(No Model.)

C. A. DUNHAM.

AUTOMATIC DRAIN FOR STEAM ENGINE CYLINDERS.

No. 583,037. Patented May 25, 1897.

Fig. 1.

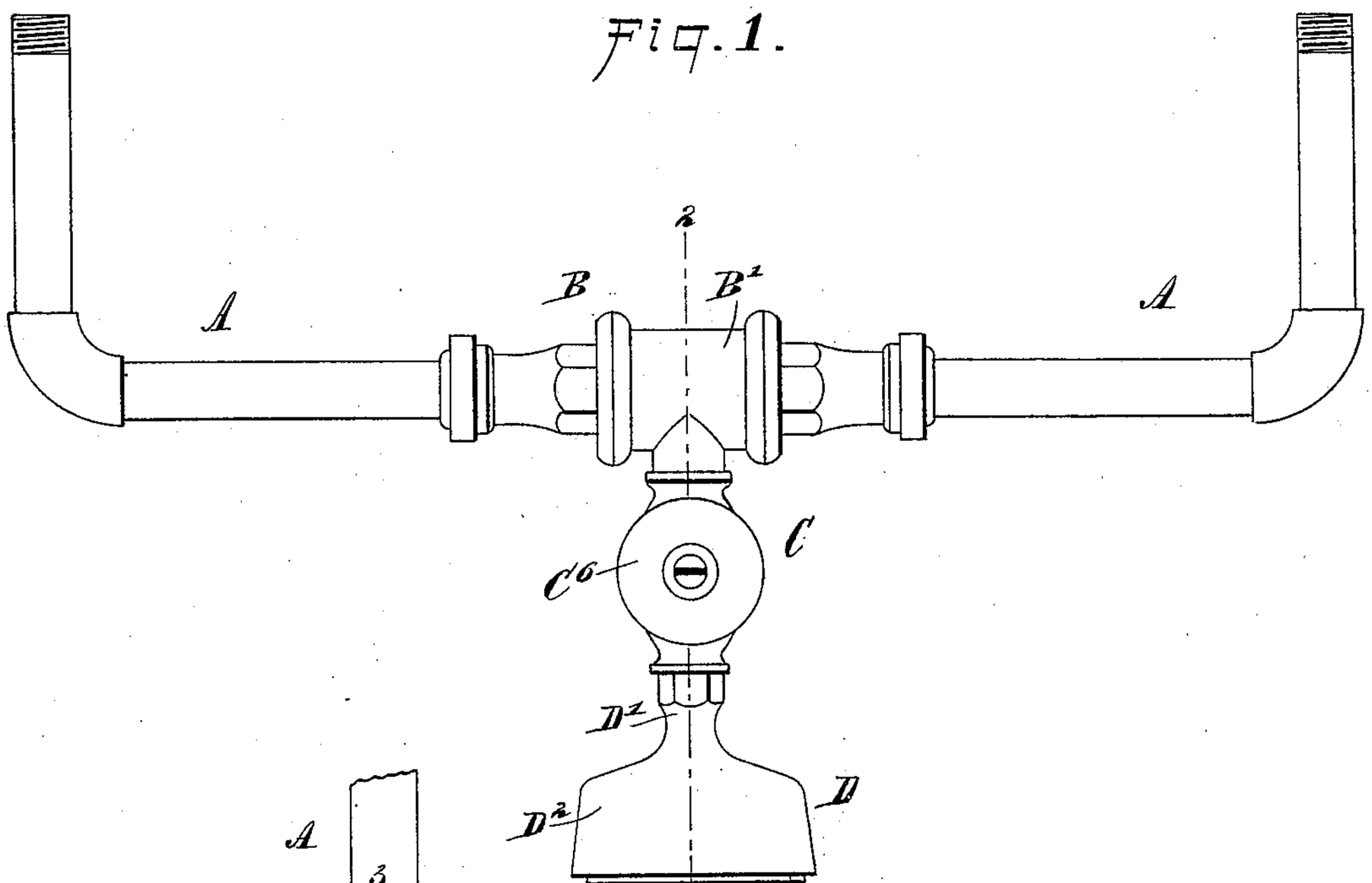


Fig. 2.

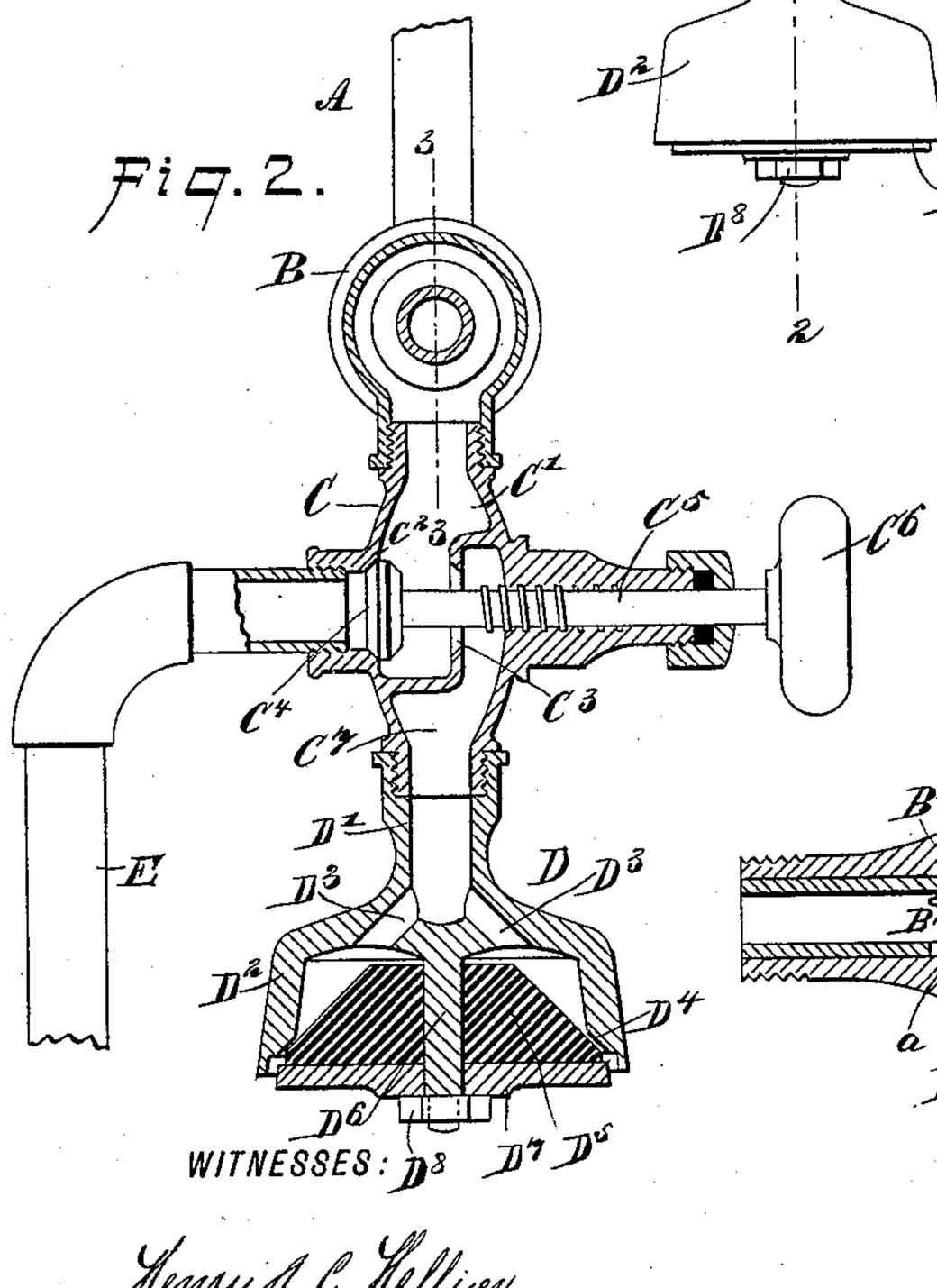
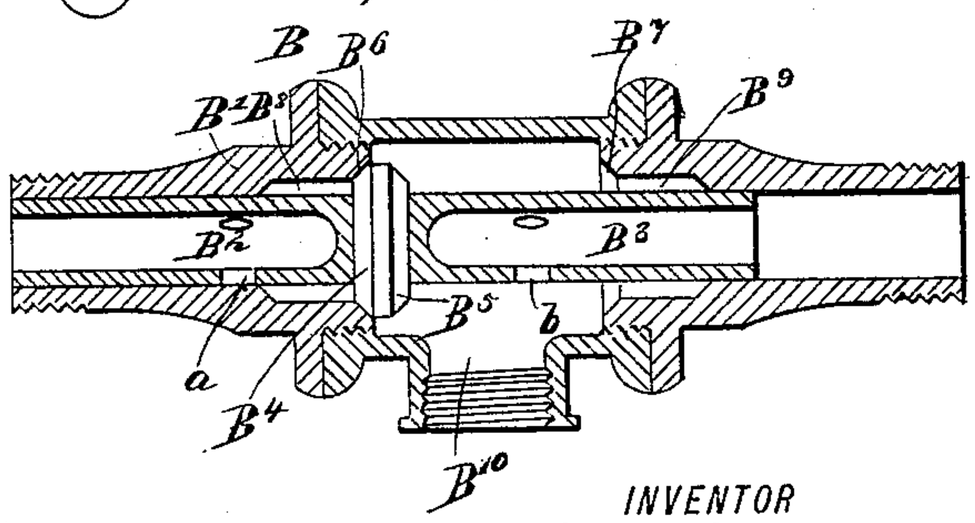


Fig. 3.



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CLAYTON A. DUNHAM, OF CLARINDA, IOWA.

AUTOMATIC DRAIN FOR STEAM-ENGINE CYLINDERS.

SPECIFICATION forming part of Letters Patent No. 583,037, dated May 25, 1897.

Application filed June 17, 1896. Serial No. 595,861. (No model.)

To all whom it may concern:

Be it known that I, CLAYTON AUBRA DUNHAM, of Clarinda, in the county of Page and State of Iowa, have invented a new and Improved Automatic Drain for Steam-Engine Cylinders, of which the following is a full, clear, and exact description.

The object of the invention is to provide a new and improved automatic drain for relieving steam-engine cylinders of all water of condensation without permitting an undesirable escape of the steam and preventing the breaking of the cylinder-heads by accumulated water or priming of the boiler.

The invention consists principally of a pipe connected at its ends with the ends of the steam-cylinder, a piston-valve connected with the pipe, and a drain-cup into which discharges the said valve, the drain-cup being provided with an expansion-plug normally open for the escape of water of condensation and adapted to close by the action of the steam.

The invention also consists of certain parts and details and combinations of the same, as will be fully described hereinafter and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a side elevation of the improvement. Fig. 2 is a transverse section of the same on the line 2 2 of Fig. 1, and Fig. 3 is a sectional side elevation of the valve on the line 3 3 of Fig. 2.

The improved drain is provided with a pipe A, made approximately U shape and connected at its ends with the ends of the cylinder. In the pipe A is interposed the casing B′ of the valve B, discharging into a globe-valve C, supporting at its bottom a drain-cup D and provided with a discharge-pipe E, as indicated in Fig. 2. The valve B is provided with two hollow stems B^2 and B^3, fitted to slide in corresponding bores in the casing B′, the said stems being formed with ports *a* and *b* for connecting either end of the pipe A with the outlet of the valve-casing.

At the adjacent ends of the stems B^2 and B^3 is held a disk-valve having two faces B^4 and B^5, adapted to be seated on valve-seats B^6 and B^7, respectively, formed in the casing B′ and leading to bores B^8 and B^9, respectively, surrounding the stems B^2 and B^3.

The outlet B^{10} of the casing B′ extends downwardly and receives the upper end of the valve-body C′ of the globe-valve C, the said valve-body being provided with two oppositely-arranged valve-seats C^2 and C^3, adapted to be engaged by the double-faced disk-valve C^4, held on the stem C^5, screwing in the casing C′ and provided on its outer end with a hand-wheel C^6 for turning the stem C^5 to move the disk-valve C^4 onto either of the seats C^2 or C^3. The seat C^2 leads to the discharge-pipe E, and the seat is normally closed by the disk-valve C^4. The other seat C^3 leads to the discharge end C^7 of the casing of the body C′, and this end C^7 is connected with the hollow shank D′ of the drain-cup.

On the shank D′ is formed the cup D^2, and the bore of the shank is connected by a series of channels D^3 with the interior of the cup, as plainly indicated in Fig. 2. On the lower edge of the cup D^2 is formed a seat D^4, adapted to be engaged by a plug D^5, made of vulcanized rubber or other suitable material, which expands when subjected to heat. The plug D^5 is held on a stem D^6, depending from the bottom of the cup and at the center thereof, and the base of the plug rests on a metallic plate D^7, supported by a nut D^8, screwing on the lower end of the stem D^6. The nut D^8 is made of an easily-breakable material, such as brittle metal, to permit the plug D^5 and the plate D^7 to slide off the stem D^6 and seat D^4 of the cup D^2 whenever the plug is subjected to an excessive pressure.

The operation of the device is as follows: When the piston in the cylinder is at one end thereof and the steam passes between the piston and the cylinder-head to force the piston forward, then the water of condensation at this end of the cylinder readily passes through the corresponding end of the pipe A to the valve B, and the pressure of the steam acting on the corresponding valve-stem B^2 or B^3 forces the same to the other side until the corresponding valve-face B^5 or B^4 is seated on the corresponding seat B^7 or B^6. The ports *a* and *b* permit the water of condensation to run into the outlet B^{10}, from which the water

can pass through the valve C into the cup D and through the opening between the plug D^5 and the seat D^4 to the outside, it being understood that the said plug D^5 normally forms a space with the seat for the escape of the water. As the piston moves to the end of its stroke the cylinder is thoroughly drained, and when the exhaust closes then the compression-space is on the opposite side of the piston, and pressure is exerted on the piston-valve to force the same in the opposite direction and connect this end of the cylinder with the atmosphere by way of the valve C and cup D. Now the steam coming into either end of the cylinder produces the water of condensation by the steam coming in contact with the cold surface of the cylinder, and this water of condensation is drained by the pipe A, the valve B, and the cup D, as above explained. Thus the simple change of the position of the piston-valve provides an outlet for the water of condensation from each end of the cylinder, it being understood that when one end of the cylinder is drained the other end of the cylinder connected with the pipe is closed to the atmosphere by way of the pipe A. After a few strokes of the piston in the cylinder there is practically dry steam only in the cylinder, and this steam, by passing through the pipe A in the same manner as the water of condensation, finally reaches the cup D and heats the expansion-plug D^5. The latter now expands and in doing so seats itself on the seat D^4, thus closing the cup D and preventing the escape of the steam. Should an overabundance of water be drawn into the cylinder at one time, then the momentum of the piston creates a greater pressure of the water on the compression end than the pressure of steam on the opposite end, and in this case the piston-valve is forced against the pressure of the steam and consequently the drain-cup D is flooded, and by the excessive pressure the nut D^8 is burst to permit the plug D^5 and plate D^7 to leave the cup D, so that the water can escape without any harm being done to the engine or any of its parts. The hand-wheel C^6 is then turned so as to move the disk-valve C^4 from the seat C^2 and onto the seat C^3 to permit the water and steam to escape from the globe-valve through the discharge-pipe E. The expansion-plug D^5 and plate D^7 are again placed in position in the cup D^2 and secured thereto by a nut D^8. It will be seen that by the arrangement described complete protection is given to the cylinder and at the same time the pressure in the cylinder is not lost or in any way interfered with.

It is further understood that the device gives immediate escape for an excessive amount of water, should it enter the cylinder from any cause besides mere condensation.

The drain is applicable to all classes of reciprocating engines, vertical or horizontal, compound or triple-expansion, condensing or non-condensing. The drain will be of great service on elevator-pumps and electric-light engines, or may be readily applied to marine or locomotive engines.

It is expressly understood that in the drain described the steam side of the cylinder has vent to the atmosphere, and consequently cushion is saved, and it matters not how large an amount of water or how great a pressure in the cylinder, as the drain is always open to that side of the cylinder that has the most pressure. Should the pressure on the exhaust side rise above that on the steam side, then the valve shifts, as above described, to the opposite seat, thereby forming a direct outlet or escape.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. An automatic drain for steam-engine cylinders, comprising a pipe adapted to be connected at its ends with the ends of the steam-cylinder, a piston-valve connected with the said pipe, and a drain-cup into which discharges the said valve, the drain-cup being provided with an expansible plug normally open for the escape of water of condensation and adapted to close when subjected to heat, substantially as shown and described.

2. An automatic drain for steam-engine cylinders, comprising a pipe adapted to be connected at its ends with the ends of the steam-cylinder, a piston-valve connected with the said pipe, a drain-cup into which discharges the said valve, the drain-cup being provided with an expansible plug normally open for the escape of water of condensation and adapted to close when subjected to heat, and a globe-valve interposed between the said piston-valve and the said drain-cup, the said globe-valve having a discharge-pipe, substantially as shown and described.

3. An automatic drain for steam-engine cylinders, provided with a piston-valve, comprising a casing adapted to connect at its ends with the ends of the cylinder, a two-faced disk-valve, hollow stems extending in opposite directions from the said valve, each stem having ports, and the stems being fitted to slide in the ends of the said casing, the ports being adapted to connect the ends of the casing with the discharge end of the casing, substantially as shown and described.

4. A drip-cup having an inlet-orifice and an open side, a stem extending through the drip-cup, a plate carried by one end of the stem and adjacent to the open side, a yielding nut for holding the plate on the stem, the nut giving way to excessive pressure within the cup, and a plug sustained by the plate and capable of expanding when subjected to heat, substantially as described.

5. A drip-cup having an inlet-orifice and having an open side, a plate held normally over said open side, yielding means by which the plate is held in place, such means giving way to excessive pressure within the drip-

cup, and a plug held within the drip-cup and expanding to close the same upon the application of heat, substantially as described.

6. A drip-cup having an inlet-orifice and an opening in one side, an expansive tapering plug, the large portion of which is situated outward from the small end and within the opening in the cup, the plug expanding against the walls of said opening to close the cup, and means for yieldingly holding the plug in place such means giving way to excessive pressure in the cup whereby the plug when expanded may be blown from the cup, substantially as described.

7. A drip-cup having an inlet-orifice and an opening in one side, and an expansive tapering plug, the large portion of which is outward from the small end and situate within the opening in the cup and the plug expanding against the walls of said opening to close the drip-cup, the plug being thus capable of being moved out of the drip when the plug is expanded, substantially as described.

8. A drip-cup having an inlet-orifice and an opening in one side, an expansive plug fitting within the drip-cup and operating to close the opening in the side thereof, and yielding means normally holding the plug in place, said means giving away to excessive pressure within the cup, substantially as described.

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