Nov. 9, 1937. H. D. MUNSON 2,098,399

CHEMICAL MANUFACTURE

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Fig. 1.

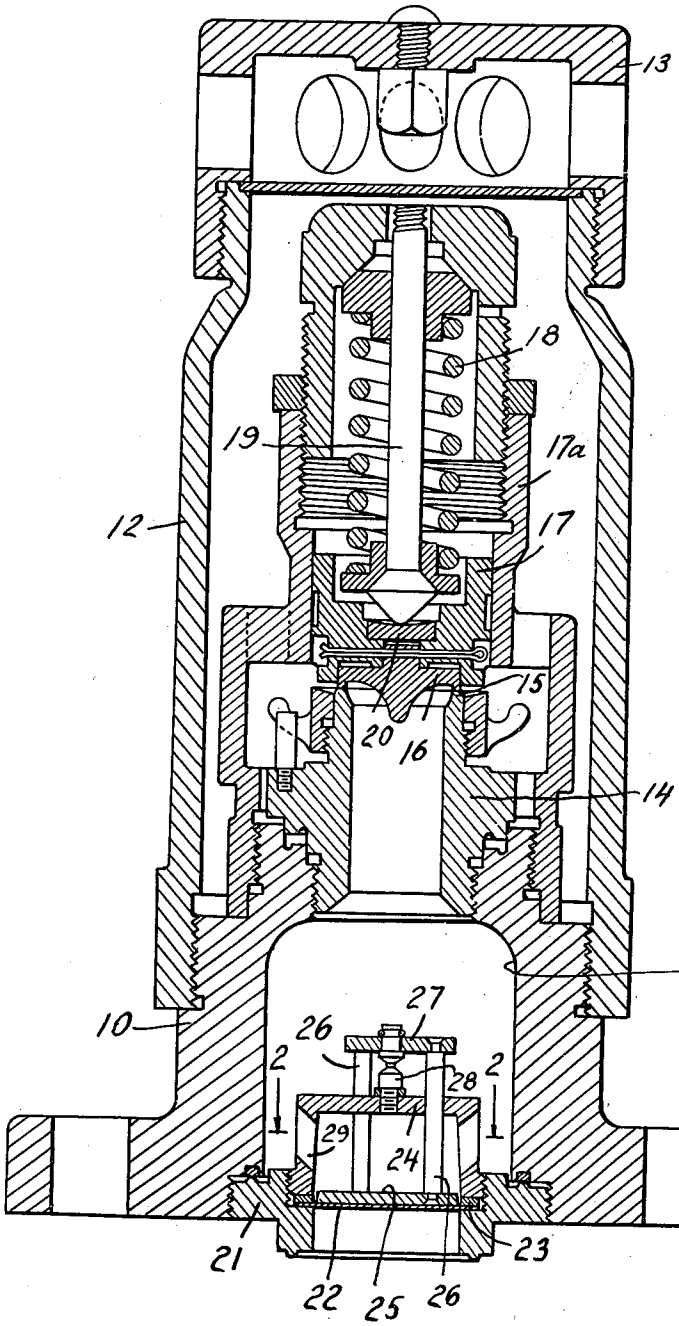
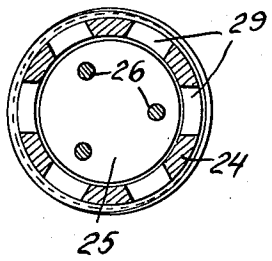



Fig. 2.




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## CHEMICAL MANUFACTURE

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8 Claims. (Cl. 220—89)

This invention relates to safety valves, such as are commonly employed in connection with vessels containing fluids under pressure, and is concerned more particularly with a device to be used in association with such a valve to protect the working parts thereof against the action of corrosive fluids, which results in the sticking of the valve. The new protective device may be employed advantageously with safety valves of various kinds, and it is especially useful for the protection of valves employed on containers for corrosive fluids such as liquid chlorine. For purposes of explanation, therefore, a form of the new protective device suitable for use with a safety valve of the type employed on chlorine tank cars will be described in detail, but it is to be understood that the utility of the invention is not limited to its use with the specific safety valve described, nor to the protection of such a valve against the action of chlorine.

At the present time, chlorine is commonly shipped under substantial pressure in single unit tank cars, and the tanks are provided with safety valves set to release the contents of the car at a selected pressure, such as 225 pounds per square inch. There are a number of different commercial valves employed for the purpose, and in all these valves, the valve seat is exposed to the action of the chlorine, with the result that the valve seat and disc become corroded and stick together and the valve does not release until pressures are generated much higher than those for which the valve has been set to operate.

For the purpose of overcoming these difficulties, it has been proposed to seal the working parts of the valve from the fluid, as by means of a diaphragm backed up by a piston which is held in place by a frangible copper disc. With such a construction, the development of an excessive pressure in the vessel acts through the diaphragm and piston to shear or puncture the disc with the result that the fluid is then admitted to the valve and causes the latter to open. This proposed expedient solves the difficulties resulting from the corrosive action of the fluid upon the valve, but it has the objection that the pressure at which the valve opens is determined by the frangibility of the copper disc, and it is difficult to obtain discs which fracture uniformly and at the same desired pressure.

The present invention is, accordingly, directed to the provision of a safety valve protective device which overcomes the difficulties above referred to, this device keeping the corrosive fluid from contact with the valve until a predetermined pressure is generated, and then fracturing within a small variation from a selected pressure to permit the valve to become effective to release the fluid. The device includes a rupturable closure for the passage through which the fluid is admitted to the working parts of the valve, and this closure, which may be a diaphragm of soft metal, is exposed on one face to the fluid and is supported against rupture by means which include a frangible member normally under tension. Upon the development in the vessel of the selected pressure, the strain placed upon the diaphragm is transmitted to the frangible member and causes the latter to break, whereupon the diaphragm is ruptured and the fluid is admitted through the passage to the disc of the safety valve.

For a better understanding of the invention, reference may be made to the accompanying drawing, in which:

Fig. 1 is a view in longitudinal section of a safety valve with the protective device in place; and

Fig. 2 is a sectional view on the line 2—2 of Fig. 1.

In the drawing, the device is illustrated in connection with a safety valve of large discharge capacity, this valve forming no part of the present invention. The valve includes a base 10 with a flange 11 by which it may be mounted in registry with a suitable aperture in the vessel, and the base carries a housing 12 with a perforated cap 13 threaded thereon. Mounted at the upper end of the base is a cylindrical member 14 formed at its upper end to provide a valve seat 15 with which cooperates a valve disc 16 mounted in a member 17 sliding in a guide housing 17a. The member 17 is forced downward by a spring 18 acting through a headed rod 19, the head of which bears upon a plate 20, mounted in the member 17. The pressure at which the valve opens depends on the compression of the spring 18, which can be adjusted as desired, and when a pressure in excess of the predetermined pressure is generated below the valve disc 16, the latter is forced upward from the seat in the usual way to permit escape of the fluid.

In order to protect the valve disc and seat from the action of the corrosive fluid, the passage 10a in the base of the valve, through which the fluid passes from the vessel to the valve disc, is closed by a rupturable closure which is normally supported against rupture by means of

a frangible member under tension. When the pressure within the vessel exceeds a predetermined value, the frangible member breaks, permitting rupture of the closure, and the fluid thereupon enters the valve to be released by the latter.

The means by which the passage for the admission of fluid to the valve is normally closed, include a plug 21 threaded into the base 10 at the end of the passage 10a. This plug has an opening through it which is closed by a rupturable closure, preferably in the form of a lead disc clamped against a seat formed in the inner wall of the plug by a washer 23 held in place by a member 24 threaded into the plug against the seat. The member 24 is cup-shaped and it is of decreasing diameter from its lower open end to its upper closed end. The disc 22 is reinforced by a plate 25, the edge of which is turned to the same taper as that of the member 24, the top of the plate being of substantially the same diameter as the inner diameter of member 24 adjacent its upper end.

The plate 25 is connected by a plurality of rods 26, passing through the upper end of the cup-shaped member 24 to a yoke 27. The yoke 27 is connected to the upper end of the cup-shaped member 24 by a frangible pin 28, which is of reduced diameter between its ends. This pin may be made of different materials, such as steel, copper, and the like, and it is so formed both with respect to material and dimensions that it will fracture when subjected to a selected tensile force.

Under normal working conditions, the diaphragm 22 closes the lower end of the base of the safety valve, and thus prevents contact of the fluid under pressure with the working parts of the valve. Corrosion of the valve parts is thus prevented, and since the fluid does not enter the valve, minor leaks, resulting in the case of tank cars from vibration, are avoided. Whenever a pressure develops within the tank or vessel in excess of the force at which the pin 28 will break, the transmission of this pressure through the ductile diaphragm 22, the rods 26, and the yoke 27 causes the pin 28 to part at the portion of reduced diameter. As soon as this occurs, the diaphragm ruptures and the central portion thereof with the plate 25 is forced upwardly and becomes wedged in the upper end of the cup 24 above the discharge openings 29. The compressed fluid now enters the base of the valve, contacts with the valve disc 16, opens the valve, and escapes in the usual way. Because of the relative sizes of the plate 25 and the bore of the member 24, the escaping fluid can act to wedge the plate tightly in position above the openings 29, so that the plate will not obstruct the openings. Preferably, the breaking pin 28 is selected so as to break at a pressure slightly less than that at which the safety valve releases, and under these conditions, the confined fluid is kept from contact with the safety valve at all times, except just before the release pressure is generated.

The new protective device thus prevents minor leakage of the confined fluid resulting from momentary opening of the safety valve, and also prevents corrosion which would result in the valve disc and valve seat sticking together. The device has the additional advantage of being relatively sensitive and uniform in operation, this advantage being obtained by the use of the breaking pin as the frangible element. Such pins can be made so that the device will release within a variation of five (5) percent plus or minus of a selected pressure, and thus are not only much more sensitive and uniform in operation than the frangible discs heretofore proposed, but also cheaper.

I claim:—

1. A protective device for closing a passage against the flow of a fluid under pressure which comprises a rupturable diaphragm closing said passage and exposed on one face to said fluid, and means normally out of contact with said fluid for supporting said diaphragm against rupture, said means including a supporting element in contact with the other face of said diaphragm and movable upon rupture thereof, and a frangible member operatively connected to said supporting element and normally preventing movement thereof by said diaphragm, said member being subjected to a pulling strain by the pressure of the fluid acting through said element.

2. A protective device for a safety valve having a passage for admission of fluid under pressure to be released by said valve, comprising a rupturable diaphragm closing said passage and exposed on one face to said fluid, and means for supporting said diaphragm against rupture including a plate contacting with the other face of said diaphragm, a hollow frame with a tapering inner bore, said plate being movable into said frame upon rupture of said diaphragm and having a tapering edge corresponding to the taper of said bore, and a frangible element operatively connected to said plate and frame, said element being normally under tension and preventing movement of said plate which would permit said diaphragm to be ruptured.

3. A protective device for closing a passage against the flow of a fluid under pressure which comprises a rupturable diaphragm closing said passage and exposed on one face to said fluid, and means on the other side of said diaphragm and normally out of contact with said fluid for supporting said diaphragm, said means including a frame, a plate contacting with the face of the diaphragm not exposed to the fluid, a yoke, a frangible element connecting said frame and yoke, and means connecting said plate and yoke to cause the frangible element to be subjected to tension.

4. A protective device for closing a passage against the flow of a fluid under pressure which comprises a rupturable diaphragm closing said passage and exposed on one face to said fluid, and means on the other side of said diaphragm and normally out of contact with said fluid for supporting said diaphragm, said means including a frame mounted in said passage beyond the diaphragm and having openings through it, a plate contacting with the face of the diaphragm not exposed to the fluid, a yoke beyond said frame, a frangible member connecting said yoke and frame, and means connecting said plate and yoke to cause the frangible element to be subjected to tension.

5. A protective device for closing a passage against the flow of a fluid under pressure which comprises an annular seat extending circumferentially of said passage, a rupturable diaphragm having its periphery resting on said seat, said diaphragm closing said passage and being exposed on one face to said fluid, a frame engaging the other face of said diaphragm and holding said diaphragm against said seat, a plate contacting with the face of the diaphragm not exposed

to the fluid, a yoke, a frangible element connecting the yoke and frame, and means connecting the plate and yoke to cause the frangible element to be subjected to tension.

6. A protective device for closing a passage against the flow of a fluid under pressure which comprises a rupturable diaphragm closing said passage and exposed on one face to said fluid, and means on the other side of said diaphragm and normally out of contact with said fluid for supporting said diaphragm, said means including a frame, a plate within the frame contacting with the face of the diaphragm not exposed to the fluid, a yoke beyond the end of the frame, a frangible element connecting the yoke and frame, and a member extending through said frame and connecting said plate and yoke to cause the frangible member to be subjected to tension.

7. A protective device for closing a passage against the flow of a fluid under pressure which comprises a plug mounted in the wall of the passage and having an opening through it, a rupturable diaphragm mounted in the opening through said plug and closing said passage, said diaphragm being exposed on one face to said fluid, and means on the other side of said diaphragm and normally out of contact with said fluid for supporting said diaphragm, said means including a frame mounted in said plug, a plate contacting with the face of the diaphragm not exposed to the fluid, a yoke, a frangible element connecting said yoke and frame, and means connecting said plate and yoke and causing the frangible member to be subjected to tension.

8. A protective device for closing a passage against the flow of a fluid under pressure which comprises a rupturable closure for said passage having a face in contact with the fluid, and means normally out of contact with the fluid for supporting the closure against rupture, said means including a frangible member subjected to a pulling strain by the pressure of the fluid acting through said closure.

HORACE D. MUNSON.