable member stationary; substantially as described.

9. In door opening mechanism, a door, a closing device connected thereto, an opening device also connected to the door, the closing device normally overcoming the action of the opening device, and means for throwing the closing device into and out of operation, with means for restoring an operative connection between the closing device and the door while the door is in its open position to thereby close the door; substantially as described.

10. In door opening mechanism, a door, a closing device connected thereto and capable of being thrown out of operation, and means for normally retaining said device in operative connection with the door, together with means for restoring the operative connection between the closing device and the door when the door is in its open position to thereby close the door; substantially as described.

11. In door opening mechanism, a door, a door closing device hinged to a fixed portion of the building and normally stationary, said device having a connection with the door arranged to hold the door closed when said device is stationary but permitting the door to stand in any position without said device being moved, means for normally holding said device stationary, and means for releasing said device to permit the door to open; substantially as described.

12. In door opening mechanism, a door, a bracket hinged to a stationary portion of the building, a door closing device supported by the bracket and connected to the door, means for normally holding the bracket stationary on its hinge, and means for permitting the bracket to move on its hinge with the door; substantially as described.

13. Door opening mechanism of the character described, comprising a system of pressure pipes or conduits having branches extending to the different doors to be opened, means for normally supplying pressure to said pipes or conduits, means for effecting a reduction of such pressure, door-opening devices rendered operative by such reduction of pressure, whereby all the doors may be simultaneously opened, and door closing means also controlled by said system, whereby the doors may be simultaneously closed; substantially as described.

14. Door operating mechanism, comprising a device for opening each of the doors, a device for closing each of the doors and normally overcoming the action of the opening device, means whereby the door closing device of each door can be thrown out of operative connection with the door, and means for restoring said operative connection while the door is in its open position, to thereby close the door substantially as described.

15. In door opening mechanism, a door, a fluid pressure system, a door closing device arranged to permit the ordinary opening and closing of the door, and means operative by change of pressure in said system and ar-

ranged to operatively connect said closing device with the door and to disconnect the same therefrom; substantially as described.

16. In a door opening system a plurality of doors, a door closing device for each door having an element connected to a fixed portion of the building and another element connected to the door, one of said connections being movable to break the operative connections, and a device arranged to be operated from a distance and arranged to maintain the operative connections when the system is intact and to throw out said operative connections when the system becomes disarranged, substantially as described.

17. In a door opening system, a plurality of doors, a door opening device for each door, a door closing device for each door arranged to permit the ordinary opening and closing of the door, and connections to all of said devices and arranged when the system becomes disarranged to permit said doors to be automatically opened; substantially as described.

18. In a door opening system, a plurality of doors, a door closing device for each door having an element connected to a fixed portion of the building and another element connected to the door, one of said connections being movable to break the operative connections, and a fluid pressure device arranged to maintain the operative connections when pressure is maintained in the system, and upon reduction of pressure in the system to throw out said operative connections, substantially as described.

19. In door opening mechanism of the character described, a device for opening each door to be opened, a door closing device for each door normally overcoming the action of the opening device, and means for throwing the closing device out of operation; substantially as described.

20. In door opening mechanism of the character described, a device for opening each of the doors, a device for closing each of the doors and normally overcoming the action of the opening device, and means whereby the door closing devices of all the doors can be simultaneously thrown out of operation; substantially as described.

21. In door opening mechanism of the character described a motive device for opening each of the doors, a motive device for closing each of the doors and normally overcoming the action of the first named motive device, and means whereby the door closing motive devices of all the doors can be simultaneously thrown out of operation from any one of a number of different points; substantially as described.

22. In door-operating mechanism, a door, a closing device connected thereto, an opening device also connected to the door, the closing device normally overcoming the action of the opening device, and means for throwing the closing device into and out of operation; substantially as described.

23. In door operating mechanism, a door, a closing device connected thereto and capable of being thrown out of operation, and means for normally retaining said device in operative connection with the door; substantially as described.

24. In door opening mechanism, the combination of a door closing device comprising two elements movably relative to each other, one of said elements being arranged for attachment to the door and the other for attachment to a stationary part of the building, a movable member to which one of said elements is connected, a fluid pressure cylinder, a piston in said cylinder, and connections from the piston to said movable member, whereby the pressure in the cylinder will hold said movable member in fixed position; substantially as described.

25. In door operating mechanism, the combination of a door closing device comprising two elements relatively movable and one arranged for connection to the door and the other for connection to a fixed part of the building, a pivoted member to which one element of said door closing device is connected, a fluid pressure cylinder, and a flexible connector from said cylinder to said pivoted member and arranged so that pressure in the cylinder will hold said pivoted member in immovable position, substantially as described.

26. In door opening mechanism, the combination of a door closing device comprising two elements relatively movable, one arranged for connection to the door and the other for connection to a fixed part of a building, a pivoted member connected to one element of the door closing device, a fluid pressure cylinder, and connections therefrom to a pivoted member and arranged when pressure is in said cylinder to hold said pivoted member immovable, substantially as described.

27. In door operating mechanism, a door mounted for normal opening and closing, and door opening and closing devices connected to said door and arranged to be operated from a distance and so arranged as to permit the ordinary opening and closing of the door.

28. In a door operating system, a door, a fluid pressure system arranged on variation of pressure to cause the door to open, a piston independent of the door operating mechanism and actuated by such variation of pressure in the system, and a signal rendered operative when said piston is actuated.

29. In a door operating system, a door, a fluid pressure system arranged on variation of pressure to cause the door to open, a piston independent of the door operating

mechanism and actuated by such variation in pressure in the system, and an audible alarm rendered operative when said piston is actuated.

30. In a door operating system, a door, a fluid pressure system arranged on reduction of pressure to cause the door to open, means for supplying pressure to said system and a fusible device connected directly to said system and arranged on melting to release the pressure from said system.

In testimony whereof, I have hereunto set my hand.

THOS. J. HERON.

Witnesses:
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H. M. CORWIN.