F. A. BARTRAM.

PISTON VALVE.

APPLICATION FILED APR. 24, 1912.

1,046,944. Patented Dec. 10, 1912.

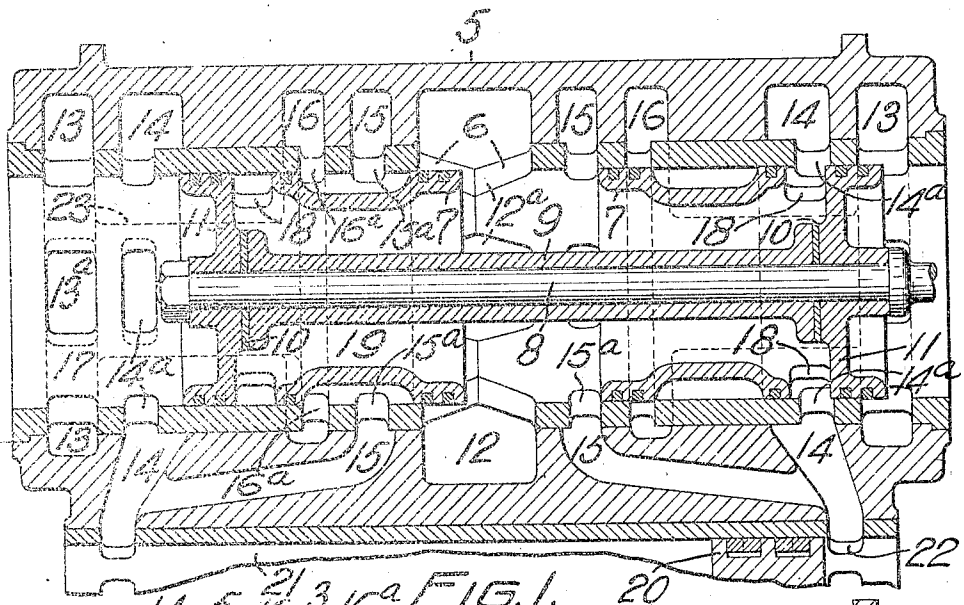

FIG. 1.

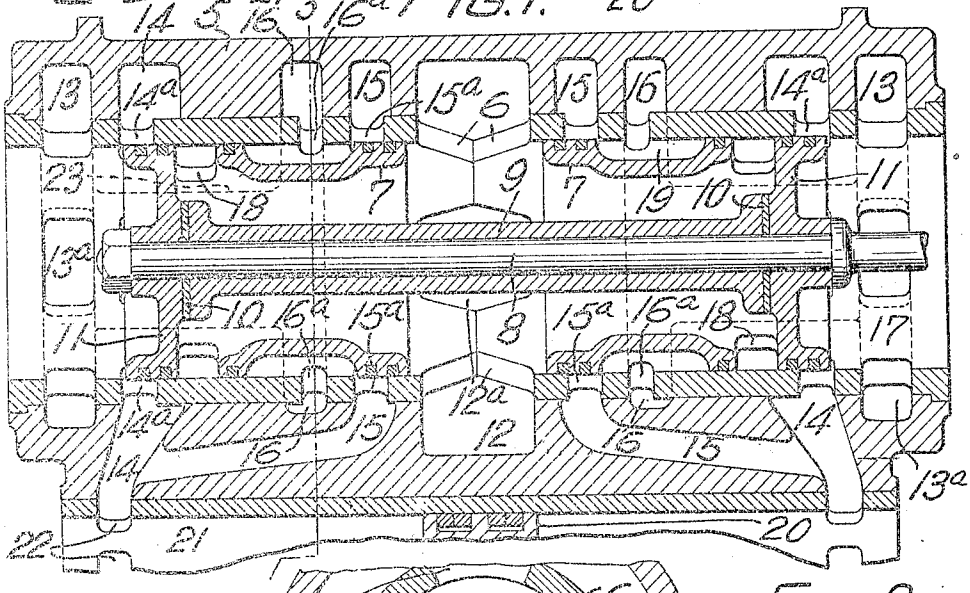

FIG. 2.

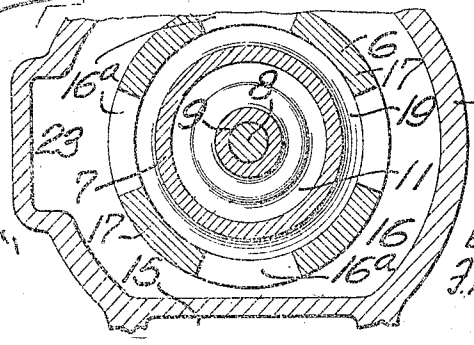

FIG. 3.

Witnesses

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UNITED STATES PATENT OFFICE.

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PISTON-VALVE.

1,046,944. Specification of Letters Patent. Patented Dec. 10, 1912.

Application filed April 24, 1912. Serial No. 693,863.

To all whom it may concern:

Be it known that I, FREDERICK A. BANTRAM, of the city of Montreal, in the Province of Quebec and Dominion of Canada, have invented new and useful Improvements in Piston-Valves, of which the following is a full, clear, and exact description.

This invention relates to improvements in piston valves, and the object is to provide a valve which will admit practically the maximum flow of steam to the engine cylinder from the very beginning of the stroke.

A further object is to provide a valve so arranged that an auxiliary outlet will be provided for the first part of the exhaust fluid.

Heretofore, the great difficulty with all classes of valves, and more particularly with piston and slide valves, has been that the full force of the steam could not be applied to the piston at the moment that it starts upon the return stroke, so that for a certain distance the piston was moved almost entirely by the inertia of the engine. This fact was due to two causes; first, the necessary restriction of the valve lead to prevent back pressure, and second, the gradual uncovering of the ports as the valve travels, so that at the point where steam is admitted the amount admitted is comparatively very small. In the same way when the ports are uncovered to exhaust the steam, the opening is at its least when the steam pressure is greatest, so that the exhaust of the steam is considerably retarded. In this invention, auxiliary ports are provided which are uncovered simultaneously with the main ports, so that twice the usual port opening is obtained at the commencement of the initial exhaust. The economy of this will be apparent as it will enable the full pressure of steam to be exerted on the piston on that point of its travel where the greatest pressure is required to produce motion. This auxiliary steam passage is connected to an auxiliary exhaust passage by the valve, so that the port area at the commencement of the exhaust is also doubled.

In the drawings:—Figure 1 is a vertical sectional view of a valve constructed according to this invention, the pistons being shown at full stroke. Fig. 2 is a similar view showing the pistons at mid stroke. Fig. 3 is a cross sectional view on the line 3—3 of Fig. 2.

Referring more particularly to the drawings, which show a type of piston valve particularly adapted for use in connection with locomotives, 5 designates the cylinder having the various inlet and exhaust passages cast therein in the usual manner. This cylinder is provided with a lining or bushing 6, which is formed in two similar parts inserted from opposite ends of the cylinder. The ports for the admission and exhaust of the steam are accurately cut in this bushing. Sliding within the bushing are a pair of pistons 7 which are mounted upon a common valve rod 8, and are spaced apart by a sleeve 9 which surrounds the valve rod. Suitable liners 10 are inserted between the pistons and the ends of the sleeve, in order that relative adjustments may be made between the two pistons and the ports of the bushing without altering the stroke or set of the valve. The outer ends of the pistons are closed by walls 11, as is clearly seen in the drawings, so that the whole interior of each piston is in free communication with the interior of the bushing. The steam inlet 12 is at the exact center of the cylinder and the exhaust outlets 13 are at the extreme ends of the cylinder. Next to the exhaust passages are the main steam passages 14, while on each side of the steam inlet valve are the mouths of the auxiliary steam passages 15. The auxiliary exhaust passages 16 are located intermediate the main and auxiliary steam passages and quite close to the auxiliary steam passages. These passages are formed in the cylinder 5 completely around the bushing 6, and are brought into communication with the interior of the bushing by means of ports 12^a, 13^a, 14^a, 15^a and 16^a respectively, which are formed at intervals entirely around the circumference of the bushing, these ports being separated by the usual bridges 17.

Immediately within the head 11 thereof, each piston is provided with a series of ports

18, which are so located as to uncover the main steam ports 14ª at the same time that the inner ends of the pistons uncover the auxiliary ports 15ª, as will be clearly seen from an inspection of the right hand end of Fig. 1. Each piston is provided intermediate the ports 18 and the inner edges thereof with a shallow and comparatively wide groove forming a circumferential port 19, the width of this groove being sufficient to connect the auxiliary steam ports 15ª and auxiliary exhaust ports 16ª during a predetermined portion of the stroke, as will be clearly seen from the left hand end of Fig. 1.

The pistons are so arranged with respect to the ports of the bushing that when the engine piston 20 is at the end of its stroke and ready for the return stroke, both the auxiliary and main steam passages will be open to permit flow of steam in front of the piston, and at the same time both the auxiliary and main exhaust ports will be uncovered at the opposite end of the valve. The flow of live steam from the inlet passage 12 is through the ports 12ª into the bushing, where the entire space between the two piston heads 11 is filled. When the valve is in the position shown in Fig. 1, the steam escapes through the ports 15ª, which are uncovered by the inner end of the piston to the auxiliary passage 15. The flow is also through the body of the piston and through the ports 18 therein, which are in register with the ports 14ª. As will be clearly seen from the drawings, the passage 15 discharges into the passage 14 a short distance outside of the engine cylinder 21. The steam rushing through these two passages mingles and is discharged through the engine cylinder ports 22 in a greater volume than would be the case if a single port were used. In the opposite end of the cylinder, the exhaust passes through the passages 14 and 15. The ports 14ª are uncovered by the valve piston and the exhaust steam is therefore free to flow out through the ports 13ª. The passage 19 formed in the valve piston connects the ports 15ª and 16ª, so that exhaust steam passes from the passage 15 into the auxiliary exhaust passage 16, from which it is discharged through the passage 23 formed in the body of the cylinder 5 into the main exhaust passage 13.

From the foregoing description, it will be easily understood that since two ports which are each preferably designed to permit the maximum steam flow are opened simultaneously for both inlet and exhaust steam, that the open port area will be just double the usual opening, so that a greater volume of steam will enter the engine cylinder at the commencement of the stroke. The arrangement of the steam passages provides for the injection of the steam into the cylinder at great pressure, and at the same time allows for the expansion of exhaust steam, which travels through the same passages in the opposite direction so that considerable economy is effected.

Having thus described my invention, what I claim is:—

1. In a piston valve, a live steam main port leading from the valve chamber to the engine cylinder at one extremity of the valve chamber, an auxiliary live steam port leading from near the center of the valve chamber into the main steam port at the end of the valve chamber, a main exhaust port beyond the main steam port, an auxiliary exhaust port intermediate the main and auxiliary steam ports, and a valve piston having a passage formed therein connecting the auxiliary steam and exhaust ports at the same time that the body of the piston uncovers the main steam and exhaust ports, and a passage connecting the auxiliary and main exhaust ports.

2. In a piston valve, a chamber, a plurality of pistons having a reduced portion intermediate their extremities, said pistons reciprocating in said chamber, primary inlet and exhaust ports at each extremity of the chamber, auxiliary inlet and exhaust ports intermediate said primary inlet and exhaust ports, the auxiliary exhaust ports communicating with the primary exhaust ports by passing around the reduced portion of the cylinders, and the auxiliary inlet ports communicating with the primary inlet ports through a passage in the wall of the chamber.

3. In combination with an engine cylinder, a piston valve comprising a chamber, a plurality of hollow pistons having an intermediate reduced portion reciprocating in said chamber, primary exhaust and inlet ports at each extremity of the chamber and communicating with the engine's cylinder, auxiliary exhaust and inlet ports intermediate the primary exhaust and inlet ports, said auxiliary exhaust ports communicating with the primary exhaust ports through the medium of the reduced portion of the pistons, and a passage in the wall of the chamber, and the auxiliary inlet communicating with the primary inlet port by means of a passage through the wall of the chamber.

4. In combination with an engine cylinder, a piston valve comprising a chamber, a plurality of open ended pistons provided with steam ports reciprocating in said chamber and each provided with a reduced portion, a main steam supply located centrally of said chamber and discharging into the open end of each of said open ended pistons, a primary and auxiliary port at each extremity of the chamber, said ports adapted to act alternately as supply and

exhaust ports, the auxiliary ports communicating with the interior of the pistons when supplying steam to the engine cylinder, and communicating with the reduced portion of the piston when exhausting steam therefrom, and said primary ports communicating with the interior of the pistons when supplying steam to the engine cylinder, and discharging directly into the exhaust port of the chamber when exhausting steam from the engine cylinder.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

FREDERICK A. BARTRAM.

Witnesses:
STUART R. W. ALLEN,
G. M. MORELAND.