(No Model.) 2 Sheets—Sheet 1.

R. L. DENNISON.

STEAM ENGINE.

No. 542,360. Patented July 9, 1895.

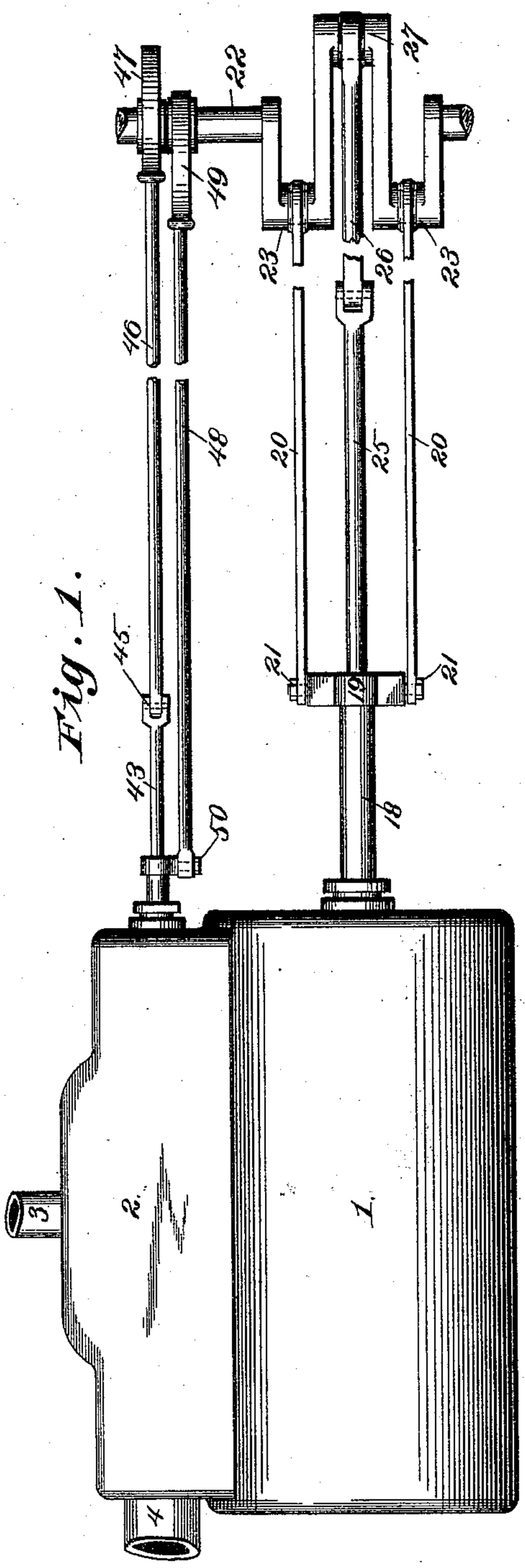

Fig. 1.

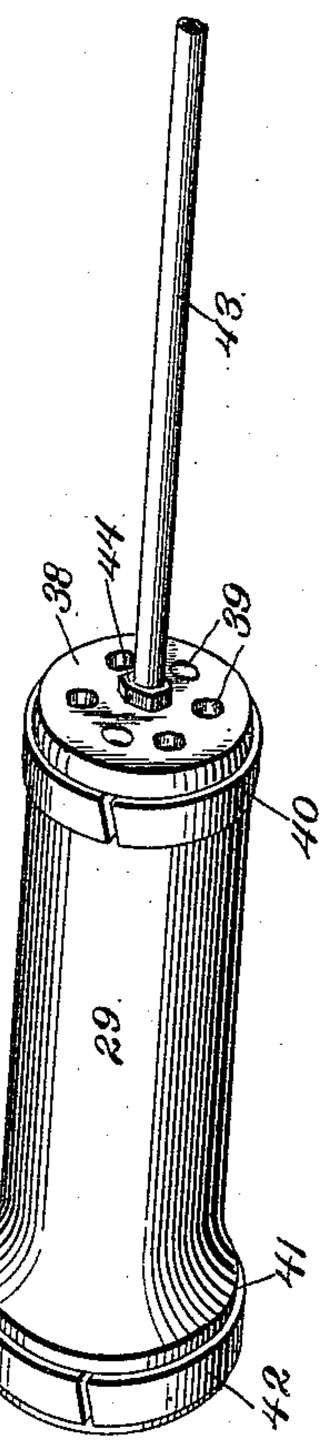

Fig. 3.

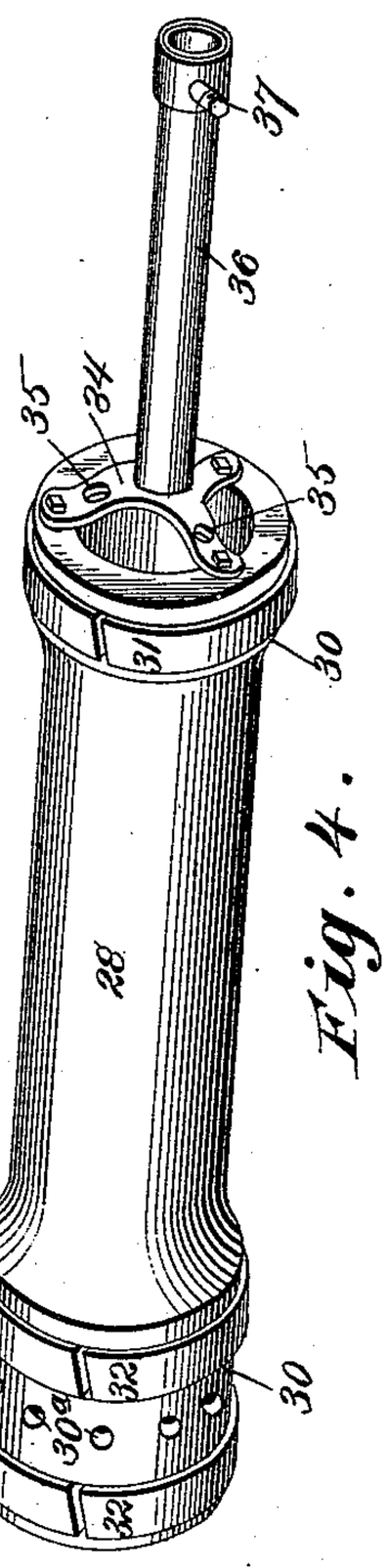

Fig. 4.

Witnesses:

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C. H. Thorpe.

Inventor:

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By Higdon & Higdon

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(No Model.) 2 Sheets—Sheet 2.

R. L. DENNISON.

STEAM ENGINE.

No. 542,360. Patented July 9, 1895.

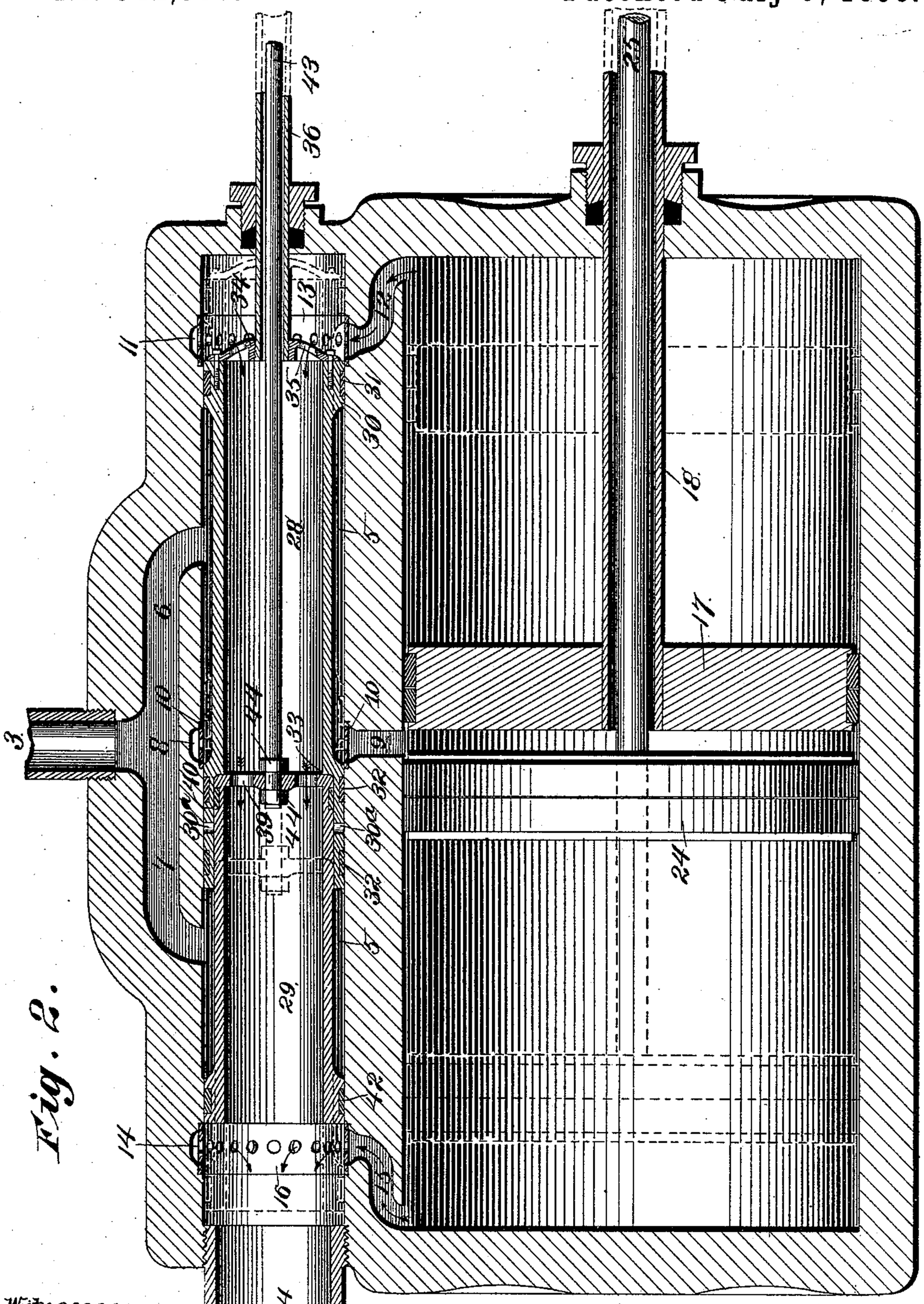

Fig. 2.

Witnesses:

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UNITED STATES PATENT OFFICE.

ROBERT L. DENNISON, OF KANSAS CITY, MISSOURI, ASSIGNOR TO THE COWLES, DENNISON MANUFACTURING COMPANY, OF SAME PLACE.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 542,360, dated July 9, 1895.

Application filed November 17, 1894. Serial No. 529,083. (No model.)

To all whom it may concern:

Be it known that I, ROBERT L. DENNISON, of Kansas City, Jackson county, Missouri, have invented certain new and useful Improvements in Steam-Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention relates to steam-engines, and more particularly to that class provided with two oppositely-operating pistons connected to the same shaft, and my object is to generally improve such engines.

With this object in view the invention consists in certain novel and peculiar features of construction and combinations of parts, as hereinafter described and claimed.

In the accompanying drawings, which illustrate a steam-engine constructed in accordance with my invention, Figure 1 is a top plan view. Fig. 2 is a vertical section of the same. Fig. 3 is a detail perspective view of one section of the valve, and Fig. 4 is a detail perspective view of the other section of the valve.

In the drawings, 1 designates the cylinder and 2 designates the steam-chest.

3 designates the steam-supply pipe leading to the steam-chest, and 4 designates the steam-exhaust pipe, which communicates with the open end of the valve-passage 5 of said steam-chest, said passage extending longitudinally of the chest. The discharge end of the supply-pipe 3 communicates with the branch passages 6 and 7 of the steam-chest, and said passages communicate at their discharge ends with the passage 5 at a suitable distance from its opposite ends and at equal distances preferably from the annular passage or channel 8, which is located midway the length of the valve-passage and communicates through the port 9 with the cylinder 1 midway its length. Said annular passage or channel 8 is partitioned off from the passage 5, by means of the perforated bush-ring 10, in the ordinary manner. Adjacent to the closed end of said valve-passage and from the discharge end of the passage 6, a distance equal to that between the discharge end of the said passage 6 and the passage or channel 8, is a similar passage or channel 11, and this passage or channel 11 communicates through the port 12 with the cylinder 1 at its corresponding end, and this passage or channel is also partitioned off from the passage 5 by means of the perforated bush-ring 13. Adjacent to the open end of said valve-passage 5, and a distance from the discharge end of the passage 7 equal to that between the discharge end of said passage 7 and the passage or channel 8, is a similar passage or channel 14, and this passage or channel 14 communicates through the port 15 with the cylinder at its corresponding end. This passage or channel is also partitioned off from the passage 5 by means of a perforated bush-ring 16. A piston 17 of the ordinary construction is arranged within the cylinder and is adapted to reciprocate between the ports 9 and 12, and this piston is mounted upon a tubular stem or sleeve 18, which projects through the corresponding end of the cylinder and also through a stuffing-box or packing to prevent the leakage of steam and carries upon its outer end a cross-head 19, which is arranged horizontally. A pair of pitmen 20 are pivotally connected, as shown at 21, to the opposite ends of the cross-head 19 to operate in a vertical plane and are pivotally connected at their opposite ends to a similar pair of cranks 23, which are of equal length and project in the same radial line from the shaft 22. Located also within the cylinder 1 and adapted to reciprocate between the ports 9 and 15 is a similar piston 24, and projecting from said piston through the stem or sleeve 18 of the first-mentioned piston is the rod 25, which is pivotally connected at its outer end by the pitman 26 to the crank 27, which is interposed between, is of equal length, and occupies the same plane as the cranks 23, but projects in the opposite direction.

A valve comprises the tubular sections 28 and 29. The section 28 is diametrically smaller than the passage 5, but a suitable distance from each end swells outwardly to approximately the same diameter as said passage, as shown at 30. One of said externally-enlarged portions of said section is annularly grooved and carries a packing-ring 31 of the usual construction to make a steam-tight joint between the same and the wall of said passage. The externally-enlarged portion at the opposite end of said section is of greater length than the enlarged portion provided with the packing-ring 31, and is provided centrally with

a series of perforations or apertures 30ª and at opposite sides of said perforations or apertures with annular grooves in which are carried the packing-rings 32, which also form a steam-tight joint in conjunction with the wall of said passage. The bore or passage of said section at the end provided with apertures or perforations is enlarged for a suitable distance, so as to provide or form the annular internal shoulder 33, and bolted or otherwise rigidly secured upon the opposite end of said section is a spider-frame 34, which is of such construction that it does not interfere to any extent with the free access of steam to the interior of said section, as hereinafter more particularly explained. To further provide free access of steam to said open end of the section, the spider-frame 34 may be provided with perforations or apertures, as shown at 35. Projecting from the spider-frame 34 and axially of the section 28 is a tube or sleeve 36, which extends through the closed end of the passage 5 and through a suitable stuffing-box and carries upon its outer end a head provided with a laterally-projecting pin 37. The section 29 of said valve is of diameter to fit snugly within the enlarged portion of the bore of section 28, and is adapted at times to lie against or adjacent to the shoulder 33. The end 38 of said section 29 is perforated, as shown at 39, or a spider-frame similar to the spider-frame 34 may be used in lieu of said perforated end if desired. Said section swells outwardly to form the enlarged external portion 41 at its opposite end, and this portion is annularly grooved and carries a packing-ring 42, which is adapted to make a steam-tight joint in connection with the wall of the passage 5. Secured by nuts 44, or in any other suitable manner, to the end 38 of the section 29, and projecting axially thereof, is the rod 43, and this rod extends through the tube or sleeve 36 of the valve-section 28 and beyond the outer end of the same for a suitable distance. A pitman 46 is pivotally connected at 45 to the rod 43 to operate in a vertical plane, and is eccentrically connected at 47 to the shaft 42. A similar rod 48 is eccentrically connected at 49 to the shaft 42 at one end, and is pivotally connected to operate in a vertical plane at its opposite end to the pin 37, being secured thereon by a retaining-nut 50. The eccentrics upon the shaft 22 are arranged diametrically opposite each other, so that the rotation of said shaft will cause said eccentrics to move the valve-sections always in opposite directions.

The operation is as follows: Supposing the pistons to be in the position shown in full lines, Fig. 2, and the cranks and the eccentrics to be disposed as shown in Fig. 1, the steam, entering the steam-chest through the pipe 3, will pass through the passage 6 into that portion of the passage 5 between the enlarged end portions of the valve-section 28, one enlarged portion being between the discharge end of the passage 6 and the port 11 and the other enlarged portion being between the discharge end of the passage 7 and the port 8. The steam necessarily passes from the described portion of the passage 5 through the perforated bush-ring 10 into the passage or channel 8 and passes thence through the port 9 to the interior of the cylinder and between the opposing faces of the pistons 17 and 24, and there expanding causes said pistons to move in opposite directions or toward the ends of the cylinder. This movement of the pistons causes the pitman 20 to push the arm 23 of the shaft and the pitman 26 to pull the arm 27 of the shaft, and by thus exerting pressure in opposite directions upon the shaft above and below its axis friction is reduced to the minimum. At the same time increased power is derived from the expansive property of the steam, as it exerts its pressure upon two yielding and coacting surfaces at the same time—coacting because the pulling of one set of pitmen counteracts or balances the pushing of the other set in such manner that the tendency of the shaft is to rotate. With the ordinary construction, where one pitman only is connected to the shaft, the tendency, except at the two points in the plane of the axis of the shaft at right angles to the movement of the piston, is always to move the crank eccentrically of its axis, which therefore creates considerable friction between the shaft and its bearings, as will be readily understood. I obviate this friction entirely by employing the oppositely-disposed cranks and connecting them with the oppositely-moving pistons. As the pistons reach the limit of their outward movement, the oppositely-disposed eccentrics upon the shaft cause the valve-sections to slide in opposite directions, each toward the contiguous end of the steam-chest, until communication between the passage or channel 8 and the passage 6 is cut off and communication between the passages 6 and 7, respectively, and the passages 11 and 14 is established, as indicated by dotted lines, Fig. 2. Simultaneously with the establishment of communication between the passage 6 and the passage or channel 11 and between the passage 7 and the passage or channel 14 the perforations 30ª in the outer section are uncovered by the inner section 29 and register with the perforated bush-ring 10. Immediately the valve assumes the position shown in dotted lines, the steam entering through the pipe 3 passes from the passages 6 and 7 into the passage 5 at opposite sides of the perforated enlarged portion of the section 28, which closes communication with the passage 8, and from the passage 5 enters the passages or channels 11 and 14 through the perforated bush-rings 13 and 16, respectively, and escapes thence by way of the ports 12 and 15 into the cylinder at its opposite ends, and there expanding causes the pistons to move toward each other and force the exhaust-steam through the port 9, the passage or channel 8, and the perforations 30ª into the section 28,

from which it escapes by way of the perforations 39 of the section 29 and the exhaust-pipe 4, as will be understood. By the time the pistons have reached the limit of their inward movement, which is shown in full lines, Fig. 2, the eccentrics again slide the valve-sections to the position shown in full lines, Fig. 2, so that the steam entering through the pipe 3 is cut off from the ports 12 and 15 and enters the cylinder between the pistons by way of the port 9, and there expanding forces the pistons outward, as before explained, and causes the exhaust-steam at one end to pass up through the port 12, the passage or channel 11 and the perforated bush-ring 13, to the passage 5, and from said passage, through the valve-section 28, the perforations 39, the valve-section 29, and the exhaust-pipe 4, as indicated by arrows, and from the opposite end of said cylinder through the port 15, the passage 14, the perforated bush-ring, and the exhaust-pipe 4, as also indicated by arrows.

From the above description it will be apparent that I have produced an engine wherein friction is reduced to the minimum and a valve which is simple, strong, durable, and comparatively inexpensive of construction.

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

1. A steam-engine, comprising a cylinder, a steam-chest having ports communicating with said cylinder at its middle and at its ends, oppositely reciprocating pistons in said cylinder, a shaft provided with oppositely projecting cranks, operative connections between said cranks and said pistons, a valve within the steam-chest, comprising a pair of telescopic sections, oppositely projecting eccentrics upon the shaft, and operative connections between said telescopic sections and said eccentrics, substantially as set forth.

2. A steam-engine, comprising a cylinder, a steam-chest having a valve-passage, ports connecting the same with said cylinder at its middle and at its ends, a passage communicating with said valve-passage between the middle port and each end port, a steam-supply pipe communicating with both of said passages, and an exhaust-pipe communicating with the valve-passage, in combination with a valve, comprising a tubular section in external diameter less than the diameter of said valve-passage, and enlarged at each end to fit snugly within said passage, and a second tubular section also in external diameter less than the diameter of said valve-passage and fitting at one end in the first-mentioned section and enlarged at its opposite end to correspond externally to the internal diameter of said valve-passage, and means to slide said sections alternately away from each other to permit steam to enter the cylinder at its ends and toward each other to permit steam to enter the cylinder at its middle, substantially as set forth.

3. A steam-engine, comprising a cylinder, a steam-chest having a valve-passage, ports connecting the same with said cylinder at its middle and at its ends, a passage communicating with said valve-passage between the middle port and each end port, a steam-supply pipe communicating with both of said passages, and an exhaust-pipe communicating with the valve-passage, in combination with a valve comprising a section which is externally of less diameter than the valve-passage and is enlarged a suitable distance from its ends to fit snugly within said passage, and is provided with packing-rings to make a steam-tight joint between the same and the wall of said passage, and is provided also at one end with a series of perforations or apertures, and a second section of external diameter less than the valve-passage and fitting in the contiguous end of the first-mentioned section, and provided externally with a packing-ring, and enlarged at its opposite end to fit snugly within said passage, also provided with a packing-ring to make a steam-tight joint, and means to cause said valve-sections to be moved simultaneously in opposite directions to permit the steam to enter the cylinder at its middle port and the exhaust-steam to escape at the end-ports, or to permit the steam to enter the cylinder at the end-ports and the exhaust-steam to escape through the middle port, substantially as set forth.

4. A steam-engine, comprising a cylinder, a steam-chest having a valve-passage, ports connecting the same with said cylinder at its middle and at its ends, a passage communicating with said valve-passage between the middle port and each end-port, a steam-supply pipe communicating with both of said passages, an exhaust-pipe communicating with the valve-passage, a shaft provided with oppositely projecting cranks, and a pair of pistons in the cylinder operatively connected to said cranks, in combination with a valve comprising a section which is externally of less diameter than the valve-passage and is enlarged a suitable distance from its ends to fit snugly within said passage, and is provided with packing-rings to make steam-tight joints between the same and the wall of said passage, and is provided also at one end with a series of perforations or apertures, and a second section of external diameter less than the valve-passage and fitting in the contiguous end of the first-mentioned section, and provided externally with a packing-ring, and enlarged at its opposite end to fit snugly within said passage, also provided with a packing-ring to make a steam-tight joint, a spider-frame secured upon the end of the first-mentioned section adjacent to the closed end of the valve-passage, a tubular stem or sleeve secured thereto and projecting through said closed end of the valve-passage, a pitman pivotally connected at one end to said tubular stem or sleeve and eccentrically connected at its opposite end to the shaft, a stem or rod secured to the corresponding end of the second

section and projecting through said tubular stem or sleeve, and a pitman pivotally connected to the same at one end and eccentrically connected to the shaft at the opposite end, substantially as set forth.

5. A steam-engine, comprising a cylinder, a steam-chest having ports communicating with the middle and with the ends of the cylinder, a valve comprising a pair of sections, and means to slide the same alternately away from and toward each other, in combination with a pair of pistons in the cylinder, a tubular stem or sleeve projecting from one of said pistons through one end of the cylinder, a cross-head mounted upon the outer end of the same, a shaft provided with a pair of similar cranks and with an interposed crank of equal length which projects oppositely from the first-mentioned cranks, pitmen pivotally connecting the cross-head with the first-mentioned cranks, a piston-rod or stem projecting from the other valve through said tubular stem or sleeve, and a pitman pivotally connecting said rod or stem with said oppositely projecting crank, substantially as set forth.

In testimony whereof I affix my signature in the presence of two witnesses.

ROBERT L. DENNISON.

Witnesses:
M. J. COWLES,
G. Y. THORPE.