WATER HAMMER CUSHIONING DEVICE
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Matthew R. Crowe, Winthrop, Mass.

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This invention relates to a water hammer cushioning device such as is commonly connected with water pipes for cushioning the water hammer shock produced when a shut-off valve in the pipe is instantly closed.

One object of the invention is to provide a device of this character which is relatively simple in construction and inexpensive to manufacture, but which is very effective in preventing damage resulting from water hammer shock.

A further object of the invention is to provide a water hammer cushioning device which includes in its construction a water receiving chamber that is constantly in communication with the water pipe and which is formed with an expansible and contractible wall portion, so that when the water pressure increases such expansible and contractible wall portion will expand in response to the increased pressure, and which is also provided with a closed expansible and contractible air chamber so connected to the expansible and contractible wall of the water receiving chamber that when the water chamber expands the closed air chamber will be contracted in volume, thereby increasing the air pressure therein and providing an increased resistance to the expanding movement of the water chamber.

An advantage of this construction is that since the closed air chamber is entirely separate from the water receiving chamber, there is no possibility that the air in the air chamber will become absorbed by the water, thereby reducing the cushioning effect of the air chamber.

A device embodying my invention will also include a spring acting against the expansible and contractible wall of the water chamber and tending to resist the expansion thereof so that the expanding movement of the water chamber occasioned by an increase of pressure in the water pipe is resisted or cushioned by the combined action of the air in the air chamber and the spring.

The drawing shows a sectional view of a water hammer cushioning device embodying my invention.

In the drawings, 1 indicates a water pipe which will be provided with the usual shut-off valve (not shown) by which the flow of water through the pipe can be controlled.

The water hammer cushioning device herein shown comprises a housing member 2 which is illustrated as being comprised of inner section 3 and the outer section 4, said sections being detachably secured together. The inner section 3 is connected to the water pipe 1 in any suitable or usual way, so that the interior chamber 5 of said section is in constant communication with the interior of the water pipe 1. As herein shown, the section 3 is connected to the water pipe 1 through the medium of the T-coupling 6, the section 3 having the neck portion 7 which is screw threaded into the branch 8 of the T-coupling as exteriorly screw-threaded at its outer end and the inner end of the outer section 4 is shown as being interiorly screw-threaded, so that the two sections can be screw-threaded together.

The housing 2 encloses a partition member 9 which has an opening 10 therethrough, and as herein shown the peripheral portion of the partition 9 is clamped between the inner and outer sections of the housing member 2, said partition resting on the end of the inner section 3 and being engaged by the shoulder 11 of the outer section 4.

Secured to the outer face of the partition 9 is an expansible and contractible member 12, preferably in the form of a corrugated expansible bellows-like element, said member 12 forming an expansible and contractible wall portion for a water chamber which includes the interior chamber 5 of the inner section 3 and the space within the bellows-like element 12, and which is permanently in communication with the interior of the water pipe 1. The interior of the expansible member 12 communicates with the chamber 5 through the opening 10 in partition 9, and normally the chamber 5 of the inner section 3 and the expansible member 12 are filled with water which has a pressure corresponding to the water pressure in the water pipe 1. The device also includes a closed air chamber 13 which is connected to the expansible member 12 in such a way that when the member 12 expands due to an increase in the water pressure in the pipe 1, the closed air chamber will be compressed.

This closed air chamber is formed by two tubular members 13, 14 having a telescopic relation. The member 13 extends through the member 14 and into the opening 10 in the partition 9, and has at its outer end a flange 15 which is welded or otherwise permanently secured to the outer end of the bellows-like member 12. It being understood that the inner end 26 of said bellows-like member is welded or otherwise permanently secured to the partition 9. The tubular member 14 is shown as telescoping within the tubular member 13, and both of these telescoping tubular members are open at their inner ends and closed at their outer ends, as shown at 16 and 17. Said tubes, therefore, encloses an air space 18 which constitutes a closed air chamber.

The outer end 17 of the inner tubular member 14 engages the top end 19 of the body member 2 and is thus held from movement.

With this construction, the expanding movement of the member 12 due to increased pressure of the water in the water chamber moves the tubular member 13 upwardly, thereby reducing the volume of the air in said closed chamber 18 and consequently increasing its pressure. The air in the closed air chamber thereby resists the expanding movement of the bellows-like member.

My improved device also includes a spring which acts against the bellows-like member 12, and also resists its expanding movement. This spring is shown at 20 and is in the form of an expanding coil spring located within the closed air chamber 18, the ends of the spring engaging the ends 16 and 17 of said chamber.

If the flow of water through the pipe 1 is suddenly checked by a quick closing of the shut-off valve, the inertia of the moving body of water will build up a pressure in the pipe 1 which would result in water hammer unless the shock of the building up of such pressure were properly cushioned. With the device herein shown the quick rise of pressure in the water chamber will tend to expand the bellows-like member 12, and consequently reduce the volume of the closed expansible and contractible air chamber 18, thus increasing the pressure of the air therein, and will also compress the spring 20. The combined action of the air in the closed air chamber and that of the spring 20 serves to cushion this shock and prevent water hammer damage. As the normal pressure in the pipe 1 is restored, the increased air pressure within the air chamber 18 cooperating with the compressed spring 20 returns the parts to their normal position as shown in the drawing, in which position the normal pressure in the water pipe and the water chamber 5...
is balanced by the combined action of the air pressure in the closed air chamber and the spring 20.

An advantage of Applicant's construction is that since the air chamber 18 is a closed chamber there is no danger that any of the air in said chamber will come in contact with and be absorbed by the water in the bellows-like member 12 or in the water chamber 5, and thus the efficiency of the device remains unimpaired for long periods of time.

I claim:

1. A water hammer cushioning device for a water pipe comprising a housing member having means for mounting it on said pipe, said member having an interior water chamber communicating at all times with the interior of the pipe and provided with an expandible and contractible wall portion, a closed expandible and contractible air chamber separate from the housing and located therein, means connecting a wall of the closed air chamber to the expansible and contractible wall portion of said water chamber whereby the closed air chamber is contracted and the air therein compressed by the expanding movement of said expansible and contractible wall portion due to an increase in water pressure in said pipe and water chamber, and a spring acting against said expansible and contractible wall portion and tending to resist the expansion thereof, whereby the spring and the air in the closed air chamber jointly resist and cushion the expansion of said water chamber resulting from an increase of pressure in the water pipe.

2. A water hammer cushioning device for a water pipe comprising a housing member having means for mounting it on said pipe, said member having an interior water chamber communicating at all times with the interior of the pipe and provided with an expansible and contractible wall portion having a bellows-like structure, a closed expansible and contractible air chamber separate from the housing and extending axially through the bellows-like portion of the water chamber, means connecting a wall of said closed air chamber to the expansible and contractible wall of the water chamber, whereby the closed air chamber is contracted and the air therein is compressed by the expanding of the water chamber, and a spring located within the closed air chamber and tending to resist the contraction thereof, whereby the spring and the air in the closed air chamber jointly resist and cushion the expansion of said water chamber resulting from an increase of pressure in the water pipe.

3. In a device of the class described, a water pipe, a water hammer cushioning device mounted on said pipe and comprising a housing having an interior water chamber communicating with the interior of the water pipe, which chamber has an expansible and contractible wall portion presenting a bellows-like structure, an expansible and contractible closed air chamber separate from the housing but located therein, said closed air chamber presenting two tubular members, one telescoping within the other and each closed at its outer end, means connecting one of the tubular members to the expansible and contractible wall portion of said water chamber, and means to hold the other tubular member stationary, whereby the expanding movement of the water chamber causes a contracting movement of the closed air chamber and a build-up of air pressure therein which resists and cushions the expansion of the expansible wall portion of the water chamber due to sudden increase of water pressure in said water pipe.

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