No. 891,220. PATENTED JUNE 16, 1908.

J. J. McGEE.

PISTON PACKING FOR STEAM ENGINES.

APPLICATION FILED SEPT. 16, 1907.

2 SHEETS—SHEET 1.

Fig. 1.

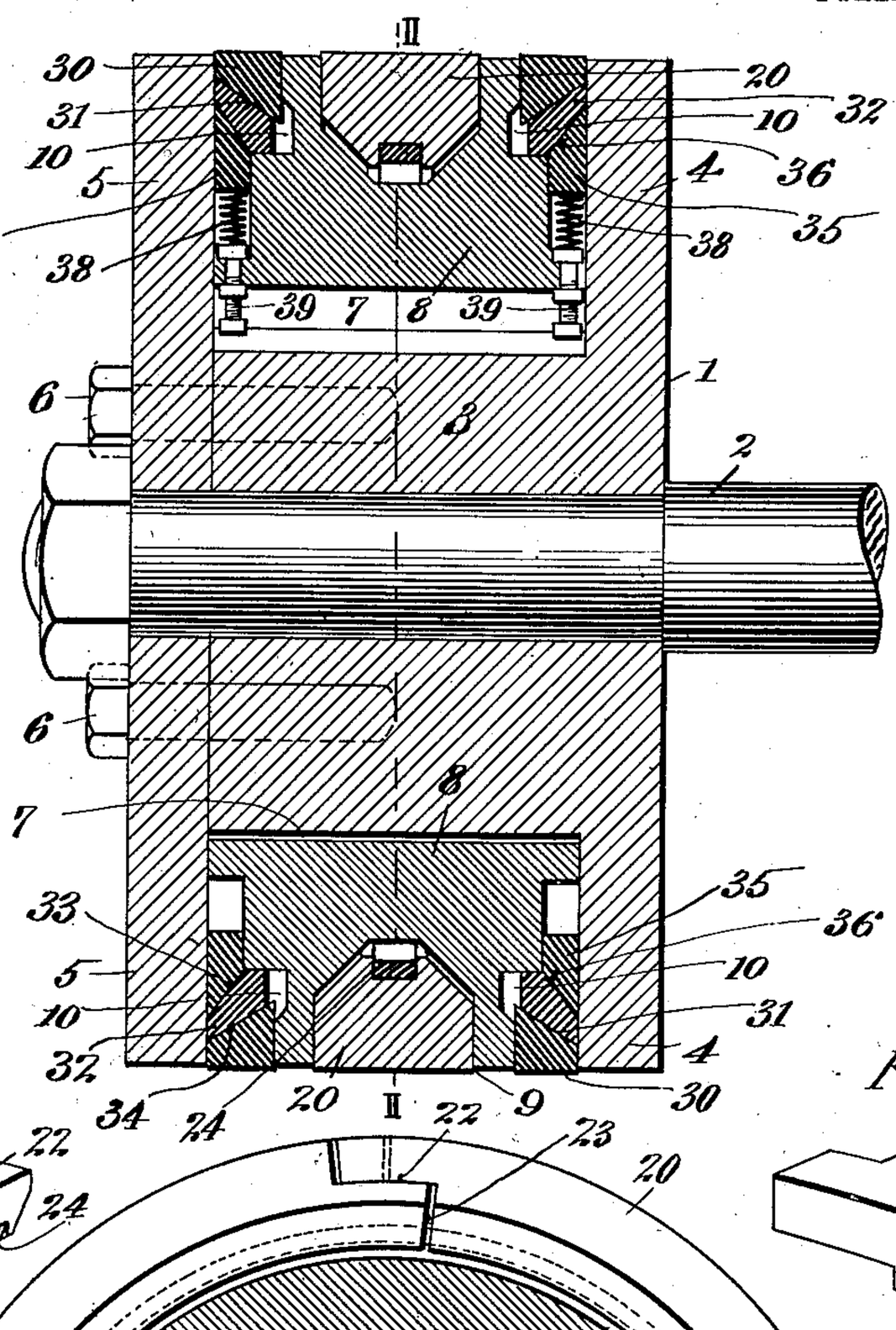


Fig. 3.

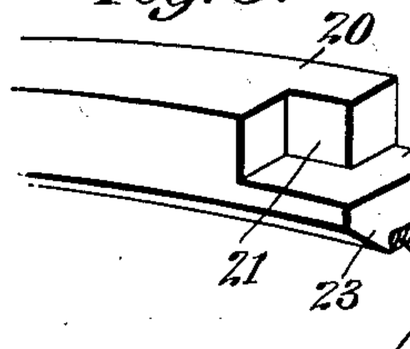


Fig. 3a.

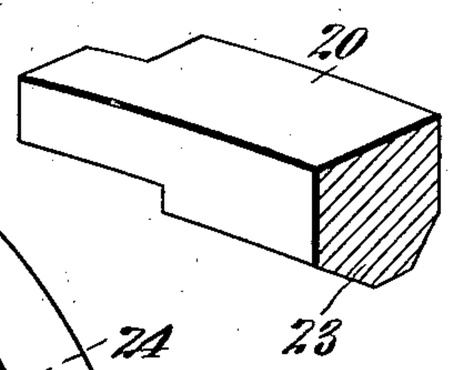
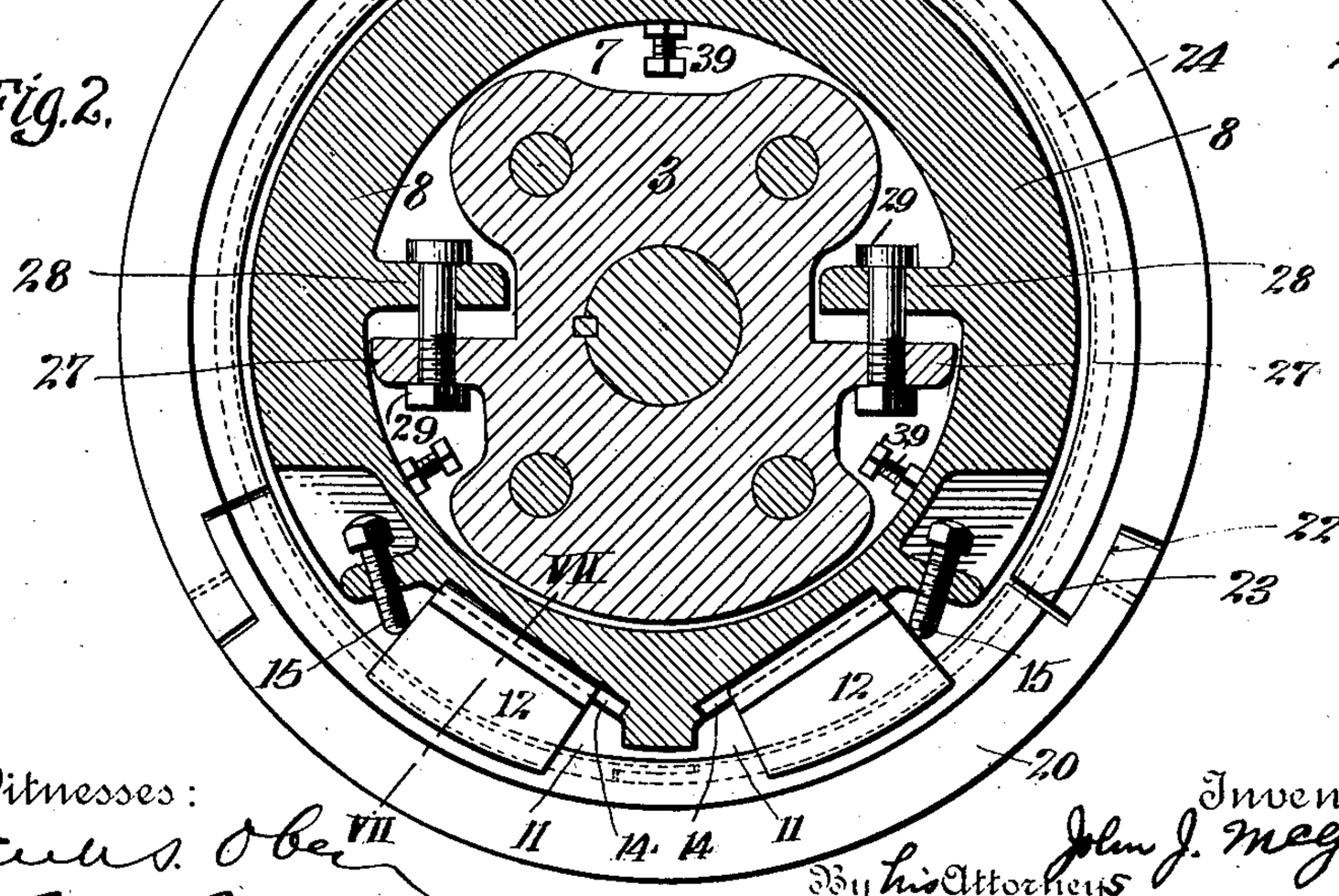


Fig. 2.



Witnesses:
Frank S. Ober
Chas. Hector

Inventor
John J. McGee
By his Attorneys
Rosenbaum & Stockbridge

No. 891,220. PATENTED JUNE 16, 1908.

J. J. McGEE.

PISTON PACKING FOR STEAM ENGINES.

APPLICATION FILED SEPT. 16, 1907.

2 SHEETS—SHEET 2.

Fig. 4.

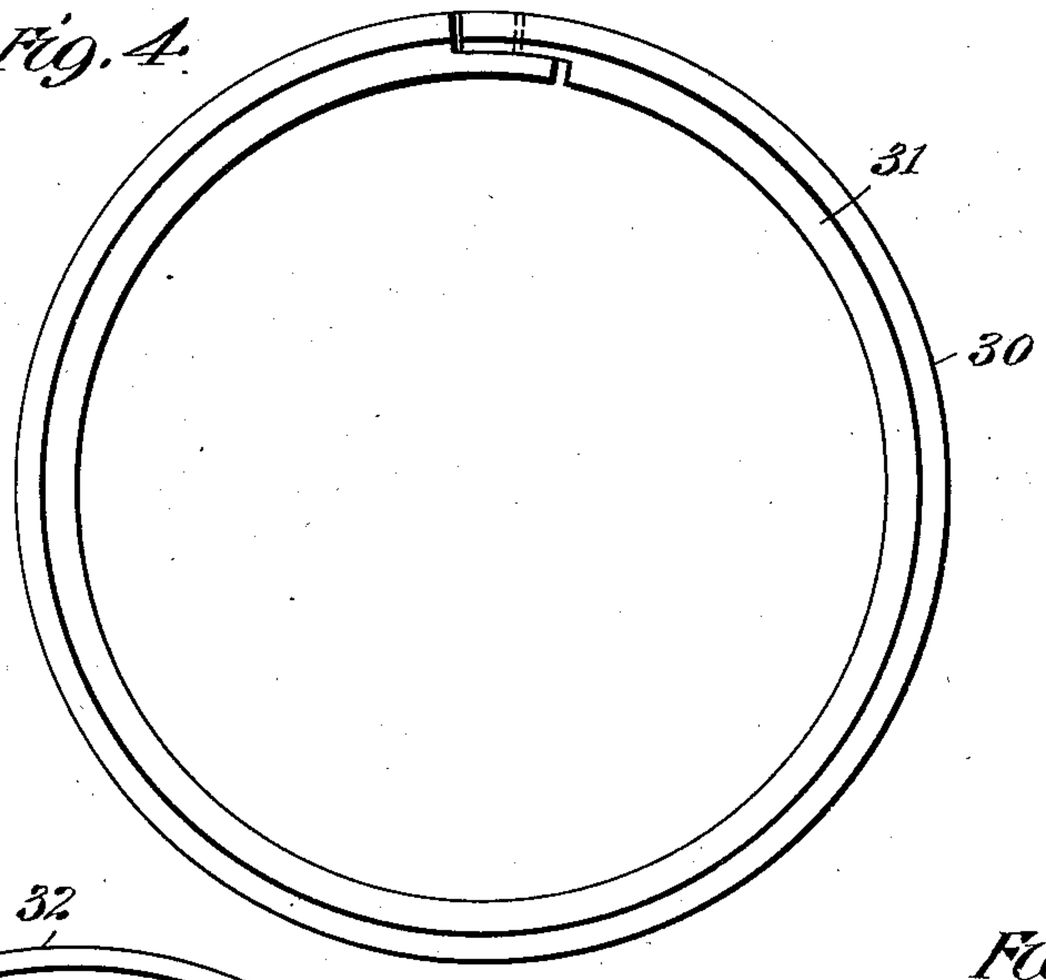


Fig. 5.

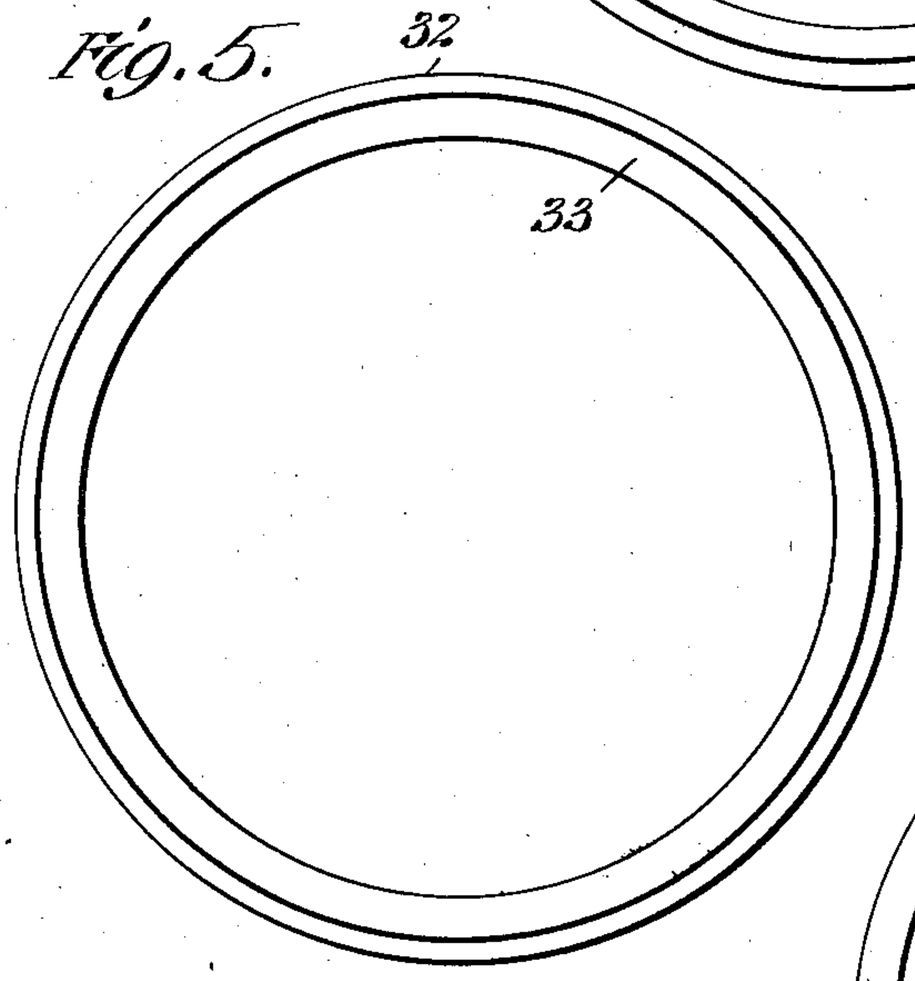
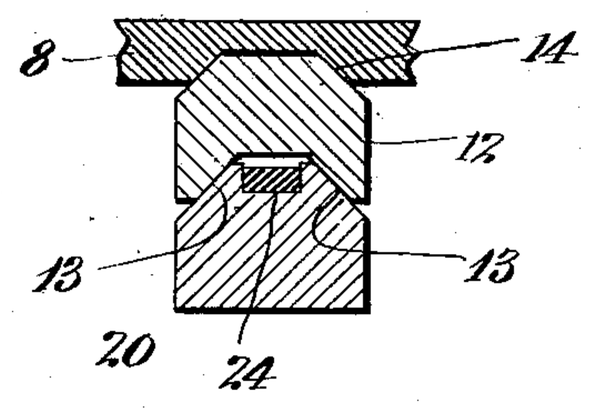


Fig. 7.



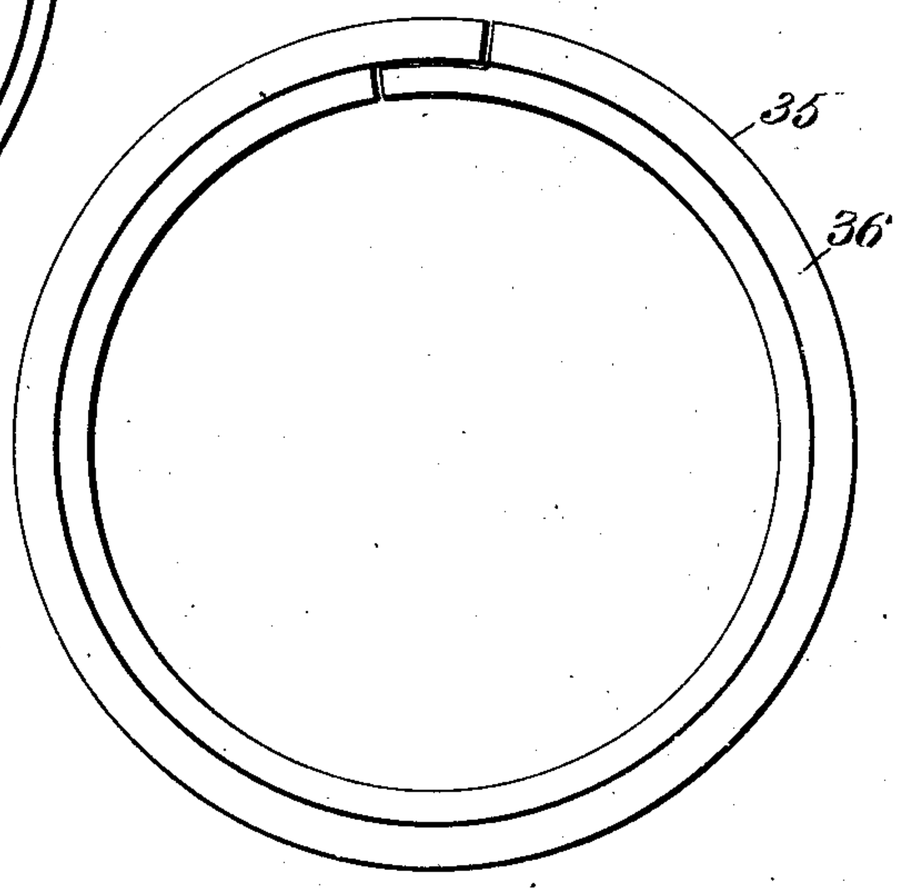


Fig. 6.

Witnesses:
Frank S. Oberbrunner

Inventor
John J. McGee
By his Attorneys
Rosenbaum & Stockmeyer

UNITED STATES PATENT OFFICE.

JOHN J. McGEE, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF TO ANTHONY F. S. GEOGHEGAN, OF NEW YORK, N. Y.

PISTON-PACKING FOR STEAM-ENGINES.

No. 891,220. Specification of Letters Patent. Patented June 16, 1908.

Application filed September 16, 1907. Serial No. 392,975.

To all whom it may concern:

Be it known that I, JOHN J. McGEE, a citizen of the United States, residing at the city of New York, in the borough of Brooklyn and State of New York, have invented certain new and useful Improvements in Piston-Packing for Steam-Engines, of which the following is a full, clear, and exact description.

My invention relates to a construction of piston packing, particularly for steam engines, although the invention is not limited to any particular field of use, being generally applicable in all cases where a tightly fitting piston movable in a cylinder is required.

In my companion applications, Serial No. 391,419 and Serial No. 392,974, I have described constructions of piston packings which are more especially applicable to explosion engines and fluid pressure pumps respectively. For use in steam engines, special conditions arise which make certain special or additional features of construction necessary or desirable. Steam cylinders run in considerably larger sizes than those of explosion engines, and are more frequently disposed in a horizontal than in a vertical position. The result is, that a comparatively heavy piston bears with its whole weight on one side of the wall or bore of the cylinder. This is a disadvantage, since the real functions of the cylinder bore or wall should be to merely furnish a surface for the packing rings to work against. Using the piston bore as a bearing surface in addition to its proper function, is liable to cause uneven and excessive wear at the side where the bearing pressure occurs, unless special means are adapted to prevent this.

In addition to the above characteristic, steam engines are ordinarily expected to give service without renewal of any of the parts for long periods, and with this end in view, all the bearings, pitman connections, etc., are made with means by which wear can be compensated for from time to time. One or both of the cylinder heads is ordinarily easily removable, so the piston can be inspected. In view of these facts, it is extremely desirable to have the piston constructed with various adjustments by which a considerable amount of wear can be corrected or compensated for, without actual renewal of any part. In carrying out the present invention, I have had these various objects in view, and am able to provide a form of piston for steam engines which is adapted to the largest or small sizes, and which will give service for a length of time corresponding to the various bearings and other parts of a steam engine, without requiring renewal of any of its elements.

The present invention also aims to obtain greatly improved steam tight efficiency in the piston of a steam engine. I aim to prevent the packing rings from working sidewise or laterally in their containing grooves thus developing wear and looseness in increasing proportion as such wear and looseness continues, with the attended leakage. I also aim to keep the packing rings impelled against the wall or bore of the cylinder with a constant and even force under all conditions, which does not vary or diminish under high temperatures within the cylinder when the engine is working. In this way, the rings are always kept tightly borne against the wall of the cylinder so as to absolutely preclude leakage, but not so tightly as to cause undue wear or friction. At the same time, the escape of steam down the sides and beneath the rings is absolutely prevented.

In the drawings, Figure 1 is a sectional view of a piston for steam cylinders embodying the principles of my invention. Fig. 2 is a transverse sectional view on the line II—II of Fig. 1, the segment ring being in side elevation. Figs. 3 and 3ª are perspective views illustrating a form of joint which I employ in the segment ring and also in the packing ring. Fig. 4 is a side elevation of one of the packing rings on a slightly reduced scale. Fig. 5 is a similar view of what I shall term the pressure transmitting ring. Fig. 6 is a similar view showing one of the spring rings. Fig. 7 is a detail section on the line VII—VII of Fig. 2.

Referring to the drawings in which like parts are designated by the same reference sign, 1 indicates the main core or body of the piston which is centrally apertured to receive the piston rod 2. The core 1 of the piston is made with a portion 3 of quite reduced diameter for the greater portion of its length, being provided with a narrow flange 4 of substantially the size of the cylinder bore on the side corresponding to the crank end of the cylinder.

5 indicates a plate or flange bolted to the other end of the piston core 3 by the screws or similar fastening devices 6. In this way

there is provided a large space or groove 7 of rectangular section around the core 3 and between the end of the plates 4 and 5. Within this space I provide what I shall term a body or bull ring 8 which is of a width to be closely clamped between the end plates or disks 4 and 5. This body or bull ring has a central peripheral groove 9 and deeply cut specially formed recesses 10 at its two side edges. The groove 9 is adapted to contain the segment ring previously referred to, while the recesses 10 contain the packing rings later more fully described.

The bottom of the groove 9 is made V-shaped in transverse section, and at its bottom side is interrupted by cavities 11 which receive certain adjustable bearing blocks 12, portions 13 of the surface of which are adapted to form a continuation of the V-shaped bottom of the groove 9. The bearing blocks 12 rest on rectilinear ways or guides 14 forming part of the body or bull ring 8. The engaging surfaces of the blocks 12 with the ways 14 have a V-shape analogous and substantially parallel to the surfaces 13 above described.

15 indicate set screws mounted in suitable projections on the body ring 8 and bearing against the blocks 12 so as to force them longitudinally on their ways 14. The ways 14 are inclined in a slightly outward direction, approaching the outer circumference of the piston, so that when the blocks are forced together by the set screws 15 their surfaces 13 will lie at a greater radial distance from the center of the body ring than before.

20 indicates the segment ring made in a plurality of segments or sections. Three separate segments are shown, each having a form of lapped joint fully described and claimed in my companion application Serial No. 392,974. The essential characteristic of this lap or joint is the provision of a flat surface 21 parallel to a side face of the ring at a less distance therefrom than the thickness of the ring, and a cylindrical surface 22 parallel with the periphery of the ring and at a less distance therefrom than the depth of the ring and extending beyond the end of the face 21 The end of the ring shown in Fig. 3[a] is milled to fit that of Fig. 3 exactly in all respects. The inner surface of the segment 20 is made V-shaped as indicated at 23 to coöperate with the V-shaped inner surface of the groove 9.

24 indicates a spring ring which may be employed to impel the sections of the segment ring outward, so that this ring will exert a steam packing function as well as its particular purpose of a bearing for the piston in its movement. On the lower side of the piston, the segment 20 engages the V surfaces 13 of the blocks 12, the entire weight of the piston being transmitted to this segment through said surfaces. By reason of the V recess construction shown, the weight of the piston keeps the lowermost segment 20, on which it rests, in an absolutely concentric position against the surfaces 13 of its containing groove. Accordingly, as the piston moves to and fro in the cylinder, there is no lateral knocking back and forth of the segment ring in its groove, which would take place with considerable resultant wear in the absence of the V recess structure described, or some other similar means. The body or bull ring 8 is adjustable in a vertical direction with respect to the piston core 3 which is fixed on the piston rod. For this purpose, the core 3 is provided with laterally extending lugs or projections 27, while the ring 8 has corresponding inwardly extending lugs or projections 28.

29 indicate bolts joining the respective lugs or projections, and the adjustment of which obviously varies the relation of the core 3 and the ring 8 in a vertical direction.

The packing rings are designated 30 and have a single lap joint of the form shown in Figs. 3 and 3[a] and a curved peripheral surface adapted to contact with the cylinder wall. The inner surfaces of the packing rings 30 are made inclined or conical in the manner shown at 31 (see particularly Fig. 1.)

32 indicates the pressure transmitting rings which are absolutely solid in construction without any lap or joint whatever, unless a joint is made in the process of manufacture and afterwards bolted together to form a solid ring. The pressure transmitting ring 32 has two cone surfaces designated 33 and 34. The ring 32 is designed to move endwise of the piston in which movement its surface 34 exerts a wedging action upon the conical surface 31 of the packing ring 30. The effective angle or power factor of the wedging action may be made anything desired, and in practice I make this greater than unity, as indicated in Fig. 1.

35 indicates a spring ring having a conical or wedge surface 36, which engages the corresponding surface 33 of the pressure transmitting ring and coöperates therewith to impel the pressure transmitting ring in its lateral movement. The power factor of the wedging action between the surfaces 36 and 37 may be made anything desired in the same way as that between surfaces 31 and 34, but in practice, I prefer to make this also greater than unity in the manner shown in Fig. 1. Making both wedge factors greater than unity, results in the non-parallel character of the two wedging faces of the pressure transmitting ring, as shown in Fig. 1, and it is evident that the transverse section of this ring will vary according to the particular power factors of the two wedging actions which are exerted on the packing ring through its coöperation.

38 indicates springs contained in suitable recesses in the body or bull ring 8 and bear-

ing against the spring ring 35. The tension of these springs may be adjusted or increased by set screws or similar devices 39 accessible from the interior of the piston.

In use, the packing rings 30 are borne outwardly against the cylinder wall partly by their own resiliency, but mostly by the pressure transmitted from the pressure transmitting ring 32. The latter in turn is forced laterally so as to apply pressure to the packing rings by the interior spring rings 35 and the adjustable spiral springs 38. This arrangement is particularly advantageous, since it not only causes the application of an amply sufficient outward pressure to the packing rings, but also insures the application of this pressure in a way to preserve the true circular outline of the packing rings. The pressure transmitting ring 32 being solid and quite substantial, is incapable of any appreciable deformation, so that this ring remains absolutely circular under all circumstances. Accordingly, the packing rings which should be fairly light and flexible, are constrained to keep perfectly circular in outline, notwithstanding continued wear and increasing expansion against the cylinder walls. The internal spring ring 35 is stiff enough to exert all necessary force on the pressure transmitting ring 32, but should this ring vary from its true circular outline when it expands, no harm will result, because of the permanent circular character of the ring 32 through which the pressure must be transmitted. The same statement applies to the spiral springs 38, which, of course, exert their pressure only at distributed points around the circumference of the piston. The spring ring 35 and the springs 38, having only a spring function, may be made of steel or material most adapted for their particular purpose, and they are adapted to continue to give good service notwithstanding the temperatures applied to them within a steam cylinder. On the other hand, the packing rings 30 having substantially no spring function, may be made of bronze or copper which is an admirable material from the standpoint of packing efficiency and wearing qualities. The ring 32, having only a pressure transmitting function, may be made of cast iron or any rigid material.

In addition to the above characteristics of keeping the packing rings circular in their outline and constantly pressed against the cylinder walls regardless of wear, etc., the special arrangement shown and having a plurality of wings with conical surfaces, also keeps the packing rings from knocking back and forth in their grooves, and also insures a steam tight fit of the packing rings against the grooves on both sides. It is evident that the packing rings are cammed toward the center line of the piston, while the spring rings 35 are cammed in the opposite direction or toward the end plates 4 and 5. The intermediate pressure transmitting rings 32 bear against both the packing rings and the spring rings, and preclude steam passing between them. In this way, the resultant composite packing ring fits this groove tightly, avoiding wear and leakage of steam.

In use, the bearing blocks 12 are adjustable by their set screws 15, so that the weight of the piston will be borne by the lower segment 20 of the segment ring when the piston is properly centered on its piston rod in the cylinder. From time to time as wear occurs, the set screws 15 may be screwed up tightly so as to adjust the bearing blocks 12 downward, causing a greater outward displacement of the lower segment 20 compensating for its wear. The other segments may be substituted from time to time should one become worn excessively. If the cylinder wall becomes worn off, or for any other reason such adjustment becomes necessary, the bolts 29 may be turned to let down the body ring 8 with respect to the core 3 to which the piston rod is attached. The latter adjustment in the case of small pistons is all that is required for taking up the wear, in which case the bearing blocks 12 may be omitted, and the segment ring 20 repose in a continuous circumferential groove of the piston.

What I claim, is:

1. In combination with a piston body having a groove with lateral plane faces, a packing having a transverse width adapted to closely fit said groove comprising a packing ring, a solid ring within said packing ring and having a wedging engagement with the packing ring when moved laterally to impel the packing ring outward, and spring means for impelling said solid ring laterally.

2. In a piston, a body having a groove with a V-shaped bottom, a ring formed in a plurality of segments and having a bottom surface corresponding to that of said groove, and adjustable means acting exclusively on the lower side of the piston for supporting the weight of the piston on a segment of said ring.

3. In a piston, a body having a groove with a V-shaped bottom, a ring formed in a plurality of segments and having a bottom surface corresponding to that of said groove, and means for supporting the weight of the piston on a segment of said ring, said means being adjustable to vary the position of said piston with respect to the ring.

4. In a piston, a body having a groove, a ring formed in a plurality of segments and having a V-shaped bottom surface, and bearing blocks adjustable toward and from the center of the piston and having V surfaces to engage the V-shaped bottom of said ring.

5. In a piston, a body having a groove, a ring formed in a plurality of segments and having a V-shaped bottom surface, and bear-

ing blocks adjustable toward and from the center of the piston and having V surfaces to engage the V-shaped bottom of said ring, said bearing blocks also having V-shaped surfaces engaging said body.

6. In a piston, a body having a groove, a ring formed in a plurality of segments and having a V-shaped bottom surface, and bearing blocks having V-shaped surfaces to engage said segment ring, and movable on inclined ways or guides directed toward the circumference of the piston.

7. In a piston, a body having a groove, a ring formed in a plurality of segments and having a V-shaped bottom surface, and bearing blocks having V-shaped surfaces to engage said segment ring and movable on inclined ways or guides directed toward the circumference of the piston, and set screws for adjusting said blocks on their inclined guides.

8. In a piston, a body having a groove interrupted by depressed portions, inclined ways contained in said depressed portions, a ring in said groove and having a V-shaped bottom, and bearing blocks with separate V-shaped surfaces to engage said ring and said ways.

9. In a piston, a body having a groove interrupted by depressed portions, inclined ways contained in said depressed portions, a ring in said groove and having a V-shaped bottom, bearing blocks with separate V-shaped surfaces to engage said ring and said ways, and means for adjusting the bearing blocks toward the circumference of the piston.

10. A packing for pistons comprising a packing ring having a conical surface, a ring within the same having a conical surface engaging that of said packing ring, and an additional ring having a conical surface engaging that of the second mentioned ring.

11. A packing for pistons comprising a packing ring having a single lap or joint, a solid ring within the same and having a wedging engagement with the packing ring when moved to laterally impel said packing ring outwardly, and means for impelling said solid ring laterally.

12. A packing for pistons comprising a packing ring having a single lap or joint, a solid ring within the same and having a wedging engagement with the packing ring when moved laterally to impel said packing ring outwardly, and a spring ring for impelling said solid ring laterally.

13. A packing for pistons comprising a packing ring having a single joint, a solid ring within the same and having a wedging engagement with the packing ring to displace the latter outwardly, and a spring ring within said solid ring having a wedging engagement therewith to displace the solid ring laterally.

14. A packing for pistons comprising a packing ring having a single joint, a solid ring within the same and having a wedging engagement with the packing ring to displace the latter outwardly, and a spring ring within said solid ring having a wedging engagement therewith to displace the solid ring laterally, one of said wedging engagements having a ratio greater than unity.

15. A packing for pistons comprising a packing ring having a single joint, a solid ring within the same and having a wedging engagement with the packing ring to displace the latter outwardly, and a spring ring within said solid ring and having a wedging engagement therewith to displace the solid ring laterally, both of said wedging engagements having a ratio greater than unity.

16. A packing for pistons comprising a packing ring having a single joint, a solid ring within the same and having a wedging engagement with the packing ring to displace the latter outwardly, a ring within said solid ring, and a plurality of spiral springs acting on the latter ring to impel it against said solid ring.

17. A packing for pistons comprising a packing ring having a conical surface, a pressure transmitting ring movable laterally and engaging said surface, and having an additional conical surface, and a spring ring having a conical surface engaging the last-named conical surface of said pressure transmitting ring.

18. A packing for pistons comprising a packing ring having a conical surface, a pressure transmitting ring having a conical surface engaging that of the packing ring, and having an additional conical surface, and a ring having a conical surface engaging the last mentioned conical surface of said pressure transmitting ring and impelled by the pressure thereof in a lateral direction opposite to that in which said packing ring is impelled by its engagement with the pressure transmitting ring.

19. In a piston, a core having laterally extending lugs, a body ring surrounding said core and having inwardly extending lugs, and bolts connecting said lugs whereby said body ring may be adjusted vertically with respect to said core.

In witness whereof, I subscribe my signature, in the presence of two witnesses.

JOHN J. McGEE.

Witnesses:
WALDO M. CHAPIN,
JAMES D'ANTONIO.