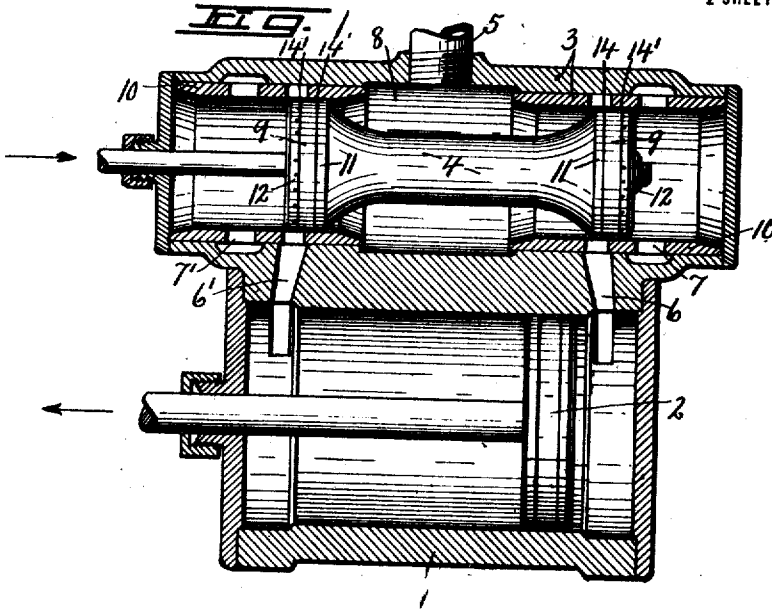
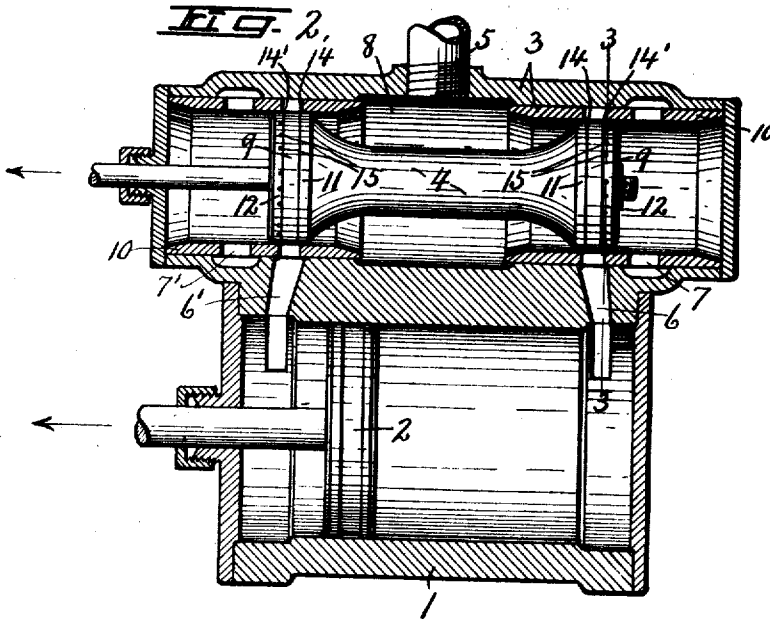


J. M. KERN.
PISTON VALVE.
APPLICATION FILED OCT. 8, 1915.

1,204,666

Patented Nov. 14, 1916.
2 SHEETS—SHEET 1.



WITNESSES:

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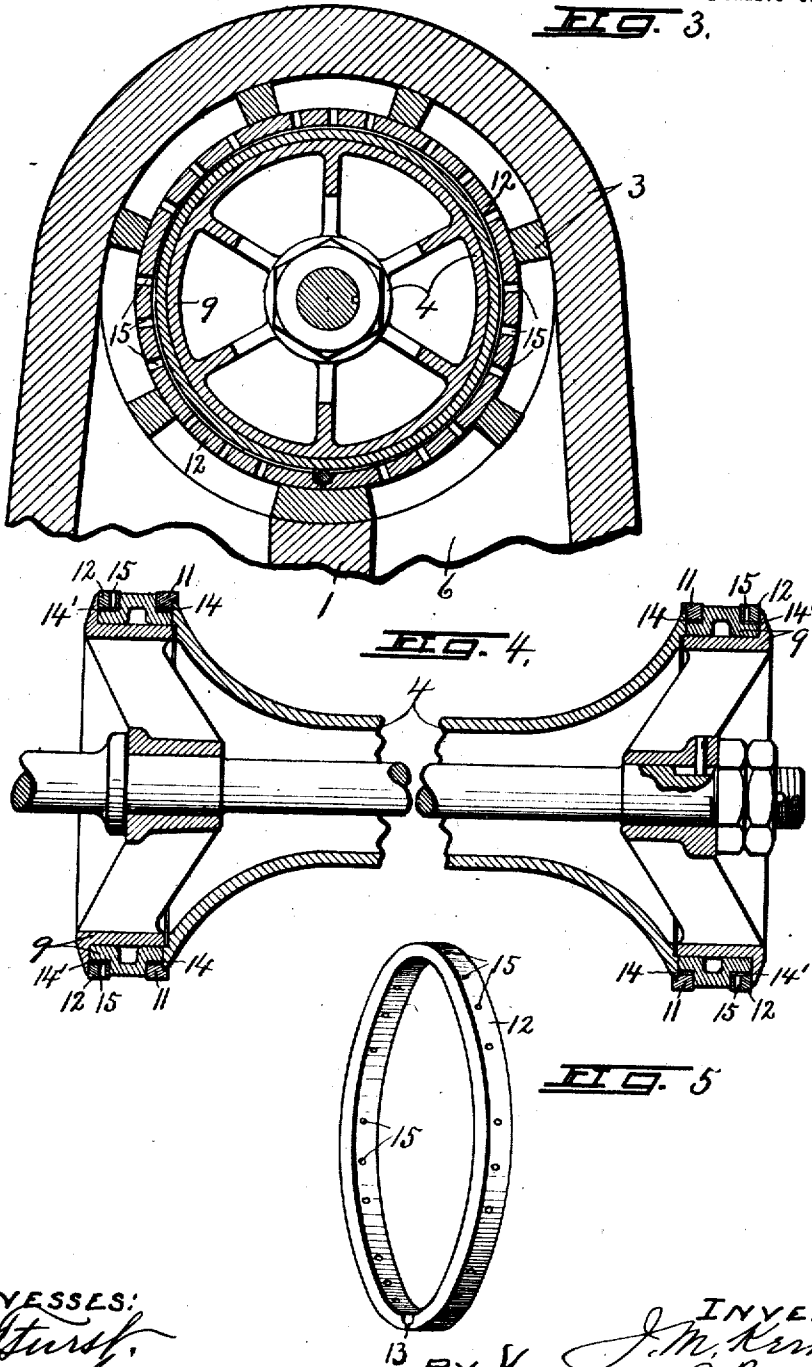
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2 SHEETS—SHEET 2.



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JOSEPH M. KERN, OF OSWEGO, NEW YORK.

PISTON-VALVE.

1,204,666.

Specification of Letters Patent.

Patented Nov. 14, 1916.

Application filed October 8, 1915. Serial No. 54,724.

To all whom it may concern:

Be it known that I, JOSEPH M. KERN, a citizen of the United States of America, and resident of Oswego, in the county of Oswego, in the State of New York, have invented new and useful Improvements in Piston-Valves, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

This invention relates to certain improvements in piston valves of the double packing-ring type, commonly used in locomotives for controlling the inlet and exhaust steam to and from the cylinder of the engine. These pistons are usually provided with opposite cylindrical end heads fitted with an easy sliding fit in the cylindrical sleeves of the valve chamber, the central portion of the valve being of less diameter than the end heads to allow a free entrance of the steam into the receiving chamber of the valve case, while the end heads control the inlet and exhaust ports leading to and from opposite ends of the cylinder, each head being provided with a pair of split packing rings which are expansible under their own tension to maintain reasonably tight joints between the piston heads and guide sleeves in which they are movable, thereby assuring a more perfect cut-off, and conserving the steam energy. One of the advantages of this type of valve is that it is automatically balanced by the steam pressure surrounding the central portion thereof so that the only appreciable friction is that produced by the expansive force of the packing rings, and in order that the valve may work with perfect freedom and with a minimum degree of friction and incidental wear, it is desirable that the outward pressure of the rings shall be just sufficient to maintain a steam-tight joint and no more. These packing rings are usually seated in separate annular grooves in the heads of the piston and must, therefore have sufficient play to permit free expansive movement under their own tension in order to be effective, the inner rings of each set adjacent the steam-receiving chamber being commonly known as "steam rings," while the outer rings nearest the exhaust chamber are commonly known as "exhaust rings." With this slight clearance of the rings in their respective grooves for freedom of movement, it is evident that more or less

of the steam, depending upon pressure, will find its way through the joints between the packing rings and valve heads tending to equalize the pressure both at the inner side and outer side of the rings and allowing said rings to exert their inherent pressure against the inner walls of the valve chamber or sleeves in which the valve heads are movable. This is particularly true of the inner or "steam rings" when they are registered with the ports leading to the steam chest or cylinder of the engine, because the steam pressure is then exerted against both sides of the "steam rings," tending to balance them, it being understood that the "steam rings" are never exposed to atmospheric pressure, but are always under the pressure of the live steam in the valve chamber or in both the valve chamber and cylinder. On the other hand, the outer or "exhaust rings" are always exposed on the outer side to the relatively low atmospheric pressure, while their inner sides are exposed to the higher steam pressure from the cylinder. This inequality of steam pressure on the "exhaust rings" tends to cause them to bind and excessively wear the shoulders at the outer sides of the corresponding grooves, which not only interferes with the free operation of these rings, but soon causes excessive leakage of the exhaust before the valve is sufficiently shifted to uncover the port leading to the cylinder. In addition to these objectionable features, another and more serious objection is that when either "exhaust ring" registers with its port, it is subjected to a crushing or compression stress equal to the pressure of the steam in the cylinder so that if the engine is running under full steam and the inherent expansive force of the ring is normal, the compression stress of the steam upon the ring would exhaust its expansive force to a degree depending upon the space between the meeting ends of the ring at the point of division, or the space between the ring and the bottom of the groove in which it is seated, thus causing the premature discharge of the exhaust, commonly known as the "blow," which is further aggravated by the wear of the "exhaust ring" incidental to the inequalities of pressure at opposite ends thereof.

The main object, therefore, of my present invention is to obviate the premature exhaust or "blow" of the steam at the instant

the "exhaust ring" begins to register with and while it is moving across the exhaust port, and at the same time to reduce to a minimum the outward end thrust of the "exhaust ring" due to the relatively high pressure at the steam end and the low pressure at the exhaust end of such ring, thereby protecting the annular shoulders at the exhaust ends of said rings against excessive wear and further reducing the liability of premature exhaust or "blow."

Other objects and uses will be brought out in the following description.

In the drawings Figures 1 and 2 are similar sectional views of an engine cylinder and valve case showing the valve in different positions. Fig. 3 is an enlarged transverse sectional view through the valve case and valve taken in the plane of line 3—3, Fig. 2. Fig. 4 is an enlarged longitudinal sectional view, partly broken away, of the detached valve. Fig. 5 is a perspective view of one of the "exhaust rings."

In order that my invention may be clearly understood, I have shown a portion of a locomotive cylinder —1— and a piston —2— movable therein, in combination with a valve case —3— and a piston valve —4— movable in the valve case. This valve case is provided with a steam inlet —5— adapted to be connected to any available source of steam supply and is connected to opposite ends of the cylinder by the usual ports —6— and —6'—, said valve case being also provided with the usual exhaust ports —7— and —7'—.

The steam inlet —5— communicates with a receiving chamber —8— which surrounds the reduced central portion of the valve —4— for the purpose of balancing the same, said valve being provided with enlarged cylindrical end heads —9— fitted with an easy sliding fit in suitable sleeves —10— in the adjacent ends of the valve case —3—.

Each head of the valve is provided with separate annular grooves for receiving suitable packing rings —11— and —12— which are divided through one side at —13— and are tensioned to expand against the walls of the adjacent sleeves —10— with sufficient pressure to produce substantially steam-tight joints, the periphery of the heads of the valve being of just sufficiently less diameter than that of the bore in their respective sleeves —10— to prevent friction therewith and allow the packing rings to perform their full function in preventing the passage of steam around the heads.

The inner packing rings commonly known as "steam rings" are L-shape in cross-section with their narrower portions seated with an easy sliding fit in the grooves as —14— and their outer wider portions overhanging the portions of the valve heads at the inner sides of said grooves, one object of which is to

enable the rings to automatically balance under the steam pressure in the chamber —8— by impinging against the inner face as well as the outer face of the overhanging portions of the rings.

The outer or "exhaust rings" to which my invention is more particularly directed are substantially rectangular in cross section and are fitted with an easy sliding fit in their respective grooves as —14— in the heads —9— and are provided near their inner edges with a circumferential series of relatively small radial openings —15—, the purpose of which is to allow the steam from the cylinder to pass through said radial openings to the interior of the ring, but at the same time that it impinges against the periphery thereof so as to balance said rings and allow them to expand against the inner faces of their respective sleeves —10— under their own tension, thereby reducing the friction to a minimum, and at the same time effecting a steam-tight joint to prevent premature escape or "blow" from the cylinder at the instant the valve is shifted to bring the inner face of the "exhaust ring" into registration with the adjacent port —6— or —6'—, this balancing effect being continued as long as any portion of either "exhaust ring" is registered with the adjacent port —6— or —6'—. This particular arrangement of the circumferential series of apertures close to, but yet slightly removed from the inner edges of the "exhaust rings," is very important, in that it allows the steam to enter the interior of the ring from the cylinders at about the same instant that the inner edge of the "exhaust rings" is registered with the corresponding ports, thereby establishing a balance of pressure inside and outside of the ring at about the same instant that it begins to register with the port during its shifting movement in opening said port to allow the exhaust of the steam from the cylinder in advance of the moving piston —2—. For example, assuming that the piston is in the position at the left-hand of the cylinder, as shown in Fig. 2, and is about to begin its stroke toward the opposite end of the cylinder, at which time the valve —4— will have been adjusted to bring the inner end of the right-hand "exhaust ring" —12— into registration with the adjacent port —6— so that the steam in the cylinder —1— in advance of the piston instead of compressing the ring against its own tension, and thereby allowing the steam to escape to the exhaust around the periphery thereof, will enter the openings —15— and thus establish a balance of pressure inside and outside of the ring and allow the latter to expand against the inner walls of the sleeve —10— for effectively preventing the escape of the steam. This balance of pressure will be maintained as long as any

portion of the "exhaust ring" is in registration with the adjacent port and will, therefore, allow the ring to expand freely against the inner walls of the corresponding sleeve —10— to prevent premature escape or "blow" of the steam from the cylinder around the ring to the exhaust. By balancing these "exhaust rings" in the manner described, they are permitted to remain in substantially the same expanded position against the walls of the valve chamber, thereby avoiding the intermittent inward and outward movement under varying pressures, as would be the case if there were no perforations in the rings, or if the perforations were located farther from the inner edges thereof, since it is evident that if the inner ends of the rings were solid or imperforate, the registration of such solid portions with the ports —6— or —6'— would allow the expansive force of the steam within the cylinder —1— to compress such rings and cause more or less leakage or "blow" around the peripheries thereof. This intermittent expansion and contraction of the rings would necessarily produce more or less wear of the end walls of the grooves in which they are located and would soon result in excessive leakage of the steam through the joints, but by perforation the rings close to the inner edges thereof in the manner described and thereby balancing said rings at all times while registered with their respective ports, this excessive wear and incidental leakage is obviated and the highest working efficiency of the valve is, therefore, maintained for a much greater period of time.

What I claim is:

1. The combination with a steam-engine cylinder having ports in one side, and a piston movable in said cylinder between said ports, of a valve case having ports registering with those in the cylinder, and a piston valve having opposite end heads controlling said ports, each valve-head having an imperforate division ring provided with reduced ends forming annular grooves, imper-

forate "steam-rings" seated in the inner end grooves, and exhaust rings seated in the outer end grooves and provided with radial apertures therethrough close to the inner sides of their respective grooves.

2. A piston valve for steam engines comprising a main body, separate division rings mounted on opposite ends of the main body, each division ring having its opposite ends reduced in diameter to form annular grooves, imperforate "steam-rings" seated in the inner end grooves, and separate "exhaust-rings" seated in the outer end grooves and provided with openings therethrough in close juxtaposition to the inner ends of their respective grooves and their remaining portions imperforate.

3. The combination with a steam-engine cylinder having ports in one side, and a piston movable in said cylinder between said ports, of a valve case having ports registering with those in the cylinder, and a piston valve having opposite end heads controlling said ports, each valve-head having an imperforate division ring provided with reduced ends forming annular grooves, imperforate "steam-rings" seated in the inner end grooves, and exhaust rings seated in the outer end grooves and provided with radial apertures therethrough close to the inner sides of their respective grooves, the distance between the apertured portions of the exhaust rings being about equal to the distance between the outer ends of the ports with which they are adapted to register so that the apertures of each exhaust ring will begin to register with its port at about the same time that the apertures in the other exhaust ring have moved out of registration with the corresponding port.

In witness whereof I have hereunto set my hand this 25th day of September, 1915.

JOSEPH M. KERN.

Witnesses:

H. E. CHASE.

ALICE M. CANNON.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."