June 16, 1936. E. A. LOWE 2,044,313

FIRE EXTINGUISHING APPARATUS

Original Filed Oct. 16, 1930 2 Sheets-Sheet 1

FIG. 1

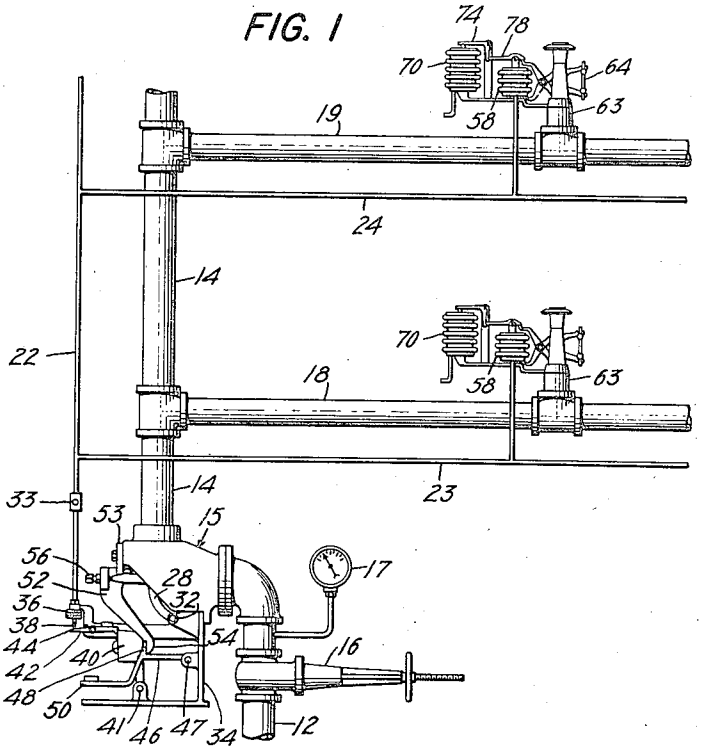



FIG. 2

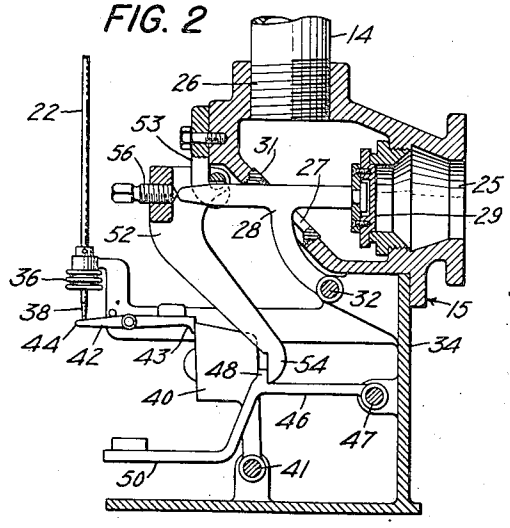
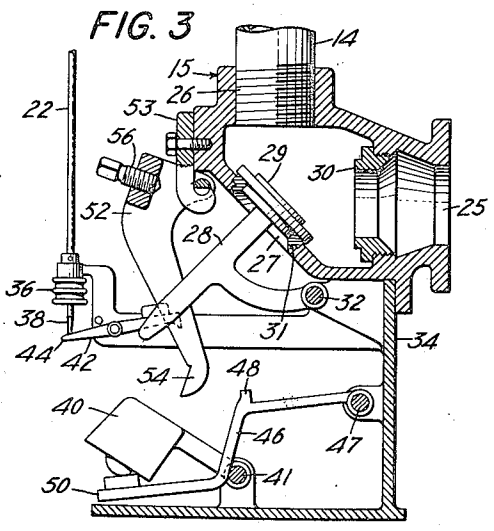



FIG. 3




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FIG. 4

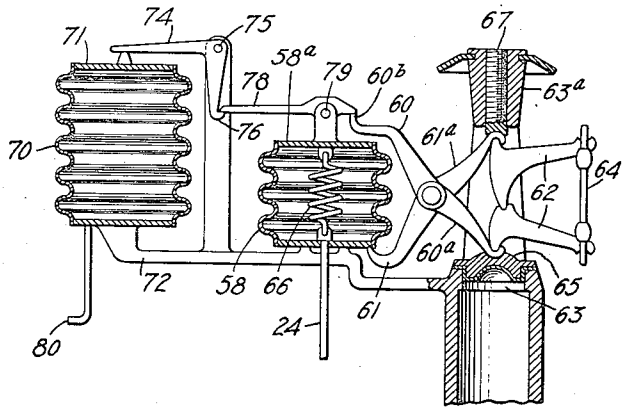



FIG. 5

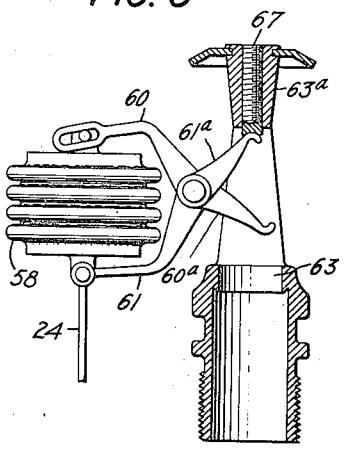
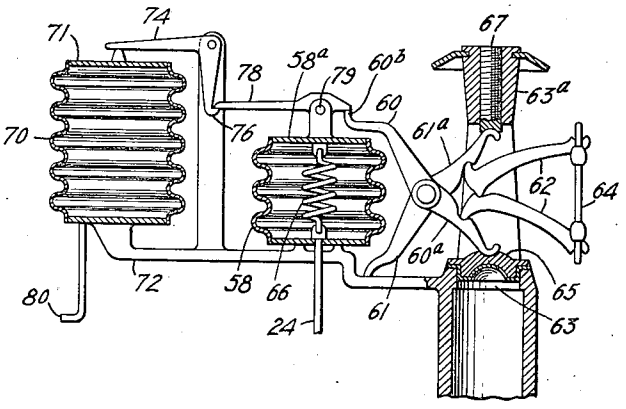



FIG. 6




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# UNITED STATES PATENT OFFICE

2,044,313

## FIRE EXTINGUISHING APPARATUS

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Original application October 16, 1930, Serial No. 489,012. Divided and this application June 29, 1934, Serial No. 732,984

5 Claims. (Cl. 169—19)

My present invention relates to means for producing pressure impulses (preferably pneumatic pressure) controlling the action of a control valve or other means whereby a fire extinguishing fluid is admitted to a pipe or pipes for emission at a fire extinguisher head or outlet in the fire zone. For the sake of illustration I have shown my present invention as applied to a valve control means such as described in my application for patent filed October 16, 1930, Serial No. 489,012, filed by me as a continuation in part of an antecedent application filed November 11, 1925, Serial No. 68,283. My present application is a division of the aforesaid application Serial No. 489,012.

The present case relates particularly to the means generating the controlling pressure impulse for operating the valve control means or other device and consists among other things in the combination with the impulse generator of means for controlling the same including heat actuated devices in the fire zone responsive to a predetermined rate of rise of temperature. In carrying out this part of my invention I preferably apply said heat actuated controlling device to an impulse generator that is itself controlled by devices responsive to a fixed abnormal temperature condition. Furthermore in the preferred embodiment of my invention the means responsive to the fixed abnormal temperature condition embodies a fuse that is applied to releasing an outlet valve in the fire zone after the manner of the usual fuse controlled sprinkler head.

Essentially the present invention consists in generating the fluid pressure impulse for the control valve or other device for the fire extinguishing fluid, by heat actuated devices responsive to a predetermined rate of rise of temperature and also in a construction in which the latter heat actuated device operates upon an impulse generator that is combined with a fuse or other means responsive to the attainment of a fixed abnormal temperature condition.

The invention further consists in combining said heat actuated device with means for controlling an outlet in the fire zone to cause the same to open for emission of the fire extinguishing fluid when or as soon as the impulse is generated for action upon the control valve or equivalent device at the inlet end of the supply pipe.

The invention in its preferred form consists in the combination of a fuse controlled or similarly controlled pressure generating device for generating the operating or controlling impulse and an outlet valve controlled by said fuse or similarly acting control device, of heat actuated devices responsive to a predetermined rate of rise of temperature for bringing the impulse generator into action and at the same time freeing the fuse controlled outlet through which the fire extinguishing fluid supplied to the piping by the action of said impulse generator is delivered in the fire zone.

The invention further consists in details of construction and combinations of devices as more particularly hereinafter described and then specified in the claims.

The apparatus constructed in accordance with my invention when used on an empty or dry pipe sprinkler system provides a relatively sudden pneumatic impulse for opening the main control valve or similar device of the system where there is a sufficiently rapid rate of rise of temperature adjacent the pressure producing element and renders the operation certain by the provision of a fixed temperature device such that when a sufficiently high temperature is reached an impulse for opening the main valve or similar device is generated, this feature assuring an operation of the main valve or other fluid control device even though the devices under the control of the rate of rise device should not be subjected to the required operating rate of temperature advance.

In the accompanying drawings:

Fig. 1 is a fragmentary view of a fire extinguishing system utilizing empty pipes having my invention applied thereto.

Fig. 2 is a sectional view of a particular type of main valve and release mechanism therefor responsive to the change of pressure generated by the rate of rise device or any part thereof adapted to produce a sudden change of pressure such as pneumatic pressure.

Fig. 3 is a view similar to Fig. 2 showing the main valve in open condition. The construction of main valve herein shown and described is merely illustrative of a construction that may be used in connection with the devices forming my present invention and is described and claimed in my application Serial No. 489,012, hereinbefore referred to.

Fig. 4 is a vertical sectional view of one form of pressure impulse developing means forming my present invention and adapted for use in the fire zone to control the means admitting the fire extinguishing fluid to the pipe leading to the outlets and also for controlling the discharge outlet itself.

Fig. 5 is a detailed figure illustrating a position assumed by a portion of the discharge outlet con-

trol mechanism after operation to open said outlet.

Fig. 6 illustrates a proportioning of the discharge outlet mechanism which best adapts the same for operation under the control either of the fuse or of other heat actuated devices responsive to predetermined rate of rise of temperature.

Referring now to the details of the drawings, there is disclosed a main water supply pipe indicated at 12 which connects with any desired number of risers or feed mains 14 (one such riser being shown in Fig. 1) leading away from the main valve head 15. It is preferred to provide a manual control valve 16 so that the supply of fire extinguishing fluid, water for example, may be manually shut off when desired, as during resetting of apparatus. For the sake of safety the pressure gauge indicated at 17 may likewise be installed on the water main adjacent its connection at the head 15 to indicate the available water pressure. From the risers 14 the required number of branch lines 18 and 19 extend into the different fire areas to insure a supply of water to all parts of the structure protected by the system.

In order to maintain the pipe lines including the risers and branch lines normally dry and subjected to atmospheric pressure, I have employed a main control valve 15 formed with an outside or drain opening of substantial size, normally unobstructed but closed on operation of the apparatus. With this construction no water will normally be present in the system outwardly of the head 15 and the risers and branch lines may therefore be installed in any unheated building without danger of the pipe becoming frozen in extreme weather.

The main valve 15 is constructed to be automatically operated upon the occurrence of a fire condition. To this end I have shown a separate impulse conducting conduit 22 extending from the main control valve 15 and connected with branch conduits 23 and 24 which lead to the various fire sections or areas. The conduits 22, 23 and 24 are formed of tubing and are preferably normally subjected to atmospheric pressure by providing a restricted outside leak or opening 33 which is sufficiently large to maintain the interior of the conduit at substantially atmospheric pressure under normal atmospheric temperature and pressure changes but which is ineffective to relieve the pneumatic impulse utilized for operating the valve 15 as hereinafter fully described.

The main control valve 15 may be constructed as shown in detail in Figs. 2 and 3. The valve casing includes the water inlet 25 and outlet 26 the former being connected to the water main 12 and the latter to the risers 14. Positioned between the inlet and outlet is an opening 27 which accommodates the operating support 28 for the valve closure 29. This closure is constructed to control the inlet 25 and also the opening 27 so that when the closure is moved away from the valve seat 30 of the inlet it is moved into engagement with the valve seat 31 of the opening 27 to close the interior of the head 15 and to permit the passage of water from the water main to the risers. This position of the valve closure is shown in Fig. 3. The opening 27 serves a further important function of permitting the system to be automatically drained when the main valve is closed and also of permitting the circulation of air within the supply pipes extending to and into the fire areas. The support 28 for the valve is shown as pivoted at 32 to a supporting structure 34 positioned without the valve casing 15.

The valve closure 29 is constructed to be controlled by an impulse preferably pneumatically transmitted through the conduits 23 or 24 and 22. In the form of the invention disclosed the pneumatic impulse is utilized to operate a partially collapsed bellows 36 to move the operating element 38 thereof. In order to insure instant and unfailing operation of the valve controlling mechanism it is preferred to store a considerable quantity of latent mechanical or other energy in the valve controlling mechanism which energy can be easily released to open the valve. To this end the valve controlling mechanism includes a weighted lever 40 pivotally supported as at 41 and which is normally retained in raised position (but in a position of unstable equilibrium) by means of a detent or latch 42. The latch 42 has one end 43 thereof engaged against the weighted lever 40 and the other end 44 positioned to be engaged by the movable element 38 of the bellows 36. The locking lever 46, shown as pivotally supported at 47 on the supporting structure 34, includes a locking lug 48 and an operating extension 50. The extension 50 is positioned to be engaged by the weighted portion of the lever 40 when the latter swings downwardly due to the force of gravity. A valve control lever 52 is pivotally supported from the valve head as by means of the bracket 53 and includes a locking extension 54, constructed to engage the lug 48, and an adjustable set screw or stop member 56 which engages the operating rod 28 of the valve to hold the latter normally in closed position against the valve seat 30. The adjustable stop member 56 permits the valve closure 29 to be accurately closed when the lugs 48 and 54 are in engagement.

By this construction it will be seen that upon a pneumatic impulse being transmitted through a conduit 22, 23, or 24 to the bellows 36 the member 38 is moved against one arm 44 of the latch 42 to release the weighted lever 40 which thereupon falls by gravity against the operating extension 50 of the retaining lever 46 releasing the latter from engagement with the control lever 52, thereby permitting the valve closure 29 to move from closed to open position, that is, from the valve seat 30 to the valve seat 31 to permit the passage of the fire extinguishing fluid from the water mains toward the discharge outlets.

Referring now to the devices illustrating one form of my present invention and shown in detail in Figs. 4, 5, and 6 and which serve to detect the fire and supply the pneumatic impulse required for opening the main valve, these devices as shown include a collapsible bellows 58 normally held in expanded position by means of the toggle levers 60 and 61 having one pair of arms thereof extending above and below the bellows, the other ends 60*a*, 61*a*, herein termed the jaws, being normally held spaced by means of the coacting levers 62 which engage against one another and against the interior of the jaws 60a, 61*a*. The levers 62 are normally prevented from separating to permit the collapsing of the bellows 58 by a fixed temperature responsive device which may be as shown a fusible element 64 technically known as a "fuse" connecting the outer or free ends of the levers 62.

In the form of the invention shown the discharge outlets 63 of the branch lines 18 and 19 are normally closed by means of the displaceable closures 65 held in place by the levers 62 coinci-

dently with the spreading of the levers 60 and 61. The jaws 60a and 61a of levers 60 and 61 are positioned between the closure 65 and the element 67 shown as an adjustable compression screw carried by the sprinkler head 63a. The spring member 66 shown as positioned within the bellows 58 is normally under tension and when the levers 60 and 61 are released by reason of fusion of the element 64 or otherwise the bellows is collapsed by means of the spring 66 permitting the displacement of the closure 65 and creating the pneumatic impulse in the conduit 24 required for operation of the bellows 36 and valve mechanism 16. The fluid discharged from the outlet 63 may be caused to assume the form of a spray by means of any preferred form of sprinkler head 63a.

For the purpose of supplying a pneumatic impulse for opening the main valve where a predetermined rate of rise of temperature occurs but without reference to the actual temperature present there is employed in association with the bellows 58 a rate of rise device comprising preferably a heat absorbing expansible element shown as a bellows 70 attached to a bracket 72. A bell crank lever 74 pivoted at 75 is engaged with the upper or movable wall 71 of the bellows 70, the lower or free end of the lever 74 being formed with a projection 76 normally engaged with and holding a retaining lever 78 pivotally supported at an intermediate point as indicated at 79 to an extension formed on the upper movable wall 58a of the compression device or bellows 58. The end of the lever 78 opposite the bell crank lever 74 bears in supported relation against the end 60b of lever 60, the levers 74 and 60 supporting the link 78 with the compression device 58 expanded as shown in Fig. 4. In order to prevent normal changes in the temperature or pressure conditions adjacent the element 70 from releasing lever 78 the interior of element 70 communicates with the outside air through a leak as shown at 80, the function of this restricted opening being to permit the passage of small quantities of air to or from the interior of the element 70 but on any substantial rise in the temperature at a rapid rate such as results from an abnormal rate of change due to fire, the opening 80 is insufficient to accommodate the pressure change within the bellows 70 and it is expanded to elevate the movable wall 71 for the purposes appearing more fully below.

In the general operation of the above controlling devices under special property conditions and when used in an empty pipe system the parts are normally retained in the position shown in Fig. 4. The lever 62 and the ends of 60a and 61a are under compression due to their resting against valve 65 and being subject to pressure of compression screw 67; coincidentally this pressure puts tension on the fusible link structure 64. The pneumatic impulse producing device such as the spring actuated bellows 58 is normally held in the position shown but is free to act by means of the spring 66 as soon as the latter is released by the rate of rise device 70 expanding sufficiently to release catch 76. The action of 58 sends the operating impulse into tubing 24 said impulse in the present instances being an increase of pressure impulse although, as well understood in the art, a device might be organized to send an impulse by a sudden decrease of the normal pressure in the pipe 24 and said impulse trips the main valve 15 or other device permitting the fire extinguishing fluid to enter the pipe 14 and as a consequence the piping or passages joining the main valve with the outlets, which passages in the present embodiment of the invention are normally empty, become filled with the extinguishing fluid up to all outlet valves 65 that are connected with said pipe 14 directly or indirectly and that are normally closed. However, no discharge of the fire extinguishing agent takes place at outlet 63 until the valve 65 is released by the action of the fixed temperature responsive element consisting in the present instance of the fuse or link 64. This operation is essentially what is known as rate of rise pre-action, that is, one in which the operation of the outlet valve results in the filling of the pipes and bringing the fire extinguishing fluid up to the outlets before the outlets function as well as permitting the giving of an alarm before said outlets function by the employment of alarm devices operated in any desired manner as for instance in the manner shown in prior Patent No. 1,738,656. Great commercial advantages are obtained by this preaction method not only in the saving of water but also in the prevention of damage from excess or premature flow of water at the outlets found in ordinary sprinkler systems which have only fixed or fusible outlets. The device further possesses the advantage that the outlet 63 will operate should the device 70 fail to detect the temperature rise, the outlet opening under such conditions when the ultimate or fixed temperature is reached which will cause fusion of 64 or other fixed temperature device which in the present embodiment of my invention is employed to permit or free the impulse producing device 58 and to thereby send the pressure impulse over 24 to operate the main valve 15 or other device employed to free the fire extinguishing fluid and permit it to flow through the connections leading to the outlet.

There are many hazards where flash fires of great rapidity occur and in such it has been found necessary to remove a fusible link 64 from all outlets leaving them open and to operate the main valve by rate of rise thermal control direct after the manner shown in many of my previous patents. Obviously, when all outlets are open the maximum discharge of water takes place when system functions under such conditions; at times it has been found that more water is discharged than required to extinguish the fire, this tends to increase water damage as all sections protected by the system are deluged at one and the same time, while the fire is generally in only one section.

On the occurrence of a fire producing a relatively rapid rate of rise of temperature adjacent the element 70 the pressure produced therein elevates the wall 71 thus disengaging the projection 76 from the lever 78. This permits the spring 66 to collapse the bellows 58 and to send a pneumatic impulse through the tubing 24 to the pressure responsive element 36 for operating the main valve or other device used in controlling flow of extinguishing fluid to the fire or for operating other devices for controlling or limiting the spread of fire. This operation, however, does not necessarily produce the opening of the outlet 63 (in the form of my invention shown in Fig. 4) but instead the levers 60, 61, and 62 remain in their original condition with the outlet closed. If and when a sufficient heat is developed to fuse the link 64 the outlet is opened and the fire extinguishing fluid, supplied adjacent the outlet 63 through the opening of the main valve or other

device is permitted to escape and to extinguish the flame. In case the fire is of such a character that the change in temperature does not actuate the heat responsive element **70** to operate the bell crank lever **74** the main valve or other device remains quiescent but when the link **64** is fused on the attainment of the predetermined relatively high heat condition at whatever rate attained and due to prolongation of the fire, the fusing of the link **64** causes the levers **60** and **61** to become free of the holding effect of the levers **62** and as a result the extension **60***b* recedes from the end of the lever **78** and permits the spring **66** to operate the pressure changing device as previously explained.

By means of the above described devices a relatively strong pneumatic impulse for operating the control valve or other device on the occurrence of a rapidly increasing or quick fire resulting in a predetermined rapid rate of rise of temperature will operate the bellows spring but in any event when a fixed abnormally high temperature is reached which may be ineffective upon bellows **70** then the fluid outlet in the fire zone is opened and the pneumatic impulse is forwarded for opening the main valve.

In Fig. 6 the devices already described are adapted to open outlet valve **65** from the action of either or both rate-of-rise control **70** or fixed temperature control **64** as well as to create the pressure impulse necessary to operate main valve **15** and in turn fill the sprinkler piping with extinguishing fluid, discharging from the outlet opened. In this modification the freeing of the impulse producer **58** by the heat absorbing expansible element **70** is, as before, due to the freeing of the retaining lever **78** which allows the action of the device **58** under the action of its spring **66** with the result that the levers **60** and **61** will be permitted to approach one another and in so doing will free the outlet valve from the restraining influence of their ends **60***a* and **61***a* and thus permit the outlet to open in practically the same way that it opens when the fuse **64** melts and frees said ends **60***a* and **61***a*. In the general operation of the device the action is substantially the same as in the case of Fig. 4 but in the case of Fig. 6 the outlet opens in response to either a predetermined rate of temperature rise or the attainment of an ultimate temperature necessary to melt the fuse control, each being independent of the other in effecting the opening of the outlet **63**, operation of main valve **15** and the consequent discharge of fire extinguishing fluid. Hence, the extreme sensitivity of operating the heat detecting apparatus and main control valve is retained as well as the reserve or dual temperature operation of the outlet **63** should either of the temperature controls **70**—**64** omit to function.

It will be understood that the specific embodiment of the invention herein disclosed is merely illustrative and that variations may be made therein without departing from the spirit of the invention.

While I have described my invention as carried out by means of a pressure producing impulse which gives rise to a sudden increase of pressure in the connections leading to the control mechanism for the main valve or other device it will be obvious that the same effects can be produced by resorting to a device which will create a pressure impulse in the nature of a decrease of pressure that would affect the pressure responsive diaphragm or other device. Where, therefore, in my claims reference is made to a pressure controlling impulse it is to be understood that the claim is intended to embrace devices which act in response to a sudden impulse involving decrease of pneumatic pressure as well as the equivalent devices or means which act in response to sudden increase of pressure.

While I have described my invention in one of its applications as applied to a dry pipe or empty distributing pipe system the invention, as will be well understood by those skilled in the art, is adapted in many of its features for use in what is known in the art as a wet pipe system.

The invention claimed is:

1. A pressure producing control device for use in a fire extinguishing system having a fluid distributing pipe, a control valve therefor, and pneumatic means for controlling the operation of said valve responsive to a pressure impulse, said pressure control producing device comprising a device collapsible to produce a pressure impulse, means tending to collapse said device, means restraining the collapse of said device comprising a lever pivotally attached intermediate its ends to said collapsible device, fusible means destructible at a predetermined temperature supporting one end of said lever, removable means supporting the other end of said lever, and a rate of rise device operable to release said last mentioned support.

2. A pressure producing control device for use in a fire extinguishing system having a fluid distributing pipe, a control valve therefor, and pneumatic means for controlling the operation of said valve responsive to a pressure impulse, said pressure control producing device comprising a device collapsible to produce a pressure impulse, means tending to collapse said device, means restraining the collapse of said device comprising a detent, plural removable restraining means constructed and arranged to cooperate to support said detent whereby removal of any one of said restraining means effects release of the detent, one of said restraining means including fusible means destructible at a predetermined temperature to effect its release; and a rate of rise device for effecting removal of the other of said restraining means.

3. A pressure producing control device for use in a fire extinguishing system having a fluid distributing pipe having a discharge outlet, a pressure displaceable seal normally closing the outlet, a control valve in said pipe, and pneumatic means for controlling the operation of said valve responsive to a pressure impulse, said pressure control producing device comprising a device collapsible to produce a pressure impulse, means tending to collapse said device, means restraining the collapse of said device comprising a detent carried by the pressure impulse producing device and plural removable restraining means constructed and arranged to cooperate to support said detent whereby removal of any one of said restraining means effects release of the detent, one of said restraining means also operating in restraining position to hold the seal from displacement and including in its construction fusible means destructible at a predetermined temperature to effect its release, and a rate of rise device for effecting removal of the other of said restraining means.

4. A pressure producing control device for use in a fire extinguishing system having a fluid distributing pipe having a discharge outlet, a pressure displaceable seal normally closing said outlet, a control valve in said pipe, and pneumatic means for controlling the operation of said valve

responsive to a pressure impulse, said pressure control producing device comprising a device collapsible to produce a pressure impulse, means tending to collapse said device, a detent carried by the pressure impulse producing device, plural removable means engaging the detent and coacting therewith to mutually restrain the pressure impulse producing device from collapse under action of the means tending to collapse it, one of said restraining means also operating in restraining position to hold the seal from displacement and including in its construction fusible means for releasing it for removal, and a rate of rise device operable to effect removal of the other of said restraining means.

5. A pressure producing control device for use in a fire extinguishing system having a fluid distributing pipe having a discharge outlet, a pressure displaceable seal normally closing the outlet, a control valve in said pipe, and pneumatic means for controlling the operation of said valve responsive to a pressure impulse, said pressure control producing device comprising a device collapsible to produce a pressure impulse, means tending to collapse said device, plural removable restraining means constructed and arranged to cooperate to prevent collapse of the pressure impulse device under the action of the means tending to collapse it, said plural restraining means being independently removable whereby removal of any one of said restraining means effects release of the pressure impulse device for impulse producing action, one of said restraining means also operating in restraining position to hold the seal from displacement and including in its construction fusible means to effect its release; and a rate of rise device for effecting removal of the other of said restraining means.

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