No. 697,644. Patented Apr. 15, 1902.

M. R. MOORE.

DASH POT.

(Application filed July 9, 1901.)

(No Model.)

Fig. 1.

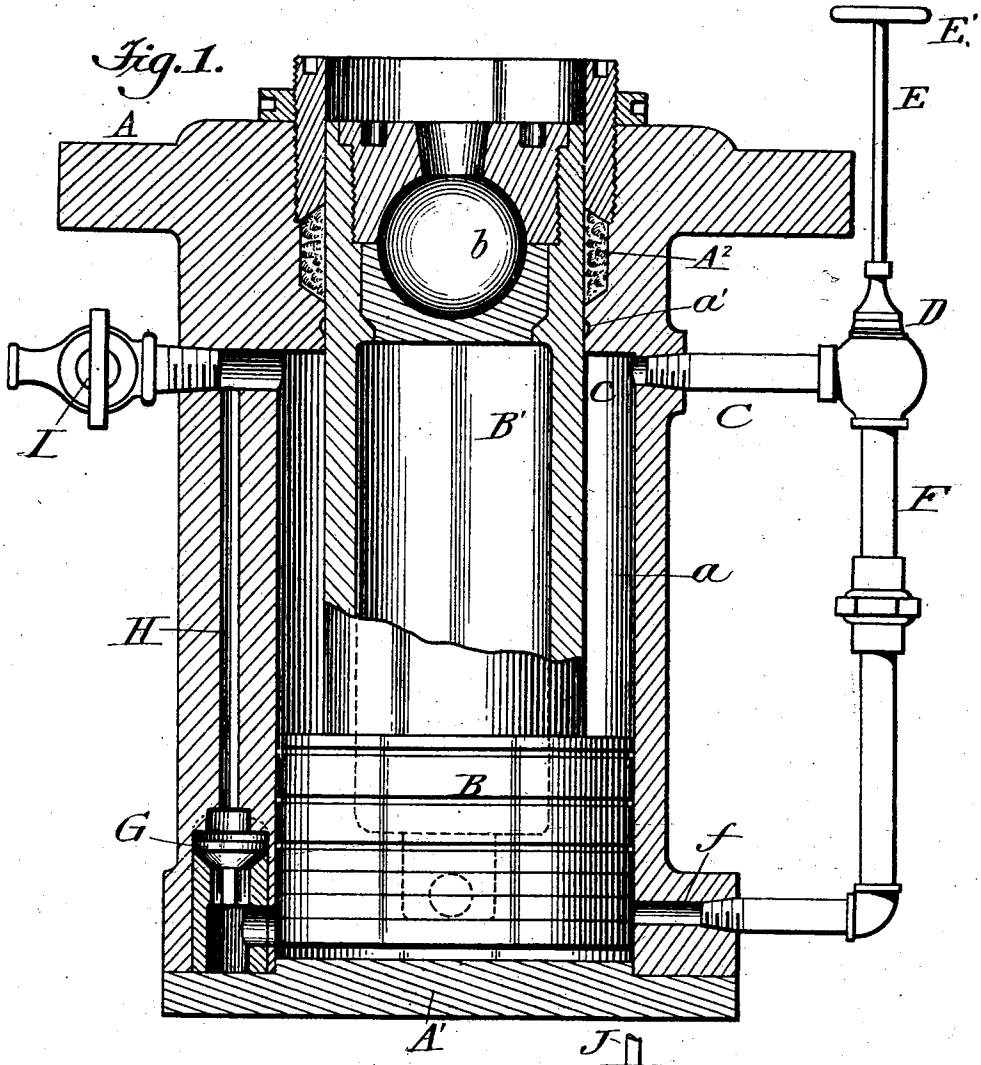


Fig. 2.

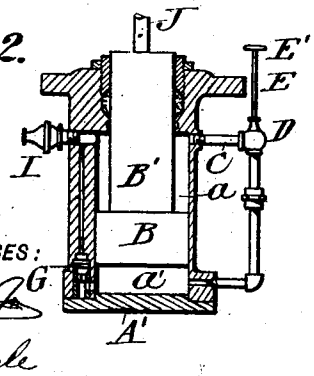
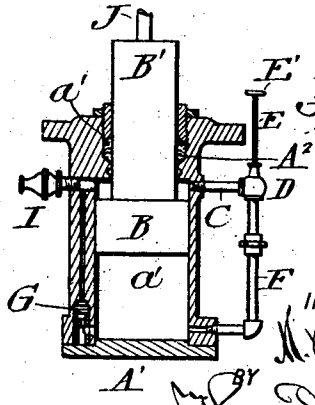


Fig. 3.



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DASH-POT.

SPECIFICATION forming part of Letters Patent No. 697,644, dated April 15, 1902.

Application filed July 9, 1901. Serial No. 67,611. (No model.)

To all whom it may concern:

Be it known that I, MATTHEW ROBERT MOORE, a citizen of the United States, residing at Indianapolis, in the county of Marion, in the State of Indiana, have invented a certain new and useful Improvement in Dash-Pots, of which the following is a specification.

My improved dash-pot may be used for generating and arresting motions in connection with a detachable device in any mechanism, but is intended more particularly for generating and arresting the rapidly-recurring closing motions of the valves in Corliss steam-engines and analogous engines.

In common with most modern dash-pots I employ air as a medium acting on a piston connected to the valve both to aid the starting and to effect the arresting of each closing movement; but instead of using mainly the pressure of the ordinary atmosphere by inducing simply a vacuum under the piston to effect the first end—the closing—I cause the rise of the piston to compress air imprisoned above it at each rise. In commencing each of the closing motions of the valve the previous compression of the air above the piston serves in making the closing motion very active.

My improved dash-pot will serve under all conditions; but its advantages are more conspicuous on engines in which the load is greatly and rapidly varied, and the extent of opening of the valve, and consequently the rise of the piston, is correspondingly varied. In other words, my dash-pot will serve well with engines which are pumping water to supply cities or doing other work which is uniform, and it will serve almost equally well with engines which are driving rolls in iron-mills or driving circular saws treating large logs or other work in which the resistance changes rapidly from nothing to the full power of which the engine is capable and back again.

When a Corliss engine has nothing to drive but idle shafting, the valve-motion promptly adapts itself to the conditions by opening the steam-valve to only a small extent and releasing it. Under these conditions the piston in the dash-pot is lifted but a little distance and early allowed to close. When the full resistance is encountered by the engine and the valve is opened widely, the piston is correspondingly lifted high and released late. My device insures that it shall shut with substantially equal promptness and gentleness under each condition. I attain these important ends by means which will be fully set forth below and pointed out in the claims.

The following is a description of what I consider the best means of carrying out the invention.

The accompanying drawings form a part of this specification.

Figure 1 is a central vertical section showing the piston in its position of rest after it has been dropped and arrested. Fig. 2 is a corresponding section on a smaller scale, showing the piston at the point of release when the valve is opened but a little, so as to work the steam very expansively and to exert but little power; and Fig. 3 is a corresponding section on the same scale, showing the piston at the point of release when the valve is opened widely and released tardily, so as to develop nearly the full power of the engine.

Similar letters of reference indicate corresponding parts in all the figures where they appear.

A is a casting bolted to the cylinder or other fixed portion of the engine. (Not shown.) It is bored of two diameters, the bore a being larger than the upper portion a'. The lower end is closed by a removable base or head A'.

B is what I have termed a "piston," equipped with packing-rings, as indicated, and adapted to move air-tight in the corresponding bore a.

B' is what I will term the "piston-rod," made much thicker than usual, but correspondingly packed by external packing A^2 in the smaller bore a'. At the upper end of the rod B' is a spherical cavity b, which receives a corresponding spherical end on a link J, which connects the piston with the valve-arm. (Not shown.) The opening motion of the valve raises this link, with the piston-rod and piston, to a variable height, according as the valve is opened to a greater or less extent in making long or short "follows" of the steam.

C is a pipe leading from an aperture c at the top of the bore a laterally to a casing con-

taining a valve D, which is operated by a stem and a hand-wheel E E'. A pipe F leads from this valve D downward and thence inward, communicating with the interior of the bore *a* at *f* a little above the bottom.

In the operation of the piston some of the air imprisoned in the apparatus remains always at the top or bottom, insuring a quick commencement and a gentle termination of the descending motion of the piston. Another portion of the air imprisoned is transferred alternately upward and downward. The quantity thus transferred and the modification of the forces acting on the piston from such cause vary with the conditions, more air being transferred when the piston is raised high, working full power. Under any conditions all the air in the upper part of the bore *a* is more or less compressed at each rise of the piston, and a portion flows through the valve D downward and into the vacuum-space in the bottom of the dash-pot. When the valve is released, the piston descends, compressing the previously-attenuated air in the large space below the piston and expanding the previously-compressed air in the annular space above, limited as will be presently explained. This condition induces a flow of the air in the opposite direction from the first. The attendant adjusts the valve D until the passage shall be just sufficiently open.

There is no appreciable sound of any kind due to the passage of the air upward or downward, the passages and valves being all tightly inclosed. My experiments indicate that with the proportions shown it is easy after the engine has commenced to work at full speed and there have been a few changes in the load to so set the valve D that the descent of the piston will be promptly made without concussion, and the condition will be attained or very closely approximated of closing the valve with exactly the same promptness and arresting it with exactly the same gentleness whether it is released early or late.

When because of the lightness of the resistance temporarily encountered by the engine the cut-off (not shown) is adjusted to release the valve early and the piston B rises but a little way, the compression of the air in the space above it will be slight and the motion of the air downward through the valve D will be insignificant. Thus conditioned the valve will close by the gentle force impressed with due promptness, and the moderate velocity attained in the short descent will be extinguished at the bottom by the small quantity of air which has preceded it by flowing downward for the very brief time allowed through the valve D. If now the engine encounters a great resistance and the steam-power is called upon and used to a large extent, the piston rises nearly to the upper end of the large bore *a*, and the air in the space above the piston is greatly compressed, while the air in the larger space below is a nearly-perfect vacuum. Under these changed conditions enough air will flow downward through the valve D to materially increase the stock of air in the bottom. When the valve thus widely opened is liberated, the rapidly-diminishing but still strong pressure above and the decreasing but strong vacuum below will start the plunger downward, and consequently initiate the closing of the valve very rapidly; but as it approaches the lower end of its motion the large quantity of air below, due to the longer time and the stronger pressure of its downward flow through the valve D, will offer so strong a resistance that its higher velocity will be overcome, and, as before, it will stop without shock. In the last portion of the descending motion of the piston and during the brief period it remains at rest in its lowest position a flow of the air upward through the valve D will tend to induce the same conditions as at first; but it will not completely attain this without the separate provision for an additional flow of the air upward at each stroke, which will now be explained.

I provide a self-acting valve G, working in an independent passage H, extending up and down and communicating with the interior at the bottom and top of the large bore *a*. This gives an additional provision for the motion of the air upward. The closing of the valve G forbids any transfer of the air through this passage from the space above down to the space below; but the air may flow upward not only through the valve D, but also through the valve G. It results that while the flow of the air in either direction through the valve D is retarded the air can flow upward easily through this passage H. In other words, while the flow downward must be gradual, so that time is required for the transfer of the air, it is essential that the flow upward shall be more free. Hence the separate passage H and check-valve G are provided. Through the action of the valve G less obstruction (dependent on the amount of air passed down through the by-pass) is offered to the descent of the piston, and the normal density of the air above is quickly restored, and the succeeding lift, whether a short or a long one, is begun under identical conditions. The large piston-rod B', working in the corresponding bore *a'*, is important, because the area of cross-section of the piston-rod is always subject to the uniform pressure of the atmosphere, and having a large proportion of the area of the piston thus covered by the piston-rod, leaving the intense pressure due to the compressed air above the piston on the high lifts confined to the remaining annular space, gives the uniformity of action required. The proportions may be varied somewhat. As shown, the cross-section of the piston-rod B' is about one-half that of the ptston B. I have found these proportions to work well and to attain very closely the condition of

uniform shutting and uniform preparation for the next opening of the valve however the point of cut-off may vary.

In practice I supply oil liberally to the upper portion of the dash-pot, and it is transferred by gravity and by the frequently-recurring vacuum to the bottom. At each descent of the piston oil will usually be driven upward through the valve G and into the space above. I is a cock which may be opened at intervals to allow the discharge of any excess of oil.

It will be noted that with this construction the constant pressure of the atmosphere on the circular area of the large piston-rod B′ is not increased as the lift of the piston is increased; but the pressure on the annular surface of the piston B exterior thereto is very markedly increased when much power is called for and the piston of my dash-pot is raised higher.

Modifications may be made without departing from the principle or sacrificing the advantages of the invention. The packing may be variously arranged both for the large piston-rod B′ and for the piston B. I can vary the proportions of the valves D and G. Usually the cock I may be considerably smaller than shown.

The piston B and rod B′ are both shown as hollow. I prefer to make them so; but the metal of each can be made thicker. The mass of the piston and rod has an important influence. For quick-running engines it is important to make these parts light.

The proportions of the small bore a' to the larger bore a may be varied, taking care, of course, to correspondingly modify the piston and rod; but such changes will modify the effect. So, also, the proportions of the passage H, controlled by the check-valve G, to the passage F, controlled by the stop-valve D, may be varied. I prefer the proportions shown.

It will be seen that the cock I may also be manipulated with the piston partially raised to modify the quantity of air inclosed in the dash-pot and the consequent tension of the air whenever desired.

I attach importance to the fact that my passage C connects at the extreme top of the large cylinder a, because it allows the compression of the air in the annular space above the piston to follow the same law throughout the whole rising and sinking of the piston whether the piston be raised to its utmost height or when it is only partly raised. A large proportion of the work of a Corliss or similar engine is done with less than its full possible power, and therefore with less than the full lifting of the piston of the dash-pot. According as my valve D is set the transfer of part of the air downward and the compression of the remainder above the piston B is graduated, increasing as the rise of said piston is made greater, but always having the limited freedom to flow downward past the valve D. In short, there is no possibility for my piston B to rise above the passage c and become subject to a different law by positively imprisoning air above it. I provide for such positive imprisoning of the air below in the last part of its descent, but never above.

I claim as my invention—

1. In a dash-pot adapted for the use of an elastic fluid, a piston B and cylinder a with a passage connecting points near the top and bottom of such cylinder, arranged to cause the fluid above the piston to be compressed with uniformly-increasing force as the piston is raised, and provisions D for varying the area of the connecting-passage and thereby allowing the variably-retarded transfer of such air during the whole of the upper portion of the movement under all conditions, substantially as herein specified.

2. In a dash-pot the cylinder bored as shown, and a corresponding piston B and large piston-rod B′ with provisions for working the same air alternately above and below the larger part of such piston, and provisions D for varying the area of the connecting-passage and thereby allowing the variably-retarded transfer of such air during the whole of the upper portion of the movement under all conditions, substantially as herein specified.

3. In a dash-pot a piston and cylinder with provisions for working the same air alternately above and below the piston and provisions for variably checking the transfer of the air downward and a separate passage and self-acting valve therein for allowing it to be more easily transferred upward, all substantially as herein specified.

4. In a dash-pot having a cylinder, a piston and a large piston-rod providing an annular space above and a larger cylindrical space below, the passage C F connecting the upper space with a point above the bottom of the lower space so that the piston will not only be urged downward by the plenum above and the vacuum below with varying force as required, but also that the air will be positively imprisoned under the piston near the end of the movement and more rapidly cushion it, all substantially as herein specified.

5. In a dash-pot having a cylinder, a piston and a large piston-rod providing an annular space above and a larger cylindrical space below, the passage C F connecting such spaces, and a valve D for adjusting the size of such passage, in combination with a separate passage H, and a check-valve G therein, arranged to deliver air or oil or both upward but forbid its descent, all substantially as herein specified.

6. In a dash-pot having a cylinder, a piston and large piston-rod providing an annular space above and a larger cylindrical space below, the passage C F connecting the upper space with a point so much above the bottom of the lower space that the piston will not only be urged downward by vacuum with va-

rying force as required, but also that the air will be imprisoned and more rapidly cushion the motion at the end of the movement, in combination with the check-valve G and passage H arranged to deliver air or oil or both upward but forbid its descent, all substantially as herein specified.

In testimony that I claim the invention above set forth I affix my signature in presence of two witnesses.

MATTHEW ROBERT MOORE.

Witnesses:
F. H. YOUNT,
E. P. DILLMAN.