Sept. 4, 1928. 1,683,380

J. A. BROCKMEYER

SELF EXPANDING PISTON

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Fig. 1.

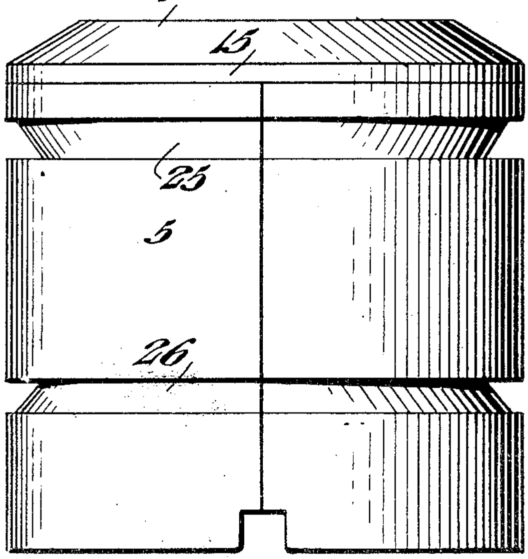

Fig. 2.

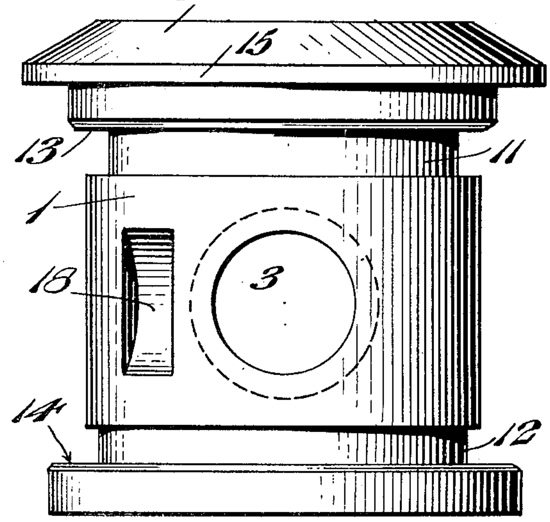

Fig. 3.

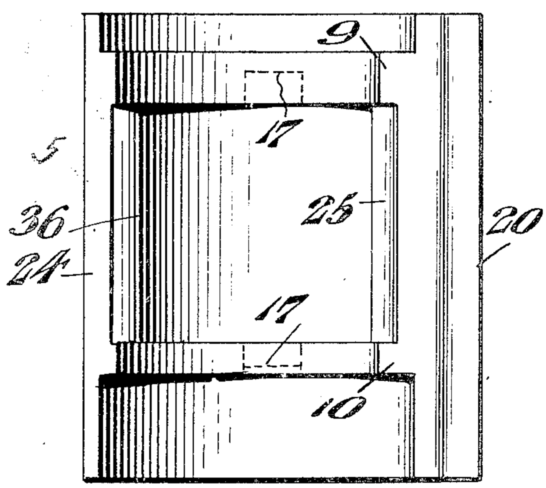

Fig. 4.

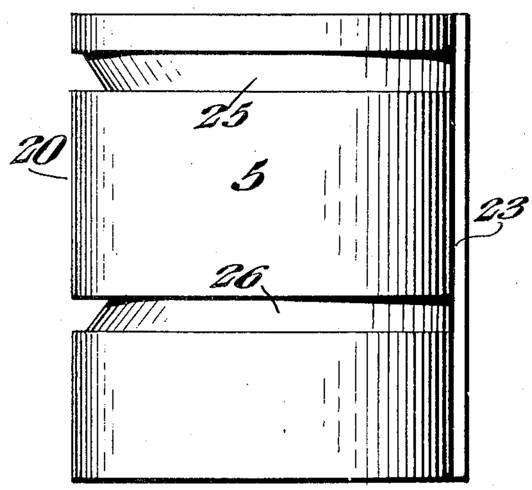

Fig. 5.

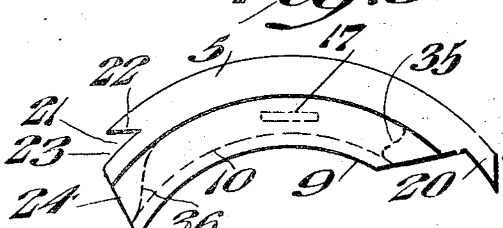

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Fig. 6.

ON LINE. 6-6. FIG. 8.

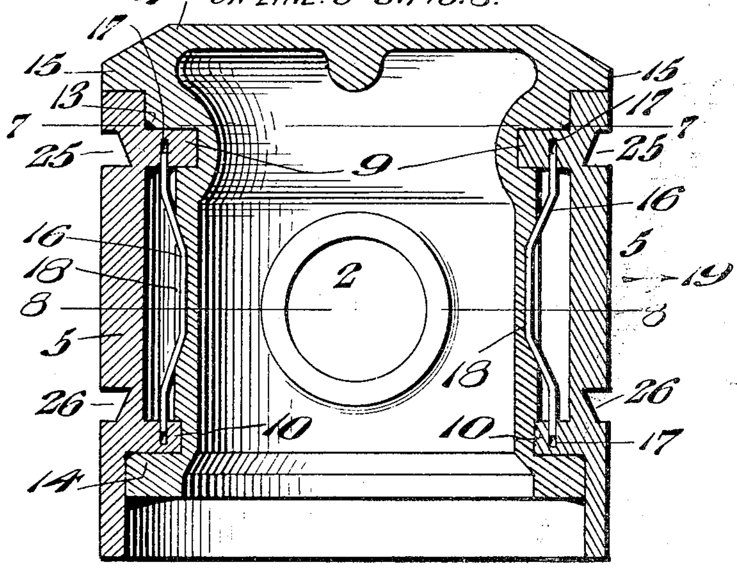

Fig. 7.

ON LINE. 7-7. FIG. 6.

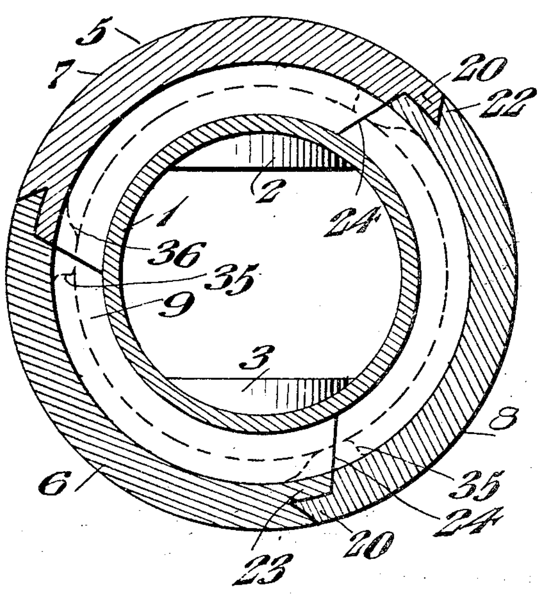

Fig. 8.

ON LINE. 8-8. FIG. 6.

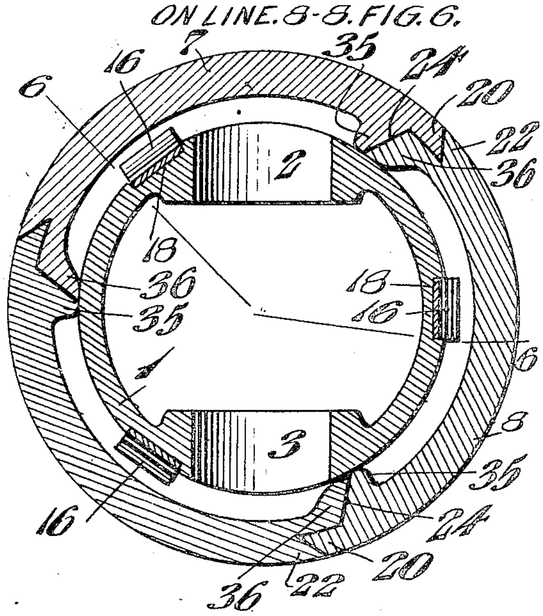

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Fig. 9.

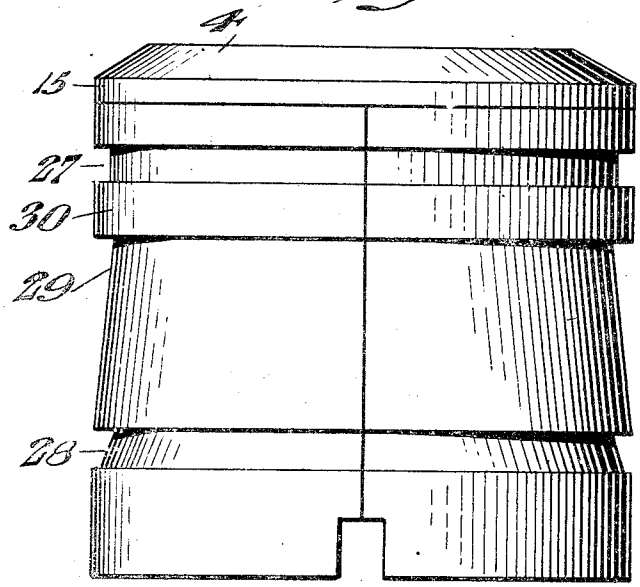


Fig. 10.

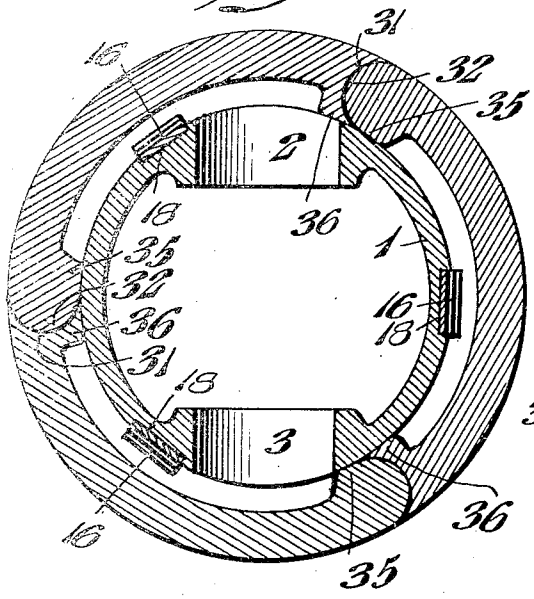
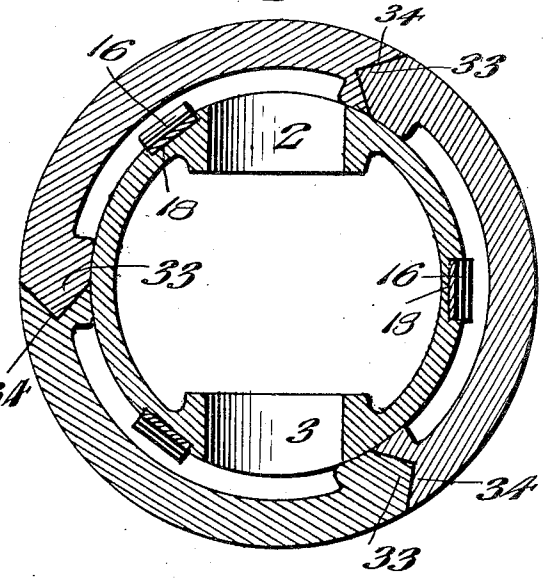


Fig. 11.



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Patented Sept. 4, 1928. 1,683,380

UNITED STATES PATENT OFFICE.

JOSEPH A. BROCKMEYER, OF BROOKLINE, PENNSYLVANIA.

SELF-EXPANDING PISTON.

Application filed July 16, 1925. Serial No. 43,903.

My invention relates to a new and useful improvement in pistons for internal combustion engines as well as for all reciprocating engines, compressors or pumps in general. My invention relates more particularly however, to a piston for the purpose set forth above which will function without any packing means or medium, such as piston rings or the like, and which will continue to function for a greater length of time than pistons made heretofore, employing piston rings.

With the above ends in view, my invention consists of a piston comprising an inner core and an outer cylindrical piston shell made of a plurality of segments throughout the circumference of the piston, which outer shell is supported by said inner core, and is capable of an outward radial expansion against the inner surface or wall of the cylinder, within which said piston is adapted to travel.

My invention further consists of a novel construction in pistons of the character stated wherein hermetically sealed joints are secured and maintained at all times, between the longitudinal contiguous edges of the several segments of the outer shell of the piston.

My invention consists of a novel construction in pistons of the character stated, wherein any longitudinal movement between the inner core of the piston and the outer segments of the shell thereof, is entirely eliminated and whereby two portions of the pistons are caused to travel back and forth as a unity.

My invention further consists of a novel construction and means intermediate of said core and said segments of the outer shell, whereby the latter will be forced radially outwardly and against the inner wall of the cylinder, with a constant pressure.

My invention further consists of novel oil retaining means in the outer cylindrical surface of the shell of said piston, whereby the oil will be retained within the crank case and prevented from entering the combustion chamber past the piston.

For the purpose of illustrating my invention, I have shown in the accompanying drawings forms thereof which are at present preferred by me, since they will give in practice satisfactory and reliable results, although it is to be understood that the various instrumentalities of which my invention consists can be variously arranged and organized and that my invention is not limited to the precise arrangement and organization of these instrumentalities as herein shown and described.

Referring to the drawings:—

Figure 1 represents a view in elevation of a piston embodying my invention.

Figure 2 represents an elevational view of the inner core of the piston, embodying my invention.

Figure 3 represents an elevational view of the interior of one segment of the outer shell of the piston.

Figure 4 represents an elevational view of the exterior of a segment of the outer shell of the piston.

Figure 5 represents a plan view of the segment shown in Figures 3 and 4.

Figure 6 represents a sectional view of the piston taken on line 6—6 of the Figure 8.

Figure 7 represents a section on line 7—7 of the Figure 6.

Figure 8 represents a section on line 8—8 of Figure 6.

Figure 9 represents an elevational view of a modified form of a piston embodying my invention.

Figure 10 represents a section similar to that shown in Figure 8, embodying a modified form of joint construction between the several segments of the outer shell.

Figure 11 represents a similar sectional view of a piston embodying another modified form of joint construction between the several segments of the outer shell.

Referring to the drawings, in which like reference characters indicate like parts, and with particular reference to the modification of my invention shown in Figures 1 to 8 inclusive, 1 designates the inner core of my novel piston, having the upper head 4 formed integral therewith, which head is adapted to receive the force of the explosion and to transmit the same to the rest of the core as well as to the outer shell 5, of the piston, which surrounds said core.

The outer shell 5 is composed of the three segments 6, 7 and 8, each occupying substantially one third of the circumference of the piston, as shown particularly in Figures 6, 7 and 8; an individual segment being shown in Figures 3 to 5 inclusive.

In order to interlock the inner core 1 with the several segments of the outer shell 5 of the piston, against any relative axial

movement, each of the segments 6, 7 and 8 is provided with the inner annular flanges 9 and 10 respectively, while the core 1 is provided with the corresponding annular grooves 11 and 12, which are adapted to receive said flanges, as shown in Figure 6. In order further to provide engagement between the core 1 and the segments 6, 7 and 8 of the outer shell 5, and in order to provide a greater bearing surface between the inner core 1 and the outer shell 5, the upper wall 13 of the upper groove 11 and the lower wall 14 of the lower groove 12, are extended outwardly so as to engage the entire corresponding surface of the flanges 9 and 10 respectively. The walls of the flanges 9 and 10 and the walls of the grooves 11 and 12 are substantially parallel and at right angles to the axis of the piston, thereby interlocking said core 1 and said shell 5 against any relative axial movement, yet permitting a radial displacement of said shell with respect to said core. Thus the flange 14^a formed near the lower end of the inner core 1 of the piston, serves to raise the shell upwardly when the piston is on its upward stroke, while the upper surface 13 serves to engage the outer shell.

In order further to engage the outer shell 5 of the piston, on the downward stroke of the same, and particularly in order to transmit the force of the explosion directly to the outermost periphery of the shell, the head portion 4, of the core 1, is provided with a flange 15, extending out over and overhanging the upper edge of the shell 5, and extending clear out to the periphery of said shell as shown particularly in Figures 2 and 6. The flange 15, being of substantially the same diameter as the cylindrical surface, also serves to center and guide the piston, although it does not make a close fitting contact with the walls of the cylinder.

Since the walls of the grooves 11 and 12, as well as the walls of the flanges 9 and 10 are substantially parallel and extend at right angles to the axis of the piston, the segments 6, 7 and 8 of the piston are capable of displacement relative to the core 1 radially outwardly, and at a right angle to the axis of the same.

The outward expansion of the segments 6, 7 and 8 is effected by means of a series of springs or other tension means 16, interposed between the core 1 and the several segments 6, 7 and 8, in a manner shown particularly in Figures 2 to 8 inclusive. Thus, each of the segments 6, 7 and 8, is provided with a flat spring 16 carried longitudinally of the axis of the piston, and supported at its two ends in two suitable recesses 17, in the flanges 9 and 10, as shown particularly in Figures 3 and 6. The springs 16 are preferably curved inwardly toward the center of recesses, as shown in Figure 6, and are seated in corresponding curved recesses 18. By this means each of the segment 6, 7 and 8 will be urged outwardly with a constant force, in a direction indicated by the arrows 19. Furthermore, due to the engagement of each of the segments at two points, near the upper and the lower extremities thereof respectively, that is, at the two flanges 9 and 10 respectively, the segments will be urged outwardly with an even force at their upper and lower ends.

In order to effect and maintain a hermetical seal or joint between the longitudinal contacting edges of the several segments 6, 7 and 8 of the piston, various means may be resorted to. One of the constructions which has been found to be particularly efficient in effecting a tight joint between the edges of the piston segments and which has been found to maintain a constantly fitting joint under varying conditions, and after considerable wear, as will be occasioned by constant use, is shown in Figures 3, 4, 5, 7 and 8. Here the edges of the segments are rabbeted in a manner shown particularly in Figures 5, 7 and 8, that is, the two longitudinal edges respectively, are provided with the tongue 20 and the groove 21 which interlock with the corresponding groove and tongue on the adjacent segments. In this form of joint construction, the tongue and groove are each provided with corresponding edges 22 and 23; being substantially on a chord of the circle of the piston, while the edges 23 are formed substantially parallel to the arc of the circle of the piston. On account of the relatively short extent of the edges 23, they may be straight instead of curved. The contacting edges of the segments are then continued inwardly along the surface 24 which forms to complete the joint. By this novel construction in a joint, the segments, when urged outwardly in a substantially radial direction by the springs 16, and retained by and against the inner surface of the cylinder, tend to expand outwardly of the core at the several joints herein described, which joints will maintain perfect seal for a considerable amount of actual expansion at the joints.

Thus as the piston wears, it will be seated more accurately in the cylinder and will thereby not lose any compression. Due to this constant outward expansion of the outer shell or surface of the piston of my novel construction, piston rings are entirely dispensed with, since the wall of the piston itself acts as the packing means. In order, however, to prevent the passage of oil past the piston, I may provide one or several oil grooves 25 and 26 in the body of the shell 5 and extending completely around the piston, throughout the several segments thereof. The oil collecting in the two grooves 25 and 26 during the operation of the piston,

will not only be prevented from entering the combustion chamber of the engine above the head 4, but is also caused to travel back and forth over the surface of the piston between said two grooves as the piston reciprocates to and fro. Thus on the explosive stroke of the piston, the force of the explosion passing the upper edge of the piston, will force some of the oil in the groove 25 downwardly along the surface of the piston into the lower groove 26; and similarly upon the suction stroke of the piston the oil in the groove 26 will be sucked up into upper groove 25, in each case the grooves 25 and 26 acting as reservoirs to contain the oil and to prevent the further travel of the same. By this means, a more perfect lubrication of the contiguous surfaces of the cylinder and piston is effected.

In Figure 9 I have shown a modification of my oil groove construction, in which, in addition to the two oil grooves 27 and 28 there is provided an inclined surface 29, which recedes from the contacting cylindrical surface of the piston, and thereby does not contact with the walls of the cylinder. The contact surface 30, intermediate the upper groove 27 and the central inclined surface 29 thereby acts as a piston ring to effect a more perfect packing or contact of the piston with the wall of the cylinder.

In Figure 10 I have shown a modified form of joint construction, applicable to my novel piston segments 6, 7 and 8, which concave edges 31 and convex edges 32, will permit of the expansion of the segments of the shell of the piston also to a considerable extent while maintaining a perfectly sealed joint between the segments.

In Figure 11 I have shown a still further modification of a joint construction, wherein the joints are formed in the shape of a V with the corresponding edges 33 and 34 telescoping into each other. In each of the joint constructions it is seen that the contacting surfaces extend inwardly towards the center of the piston to a distance greater than the thickness of the wall of the shell 5, by the provision of the longitudinal edge flanges 35 and 36, along each of the contacting edges, which extend clear back to the inner core 1 of the piston as shown particularly in Figures 3, 5, 7, 8, 10 and 11.

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

1. A piston comprising an inner core member, an outer shell surrounding said core and formed of a plurality of longitudinal segments, and resilient means operatively interposed between each of said segments and said core, urging the former outwardly of the latter in a yieldable manner; the contiguous longitudinal edges of said segments being alternately provided with opposed tongue and groove portions extending longitudinally of said edges, which telescope into one another in the operative position of said shell, thereby to seal the joint between said edges.

2. A piston comprising an inner core member, an outer shell surrounding said core formed of a plurality of longitudinal segments, resilient means operatively interposed between each of said segments and core, means for preventing any relative longitudinal displacement between the two, and for permitting a transverse radial displacement of said segments with respect to said core; the contiguous longitudinal edges of said segments being provided with tongue and groove portions respectively, extending longitudinally of said edges, which telescope into one another in the operative position of said shell, thereby to seal the joint between said edges.

3. A piston comprising an inner core member, an outer shell surrounding said core and formed of three longitudinal segments, and resilient means operatively interposed between each of said segments and said core, urging the former outwardly of the latter in a yieldable manner; the contiguous longitudinal edges of said segments being alternately provided with opposed tongue and groove portions extending longitudinally of said edges which telescope into one another in the operative position of said shell, thereby to seal the joint between said edges.

4. A piston comprising an inner core member, an outer shell surrounding said core formed of three longitudinal segments, resilient means operatively interposed between each of said segments and core, means for preventing any relative longitudinal displacement between the two, and for permitting a transverse radial displacement of said segments with respect to said core; the contiguous longitudinal edges of said segments being provided with tongue and groove portions respectively, extending longitudinally of said edges, which telescope into one another in the operative position of said shell, thereby to seal the joint between said edges.

JOSEPH A. BROCKMEYER.