July 29, 1924. 1,502,739

F. MUNZINGER

CUSHIONING DEVICE FOR LIQUID CONVEYED UNDER PRESSURE

Filed Sept. 3, 1921

Fig. 1.

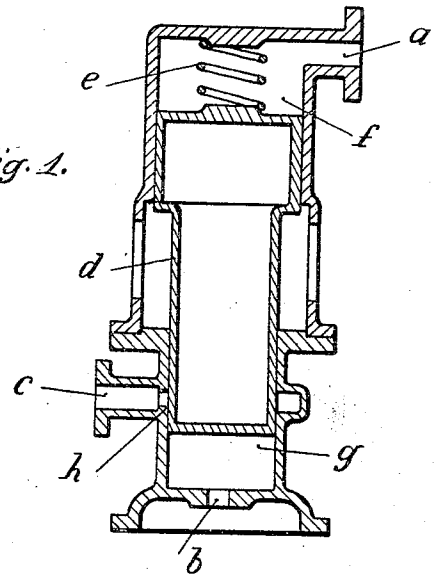
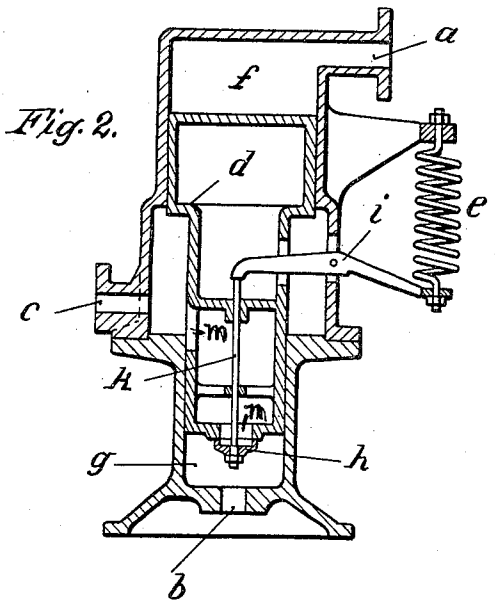


Fig. 2.



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Patented July 29, 1924. 1,502,739

UNITED STATES PATENT OFFICE.

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CUSHIONING DEVICE FOR LIQUID CONVEYED UNDER PRESSURE.

Application filed September 3, 1921. Serial No. 498,525.

(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

To all whom it may concern:

Be it known that I, FRIEDRICH MÜNZINGER, a citizen of Germany, residing at Berlin, Germany, have invented certain new and useful Improvements in Cushioning Devices for Liquid Conveyed Under Pressure, for which I have filed applications in Germany, October 16, 1919, Italy October 15, 1920, Austria October 15, 1920, No. 89229; Czechoslovakia, October 15, 1920, No. 8018; France October 16, 1920, No. 526102, Great Britain October 18, 1920, No. 152655, of which the following is a specification.

My invention refers to cushioning devices for liquids under pressure and more particularly to a device to be connected for instance with a boiler feed pipe. It is an object of my invention to provide means for absorbing shocks arising in pipes or the like in which liquid is conveyed under pressure, in a more efficient way than was hitherto possible. As is well known to those skilled in the art, such shocks are due to a temporary excess of pressure in the chamber to which the feed is supplied, for example, the feed space of a steam-boiler over the pressure of the liquid supplied and they are inevitable unless the feed can be effected with perfect uniformity, a condition very seldom attainable in practice. The automatic feed-water regulators more especially and also the feed-pumps of high working capacity, which are in general use at the present time, give rise to these undesirable excesses of pressure. As it is a common practice to-day, in power stations or like plants, to exceed a pressure of 20 atm. or more, extraordinarily heavy stresses are exerted upon the feed-system and more particularly by the cast-iron economizer included in it, in the use of an ordinary safety-valve, the stresses not infrequently resulting in the breakage of some member. Exhaustive experiments have demonstrated that even when the operating pressure of the safety-valve of the economizer, or of other safety-valves in the feed-system, has been considerably exceeded, these devices are either utterly unable to cope with sudden sharp impulse shocks or can do so only very inadequately. But it is precisely these sudden momentary shocks which exert such extremely detrimental effects on the system. Any method, moreover, of attempting to protect the economizers leads to exceptionally great difficulties, as, on the one hand, the pressure to which the safety valve must be adjusted is generally very high and must be considerably in excess of that of the steam in the boiler, and, on the other hand, valves which are closed either by weight or by spring can never be so delicately adjusted as to open with the precision which is requisite for the minimum value of the excess of pressure. The operating-pressure of the safety-valve must be fixed at a relatively high value because otherwise as soon as the resistance of the economizer rises by reason of a heavy demand for water by the boiler under such circumstances only a portion of the water fed will find its way to the boiler while another portion flows off through the valve. For this reason and also in view of the inherent inaccuracy in the adjustment hereinbefore mentioned, it is imperative that the operating pressure or load of the safety-device in the feed-system or in the economizer be fixed considerably higher than is necessary merely to overcome the resistance in the economizer. As a consequence, the safety-valve will remain closed when light shocks occur and even under heavier shocks if they develop suddenly, taking into consideration the force necessary to overcome inertia, friction and like effects, and the service it will perform can therefore only be imperfect.

According to the present invention these disadvantages are overcome by connecting to the feed supply piping a space of variable cubic capacity having a movable boundary surface or wall which is capable of being displaced so as to increase the volume of the space enclosed, and of overcoming a reactionary force which increases with the increase in volume of the space in such manner that an overflow for the pressure-fluid is only permitted to become operative when a certain defined position has been reached. The device can be carried into practical effect by such simple means as, for example, a piston which will act as the movable boundary surface or wall and which, under normal circumstances, will maintain closed an overflow, the arrangement being such that the reactionary force which must be overcome is the operating pressure in

the chamber that has to be fed, supplemented by the force exerted by a spring.

By means of the novel device the lighter shocks are prevented or for the most part absorbed and the more violent shocks cannot develop to their full extent, because immediately the permissible limit for the rise in pressure has been reached, the relief outlet for the fluid is fully uncovered. This limit may be, as desired, just above the operating pressure without incurring the drawbacks and defects hereinbefore mentioned. This is rendered possible by the fact that whatever be the pressure which, under normal circumstances, prevails in the feed-supply piping, the pressure on the movable member serving as the safety device is equalized on both sides and because in the uncovering of the overflow following the movement of the movable member, there is no inertia or frictional resistance to be overcome.

In the drawings affixed to this specification two forms of a device embodying my invention are illustrated diagrammatically by way of example in longitudinal section.

In both forms the reactionary force required, is provided by the operating pressure of the boiler or the like in addition to a spring. This arrangement is advantageous, because the spring, if used by itself to provide the reactionary force would require to be very long and strong, and would have the further disadvantage that the comparatively slight difference between the operating pressure in the chamber to be fed and that necessary to actuate the safety-device could not be adjusted with sufficient exactitude and certainty. By making use of the operating pressure for the reactionary force, the difference between the two forces remains practically constant and that, too, independently of fluctuations in the operating pressure, and in addition the spring may be small without rendering the stroke of the movable member insufficient.

In the drawings *f* is the chamber of the cylinder which latter, by means of the conduit *a* communicates with the vessel to be fed, a steam boiler for example, and *g* represents the chamber communicating with the feed pipe, through the opening *b*. The piston *d* is, in the construction shown in Fig. 1, acted on by these two pressures and, in addition, by the spring *e*, which counteracts the pressure in the feed-pipe. The piston *d*, which here represents the movable boundary surface or wall for the variable space or chamber *g*, serves also, in the case of Fig. 1, to maintain closed the overflow *h* which, when a certain pressure-limit has been exceeded, permits the feed-fluid to pass into the conduit *c*.

In the construction of Fig. 2 the spring *e* does not act directly on the face of the piston which is exposed to the action of the motive pressure, but indirectly and through the intermediary of a lever system. Such an arrangement renders it possible for the spring to be located outside the casing of the safety device so that it can at any time be tested and re-adjusted with convenience. A further difference in this construction is that a special overflow device *h* is provided consisting of a valve fitted to the piston. For this purpose a passage is provided between an opening *m* in the circumference of the piston facing the overflow and another opening *n*. On the side of the piston which is exposed to the pressure of the feed pipe, which is closed by the valve. The latter is connected to the rod *k* which is in contact with the double-armed lever *i* which is subjected to the action of the spring *e*.

The method of operation of the construction shown in Fig. 2 is as follows: So long as the valve *h* bears against the piston *d* there acts on the latter, exactly as in Fig. 1, on the one side the pressure of the feed-pipe and on the other side the operating pressure of the chamber to be fed, reinforced by the stress of the spring, in this case a tensile stress. The force of the spring acts indirectly on the piston, and provides a force acting against the valve-pressure. As the pressure in the feed-pipe rises, the piston *d* together with the valve rises till the pressure on the valve no longer suffices to keep it pressed against the piston, or, in other words, till the pressure acting on the annular surface of the piston equalizes the reactionary effect of the operating pressure. The valve is now lifted from its seat and the pressure-fluid can escape through the hollow piston into the discharging-conduit *c*.

In addition to the spring *e*, which is disposed outside the casing, another supplementary or secondary spring may be provided, to act, in a manner similar to that in Fig. 1, directly on the piston *d*. In order to regulate the opening pressure it, of course, suffices to provide one of the two springs to be accessible; to the other may then be allotted the duty of forming a constant resilient reacting force for the piston *d*.

I claim:

1. In a cushioning device for liquid conveyed under pressure in combination, a cylinder having an inlet near either end, a piston movable in said cylinder and permanently separating said inlets and an overflow in the cylinder wall capable of being covered and uncovered by said piston and of being set in communication with only one of said inlets.

2. In a cushioning device for liquid conveyed under pressure in combination, a cylinder and a piston movable and tightly fitting in said cylinder, said cylinder being provided with a liquid inlet, another inlet

for a pressure medium separated from said first inlet by said piston and an overflow intermediate said inlets and adapted to be uncovered by said piston as it recedes from said first inlet.

3. In a cushioning device for liquid conveyed under pressure in combination, a cylinder and a piston movable and tightly fitting in said cylinder, said cylinder being provided with a liquid inlet, another inlet for a pressure medium separated from said first inlet by said piston and an overflow intermediate said inlets and adapted to be uncovered by said piston as it recedes from said first inlet, said piston being provided with a channel extending between the piston face near said first inlet and the circumference of the piston so as to be capable of communication with said overflow, means adapted to be acted upon by said liquid for closing said channel and a spring tending to open said channel.

4. In a cushioning device for liquid conveyed under pressure in combination, a cylinder and a piston movable and tightly fitting in said cylinder, said cylinder being provided with a liquid inlet, another inlet for a pressure medium separated from said first inlet by said piston and an overflow intermediate said inlets and adapted to be uncovered by said piston as it recedes from said first inlet, said piston being provided with a channel extending between the piston face near said first inlet and the circumference of the piston so as to be capable of communication with said overflow, means adapted to be acted upon by said liquid for closing said channel, a spring outside said cylinder and connection between said spring closing means for rendering said closing means inoperative by the action of said spring.

In testimony whereof I affix my signature.

FRIEDRICH MÜNZINGER.