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PISTON.

No. 588,256. Patented Aug. 17, 1897.

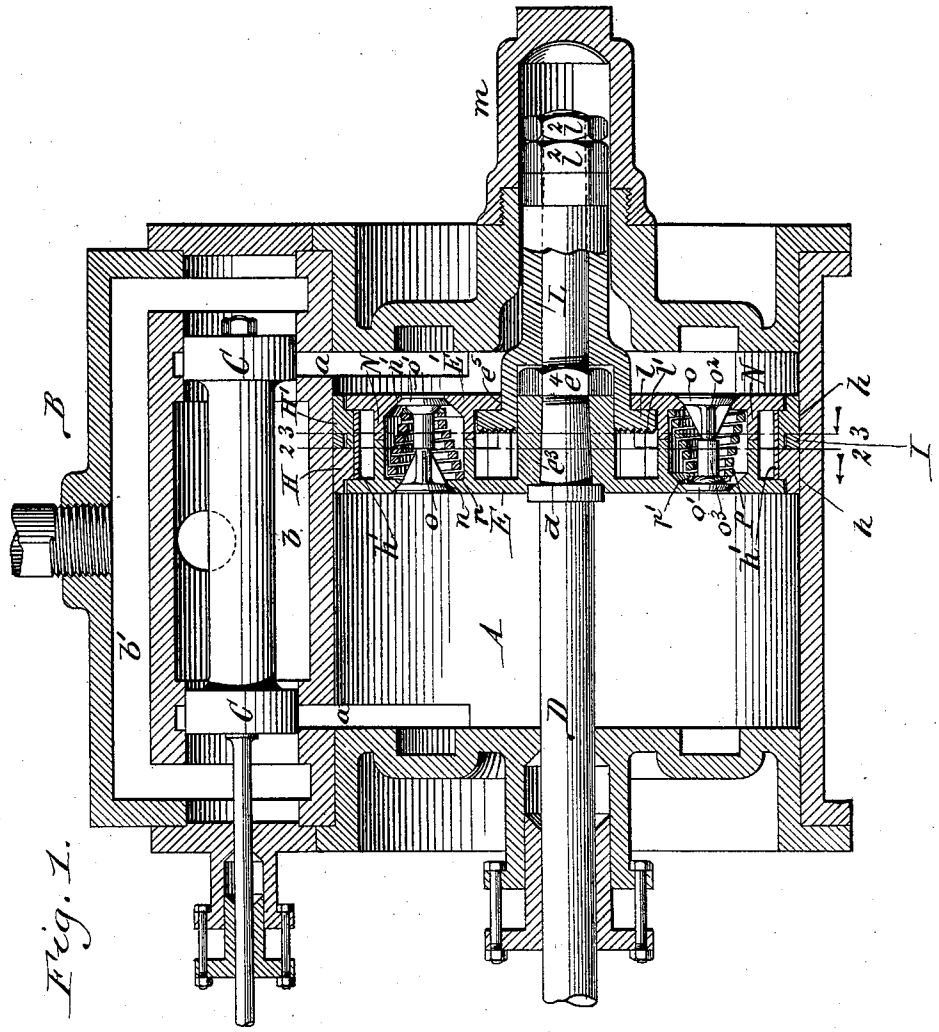


Fig. 1.

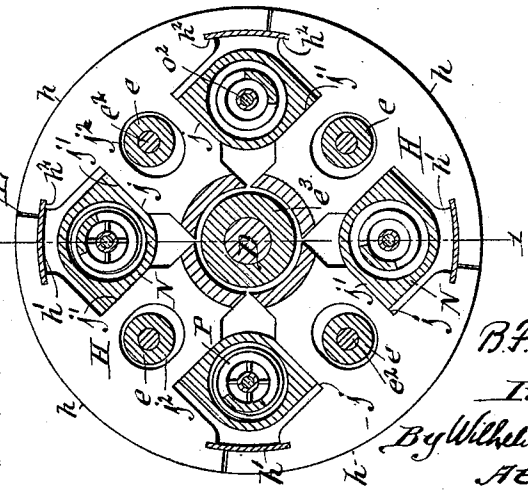


Fig. 2.

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Fig. 6.

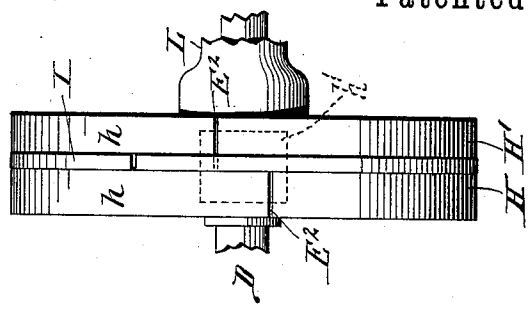


Fig. 5.

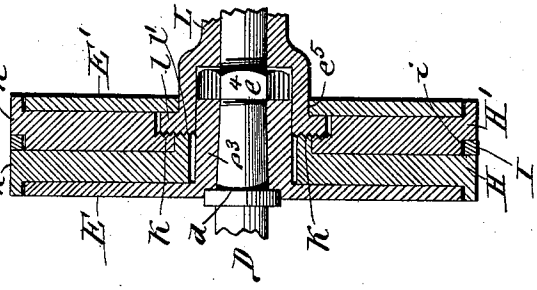


Fig. 7.

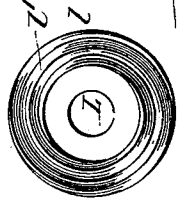


Fig. 4.

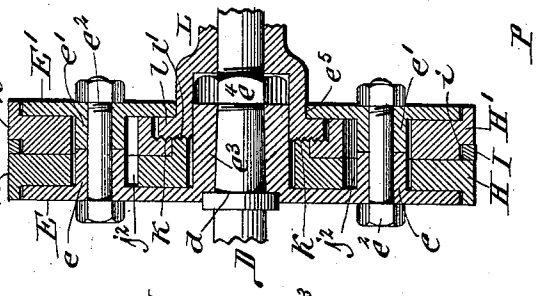


Fig. 3.

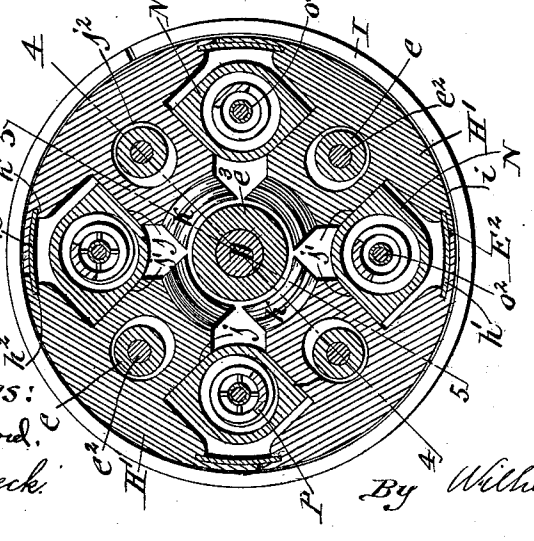


Fig. 9.

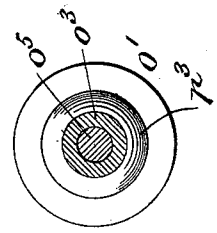
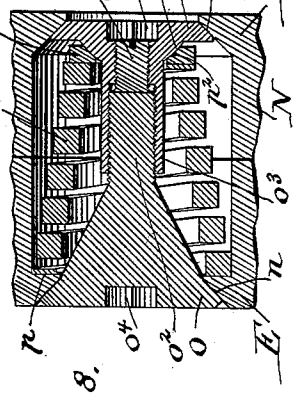


Fig. 8.



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Fig. 13.

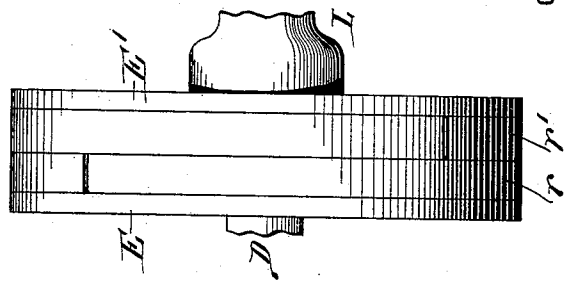


Fig. 12.

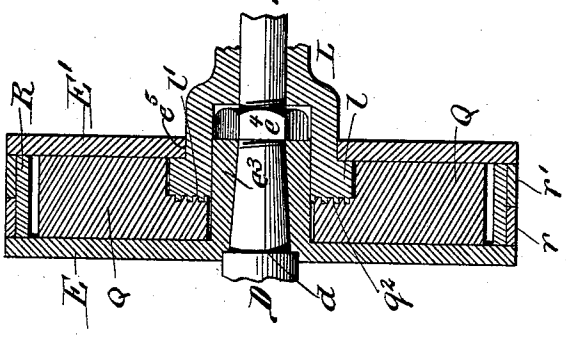


Fig. 11.

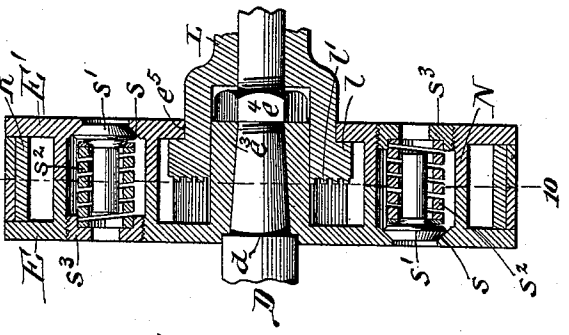
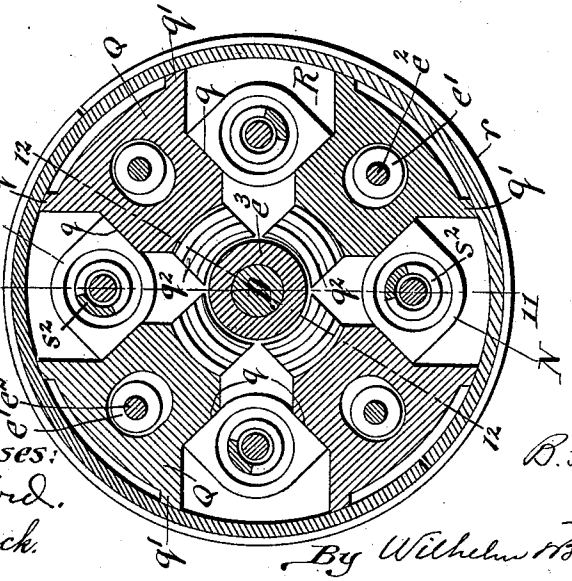


Fig. 10.



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UNITED STATES PATENT OFFICE.

BENJAMIN F. WILSON, OF NORTH TONAWANDA, NEW YORK.

PISTON.

SPECIFICATION forming part of Letters Patent No. 588,256, dated August 17, 1897.

Application filed November 18, 1896. Serial No. 612,543. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN F. WILSON, a citizen of the United States, residing at North Tonawanda, in the county of Niagara and State of New York, have invented a new and useful Improvement in Pistons for Steam and other Engines, of which the following is a specification.

This invention relates to a piston for steam and other engines, and has for its objects to provide simple and reliable means for adjusting the piston to the working cylinder and to provide the piston with relief-valves, whereby the water which may be caught in the cylinder on one side of the piston is permitted to pass through the piston to the opposite side thereof for the purpose of avoiding injury to the engine.

In the accompanying drawings, consisting of three sheets, Figure 1 is a longitudinal sectional elevation of a steam-engine cylinder and connecting parts provided with my improved piston, the section of the piston being taken in line 1 1, Fig. 2. Figs. 2 and 3 are diametrical sections of the piston in lines 2 2 and 3 3, Fig. 1, respectively. Figs. 4 and 5 are axial sections thereof in lines 4 4 and 5 5, Fig. 3, respectively. Fig. 6 is an edge view of my improved piston. Fig. 7 is an end view of the adjusting-sleeve. Fig. 8 is a fragmentary section, on an enlarged scale, of one of the relief-valves in the piston. Fig. 9 is a sectional elevation of one of the relief-valves. Fig. 10 is a diametrical section showing a modification of the means for adjusting the piston and of the relief-valves. Figs. 11 and 12 are axial sections of the same in lines 11 11 and 12 12, Fig. 10, respectively. Fig. 13 is an edge view thereof.

Like letters of reference refer to like parts in the several figures.

A represents the working cylinder, provided with steam-ports *a a*; B, the steam-chest, provided with a steam-chamber *b* and an exhaust-chamber *b'*, and C the valves whereby the steam-ports are alternately connected with the steam-chamber and exhaust-chamber.

D represents the piston-rod, which is provided within the cylinder with a collar or shoulder *d*. The piston, mounted on the piston-rod within the cylinder, is capable of being adjusted to fit the cylinder and to take up wear and is constructed as follows:

E E' represent two supporting-disks arranged side by side around the inner end of the piston-rod and separated from each other, so as to form an intervening space. The supporting-disks are held apart a definite distance by means of opposing bosses *e e'*, formed, respectively, on the inner sides of the disks. Each of these disks is preferably provided with four equidistant bosses, and the disks are rigidly secured together by bolts e^2, passing through these bosses. One of the supporting-disks E is provided with a hub e^3, which is mounted on the piston-rod and held with one end against the shoulder *d* of the piston-rod by a screw-nut e^4, arranged on a screw-threaded portion of the piston-rod and bearing against the other end of the hub. The other supporting-disk E' is provided with a central opening e^5, the edge of which is separated from the adjacent hub of the other disk by an annular space.

H H' represent two annular sets of radially-movable ring or piston sections which are arranged between the supporting-disks, the outer enlarged portions of the sections being provided with segmental faces *h*, which together form the peripheral face of the piston. These sections consist, preferably, of four pairs, each pair being composed of one section of each set and the sections of each pair fitting with their inner sides against each other and with their outer sides against the inner sides of the supporting-disks, as represented in Fig. 5.

In order to prevent leakage of steam through the piston at the joints between the sections, the divisions, slits, or spaces E^2 between one set of sections and the other set of sections are arranged out of line with each other, and the inner ends of these spaces are covered between the supporting-disks by curved packing or cover plates *h'*. Each of these plates extends transversely from the inner side of one supporting-disk to the inner side of the other supporting-disk and is of such length that it covers those portions of two adjacent divisions or slits which open into the space between the supporting-disks. Each packing-plate is held in position by means of notches or seats h^2, which are formed in the

opposing ends of the piston-sections and with which the ends of the packing-plates engage, as represented in Figs. 2 and 3. These seats are of sufficient depth to properly support the packing-plates and permit the requisite expansion and contraction of the piston-sections for adjusting the piston to the cylinder. The outer portions of the piston-sections preferably overhang the peripheries of the supporting-disks, so as to increase their bearing-surface, as shown in Figs. 4 and 5.

I represents a split packing-ring whereby a tight fit is produced between the piston and working cylinder and any slight wear is taken up automatically in the usual manner. This ring is arranged between the marginal portion of the two sets of piston-sections and is preferably seated in an annular groove *i* in the inner side of one of the sets of piston-sections, as shown in Figs. 1, 4, and 5.

The inner portions of the piston-sections are contracted and provided with straight sides or guide-faces *j*. The guide-faces of each pair of piston-sections engage with radial ways *j'*, which are formed on the supporting-disks and whereby the piston-sections are guided in their radial movement.

The piston-sections are provided with radial slots j^2, through which the connecting bosses and bolts of the supporting-disks pass. Each of the piston-sections is provided at its inner end with a spirally-threaded portion *k*, the threaded portions of the several sections being arranged radially in line and forming together a continued spiral thread.

L represents an adjusting-sleeve whereby the piston-sections are moved outward for adjusting the same to the cylinder and for taking up wear of the sections and which is mounted loosely on the inner end of the piston-rod. One end of the adjusting-sleeve projects through the annular space between the supporting-disk E and the hub of the supporting-disk E' and is provided within the space between the supporting-disks with an annular flange *l*. This flange bears with one side against the supporting-disk E' and is provided on its opposite side with a spiral thread *l'*, which engages with the threaded portions of the piston-sections, as shown in Figs. 1 and 4. Upon turning the adjusting-sleeve in the proper direction the piston-sections are moved radially outward between the supporting-disks by the action of its spiral thread *l'* against the threaded portions of the piston-sections. The position of the spiral thread on the adjusting-sleeve never changes radially, but the position of the threads on the piston-sections is shifted radially with reference to the thread of the sleeve upon adjusting the sections, thereby causing the threads of the sections to engage with the sleeve-thread at a greater or less distance from the center, so that the arcs of the sleeve-thread with which the threads of the piston-sections engage vary in radii.

In order to prevent the threads of the piston-sections from binding on the thread of the sleeve while the former shift their position radially with reference to the latter, the interlocking threads of the sleeve and the piston-sections are fitted sufficiently loose to compensate for the variation in the arcs of the threads of the adjusting-sleeve and the piston-sections.

l^2 are jam-nuts arranged on the screw-threaded inner end of the piston-rod and adapted to bear against the end of the adjusting-sleeve for holding the same in position after the piston-sections have been adjusted.

In order to permit the piston-sections to be easily adjusted to the cylinder without removing an entire head, the rear head of the cylinder is provided with an opening through which the outer end of the adjusting-sleeve projects when in its rearmost position, thereby enabling the sleeve to be turned from the outside for taking up wear on the piston-sections. This opening is closed by a screw-cap *m* when the engine is in operation. In this construction of my improved piston the principal wear is upon the faces of the piston-sections, and when the faces become worn considerably they must be renewed.

For the purpose of preventing the engine from being injured by water which may be caught between the piston and the heads of the cylinder the piston is provided with relief passages and valves which permit the caught water to pass from one side of the piston to the other and which are constructed as follows:

N represents relief passages or chambers, which inclose the relief-valves and which are preferably arranged between adjacent pairs of piston-sections. Each of these passages extends from one supporting-disk to the other and is formed partly on each of these disks, as shown in Figs. 1 and 8. The ways *j'*, in which the piston-sections are guided, are preferably formed on the outer sides of the relief-passages, as shown. The ends of each relief-passage communicate with the cylinder on opposite sides of the piston by openings formed in the supporting-disks, said openings being provided with valve-seats *n n'*, one of which faces outwardly and the other inwardly.

o o' represent outwardly and inwardly opening relief-valves which are adapted to engage with the outwardly and inwardly facing valve-seats, respectively. These valves are adjustably connected, so that they move simultaneously toward and from their seats. This adjustable connection consists, preferably, of an externally-screw-threaded valve-stem o^2, formed on the outwardly-opening valve and engaging with an internally-screw-threaded tubular stem o^3, formed on the inwardly-opening valve, as shown in Figs. 1 and 8. For convenience in turning the valves for adjusting them with reference to each other the outer side of each valve is provided with a flat-sided socket o^4, which receives a wrench. After the valves have been ad-

justed they are held in position by means of a set-screw o^5, which engages with a screw-threaded opening formed in the bottom of the tubular stem and bears against the end of the externally-threaded stem.

P represents a spring whereby the relief-valves are yieldingly held in a closed position. This spring surrounds the stems of the relief-valves and bears with one end against a shoulder p, formed on one of the supporting-disks around the outwardly-facing valve-seat, and with its other end against a washer p'. The latter is provided with a concave spherical face p^2, which fits against a convex spherical face p^3, formed on the inner side of the inwardly-opening relief-valve. This means of connecting the spring with the relief-valves enables the spring to adjust itself to the valves and hold the same properly against their seats instead of tipping the valves and causing leakage, which would otherwise occur if the spring were not allowed to adjust itself to the valves. The tension of the relief-valve spring is such that it holds the valves closed during the ordinary operation of the engine, but if any water has been caught in the end of the cylinder toward which the piston is moving the relief-valves are forced open by the pressure of the water, whereby the latter is allowed to pass through the piston to the opposite side thereof and escape with the exhaust on that side of the piston.

The relief-valves in two of the relief-passages are arranged to open toward one end of the cylinder, while the relief-valves in the other relief-passages are arranged to open toward the opposite side of the cylinder, as shown in Fig. 1, thereby affording relief to the caught water when the piston moves in either direction.

By employing a double relief-valve, as shown is Figs. 1 and 8, the possibility of steam leaking through the valve-chamber is reduced to a minimum.

My improved piston may be organized so as to embody only one annular set of piston-sections and only one relief-valve in each relief-passage, such a piston being shown in Figs. 10, 11, 12, and 13, and constructed as follows: Q represents an annular set of piston-sections which are arranged to slide radially between the supporting-disks of the piston on ways q, formed on the sides of the relief-valve chambers or passages, and each of which is provided on its outer side with two bearing-lugs q'. The inner end of each piston-section is provided with a spirally-threaded portion q^2, which engages with the spiral thread of the adjusting-sleeve, whereby upon turning the latter in the proper direction the sections are moved radially outward. R represents an inner split packing-ring which is fitted with its edges against the inner sides of the supporting-disks and which is supported on the lugs of the piston-sections. r r' are two outer split packing-rings which are arranged side by side on the outer side of the inner packing-ring and which together are of the same width as the inner ring, so as to fill the space between the supporting-disks. The split portions or divisions of the outer packing-rings are out of line with each other, and the split portions of both outer rings are out of line with the split portion of the inner packing-ring, so as to prevent steam from leaking through the piston. Upon turning the adjusting-sleeve the piston-sections expand the split packing-rings, thereby adjusting the piston to the cylinder. In this modified construction of my improved piston the wear takes place on the outer packing-rings, which can be easily replaced without renewing the piston-sections.

In the modified construction of the relief-valves shown in Fig. 11 each of the relief-passages is provided with only one inwardly-facing valve-seat s and an inwardly-opening valve s', bearing against said seat. This valve is yieldingly held in its closed position by a spring s^2, bearing with one end against the inner side of the valve and with its outer end against an externally-screw-threaded ring s^3, engaging with an internally-screw-threaded opening formed in the opposite end of the relief-passage.

I claim as my invention—

1. In a piston, the combination with a supporting-disk, of radially-movable piston-sections mounted on said disk and provided with spirally-threaded portions, and an adjusting-sleeve provided with a spiral thread engaging with said threaded portions, substantially as set forth.

2. In a piston, the combination with the supporting-disks, of two annular sets of piston-sections arranged between said disks and capable of radial adjustment, the divisions or spaces between the sections of one set being out of line with the divisions or spaces between the other set of sections, and cover-plates arranged between said disks and extending across said divisions or spaces, substantially as set forth.

3. In a piston, the combination with the supporting-disks, of two annular sets of piston-sections arranged between said disks and capable of radial adjustment, the divisions or spaces between the sections of one set being out of line with the divisions or spaces between the other set of sections, cover-plates arranged between said disks and extending across said divisions or spaces, and ledges or seats formed on the opposing portions of said sections and adapted to engage with the ends of the cover-plates, substantially as set forth.

4. In a piston, the combination with the supporting-disks, of two annular sets of piston-sections arranged between said disks and capable of radial adjustment and a split packing-ring arranged between the two sets of piston-sections, substantially as set forth.

5. In a piston, the combination with the supporting-disks, of two annular sets of pis-

ton-sections capable of radial movement between said disks, said sections being provided with spirally-threaded portions, and a rotary adjusting-sleeve provided with a spiral thread engaging with the spirally-threaded portions of said sections, substantially as set forth.

6. The combination with a piston provided with a relief-passage having an inwardly-facing valve-seat at one end and an outwardly-facing valve-seat at the other end, of two connected valves adapted to bear respectively against said valve-seats, substantially as set forth.

7. The combination with a piston provided with a relief-passage having two valve-seats arranged at opposite ends thereof, of a valve adapted to bear against one of said seats and provided with an internally-screw-threaded tubular stem and a valve bearing against the other valve-seat and provided with an externally-screw-threaded stem engaging with said tubular stem, substantially as set forth.

Witness my hand this 16th day of November, 1896.

BENJAMIN F. WILSON.

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